THE FUTURE OF WATER CONSERVATION: CHALLENGES AHEAD

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Starting with a brief historical retrospective on the milestones that have shaped the field of water conservation to make it what it is today, this paper discusses some of the challenges and opportunities that are redefining the future of conservation.

1980-2000: A RECAP

The 1980s and 1990s marked major advances and milestones in the field of urban water conservation in the United States. At least seven important developments come to mind while looking back over the last two decades. These are:

Industrial and Commercial Recycling

By the early 1980s, the U.S. Clean Water Act had prompted some industrial and commercial water users to implement measures to reduce wastewater pollution discharges, many of which also saved water through improvements in equipment, processes, and the introduction of on-site reuse and recycling systems.

Landscape Irrigation

The 1980s also witnessed the advent of "Xeriscape" (a trademarked term) or water-efficient landscape design and management concepts, practices geared to *permanently* reduce excessive irrigation rather than just as a temporary response during drought.

Efficient Plumbing Fixtures

Distribution of plumbing fixture "retrofit kits" by a number of water and energy utilities in the 1980s and early 1990s helped save water and energy in homes, business, and public properties, and their public acceptance also helped spur demand for additional fixture efficiency improvements. In 1992, the U.S. Energy Policy Act established national water efficiency requirements for plumbing fixtures that set maximum flow rates of 1.6 gallons per flush (gpf) toilets, 1.0 gpf for urinals, 2.2 gallon per minute (gpm) (@ 60 psi) for showerheads, and 2.2 gpm for faucets for all new and replacement fixtures. This new generation of fixtures saves 30-60 percent of water use over previously-installed high-volume models.

Efficient Household Appliances

By the mid-1990s, appliance manufacturers had also begun to voluntarily introduce high-efficiency clothes washers and dishwashers that used 30-50 percent less water than conventional models.

Water and Sewer Pricing Efficiency

During these same decades, a growing number of water utilities adopted inclining water and sewer rate structures designed to charge more per unit of volume as the customer's usage increases. These inclining structures are used as a pricing incentive to promote more efficient use.

National Conservation Information Clearinghouse

A national information clearinghouse on water efficiency, "Water Wiser," is established and located at the headquarters of the American Water Works Association in Denver with financial backing from the EPA and the U.S. Bureau of Reclamation.

Federal Water Conservation Planning Guidelines

In 1998, the U.S. Environmental Protection Agency, as per amendments to the Safe Drinking Water Act, established voluntary (and in some cases mandatory) baseline water conservation planning guidelines for water utilities.

No doubt, these accomplishments reflect important breakthroughs in the status and impact of conservation in the mainstream water utility industry, but the extent of their implementation also reveals critical issues and challenges that remain to be addressed.

THE 21ST CENTURY: OPPORTUNITIES AND CHALLENGES AHEAD

Despite the progress outlined above, the *large-scale* adoption of water efficiency measures, policies, and comprehensive programs is still very rare, at least among U.S. water suppliers, as witnessed by the paucity of water suppliers that can report significant *systemwide* water demand reductions as a result of their conservation efforts. For example, it is only the Massachusetts Water Resources Authority (serving metropolitan Boston) and the city of Albuquerque, New Mexico, which can report major systemwide demand reductions, 25 percent and 18 percent, respectively, as a result of their aggressive conservation efforts. A few other systems, such as New York City, have also realized substantial water savings and wastewater volume reductions that have allowed them to avert major infrastructure expansions and avoid the related costs.

What does this mean? It means that we have yet to see the full potential of water conservation, that we really don't have any idea of what a "sustainable water use system" really looks like. It reveals that despite the existence of a plethora of water efficiency technologies, products, and practices that can be applied to each water use sector, thus far, practical "water conservation programs" as implemented by water utilities, are very limited. These programs usually include the distribution (though not necessarily *installation*) of retrofit kits, possibly a toilet and/or clothes washer rebate offer, "sensible" landscape irrigation advisories, and lots and lots of public education with no follow-up to assist water users to install or adopt practices that result in permanent water use reductions.

At present, the underlying assumption or statement that follows the meager results of deficient conservation programs is that "I guess this is all that conservation offers," suggesting that conservation is a limited option for solving water supply deficits or infrastructure capacity shortfalls. Following this approach, more than a few water utilities are now pursuing costly supply-side "solutions," effectively abandoning their persistent problem of system water use inefficiencies.

<u>System Leakage: The Great Untapped Water Supply</u>

System water leakage is chronically underestimated, ignored, or treated as a tired "Unsolved Mystery" by most water suppliers, yet it is one of the most cost-effective and accessible sources of additional supplies available. For any given water system, it is common to note that the utility itself is the largest contributor to this water waste. It is interesting how much wasted water this category of use demands - and also why it is so often ignored.

How much water can be recovered by reducing system leakage? In some cases, a considerable amount. System unaccounted-for water (UFW), usually described as the percent of total water produced, is a measure of both leakage and unmetered uses. While the portion of UFW that is recoverable leakage varies among systems, it is often about 60 to 75 percent of UFW. Unaccounted-for water is typically reported to range from about 15 to 25 percent among U.S. water suppliers, although it is sometimes higher. Leakage is common in older systems in particular, with losses sometimes over 40 percent of production. A recent study of three municipalities in Vermont found UFW to range from 37 to 46 percent. During the 1980s, the City of Boston's UFW exceeded 50 percent (a situation that has since improved greatly). The American Water Works Association has established a recommended guideline of a maximum of 10 percent UFW, but few utilities actually meet this voluntary standard.

Historically, utilities have balked at including UFW evaluations and measures to recover lost water in water conservation plans as high loss figures are politically embarrassing, particularly when a utility is in the process of making expansion plans due to supply shortfalls. The truth is, many water systems don't know and/or do not report correct UFW figures. Production meter errors, customer meter reading errors, and a host of other factors contribute to a fuzzy understanding of "water losses," both on the part of the public as well as utility managers. To begin to address the problem of system water loss and waste, water conservation plans should *automatically* include an evaluation of system water efficiency as well as steps to minimize waste and avoidable leakage.

<u>Reuse: Put It In It's Place</u>

Aquifer recharge, golf course irrigation, and industrial applications are some of the beneficial uses of greywater. Reusing water clearly makes sense when it would otherwise be wasted, but is reuse a cost-effective solution to address the problem of excessive irrigation on a *systemwide* basis?

Other than supplying specific facilities with high water demands that can utilize greywater in a cost-effective manner, the infrastructure and cost impacts of constructing a reuse network when applied on a systemwide basis to provide for discretionary irrigating landscapes may easily be underestimated. Properties connected to a dual system would also double utility customer meter purchase and repair costs as well as related reading and billing requirements. Greywater systems, like those for potable supplies, will inevitably leak. This implies that dual water systems could double the ongoing audit and repair work and costs that are inimical to every water system's operation. As discussed above, few utilities are adequately addressing the problem of water losses now; what makes us think that reuse systems will be managed any more efficiently?

Reuse is increasingly being touted as a new "solution" to meet water demands -- typically residential irrigation needs, but this supply-side approach is not a panacea. The average American single family home does not produce enough greywater from indoor uses to satisfy the volumes of irrigation water that are commonly applied to lawns, so the moniker of it being a "sustainable use" system is misapplied. Further, per capita indoor residential water use is declining as new water efficient plumbing fixtures and appliance are installed -- and it is projected to continue to decline for another 20-25 years as existing high-volume models are replaced -- so even less greywater will be available per household in the future. Perhaps the best example of a reuse system being an inadequate approach to the problem of high outdoor water use is the City of St. Petersburg, Florida. St. Petersburg has one of the oldest and largest dual water systems in the U.S., yet for several years it has pursued conservation programs to reduce (primarily) residential water demands. Problem solved?

CONCLUSION

In closing, a glimpse of the potential for saving water has been shown by a small number of water utilities that have implemented conservation programs, yet no U.S. water supplier has yet to exploit water efficiency's full capabilities to optimize customer water demands. Similarly, utilities themselves are all too often lax in addressing their own water use inefficiencies, as evidenced by the high rate of system water leaks and losses among water systems themselves. Despite the great promise of water conservation to enable the public and non-residential customers to live within their water means, in reality few utilities have made significant investments in conservation programs to make much of a difference. To some extent, this may explain the growing water industry trend toward supply-side approaches such as reuse of treated wastewater in meeting future water needs.

Amy L. Vickers, President, Amy Vickers & Associates, Inc., based in Amherst, Massachusetts, is an engineer with a consulting practice specializing in water conservation that serves water utilities, agencies, private companies, and various other organizations throughout the United States and overseas. She is the author of *Handbook of Water Use and Conservation*, to be published and released by CRC Press/Lewis Publishers in July 1999. The book will provide the first comprehensive treatment of water efficiency measures and their related benefits and costs for all water use sectors - residential, industrial-commercial-institutional, landscape-irrigation, and agricultural. Amy holds an M.S. in Engineering from Dartmouth College and a B.A. in Philosophy from New York University. She is an active member of the American Water Works Association's Conservation Division and is an appointed member of the Advisory Board for Journal AWWA.