Tech Brief
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Water Efficiency and Conservation

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Summary

Water is a limited resource, and in many areas—especially those plagued by drought—future water supplies are so uncertain that many worry whether usable water will be exhausted. If water supplies were depleted, the impact on economic and social interests would be profound: businesses would likely fail, agriculture would dry up, and many towns might end up like ghost towns of the Old West. This *Tech Brief* discusses those measures and elaborates on other means that small systems can take to save, reduce, and use drinking water more efficiently from filtration to the customers' tap.

Because water is inexpensive, citizens and utilities have little incentive to reduce water use or loss. Raising water rates may overcome this hurdle, but that often comes with its own set of issues. Fortunately, there are other ways to conserve water. Filter backwashing, filter wash water recycling, maintenance procedures, metering, leak detection, water theft prevention, appropriate rate setting, and public education are key ways small systems can reduce water use.

Filter Backwashing

Rapid sand filters, pressure filters, and even membrane filters must be backwashed regularly—a process that uses potable water. During times of shortage, system operators worry that backwashing filters takes too much clean water and may be tempted to cut back. Limiting the filter wash rate or duration is usually not a good idea, because it can compromise water quality and shorten filter media life.

To overcome any anxiety about backwashing, systems can find ways to make filter backwashing as efficient as possible. Most plants have the capability to adjust the backwash rate and duration of the cycle. Careful adjustments to the backwash pressure assures that neither water nor filter media will be lost. Ways to maximize filter backwashing include surface washing, air scouring, and hand raking to clean the filter media.

Filter Wash Water Recycling

When a rapid sand filter or membrane filter is backwashed, the backwash water usually goes to a sediment basin or the sewer system. If the backwash water goes to a sediment basin, it is given time to settle, and then the top layer of water can be transferred—pumped, siphoned, or gravity flowed—to the head of the water treatment plant where it's mixed with the raw water coming in to the water plant instead of discharging to the sewer or receiving stream.

Mixing backwash water with raw water recycles it. In some locations, recycling backwash water is mandatory even if there is no drought. The federal regulation that addresses recycling backwash water is called the Filter Backwash Recycling Rule. Because the filter backwash water will have more concentrated contaminants, the rule states that water systems cannot use more than 10 percent mixture of the backwash water with the raw water that is normally used at the water plant.

During times of drought, this filter backwash water can be very helpful. But, if the water system has no means of recycling the backwash water, the water treatment plant can retrofit portable pumps and piping from the backwash sediment basin to create its own system.

If the water plant has no basin and the backwash water goes straight to the sewer system, the plant may divert piping to a temporary sediment basin with a transfer pump and piping to use the top layer after

settlement. This setup could help small systems get through the dry spells. Keep in mind any changes such as this will likely require state primacy agency approval first.

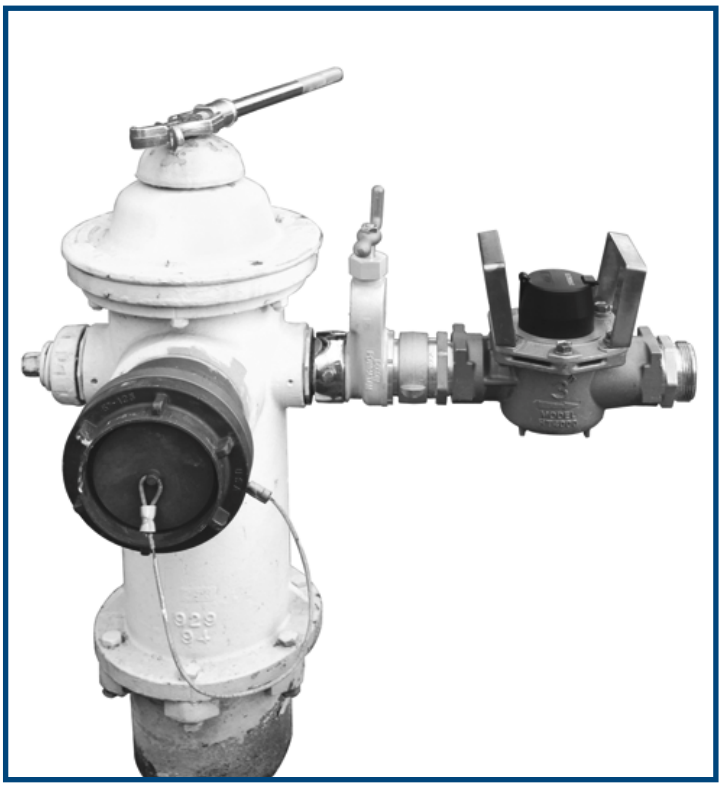
Maintenance Flushing and Public Water Use

When customers' water use is restricted, nothing irritates people more than seeing an automatic flush hydrant or fire hydrant dumping water on the ground. Many people do not realize that flushing the distribution system is necessary maintenance—especially when water use is restricted. Because there is less turnover in the water storage tank, flushing may need to be done more frequently. To conserve water that must be flushed for maintenance purposes, a water system should:

- communicate to customers that flushing is a necessary maintenance program. To get the word out, use the consumer confidence report (CCR), the consumer bill, public service announcements, newspapers, and radio;
- schedule the flushing with the local fire departments or department of highways so they can fill their tankers and trucks for non-drinking water use;
- check with local sewer authorities to see if they need water for flushing their collection lines;
- contact local landscape contractors—because they use a lot of water—maybe even sell them the water at a reduced price if they pick it up at specific locations;
- contact local farmers who may have ponds drying up and need water for livestock use or irrigating crops; a program could be set up through the extension office or the Farm Bureau;
- in extreme situations, water could be hauled back to the water treatment plant and retreated.

Metering Is Key

Meters at the water plant can show how much raw water is pumped, treated, or produced. Master meters at connection points and meters at customer connections will not only help with billing, but can be used to reveal water loss through leaks. Although the system should plan to meter sources, unmetered source water can be estimated by multiplying the pumping rate by the time of operation based on electric meter readings.



Hydrant water meter (top) and meter installed. Images courtesy of Pollardwater.com.

All customers should be metered. Metered customers use considerably less water than unmetered customers because they know they must pay for any misuse or negligence. Keep in mind that meters should be tested and calibrated every seven to 10 years.

Accounting for as much of the water in the system as possible is important for revenue and efficiency purposes. Even though some water isn't regularly metered, such as the water used for fighting fires and flushing

maintenance, the water used for these situations can be estimated. Some systems may have access to temporary meters, which can be invaluable when water use must be monitored.

Leak Detection

If a utility makes great efforts to conserve water, its customers are more likely to cooperate with water conservation programs. In *Economics of Leak Detection,* E.E. Moyer states that of the many options available for conserving water, leak detection is a logical first step. A highly visible leak detection program encourages people to think about water conservation before they are asked to take action to reduce their own water use. When leaks are repaired, the water savings realized not only reduce the power costs to deliver water, it also reduces the chemicals needed to treat water and the costs of wholesale supplies.

According to the paper *Using Water Efficiently: Technological Options*, old and poorly constructed pipelines, inadequate corrosion protection, poorly maintained valves and mechanical damage are major factors contributing to leaks. In addition to loss of water, leaks reduce pressure in the supply system. Raising pressure to compensate for such losses increases energy consumption and can make leaking worse, as well as causing adverse environmental impacts.

Part of the leak detection program a water system should have in place is a water accountability report. This report will show the system how much water is being lost. To estimate unaccounted for water, use the amount of water produced, raw water pumped, or water bought through the master meter, minus water sold to customers and water used for maintenance. The difference is the unaccounted for water that is usually water lost through leaks. The American Water Works Association (AWWA) and most state primacy agencies stress that unaccounted for water should never exceed 15 percent.

Other strategies for a leak detection program include regular onsite testing using computer-assisted leak detection equipment, a sonic leak-detection survey, or another acceptable method for detecting leaks along water distribution mains, valves, services, and meters.

Each system should institute a loss-prevention program, which may include pipe inspection, cleaning, lining, and other maintenance efforts to improve the distribution system and prevent leaks and ruptures. Whenever possible, utilities might also consider methods for minimizing water used in routine water system maintenance procedures.

In times of shortage, water use may be severely restricted and that's when water theft becomes an issue. Stepping up efforts to reduce or eliminate illegal connections and other forms of theft will save both money and water. Even if your water meters feature auto touch or drive-by reading it's still a good idea to have the meter reader visually check each meter for signs of tampering.

Water Rate Setting

According to AWWA, water rates should reflect the real cost of water. Most water rates are based only on a portion of what it costs to obtain, develop, transport, treat, and deliver water to the consumer. Experts recommend that rates include not only current costs but those necessary for future water supply development. Only when rates include all costs can water users understand the real cost of water service and consequently, the need to conserve.

Political objections and constraints to increasing water charges are often seen as insurmountable. However, low water charges encourage consumption and waste and can put pressure on operations and maintenance budgets, leading to poor water treatment and deterioration in water quality.

Many communities are implementing rate structures known as conservation rates that increase as water use increases. But, warns Carl Brown, a rate expert from Missouri, although "conservation rates might cause water wasters to waste less, the savings will probably be far less than you would think. Many of those water wasters are affluent, and they love their beautiful green lawns so much that their water bill could triple —and it still wouldn't curb their water use.

"However," he continues "even if conservation rates don't cause conservation, they will end up collecting more money from those who generally can afford to pay more. It is important to have very strong reserves if you adopt aggressive conservation rates. That is because your rate revenues, especially those high-volume sales, are extra sensitive to sales fluctuations."

Many utility managers argue, correctly, that an effective water conservation program will necessitate rate increases. A reduction in water use by customers in response to a water conservation program can decrease a water utility's revenues, and the utility may need to re-examine the water rate structure needs and possibly raise rates to compensate for this effect.

In some communities, water managers are using social psychology to affect consumer water use. In the monthly bill, these utilities provide a simple comparison of the current

month's use to the month just past, and the current month's use compared to the same month last year. But, they take it a step further by showing the consumer's use compared to average uses in their neighborhood.

"By nature, humans are very competitive," says Lauren Lucas, Ph.D., a Florida-based psychologist who consults on water-use behavior change. "If you thought your neighbor was doing better than you—in this case using less water—your competitive spirit may kick in to see if you can save more."

Provide Conservation Information and Education

Water systems should be prepared to provide information to their customers. Consumers are often willing to participate in sound water management practices if provided with accurate information. A public education program should explain to water users all of the costs involved in supplying drinking water and demonstrate how water conservation practices will provide water users with long-term savings.

Systems can include inserts in their customers' water bills that provide information about water use, costs, or conservation tips. School programs can be a great way to get information out. Systems can provide information on water conservation and encourage the use of water conservation practices through these programs. Regardless of the method used, the more people know about water conservation the more they'll want to save and the community will be better off for it.

More Information

On Tap magazine has published several articles that may be of use in community water conservation efforts.

- "You'd be Surprised Who's Stealing Your Water" (Winter 2004) is available at: **www.nesc.wvu.edu/pdf/dw/publications/ontap/magazine/OT_WI04.pdf**
- "The Future Starts Now: Setting Rates Helps Systems Today and Tomorrow" (Winter 2007) is available at: *www.nesc.wvu.edu/pdf/dw/publications/ontap/magazine/OT_WI07.pdf*
- "Conservation Rates" (Spring/Summer 2010) is available at: **www.nesc.wvu.edu/pdf/dw/publications/ontap/magazine/OTSPSU10_features/Conservation_Rates.pdf**
- "Using the Water Bill to Foster Conservation" (Winter 2010) is available at: **www.nesc.wvu.edu/pdf/dw/publications/ontap/magazine/OT_WI10.pdf**

The U.S. Environmental Protection Agency's Water Conservation Plan Guidelines may be downloaded at **www.epa.gov/watersense/docs/title_508.pdf**

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