ENVIRONMENTAL FINANCIAL ADVISORY BOARD

March 31, 2010

Honorable Peter Silva
Assistant Administrator
Office of Water
U.S. Environmental Protection Agency
Washington, DC 20460

Dear Mr. Silva:

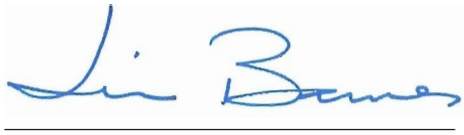
The Environmental Financial Advisory Board (EFAB) is pleased to submit the enclosed report, "*Water Loss Reduction Financing Mechanisms for Drinking Water Distribution Systems,*" for the Office of Water's consideration and use. This report addresses the current scope of water loss; practices, benefits, and obstacles for implementing water loss control programs; case studies of successful water loss control programs, and an overview of funding mechanisms available.

The increase in the U.S. population and its demand for water has put additional stress on water supplies and distribution systems, threatening both human health and the environment. Increased water use also has a significant energy component and a corresponding impact on climate. By using water more efficiently, we can help preserve water supplies for future generations, save money and protect human health and the environment.

In this era of heightened environmental consciousness and very tight municipal budgets, it is helpful to encourage water utilities to address the inefficiencies in their distribution systems such as the loss of water through leaks in underground pipes. In addition to the environmental impacts such as increased water consumption and air emissions, these water leaks are very costly in terms of increased costs for water treatment, pumping and operations. Moreover, they impact the utility's environmental reputation and its ability to ask customers to conserve. To make water loss programs effective and encourage water utilities to implement these programs, the EFAB makes seven recommendations for your consideration.

We hope that you find our advice and recommendations constructive and useful. The Board is always ready to take any follow-up actions that are consistent with its charter. If you or your staff have questions about this report, or would like to arrange a meeting, please let us know. We greatly appreciate the continuing opportunity to serve the Agency.

Sincerely,



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EFAB Chair

A. Stanley Meiburg
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Enclosure

cc: Lisa P. Jackson, Administrator
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Environmental Financial Advisory Board

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Water Loss Reduction Financing Mechanisms for Drinking Water Distribution Systems

March 2010

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Environmental Financial Advisory Board

WATER LOSS REDUCTION
FINANCING MECHANISMS
FOR DRINKING WATER DISTRIBUTION SYSTEMS

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EXECUTIVE SUMMARY

Insufficient investment in water utility infrastructure necessary to meet water quality standards has been documented by numerous sources including the 2002 USEPA "Infrastructure Gap Analysis." Spending shortfalls are estimated between $11 and 22 billion per year. Factors that contribute to deteriorating water supply infrastructure include poor efficiency characterized by sometimes large quantities of lost treated water; reactive intervention practices where infrastructure repair is performed after pipe leaks become readily apparent and/or disruptive, further contributing to lost water; and rate structures that are inadequate to cover operating costs and infrastructure investment. The large number (53,000) of community water systems in the U.S., of which 83% are characterized as small water suppliers (serving fewer than 3,300 people), makes regulatory oversight of the water supply industry complicated. In many regions of the country, water accountability and efficiency is either not mandated or, when mandated, is not enforced. In this context, water accountability refers to audit and management programs a utility conducts to characterize the performance of their system and water efficiency encompasses the actions taken to improve infrastructure and reduce water losses. While increases in infrastructure spending can address the estimated investment shortfall, increased spending alone may not result in effective infrastructure rehabilitation if a water utility has inadequate management practices and insufficient business focus.

Improving infrastructure performance is closely related to improving water efficiency. Water loss control programs including water audit practices, strategically planned intervention and repair, and continual evaluation of program performance have demonstrated significant benefits in improved infrastructure performance for those utilities that have implemented these programs. Environmental benefits achieved through effective water loss control include minimizing resource (water and energy) depletion. To this end, many water utilities that implement comprehensive water loss control programs have not only experienced improved water efficiency but have further improved infrastructure performance by developing effective asset management programs that identify the poorest performing areas in their system and result in

repairs that generate maximum benefit for the dollars spent. Despite these benefits, few water utilities have implemented comprehensive water loss control programs.

Funding mechanisms available to water utilities are numerous. User fees are the primary revenue source for most water utilities. When used effectively, the larger asset base and economy of scale of a large water supplier allow better access and more varied options for financing capital investment. Small water utilities lack this economy of scale, oftentimes resulting in less affordable access to capital. As a result, numerous grant and loan program are available to small water suppliers; however, the application process can be cumbersome, the types of fundable projects can be limited, and competition for available funds can be substantial.

The Environmental Finance Advisory Board (EFAB) has evaluated how water loss control programs can be financed most effectively. This project was initiated with the assumption that the environmental benefits of decreasing water losses in water supply systems will benefit both system accountability and economic performance. This report discusses the current scope of water loss; practices, benefits, and obstacles for implementing water loss control programs; case studies of successful water loss control programs; and an overview of funding mechanisms available.

Water Loss Reduction Status

Water loss, referred to as non-revenue water (NRW), includes both apparent and real losses. Apparent water loss refers to treated water that is delivered and consumed but not properly measured, accounted, or paid for, resulting in lost revenue. Real water loss includes physical losses from the distribution system, including leakage and storage overflow. Water loss in the U.S. is estimated to be approximately seven billion gallons per day; however, accurate estimates are difficult to quantify due to a lack of data and inconsistencies in the way NRW is reported.

Water utilities can effectively reduce their NRW by implementing water loss control programs. The benefits of reducing real water loss include increased efficiency, improved system reliability, and in some cases, decreased frequency and cost of emergency line repairs. Despite the apparent benefits, many U.S. water utilities do not have water loss control programs.

The U.S. water supply industry faces many problems, including an inadequate business enterprise focus and a frequent political hesitation on the part of local councils, supervisors, and other governing bodies to educate users about the need to set rates at adequate levels for operations, maintenance, and capital investment. The scope and degree of these problems also tend to vary based on the size of the water utility and its regional location. The principles of implementing and managing water loss control programs are straightforward; however, the volume and availability of data necessary can complicate the process. Large water systems have the advantage of more management oversight and technical staff to implement water loss control programs, but the size and complexity of the distribution systems can be a disadvantage. In contrast, small water systems have less complex distribution systems but often lack sufficient management oversight and well-trained staff.

Funding Mechanisms Available for Water Loss Control Programs

User Charges

The largest source of revenue for water utilities are user charges (revenue) from the sale of water produced, treated, and distributed to the customer. According to USEPA and GAO studies, water utility user fees frequently remain insufficient to meet current and future funding needs. A 2002 GAO report found that 29% of large water suppliers did not cover their full cost of service. Small water utilities have an even harder time, and because they lack economies of scale, covering needed capital investment solely through increased user fees would be burdensome on their customers. Numerous regulatory, professional, and stakeholder organizations have suggested that cooperative arrangements such as partnerships or consolidation of small water utilities may improve their financial, management, and water quality performance.

Loans and Grants

There are numerous federal, state, regional, public and private loan and grant programs available for community water development. Only the federal programs are discussed in this report.

In general, federal loan and grant programs prioritize water supply projects that are performing poorly (not meeting water quality requirements) and/or located in distressed areas. With the exception of USEPA funding programs, proactive projects to reduce water loss and increase efficiency are eligible for funding under other federal programs but they would likely receive lower priority than projects that specifically address disadvantaged communities and/or water quality improvement. Therefore, they would be less competitive for limited funding available.

As part of the 2009 American Recovery and Reinvestment Act (ARRA) appropriation, USEPA requirements for drinking water state revolving funds (DWSRF) funding required that 20% of the funds dispersed meet a "green project" requirement, which was also incorporated into the FY 2010 appropriation. Additionally, the 20% of funding set aside as the Green Project Reserve (GPR) mandates that efficiency be incorporated into water projects funded through the DWSRF. GPR guidance stipulates that a business case for improved water and energy efficiency must be demonstrated for a project to qualify. The business case must demonstrate that the proposed project represents "substantial benefits/savings compared to the average level of efficiency currently available" and that improved water and energy efficiency is an intentional part of the project, not simply an incidental benefit.

Recommendations

Although recent increases in available federal funding for water infrastructure are useful, government funding alone is unlikely to be able to address the entire shortfall. Improvements in water infrastructure in the U.S. will require the drinking water industry to improve its business focus and require rate setting practices to support this improvement. Effective water loss control programs have the potential to assist water utilities by reducing their overall costs, which will help to improve their infrastructure. To make water loss programs effective and encourage water utilities to implement these programs, the following recommendations are made.

1. Improved business focus and effective water loss control will make the best use of the financial resources available to water utilities. Regulatory agencies should encourage utilities to initiate practices to improve asset management and implement environmental management systems.

2. Increased utility revenue and funding amounts will be necessary to initiate, implement, and continue water loss control programs. This can be accomplished through existing funding mechanisms such as user charges; federal, state, regional, and private grant and loan programs; and revenue bonds. New types of funding mechanisms do not appear necessary. However, improved networking and coordination among regulatory agencies and stakeholders may be warranted to utilize the funds available more efficiently.

3. Obstacles to implementing utility full cost rate pricing should be addressed. By maximizing the use of reasonable financing mechanisms and incorporating a household affordability rather than community affordability focus to rate making practices, communities can meet their capital requirements and minimize the cost burden on their low income residents.

4. EFAB endorses water audit and asset management programs as excellent tools to assist in decreasing water losses. However, whether a state mandates or provides incentives to perform water audits and asset management programs as part of the SRF funding process, should be determined on a state by state basis. EFAB notes that where Green Project Reserve qualification requires that a business case for improved efficiency be demonstrated, a water audit and an on-going asset management program are the best means to accomplishing a successful business case. States may consider ranking strategies for SRF funding applications that provide an incentive for projects that include implementing water loss control and for systems with existing, successful water loss control programs.

5. States should be encouraged to implement or clarify requirements for water loss reporting and control. Further, state regulatory agencies should provide assistance for implementing water audit practices, especially for small water supply systems.

6. Water projects that do not automatically meet categorical criteria for “green project” status should still be able to qualify for the Green Project Reserve program provided that sufficient business case for improved efficiency is established.

7. Small water utilities experience additional challenges in obtaining sufficient financing to implement water loss control projects. Regionalization, consolidation, and cooperative partnerships are mechanisms that might assist small utilities to improve their economies of scale, decrease expenses, and provide better access to limited funding sources. Where feasible and appropriate, regulatory agencies should facilitate small utility consolidation or other service provider relationships, usually with larger neighboring utilities, that can provide infrastructure management and financing more efficiently.

Conclusion

Water loss control programs have the potential to encourage effective infrastructure investment, resulting in improved water efficiency, savings of a scarce resource, and lower long-term costs. The benefits of effective water loss control programs include improved water and energy efficiency, improved asset management and decreased emergency repair costs. New funding mechanisms do not appear warranted to assist water utilities in implementing water loss control. However, increased funding (especially in the form of full cost of service pricing), better coordination between regulatory and funding agencies, and more focused regulatory oversight might be warranted to make use of the funds available more effectively.

I. INTRODUCTION

Several studies published in the past ten years have estimated that current and even projected spending on repair, refurbishment, and replacement of U.S. water infrastructure is critically underfunded, with the estimated annual shortfall ranging from $11 to $22 billion.[1] A 2002 Government Accounting Office (GAO) report stated that approximately 30% of water utilities have a portion of their distribution systems nearing the end of its design life and/or have deferred maintenance because of insufficient revenue.[2]

In many water utilities, the current user charges are insufficient to meet current and future funding needs to maintain and refurbish aging infrastructure. Further, federal and state funds for these activities remained flat in the FY1998 to FY2008 appropriations, further widening the gap between what is spent and what is needed.[3] Federal appropriations under the 2009 American Recovery and Reinvestment Act (ARRA) provide a one-time increase for various federal water development and infrastructure programs. However, the future of federal and state appropriations for water infrastructure projects is uncertain due to the continuing economic downturn and decreased tax revenues at all levels of government.

Non-revenue water (NRW), including both apparent and real losses, is a pervasive and poorly characterized problem in water utilities internationally.[4] Apparent water loss is defined by American Water Works Association (AWWA) as "water that is consumed but not properly measured, accounted or paid for," resulting in lost revenue. Real water loss is defined by the

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[1] USEPA. "Drinking Water Infrastructure Needs Survey and Assessment, Fourth Report to Congress." EPA816-R-09-001, February, 2009a.

American Society of Civil Engineers (ASCE), *Report Card for America's Infrastructure*, , http://www.infrastructurereportcard.org/fact-sheet/drinking-water#sources, accessed July 27, 2009.

[2] Government Accounting Office (GAO), "Water Infrastructure, Information on Financing Capital Planning and Privatization." GAO-02-764, August, 2002, p. 4.

[3] USEPA, 2009a.

[4] Kingdom, B., Leimberger, R., and Martin, P., "The Challenge of Reducing Non-Revenue Water (NRW) in Developing Countries. How the Private Sector Can Help: A Look at Performance-Based Service Contracting." World Bank Group, Water Supply and Sanitation Sector Board Discussion Paper Series, Paper No. 8, December 2006.

AWWA as "physical losses from the distribution system, including leakage and storage overflow."[5]

The scope of water loss in the United States is estimated to be seven billion gallons per day[6] but is difficult to quantify accurately due to a lack of data and inconsistencies in the way NRW is reported. A 2002 AWWA report addressing U.S. water loss reporting practices found that 36 states have water loss reduction mandates but that "the prevailing policies are not entirely clear, consistent, or operational."[7] The results of this survey highlight that while the majority of states have some sort of water loss control mandate, the lack of clear definitions, standards, or enforcement have resulted in limited success in reducing NRW nationwide.

Water utilities can reduce their NRW by implementing effective water loss control programs. The major components of an effective water loss control program include a water audit, an intervention plan, and recurrent evaluation of these audit and intervention practices.[8] The benefits of reducing real water loss include increased efficiency (minimizing treated water losses), improved system reliability and in some cases, decreased frequency and cost of emergency line repairs. Despite the apparent benefits, many U.S. water utilities do not have water loss control programs.

Funding mechanisms available to water utilities are numerous. The majority of water utility revenue comes from user charges for water produced, treated, and distributed to the customer. When used effectively, the larger asset base and economy of scale of a large water supplier allow better access and more varied options for financing capital investment. Large water suppliers have the capacity to implement capital investment to expand, repair, and/or rehabilitate distribution and spread the cost over a large customer base resulting generally in relatively small

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[5] American Water Works Association (AWWA). *Water Loss Control*, http://www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=47847&navItemNumber=48156, accessed July 22, 2009.

[6] ASCE.

[7] Beecher, J.A., "Survey of State Agency Water Loss Reporting Practices," Beecher Policy Research, Inc., Final Report to the American Water Works Association, January 2002.

[8] USEPA, "Review Draft, Control and Mitigation of Drinking Water Losses in Distribution Systems," EPA815-D-09-001, November, 2009b.

rate increases. Despite these advantages, the GAO found that 29% of large water utilities have rate structures that are insufficient to cover operating expenses or infrastructure improvement.[9] Small water suppliers lack this economy of scale and even minimal capital investment, if covered by rate increases alone, could result in a burden on their customers.[10]

Large water suppliers are usually government owned and have larger operating budgets, a stable revenue source, and a large asset base and, therefore, can more easily issue bonds to finance capital investments. Since small water suppliers often have less affordable access to capital markets, there are numerous grant or loan programs available to small systems, but the application process can be time consuming, have limitations on the types of projects that can be funded, and there can be substantial competition for available funds.[11]

The Environmental Finance Advisory Board (EFAB) has evaluated how water loss control programs can be financed more efficiently. This project was initiated with the assumption that the environmental benefits of decreasing water losses in water supply systems will improve both system accountability and water efficiency. This report discusses the current scope of water loss; practices, benefits, and obstacles for implementing water loss control programs; case studies of successful water loss control programs, and an overview of funding mechanisms available.

II. WATER LOSS REDUCTION

WATER LOSS REDUCTION PRACTICES

A number of studies have noted that leakage management in many U.S. water utilities is reactive in nature, with leaks or ruptures only being repaired when the water loss becomes visually apparent and usually disruptive.[12] The AWWA Water Loss Control Committee distinguishes

[9] GAO, 2002, p. 4.

[10] USEPA, "Water Quality in Small Community Distribution Systems, A Reference Guide for Operators," EPA600-R-08-039, March, 2008, p. 7-3.

[11] *Ibid, p. 7-8.*

[12] Rogers, I.D., Gastaldi, M., and Figliolini, I.A., "Managing Leakage Economically," Report presented at the International Water Association, Water Loss 2007 Conference, Bucharest, Romania, September 2007. USEPA, "Rehabilitation of Wastewater Collection and Water Distribution Systems, State of Technology Review Report," EPA600-R-09-048, May, 2009c.

two equally important but not interchangeable components of all successful water loss control programs, namely, accountability and efficiency. Accountability in water supply operations is achieved via the water audit process and enhanced by asset management programs that a utility conducts to characterize the performance of their system. Efficiency is achieved when highly effective management of the supply, metering and billing systems result in economically controlled water and revenue losses.[13] It is useful to point out that a water supply system can have good accountability while having poor efficiency. In contrast, a system that has poor accountability cannot really know the state of efficiency in the system. This is an important distinction when water utilities perform reactive infrastructure management and neglect accountability. Reactive leak response can result in an inefficient use of often limited repair/maintenance budgets and may not improve the overall water loss performance of the system.[14]

The AWWA, in conjunction with the International Water Association (IWA), has developed a comprehensive water audit method to provide a standardized methodology for evaluating distribution system losses to allow more targeted and effective loss control practices. Guidance on comprehensive auditing procedures is addressed in the AWWA M36 publication entitled Water Audits and Loss Control Programs. This method includes four primary components, including (1) data collection and verification, (2) water balance calculation to distinguish between apparent and real system losses, (3) detailed quantification of real losses to determine if water portions of the distribution system are performing poorly, and (4) performance indicator measures to evaluate the effectiveness of the system assessment and intervention measures.[15]

While the IWA/AWWA water audit method standardizes the water loss assessment process, it is most useful when routinely conducted or updated to incorporate new or more detailed data of both apparent and real losses. Water audits conducted infrequently (every 3 or more years) can

[13] Kunkel, G., "Water Efficiency and Accountability," American Water Works Association, Water Efficiency, March 2008.

[14] Bach, N.L., Fujiwara, O., and Luong, H.T. "Optimal Fund Assignment and Allocation Models for Pipe Repair Maintenance in Leaky Water Distribution Networks," Water Resources Research, V. 36, No. 5, May 2000, p. 1315-1324.

[15] AWWA.

be considered isolated snapshots of distribution system performance and do not result in improved understanding of the type and volume of water loss, thus making it difficult to implement effective loss control strategies and improve system efficiency.

A discussion of available best technological practices for water loss control is beyond the scope of this report and is covered in detail in other publications.[16] However, it is useful to note that these reports emphasize that an effective water loss reduction program begins with a thorough water audit.

BENEFITS OF WATER LOSS CONTROL

There are numerous benefits that a water utility can realize by implementing an effective water loss control program. These benefits include improved water and energy efficiency, improved asset management, and decreased emergency repair costs.

The primary motivation for water loss reduction has been to reduce production costs or delay development of additional water sources, but as energy costs continue to increase, energy efficiency may also become a driving factor in implementing water loss control programs. Leaking distribution systems increase production costs, use more treatment chemicals unnecessarily, increase the amount of energy used to pump and treat water that is then lost, use more energy to maintain system pressure, increase system rehabilitation costs, and have the potential to cause water quality deterioration if consequent low pressures allow for infiltration. Deterioration of drinking water quality resulting from leaking water distribution pipes is possible but somewhat rare. The additional energy consumed by a leaking system places additional burden on the environment through resource depletion and increased emissions.[17] Although not addressed in this report, it should be noted that leaking wastewater collection systems can significantly degrade groundwater and surface water quality and like water distribution systems, maintenance and repair of wastewater collection infrastructure is underfunded.

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[16] Fanner, V.P., et al., "Leakage Management Technologies," AWWA Research Foundation, 2007.

USEPA, 2009c.

[17] Colombo, A.F., and Karney, B.W., "Leaks and Water Use Representation in Water Distribution System Models: Finding a Working Equivalence," Journal of Hydraulic Engineering, 135:3, March 2009, p. 234-239.

Routine water audit practices resulting in proactive water loss control can be an important tool in a comprehensive asset management program. Reactive infrastructure management involves replacing or refurbishing distribution equipment when it fails or is based on limited criteria such as equipment age. There are numerous factors that can compromise distribution system performance such as corrosion, faulty installation, damage from other utility lines or road structures, damage from nearby construction, and intermittent excessive pressure.[18] A well designed, well implemented water loss control program can assist in identifying portions of the system that are compromised and thus allow managers to employ strategic replacement/refurbishment of assets.

Asset management incorporates cost benefit analysis and goal setting evaluated by calculating performance indicators.[19] A water loss control program (water audit, intervention plan, and recurrent evaluation) is an important tool in effective asset management but the two are not interchangeable. A water utility with a newer, well-maintained distribution system can have low water loss and with an effective asset management program, including a water audit, may be able to maintain this performance without an active leak detection (intervention) program. The Seattle Public Utilities (SPU) department is an example of this. Beginning in 1998, SPU initiated a water conservation program that reduced customer side per capita consumption by 20% and an asset management program that implemented capital improvement expenditures focused on the poorest performing sections of the distribution system.[20] SPU conducts routine water audits and maintains an NRW of 5-7% of its 67mgd produced and through strategic infrastructure replacement has reduced the occurrence of water main breaks annually from 12 to 8 breaks per 100 miles of pipe.[21] In contrast, a utility with an aging and/or poorly performing distribution system would benefit significantly from beginning with a water loss control program

[18] Colombo, A.F., and Karney, B.W., "Energy and Costs of Leaky Pipes: Toward Comprehensive Picture," Journal of Water Resources Planning and Management, 128:6, December 2002, p. 441-450.

[19] Another context in which water loss issues can be addressed is through implementing Environmental Management Systems (EMS). EMS resources to provide organizations with a structured approach for assessing and reducing their environmental impacts can be found through USEPA at http://www.epa.gov/ems/info/index.htm.

[20] Seattle Public Utilities (SPU), "Seattle Water Supply System Regional 1% Water Conservation Program, Saving Water Partnership 2008 Annual Report," Seattle, WA, May 2009, p.3.

[21] SPU, "2007 Water System Plan, Vol 1," November 2006, p. 5-19.

and once losses are identified and intervention planned, then this program could be incorporated into a more comprehensive asset management program. An example of this is the Philadelphia Water Department (PWD) which is discussed in detail below.

There are numerous software tools available to assist water utilities in performing these analyses; however, using these tools still involves informed judgment on the part of the utility. The utility must have a good understanding of its marginal and retail costs, variable operating costs, variable revenue, and available budget for water loss control to effectively use any cost benefit model.

Other cost benefit considerations relate to the fact that emergency repair costs can decrease when active leak detection is effectively employed. For example, Halifax Water, the water supply utility for the city of Halifax, Nova Scotia, estimates that its water loss control program saves the utility $600,000 per year in direct operating costs. Further, the utility saw a 50% decrease in the annual number of line breaks as a result of implementing its water loss control program and estimates an additional $44,000 savings from the decrease in emergency repair occurrences.[22] In many cases, the costs of emergency repairs mitigated by active leak detection may not be predictable prior to initiating the program. These savings, though, have been consistently demonstrated.

OBSTACLES TO IMPLEMENTING WATER LOSS REDUCTION

The U.S. water supply industry faces many problems, including an inadequate business enterprise focus and a frequent political hesitation on the part of local councils, supervisors, and other governing bodies to educate users about the need to set rates at adequate levels for operations, maintenance, and capital investment The scope and degree of these problems also tend to vary based on the size of the water utility and its regional location.

[22] Yates, C.D. and MacDonald, G.D., "Advanced Pressure Management via Flow Modulation; the Dartmouth Central PMA," Report presented at the International Water Association, Water Loss 2009 Conference, Cape Town, South Africa, September 2009.

There are approximately 53,000 community water systems (systems serving at least 25 people or 15 connections) with an estimated annual expenditure of $30 to $40 billion.[23] Of these community water systems, 83% serve fewer than 3,300 people each, representing 9% of the U.S. population; however, 8% of water utilities serve greater than 10,000 people, representing 81% of the U.S. population.[24] In general, very small systems (serving less than 500 people) tend to be non-government owned while systems serving more than 500 people tend to be government owned.[25] Non-government owned systems encompass a wide variety of ownership and operational structures including investor owned, developer owned, homeowner or business association owned, tribal owned, and public/private partnership arrangements.[26]

A 2008 report prepared by the National Regulatory Research Institute (NRRI), specifically addressing small water systems, determined that the primary obstacles faced by these utilities include "deteriorating infrastructure, increasing federal requirements, deficient customer service and rising customer expectations, inadequately trained management, poor accounting principles, rates that are not based on costs, and lack of financial resources."[27] The large number of small water systems in the U.S., their geographic separation, and the obstacles faced by small utilities presents a challenge at all levels of government in implementing effective regulatory requirements.

In many water supply systems, effective water loss control is made more difficult by the organization of the utility and/or accounting practices. In many water utilities, the billing, engineering, and conservation sections do not have sufficient interdepartmental communication to allow effective water loss control implementation.[28] In some municipalities, drinking water

[23] ASCE. Grigg, N.S., "Water Sector Structure, Size, and Demographics," Journal of Water Resources Planning and Management, 133:1, February 2007, p. 60-66.

[24] ASCE.

[25] Levin, R.B, et al., "U.S. Drinking Water Challenges in the Twenty-First Century," Environmental Health Perspectives, V. 110, Supplement 1, February 2002, pp. 43-52.

[26] USEPA, 2008, p. 2-6.

[27] Stanford, Melissa, J.. "Small Water Systems: Challenges and Recommendations," National Regulatory Research Institute, February, 2008, p. 6.

[28] Vogel, C. and Longworth, J., "Implementing AWWA Water Use Accounting in New Mexico – Case Studies," Presentation given at the AWWA 2008 Sustainable Water Sources Conference, Reno, NV, February, 2008.

revenues are not separated from general public funds adding a level of complexity to understanding system costs and revenue.[29] Utility management fails to recognize that water loss control can result in a relatively quick payback of the staff and capital expenses necessary to assess losses and locate and repair leaks.[30]

While not technically difficult, implementing and managing water loss control programs can be very complex, especially if the supply, consumption, and cost data are inadequate.[31] Large water systems have the advantage of more management oversight and technical staff to implement water loss control, but the size and complexity of the distribution systems can be a disadvantage. In contrast, small water systems have less complex distribution but often lack sufficient management oversight and well-trained staff.[32] There is a good deal of ongoing research into leak detection modeling and utility cost modeling that is intended to develop tools that address the complexity of water loss control more effectively.[33] It will take time, though, for this research to coalesce into standard practice and filter down to individual utilities.

The 2002 GAO water infrastructure analysis report highlighted that user charges in most water utilities are insufficient to meet current and future needs for operation and maintenance.[34] In 2006, the USEPA launched the Sustainable Water Infrastructure initiative to promote better management, full cost of service, water efficiency, and watershed approach concepts throughout the water industry. Full cost of service incorporates present and future operation, maintenance, and capital costs into utility rate structures. Full cost of service pricing is predicated on the idea that user charges that fully account for present and future costs will promote infrastructure

[29] Levin, et. al.

[30] Strum, R., and Thornton, J., "Water Loss Control in North America: More Cost Effective Than Customer Side Conservation – Why Wouldn't You Do It?!" Report presented at the International Water Association, Water Loss 2007 Conference, Bucharest, Romania, September 2007.

[31] Kingdom et al., p.6.

[32] USEPA, 2008, p. 1-2.

[33] USEPA, 2009c; Rogers et al.; Colombo et al., 2009;. Bach et al.

[34] GAO, 2002.

investment, encourage better management through understanding cost effectiveness, and improve supply side (distribution side) water conservation by improving water efficiency.[35]

There are often political barriers that must be overcome before effective water loss control is implemented. It is often more favorable politically to develop a new water source resulting in a visible project (i.e. ribbon cutting) than to implement water loss control, which may be seen as tacitly admitting that the existing system is performing below expectations.[36] In many municipalities, rate increases to support capital expenditures must be approved by a local government entity and there is often resistance to these increases. In some cases, increased funding for infrastructure rehabilitation suffers from an "out-of-sight, out-of-mind" barrier in many municipalities.[37]

Often the political barrier to increasing user rates relates to how rate affordability is viewed. A 2006 EFAB report points out that if affordability is defined as a community problem, where rates for all utility users should not be a burden on the least able to pay, then resistance to setting full cost rates occurs and infrastructure is neglected. However, if affordability is defined as a household problem, and effective "subsidy, collections, and financial assistance" policies are adopted, then rate increase conflicts diminish. The report recommended that EPA develop guidance on incorporating household affordability considerations into rate making practices.[38] The larger consequence of political barriers to full cost pricing is that infrastructure deteriorates due to neglect resulting in greater long term costs and burdens on users.

WATER LOSS CONTROL CASE STUDIES

There are no national regulations requiring water utilities to report or limit water loss. Although, a number of state and regional agencies have enacted requirements for their regulated water utilities to conduct routine water audits and implement programs to limit water losses, these

[35] USEPA, "Sustaining Our Nation's Water Infrastructure," EPA852-E-06-004, August, 2006.

[36] Kingdom et al., p. 6; Strum et al., p. 268.

[37] USEPA, 2009c, p. 4.

[38] Environmental Financial Advisory Board, "Affordability Rate Design for Households," USEPA, Washington, DC February 2006.

programs are largely ineffective because they do not require reporting of water loss performance and do not specify sanctions for non-compliance.[39]

The following case studies summarize the efforts of the Texas Water Development Board (TWDB) to implement comprehensive water loss reduction requirements, the California Urban Water Conservation Council (CUWCC) to develop comprehensive best management practices (BMPs) for water loss control, and the results of the Philadelphia Water Department water loss control program.

TEXAS EXAMPLE:

In 2003, Texas passed legislation requiring public water utilities every five years to "perform and file with the TWDB a water audit computing the utility's most recent annual system water loss."[40] The Texas legislation specifies that water audit methods must be "financially feasible" for the water utility and that the TWBD may provide "financial assistance to political subdivisions" if the water improvement project meet select criteria, including that a water audit has been completed and filed. Under this mandate, the TWDB defined water audit requirements, using the IWA/AWWA Water Audit Method as a guideline, and established a March 2006 deadline for submittal of the first set of water loss data.[41]

The March 2006 reporting deadline was met by only 49% of Texas water utilities. The water loss results from the reporting utilities indicated NRW ranged between 8.3% and 15%. The TWDB estimated the value of total water loss between $152 and $513 million over the period of the survey, assuming that real losses are valued at the marginal production cost and apparent

[39] AWWA.

[40] HB No. 3338, 2003. *An Act Relating to the Performance of a Water Audit by a Retail Public Utility Providing Potable Water*. Texas Legislature, Austin, TX. http://www.capitol.state.tx.us/tlodocs/78R/billtext/html/HB03338F.htm, accessed July 22, 2009

[41] Mathis, M., Kunkel, G., and Howley, A.C., "Water Loss Audit Manual for Texas Utilities," Texas Water Development Board, Report 367, March 2008.

losses are valued at the retail water cost. These estimates represent the value of water lost, not the value of recoverable revenue, since it is not realistic to have zero water losses.[42]

Based on the March 2006 water loss data, the TWDB developed recommendations for refining the Texas water audit requirements to improve the data quality and reporting compliance.[43] The 2006 reported water audit data indicated that many water utilities had difficulty interpreting their water supply, consumption, and loss data. Many small utilities were including their estimated real losses as part of their accounted for water, thus significantly under-reporting their overall water losses. TWDB staff have put considerable effort into educating and training small water utilities in proper water audit practices and resulting benefits of effective audits. From the 2006 reported data, it is apparent that the lack of sanctions for non-compliance resulted in an ineffective response by the utilities, which prevents useful comparisons between utilities. Also, it became obvious that a once-in-five-year reporting requirement for water loss data is insufficient for a useful comparison for the same utility over time.

CALIFORNIA EXAMPLE:

The California Urban Water Conservation Council (CUWCC) is a partnership of member urban water agencies, public interest organizations, and private entities. The CUWCC is a membership organization that provides technical assistance, training, and program guidance to members; facilitates networking opportunities between utilities and stakeholders; and serves a coordinating role between members and regulators. Members pay an annual fee and must sign the Council's memorandum of understanding (MOU) that is intended to "expedite implementation of reasonable water conservation measures" and specifies BMPs to achieve this goal.[44]

In September 2009, the CUWCC updated its BMP guidelines for water loss control requirements for all signatory utilities. These updated water loss control guidelines are some of the most

[42] TWDB, "An Analysis of Water Loss As Reported By Public Water Suppliers in Texas. Texas Water Development Board," Prepared by Alan Plummer Associates, Inc. and Water Prospecting and Resource Consulting, LLC, Fort Worth, TX for TWDB, January, 2007, p. 1-7.

[43] *Ibid, p.1-9 to 1-13*.

[44] California Urban Water Conservation Council, "Memorandum of Understanding Regarding Urban Water Conservation in California," Sacramento, CA, September 2009, p.6.

comprehensive in the U.S. The goal of the guidelines is to "increase water use efficiency … and [develop] proper economic valuation of water losses."[45] The water loss control BMPs were updated to include very specific actions and schedules for developing water loss control programs, recognizing that haphazard or intermittent efforts in water loss control can result in inefficient and ineffective programs. The CUWCC is not a regulatory agency, and while its BMP guidelines are comprehensive, there are no sanctions on its signatory utilities for failing to follow these guidelines.

The BMPs call for annual water audit, data validation, calculation of economic value of real loss recovery, and data reporting. The program requires signatory utilities to cost-effectively reduce real losses, advise customers of possible leaks on their side of a meter, and routinely calibrate source and production meters. Further, each utility is required to conduct a component analysis of apparent and real losses and their causes by quantity and location and to set a benchmark or goal for optimal water loss conditions based upon the first four years of water audit data. Following completion of component analysis and benchmark establishment, water utilities are expected to demonstrate progress in water loss control performance each year for a period of five years with the intended goal of achieving the optimum efficiency.[46] Since the BMP guidelines have only recently been published, the effectiveness of these practices cannot be assessed at this time. However, numerous regulatory agencies and professional trade organizations are closely observing these practices in an effort to evaluate the outcome of these water loss control reporting, intervention, and benchmark requirements.

PHILADELPHIA EXAMPLE:

The PWD was one of the earliest implementers of water loss control programs in Pennsylvania and nationally. In the early 1990s, the aging and complex PWD water distribution system was believed to suffer high leakage, and metering and billing effectiveness was suspect. Starting in 1994, PWD implemented programs to address water and revenue losses, the foundation of which has been the compilation of an annual water audit report. In 2000, PWD became the first water

[45] *Ibid, p.22*.

[46] *Ibid, p. 22-24*.

utility in the United States to employ the IWA/AWWA Water Audit Methodology.[47] The annual water audit serves as both an assessment of current standing and a tracking tool to observe progress from year-to-year.

PWD has long been proactive in managing its water distribution system - one of the oldest in the United States - by launching a capital program for water main replacement in the 1960s and an ongoing leak detection program in the 1970s. But PWD increased its management efforts dramatically since it began to audit supplies routinely. Monthly billing was instituted in 1993, and the largest water utility automatic meter reading (AMR) system was installed from 1997-1999. With the more reliable billing data available from AMR, the utility estimates that its "Revenue Protection Program," to address apparent losses, has recovered $27 million since 2000; much of these recoveries stemmed from halting unauthorized consumption. However, on-going apparent losses are estimated to be 19 million gallons per day (mgd) with 67% of this resulting from accounting errors in the billing system as opposed to meter errors for water delivered but not billed. The missing revenue from these losses is estimated to be $27 million annually, so aggressive apparent loss control is still warranted. [48]

Real water loss (leakage) is addressed through traditional leak detection and repair surveys and water main replacement for pipelines that have reached the end of their useful life. These efforts have cut leakage levels in the PWD network from 96 mgd in the early 1990s to roughly 53 mgd in 2008, saving approximately $3.4 million/year in chemical treatment and electrical costs. The PWD spends approximately $800,000 annually on its active leak detection program and estimates that the water recovered from this program corresponded to $2.5 million in recovered revenue for 2008. PWD has improved its level of asset management by implementing a system-wide geographical information system (GIS), updated its hydraulic model, launched a new customer billing system in 2008, and is preparing to launch a new GIS-based computerized maintenance management system for its street-based infrastructure in 2010.[49] Using existing

[47] Philadelphia Water Department (PWD), "Annual Financial Report," , Philadelphia, PA, December 2008, p. 15.

[48] Kunkel, G., email correspondence regarding PWD water loss control program, January 19, 2010.

[49] *Ibid.*

tools, PWD has taken proactive steps to maintain accountability and gradually increase its water efficiency.

RESOURCES FOR IMPLEMENTING WATER LOSS CONTROL PROGRAMS

There are numerous federal, state, and regional programs and professional organization sources of education, information, and support for implementing and finding financing for water loss control programs. The USEPA's, Center for Environmental Finance website provides links to numerous federal programs that provide water infrastructure financing. Further, the USEPA maintains numerous Environmental Finance Centers (EFC) throughout the country that provide program guidance, education, and assistance to local and state government and water utilities regarding financing environmental projects. Four of the ten EFCs have developed programs specifically to address water and wastewater financing and are summarized below. The EFC at the University of Maryland has developed courses in equitable utility rate structuring and capital improvement planning. The University of North Carolina-Chapel Hill EFC has developed a database of low cost loan and grant sources for environmental projects in the southeast U.S. and has presented courses in environmental finance. The EFC at New Mexico Institute of Mining and Technology focuses on financing access for small communities. The Boise State EFC has developed numerous software programs that assist utilities in assessing their financial stability, evaluating their rate structures, and developing effective asset management and capital finance plans.

For information on best practices and water audits, the AWWA also has developed a comprehensive water audit methodology and offers free software tools. Asset management resources for water utilities are available at www.WaterEUM.org. Numerous publications addressing BMPs and technical developments for water loss control implementation are available through the USEPA, Office of Water and AWWA.

III. FUNDING MECHANISMS

There are numerous funding mechanisms available to all-sized water utilities for initiating and implementing water loss control programs. The categories of funding mechanisms are briefly discussed below and are intended to demonstrate a broad range of options. Existing federal, state, regional, public, and private funding mechanisms appear adequate for assisting water

utilities in the implementation of effective water loss control programs, although greater funding amounts and better coordination and networking of available funding sources is warranted. Attachment A includes a list of available funding mechanisms by category but is not intended to comprise an exhaustive list.

USER CHARGES

The largest source of revenues for water utilities is user charges from the sale of water produced, treated, and distributed to the customer. This revenue must not only address current expenses but is also the basis for repaying debt incurred through bonds or loans. According to USEPA and GAO studies, water utility user fees remain insufficient to meet current and future funding needs.[50]

Large water suppliers have the capability to spread the cost of new capital investment to expand, repair, and/or rehabilitate distribution over a large customer base, generally resulting in relatively small rate increase. Despite this ability, the 2002 GAO report found that user fees for 29% of large water utilities (serving more than 10,000 people) did not cover their full cost of service.

Small water suppliers lack this economy of scale, and even minimal capital investment, if covered by rate increases alone, can frequently result in a burden on their customers.[51] As previously mentioned, 83% of the community water systems are considered small water systems (fewer than 3,300 customers) and serve approximately 9% of the U.S. population. The number of small water systems presents a challenge at all levels of government in providing effective oversight, support, and funding for these systems to meet regulatory requirements.

Small water utilities might benefit from cooperative arrangements including partnerships or, possibly, consolidation to allow more efficient use of user charges and larger economies of scale to maintain and improve infrastructure. A 2008 EFAB report addressed the barriers and incentives for public-private partnerships in the water and wastewater sectors. The report

[50] USEPA, 2009a.; GAO.

[51] USEPA, 2008, p. 7-8.

recommended evaluating legal, tax, policy, and perception barriers to public-private partnerships and encouraging modification of these practices were appropriate.[52]

The 2008 NRRI report on small water systems includes recommendations for how state regulatory bodies can assist these utilities in improving compliance and financial performance. These recommendations were grouped into five categories, including (1) tailoring regulatory procedures to small systems, (2) policies to encourage regionalization, (3) certification of new small utilities, (4) cooperation and coordination between state commissions, primacy agencies, and stakeholders, and (5) establishing standards for asset management. Each of these categories, with the exception of (3), include specific actions that impact user charges and are intended to improve the financial performance of small systems. A summary is below.[53]

Recommended regulatory procedure changes include modifying rate change filing procedures to simplify the process for small utilities and changing ratemaking and accounting requirements, including allowing or encouraging (a) state commission staff to assist small utilities in rate cases, (b) flexibility in selecting rate of return, (c) capital improvement surcharges, (d) commodity cost rate adjustments, (e) rate indexing, and (f) escrow accounts for specified improvements. Policies recommended to encourage regionalization include requiring new system applicants to evaluate the feasibility of tying into an existing system versus creating a stand-alone system; allowing rate setting flexibility for acquisitions; and improving the authority of state commissions to induce acquisitions.[54] Mechanisms recommended for improving cooperation and coordination between state commissions, primacy agencies, and stakeholders include using memoranda of understanding to formalize objectives and responsibilities between these entities and consolidating economic and environmental regulation of water utilities, under one authority. State commissions in many cases set financial standards for water utilities but the ability to meet these standards are dependent upon effective asset management. The NRRI report recommends

[52] EFAB, "Public Private Partnerships in the Provision of Water and Wastewater Services: Barriers and Incentives," USEPA, Washington, DC, April 2008.

[53] Stanford, p. 11.

[54] *Ibid.*, p. 13.

that state commissions include asset management guidelines as part of their financial standards, if they have the legal authority to do so.

As previously discussed, political barriers to rate increases can arise when rate affordability is viewed from a community perspective. Consistent with a 2006 EFAB report, rate making procedures and regulatory oversight and guidance should encourage treating rate affordability from a household perspective and implement appropriate "subsidy, collection, and financial assistance" policies to address low income households.[55]

MUNICIPALLY ISSUED REVENUE BONDS

Many communities issue their own bonds directly to the marketplace. Although general obligation bonds (which pledge the full taxing power of a community) can be used to finance water projects, the more common type of municipal financing for water projects is revenue bond financing. Revenue bonds specifically do not obtain the full faith and credit of the issuer and, therefore, do not ordinarily require voter approval.

Revenue bonds are backed by a dedicated income stream. Since most water utilities charge a water use fee, water systems are excellent candidates for revenue bond financing; they pledge their user fee income to repay the debt incurred through the bonds. Depending on individual governmental structures, revenue bonds for water projects may be issued by the community that owns the facilities being financed or the community may have established a public authority with the power to issue revenue bonds on behalf of the water system.

Of particular note, since water and sewer systems have very good histories of collecting their user fees and repaying their bonds, in many instances water system revenue bonds may receive higher credit ratings than the general obligation bonds of their community.

For non-government-owned water utilities, revenue bonds are also an excellent method of financing capital projects. Under federal tax law, because of their public benefit, non-government-owned water projects are eligible for tax-exempt financing, with the benefit of lower

[55] EFAB, 2006, p. 5.

interest rates than taxable debt would carry, but they are identified as "private activity" projects because they are not owned by governmental entities. Tax law limits the volume of "private activity bonds" each state may issue on an annual basis ("volume cap"), and in addition to water projects, other public benefit projects like housing or airports are also included as private activity projects. Therefore, in seeking authorization to issue private activity tax-exempt bonds, non-government owned water utilities must compete for scarce annual private activity allocations. Unfortunately, water utilities frequently are not successful in obtaining volume cap because their projects are expensive and usually not very visible. Government officials in charge of allocating volume cap may often prefer projects that citizens can easily see over those whose benefits are generally buried beneath the streets.

In 2007, the National Association of Regulatory Utility Commissioners (NARUC) passed a resolution calling for new federal legislation to exempt water and wastewater projects from having to compete for state private activity bond volume cap. Such legislation would substantially assist many non-government-owned water utilities in obtaining lower costs, tax exempt financing that has been difficult to receive. In 2007, EFAB issued a letter supporting language in the 2008 proposed budget that would exempt from the state volume cap qualified water and wastewater projects financed using private activity bonds.[56] To date, legislation of this nature has not been enacted.

As part of the American Recovery and Reinvestment Act of 2009, Congress created a new kind of municipal bond, called Build America Bonds (BABs), which can be used for any governmental purpose. These are taxable bonds that either can be issued to provide a tax credit to investors or the issuer can opt to receive a direct interest subsidy payment from the federal government. BABs rapidly became popular because of the net interest savings that can be achieved in certain circumstances. The use of BABs versus traditional tax-exempt municipal bonds should not affect the projects being financed other than to provide additional savings when properly structured.

[56] Environmental Financial Advisory Board, letter supporting legislation to exempt from state volume cap private activity bonds to fund water and wastewater projects, USEPA, Washington, DC, April 2007.

FINANCING SECURITY

Large and/or Financially Healthy Water Systems

For those water systems that will issue debt to finance water loss reduction projects, there needs to be a mechanism by which debt (bond) holders are assured of repayment. For most communities issuing their own bonds, this mechanism is usually either a "general obligation" pledge of a community's "full faith and credit and taxing power" or a revenue pledge of the income stream derived from user charges.

Municipal Bond Insurance

Historically, in situations where a community's credit is lower investment grade, communities could purchase municipal bond insurance. Bond insurance guarantees investors the timely payment of principal and interest due on the bonds. Because investors traditionally valued bond insurance highly, even when a bond issuer had reasonably good credit ratings, the issuer might have purchased insurance to make its bonds more marketable, and as a result of the greater demand, achieved a lower cost of funds. Unfortunately, recent events in the financial industry have included the implosion of municipal bond insurers, as they were tied to some of the products that caused the financial crisis. Most of the municipal bond insurers who had triple-A ratings at the beginning of 2007 are either out of business or have stopped writing insurance. No municipal bond insurer currently has triple-A ratings from more than one rating agency. Indeed, Moody's does not rate any insurer "Aaa." From a high in 2005, when 57.1% of new bond issuance was insured, the insurance market has cratered, and in December 2009, only 8.7% of new issuance carried insurance.[57] Nonetheless, some bond issuers continue to be able to access bond insurance and it can provide additional security for water system bonds, providing savings in the total cost of the debt. Also, there is a possibility that bond insurance may again be more widely available in the future. A number of new or reconstituted municipal bond insurance companies are currently considering entering – or re-entering – the business.

[57] The Bond Buyer, December 31, 2009

Small Systems and/or Systems with Weak Credit

There are a variety of mechanisms that can be used for small systems and/or those with weak credit to enhance the security of their bonds. Although, the funding mechanism has been rarely used, State Revolving Funds (SRFs) are legally authorized under the Safe Drinking Water Act, to use the program to guarantee debt of municipal issuers. Particularly with the current limitations on the availability of municipal bond insurance, SRF program administrators may want to consider the value of using a portion of their equity to develop a guarantee program for small issuers or those with weaker credit.

Another opportunity that small water systems could take advantage of would be to develop a program whereby all revenues of the water system would go into a "lock box" held by a trustee. Only after the funds needed to pay bondholders were set aside, would the remainder of the revenues be released to the water system for its other uses, such as salaries, maintenance, etc. Lock boxes have a history of being a successful tool in helping small debt issuers market their debt – even if the primary purchaser of the debt is the local bank.

Finally, small systems can consider entering a pooling arrangement as a means to increase the size of the debt issuance, making it attractive to more investors, and/or to distribute risk. Over time, there have been various proposals to encourage regionalization among small water systems. Although some small communities are averse to ceding their autonomy to a larger water system, by regionalizing certain activities they may be able to achieve savings in both operating and financing programs.

For example, in the 1990s, at the request of the New York State Public Service Commission (PSC), the New York State Environmental Facilities Corporation undertook a financing on behalf of three small private water utilities. None of the three companies had the financial strength to issue debt on their own. By combining the financing into a pool and by cross-pledging revenues, the companies were able to successfully complete a financing. Although each of the utilities agreed to cover any shortfalls in debt repayment by any of the other

participants, the covenants in the financing required the defaulter to repay any shortfalls in full. The PSC agreed to allow the cross-pledges, which gave all of the participants the confidence that they would be allowed to raise rates, if necessary, to cover any shortfalls in the pool.

The bottom line is that even for small and/or weak water system credits, there are creative solutions available that will allow for financing necessary projects.

LOAN AND GRANT PROGRAMS

The following discussion addresses the federal loan and grant programs available to water utilities that could be used to implement water loss control. Select state administered loan and grant programs are addressed, including drinking water state revolving fund (DWSRF) and state energy programs (SEP); other state funding programs exist but are not discussed here. There are also regional and private organizations that provide grants and loans for community water development, but these are also not discussed here. Additional information on these programs can be found at most state websites.

In general, federal loan and grant programs prioritize water supply projects that are performing poorly (i.e., not meeting water quality requirements) and/or located in distressed areas. With the exception of designated "green" DWSRF projects, proactive projects to reduce water loss and increase efficiency would be eligible for funding under other federal programs, but they would likely receive lower priority compared with projects that specifically benefit distressed communities or improve water quality, and therefore, they would be less competitive for limited funding available.

Rural Utility Service

The U.S. Department of Agriculture oversees the Rural Utilities Service (RUS) that provides loans and grants to public and/or non-profit water utilities serving up to 10,000 people in rural areas. This program can provide emergency assistance grants to communities that have experienced a significant decline in the quantity or quality of drinking water.[58] For 2010, the RUS budget is $568 million.

[58] USEPA, 2008, p.7-7.

Community Development Block Grant

The U.S. Department of Housing and Urban Development administers the Community Development Block Grant (CDBG) program that provides grants to cities with populations less than 50,000 or counties with populations less than 200,000. While the CDBG program will provide funds "necessary to improve compliance and overall drinking water quality," the project must benefit lower-income people.[59] CDBG program funds are used for a wide variety of development projects, not exclusively drinking water related. The FY 2010 appropriation for the CDBG program is $3.99 billion.

Economic Development Administration

The U.S. Department of Commerce, Economic Development Administration provides grants which can be applied to drinking water projects but a project. However, in order to receive these grants, "must be located in a community determined to be economically distressed, and the project must be directly related to future economic development."[60]

Drinking Water State Revolving Fund

The DWSRF, which is administered by the states and funded by capitalization grants through USEPA and by state matching contributions, provides loan and grant funding to government and non-government owned water utilities. Funding requests are generally prioritized by state administrators in the following order: abatement of serious health risk, compliance with Safe Drinking Water Act standards, and assistance to water systems in disadvantaged communities.[61] With adoption of the 2009 ARRA legislation, additional funding priorities were specified for green projects and are discussed below.

Between 2000 and 2008, annual federal DWSRF funding ranged from $800 to 900 million with a total fund allocation since 1997 of approximately $16 billion. As part of the 2009 ARRA appropriation, $2 billion was set aside for DWSRF funding. Further, the ARRA legislation

[59] USEPA, "Sources of Technical and Financial Assistance for Small Drinking Water Systems," EPA816-K-02-005, July, 2002, p. 14.

[60] USEPA, 2008, p. 7-7.

[61] *Ibid., p. 7-5.*

stipulated that 20% of projects funded through the DWSRF must qualify as green projects, this requirement is also incorporated into the FY 2010 USEPA appropriation. For the 2010 budget, DWSRF funding is set at $1.39 billion, of which $278 million (20%) must be used for "green infrastructure, water or energy efficiency improvements."[62]

Green Project Reserve

The 2009 ARRA and FY 2010 appropriations for DWSRF require that 20% of the funds dispersed be marked as the Green Project Reserve (GPR) and used to fund "green" projects. A June 2009 guidance document prepared by the USEPA, Office of Water discusses the guiding principles for defining eligibility under the GPR for ARRA and includes a question and answer section addressing eligibility requirements for specific types of projects.[63] The GPR guidance provides a list of categorical projects and all other projects would require a business case to qualify. The business case must demonstrate that the proposed project represents "substantial benefits/savings compared to the average level of efficiency currently available" and that improved water and energy efficiency is an intentional part of the project, not simply an incidental benefit. Further, the business case must include technical and financial components. The technical component identifies and quantifies existing facility inefficiencies and addresses how the proposed project will improve efficiency. The financial component requires that estimates of water and cost savings be developed based on the technical components and that the associated savings represent a "substantial part of the financial justification for the project."

Current data for drinking water projects funded using ARRA funds indicates that projects whose goals include water loss reduction and were determined to be categorically eligible account for up to 63% of GPR projects nationally.[64] EPA expects that GPR policy emphasis on projects that achieve water efficiency through effective water loss control practices will help reduce water losses throughout the country. Also relevant to water loss reduction goals, GPR eligible projects

[62] H.R. 2996. *Making appropriations for the Department of the Interior, environment, and related agencies for the fiscal year ending September 30, 2010, and for other purposes*. http://thomas.loc.gov/cgi-bin/bdquery/z?d111:H.R.2996:, accessed December 10, 2009.

[63] USEPA, "American Recovery and Reinvestment Act, The Green Project Reserve," June 2009. http://www.epa.gov/water/eparecovery/docs/2009_6_22_GPR_Q_A.pdf., p. 1.

[64] DWSRF Green Project Reserve Funding Status, February 25, 2010. (DWSRF Comprehensive Benefits Reporting System)

achieved some important energy efficiency improvements in drinking water systems. Because transmission and treatment of drinking water can account for a large portion of utility energy expenditures, reduction of real water losses translates to reduced energy demand.

Water loss control projects qualify under the GPR guidance, provided the project is considered categorically 'water efficient' or it makes a sufficient business case for the efficiency benefits expected from the project. Water audits are "categorically eligible if they are required as a condition of assistance or if they are reasonably likely to result in a capital project." The guidance states that water audits may be funded as projects for planning and design or from set-asides for technical assistance. Other specific projects such as water line replacement or installation of water meters are also discussed. The GPR guidance stipulates that eligible water line replacement projects must supply "specific data documenting water loss" and "that the pipes to be replaced are the primary source of water loss." Additionally, line replacement projects must demonstrate that "substantial (not incidental) water and energy benefits" will result for the project to qualify under the GPR. Regarding water meter installation, projects to install meters in a system that is previously unmetered would "categorically" qualify under the GPR; however, projects to replace existing meters must make a sufficient business case to demonstrate improved efficiency.[65]

The USEPA Office of Water is drafting updated guidance addressing the GPR for 2010. The draft separates projects into four categories including water efficiency, energy efficiency, green infrastructure, and environmentally innovative projects. Each category is defined, its special principles stated, and examples of categorically eligible projects are provided. Further, the draft guidance clarifies requirements for demonstrating a business case with the overall goal that developing the business case be "adequate but not exhaustive."[66] While the draft guidance includes four separate project categories, it is possible for a single, well planned project to involve improvements in all four categories simultaneously. For example as water loss control technologies are advanced, it is reasonable to expect a new "environmentally innovative"

[65] USEPA, June 2009.

[66] USEPA, "2010 Clean and Drinking Water State Revolving Fund 20% Green Project Reserve: Guidance for Determining Project Eligibility," draft accessed February 18, 2010.

approach to water loss could result in "green infrastructure" that improves both "water and energy efficiency." While any project satisfying a single category would qualify under the GPR, it might be useful to consider prioritizing funding for projects that demonstrate qualification under two or more categories.

Projects do not have to be part of a larger capital project to be eligible for funding but may be for planning, treatment, or capacity development assistance that meet green objectives. For instance, small upgrades, or parts of projects whose sole purpose is to improve water or energy efficiency, are eligible. Whatever projects or project components are counted toward the GPR requirement, the project or project component must clearly advance the objectives articulated in the four categories of GPR.

Energy Efficiency Programs

The ARRA legislation allocated $3.1 billion for the USDOE SEP. The SEP through the USDOE Office of Energy Efficiency and Renewable Energy provides grants and directs funding to state energy offices to "address their energy priorities and program funding to adopt emerging renewable energy and energy efficiency technologies."[67]

The USDOE is encouraging the use of SEP funds in developing state administered revolving loan funds that could be used to support renewable and efficient energy projects. Since the energy production and water supply industries are so closely linked (energy production uses significant quantities of water and most water treatment processes are energy intensive), the U.S. DOE has acknowledged that improving water treatment efficiency will simultaneously decrease water and energy use.[68] According to the U.S. DOE Database of State Incentives for Renewables and Efficiency (DSIRE), there are 29 states that have energy loan programs that are intended support renewable and efficient energy technologies.[69] A brief review of these programs indicates that most of them are intended to support residential, local government, and

[67] US Department of Energy, State Energy Program, http://apps1.eere.energy.gov/state_energy_program/accessed January 26, 2010.

[68] Booth, Sam, "Revolving Loan Funds," guidance document prepared at U.S. DOE, National Renewable Energy Laboratory, July 2009.

[69] DSIRE, U. S. DOE, NC Solar Center, and Interstate Renewable Energy Council, Database of State Incentives for Renewable Energy. http://www.dsireusa.org/, accessed January 13, 2010.

commercial efforts to improve the energy efficiency of buildings. Therefore, it appears that state energy loan programs are primarily focused on building efficiency and do not specifically include water efficiency at this time.

IV. RECOMMENDATIONS

There is a projected annual shortfall in infrastructure spending ranging from $11 to $22 billion over the next 20 years. Although recent increases in federal funding for water infrastructure are helpful, government funding alone cannot cover the shortfall. Improvements in water infrastructure in the U.S. will require the drinking water industry to improve its business focus and require rate setting practices to support this improvement.

Water loss control programs have the potential to assist water utilities in effectively improving their infrastructure. To make water loss programs effective and encourage water utilities to implement these programs, the following recommendations are made.

1. Improved business focus and effective water loss control will make the best use of the financial resources available to water utilities. USEPA should encourage utilities to initiate practices to improve asset management and implement environmental management systems.

2. Increased utility funding will be necessary to initiate, implement, and continue water loss control programs. This can be accomplished through existing funding mechanisms such as user charges; federal, state, public, and private grant and loan programs; and revenue bonds. New types of funding mechanisms do not appear necessary. However, improved networking and coordination among regulatory agencies and stakeholders may be warranted to utilize the funds available more effectively.

3. Obstacles to implementing utility full cost rate pricing should be addressed. By maximizing the use of reasonable financing mechanisms and incorporating a household affordability rather than community affordability focus to rate making practices, communities can better meet their capital requirements and minimize the cost burden on their low income residents.

4. EFAB endorses water audit and asset management programs as excellent tools to assist in decreasing water losses. However, whether a state mandates or provides incentives to perform water audits and asset management programs as part of the SRF funding process, should be determined on a state by state basis. EFAB notes that where Green Project Reserve qualification requires that a business case for improved efficiency be demonstrated, a water audit and an on-going asset management program are the best means to accomplishing a successful business case. States may consider ranking strategies for SRF funding applications that provide an incentive for projects that include implementing water loss control and for systems with existing, successful water loss control programs.

5. States should be encouraged to implement or clarify requirements for water loss reporting and control. Further, state regulatory agencies should provide assistance for implementing water audit practices, especially for small water supply systems.

6. Water projects that do not automatically meet categorical criteria for "green project" status should still be able to qualify for the Green Project Reserve program provided that sufficient business case for improved efficiency is established.

7. Small water utilities experience additional challenges in obtaining sufficient financing to implement water loss control projects. Regionalization, consolidation, and cooperative partnerships are mechanisms that might assist small utilities to improve their economies of scale, decrease expenses, and provide better access to limited funding sources. Where feasible and appropriate, regulatory agencies should facilitate small utility consolidation or other service provider relationships, usually with larger neighboring utilities that can provide infrastructure management and financing more efficiently.

V. CONCLUSION

Water infrastructure spending is critically underfunded in the U.S. which is compounded by the fact that user fees charged by many water utilities do not meet operating expenses. Water loss control programs have the potential to encourage effective infrastructure investment, resulting in

improved water efficiency, savings of a scarce resource, and lower long-term costs. The benefits of effective water loss control programs include improved water and energy efficiency and decreased emergency repair costs. Existing funding mechanisms appear adequate to provide financial resources for implementing water loss control; although, increased funding amounts, especially in the form of full cost of service pricing, are warranted. Full-cost pricing can include the cost of servicing the debt incurred in the various financing programs described in this report. The wise use of financing programs can help communities smooth out their debt repayments and minimize required user charges.

To reduce water losses in the US, water utilities should employ existing management tools and available funding mechanisms to increase effectiveness, save money, and preserve valuable resources, simultaneously.

ATTACHMENT A

SUMMARY OF FUNDING MECHANISMS
APPLICABLE TO WATER LOSS REDUCTION PROJECTS

Funding Mechanism	Description	Eligibility Limits
REVENUE		
Fees and Charges		
User Fees	Full cost of service pricing	
Connection Charges	Fee to connect with water utility	
Water and Sewer Capacity Credits (Access Rights)	Charged on a one-time basis to new users requesting access and existing users requiring increase in capacity.	
Franchise Fees*	Imposed by state or local government on new business	
State Public Water Withdrawal Fees*	Charged for permits for large quantity public water withdrawals	
Extractions (Proffer)*	Financial obligations placed on developers to aid local government in providing public services to new developments	
Special Assessments*	Recurrent surcharges levied by local jurisdictions on a subgroup that directly benefits from the improvement	
Impact Fees*	Assessed on new construction for improvements to public services	
Pricing Mechanisms	*Demand-Side Management Pricing* (Peak Load or Critical Peak Pricing): refers to a unit pricing structure that is sensitive to time of usage during peak demand (daily, seasonally, etc.)	
	Tiered Pricing: charge per unit water used increases as usage increases in block volumes	
Taxes*		
Bonds		
General Obligation*	Backed with the guarantee that the issuing government will use its taxing power to repay them	
Revenue	Debt is serviced by revenue generated through operating the project being financed	
Certificates of Participation	Instruments used to finance capital projects where the certificates are backed by the leasing of property or physical assets	
Double Barrel*	Municipal revenue bond secured by two or more sources of payment such as user fees and taxes	
Private Activity	Bond issued by local or state government to finance a private entity (in this case water utility)	
Special Assessment	Finance specific public infrastructure projects that directly benefit limited, identifiable areas and are secured by special taxes, charges, or fees	

Note: * indicates that the funding source is available only to government owned water utilities

ATTACHMENT A
CONTINUED

Funding Mechanism	Description	Eligibility Limits
GRANTS		
Federal Programs		
USDA*	Rural Utilities Service (RUS), Technical Training and Assistance Grant Pgm	x
	Rural Development, Grants for Water and Wastewater Revolving Funds	x
	Business and Cooperative Programs: Rural Business Enterprise Grants	x
Commerce*	Economic Development Administration, Public Works and Economic Development Grants	x
US HUD*	Community Development Block Grants (CDBG) Entitlement Communities Grants	x
State Programs		
	State Program for Non-Entitlement Areas, funding supplemented by CDBG*	x
	Drinking Water State Revolving Fund (DWSRF) Loan Principal Forgiveness, capitalized by federal funds administered by USEPA	

Note: * indicates that the funding source is available only to government owned water utilities

ATTACHMENT A
CONTINUED

Funding Mechanism	Description	Eligibility Limits
LOANS		
Federal Programs		
USDA*	RUS, Water and Waste Disposal Systems Loans for Rural Communities	x
	Business and Cooperative Programs, Economic Development Loans	x
Regional, State, Local Programs		
State Revolving Funds (capitalized with federal funds allocated by USEPA)	DWSRF loans	
	DWSRF Pre-Financing and Short-Term Loans: SRF funds can be used pre-finance projects approved for other federal or state long-term loans. Also, SRF short-term loans can be used for planning, design, or groundbreaking for projects that are subject to long-term financing	
Appalachian Regional Commission	Grant types include regional, area, and local district development and research, technical, and demonstration projects in the Appalachia region	x
Co-Funding	Combining different forms of funding to finance a single project	
Montana	Renewable Resource Grant and Loan Program	x
Nevada	Financial Assistance for Drinking Water Systems Program	x
Pennsylvania	Growing Greener Program	x
Private		
Co-Bank	A financial cooperative that is part of the Farm Credit Service	x
Commercial loans	Public finance departments of commercial banks and financial institutions	
North American Development Bank, Border Environmental Cooperation Commission	Funded bi-laterally by U.S. and Mexico to finance border projects including improved water treatment	x
Private Investment	Private investment in public utilities is limited by federal law	

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ATTACHMENT A
CONTINUED

Funding Mechanism	Description	Eligibility Limits
CREDIT ENHANCEMENT		
Pooled Financial Programs (PFP)	Pooling refers to uniting or aggregating utilities belonging to different entities to seek cooperative financing, loans or bonds. PFP can result in lower interest rates, lower issuance costs, and allow small utilities to take advantage of financial product economies of scale.	
Bond Insurance	Legal commitment by an insurance company to make principal and interest payments on debt in the event the issuer is unable. In general, bond insurance reduces interest cost to issuer, provides security to investors, and improves secondary market liquidity.	
State Bond Banks	Resource for communities to obtain financing on improved terms.	
State Loan/Bond Guarantees	A form of credit assistance offered by states intended to reduce the costs for bond issuers and loan recipients	
Letter of Credit	Generally issued by commercial banks and used to enhance credit	
Senior and Subordinated Debt Structuring	Provides two categories of debt for loan recipients. Senior debt is required to be repaid first in the event of default or payment delay. Subordinated debt is paid only after senior lenders are paid. Serves as a credit enhancement for the senior lender.	
SRF Interest Rate Subsidies	Enhance credit for borrowers because subsidies reduce the cost of loans	
SRF Cross-Collateralization	Allows SRF funds to be used to leverage grants or loans from other public funding sources	
Pay-As-You-Go	Financing some or all costs through revenue, tax, fee, etc sources rather than by debt.	
Refinancing Loans	To lower the interest rate on a debt or extend the repayment period	x

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References:

U.S. EPA, 2007. *Tools for Financing Water Infrastructure*. U.S. Environmental Protection Agency, Office of the Chief Financial Officer, Office of Enterprise Technology and Innovation, Environmental Finance Staff, March.

U.S. EPA, 2008. *Guidebook for Financial Tools: Paying for Environmental Systems*. U.S. Environmental Protection Agency, Office of the Chief Financial Officer, Environmental Finance Program, August.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF
WATER

A. James Barnes
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Dear Mr. Barnes:

Thank you for your letter of March 31, 2010, providing a summary of the Environmental Financial Advisory Board (EFAB) report, "*Water Loss Reduction Financing Mechanisms for Drinking Water Distribution Systems*," for the Office of Water's consideration and use. I appreciate the significant time and effort that the EFAB spent in conducting research and in preparing the report.

We value your suggestions and appreciate the EFAB's willingness to engage the Office of Water on our water loss outreach efforts and Green Project Reserve guidance with regard to water and energy efficiency. We also appreciate the opportunity to submit comments and participate on the revision of report drafts. The recommendations provided in your report support our ongoing efforts for water loss reduction and substantiate the need for water loss reduction projects.

Again, thank you for your assistance with this important effort. If you have any questions, please contact Cynthia Dougherty, Director of the Office of Ground Water and Drinking Water, at (202) 564-3750.

Sincerely,

Peter S. Silva
Assistant Administrator