CHANGE DOESN'T COME EASY
Understanding Behavior to Encourage Conservation Goals

Also in this Issue:
- What Private Well Owners Need To Know About Water Testing
- Plan to Protect Drinking Water: Why Are Source Water Protection Plans Important?
- How to Flush Distribution Lines
- Water Efficiency and Conservation
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.
The Director’s Perspective

We are all now painfully aware of the impacts the economic downturn has had on the American family, the job force, and our perception about the future. Regardless of your stance in the current Congressional budgetary debate, certain realities exist that shouldn’t become victims of our national efforts to become more fiscally responsible. The necessity to support the provision of adequate drinking water and wastewater services to all sectors of our society is one of those realities. Unfortunately, the unequivocal fact of the interdependence between the level of public health afforded by these water services and our economic well-being is at risk of becoming lost.

Here at the National Environmental Services Center (NESC), we recognize that it is in our nation’s interest to provide the technical support, education, and training that must go with new infrastructure development and societal changes. Most of you appreciate this, but it may not be so easily apparent to Congress when faced with the critical issues of today. Federal support through the U.S. Environmental Protection Agency and U.S. Department of Agriculture for technical assistance has already become a casualty for many service providers in the water arena, such as NESC. Federal funding to continue the training programs that benefit you, the products that help you daily and the information you need to do your job is simply at risk of going away or already gone. Without a Congressional understanding of the importance of drinking water and wastewater service programs, they lose national priority compared to other interests.

Stay informed on the issues our elected officials are wrestling with, help them keep our national priorities in their proper perspective and… keep up the good work!

Regards,

Gerald R. Iwan Ph.D., Director
RDUS Loan Rates

Interest rates for Rural Development Utilities Service (RDUS) water and wastewater loans—issued at three different levels: the poverty line rate, the intermediate rate, and the market rate—have been announced. The rate applied to a particular project depends on community income and the type of project being funded.

To qualify for the poverty line rate, two criteria must be met. First, the loan must primarily be used for facilities required to meet health and sanitary standards. Second, the median household income of the area being served must be below 80 percent of the state’s non-metropolitan median income or fall below the federal poverty level. For 2011, the federal poverty level is $22,350 for a family of four.

To qualify for the intermediate rate, the service area’s median household income cannot exceed 100 percent of the state’s non-metropolitan median income.

The market rate is applied to projects that don’t qualify for either the poverty or intermediate rates. The market rate is based on the average of the Bond Buyer index.

The rates, which apply to all loans approved on or after May 23, 2011, are:
- poverty line: 2.875 percent;
- intermediate: 3.75 percent; and
- market: 4.75 percent.

Rates approved before May 23, 2011, are:
- poverty line: 4.50 percent;
- intermediate: 4.625 percent; and
- market: 4.75 percent.

RDUS loans are administered through state Rural Development offices, which can provide specific information concerning RDUS loan requirements and applications procedures.

For the phone number of your state Rural Development office, contact the National Environmental Services Center at (800) 624-8301 or (304) 293-4191. The list is also available on the Rural Development Web site at www.rurdev.usda.gov/recd_map.html.

EPA Has Website for Regulatory Activities

In an effort to enhance understanding of its regulatory process, the U.S. Environmental Protection Agency (EPA) has developed a website called Reg Stat. The site provides information about documents the agency has published in the Federal Register between 2005 and 2009, including in-depth information about rule making.

The site notes, “EPA protects public health and the environment in a variety of ways, but one of the most important ways is through the development of regulations. EPA regulations cover a range of environmental and public health protection issues, from setting standards for clean water and establishing requirements for proper handling and reductions of toxic wastes to controlling air pollution from industry and other sources. Each year, the Agency develops a considerable number of rules, which address highly technical, scientific, and complex environmental problems.”

Learn more about Reg Stat by going to www.epa.gov/regstat.
Enhancing Community Resilience

The Association of State Drinking Water Administrators (ASDWA) has created a community guide about preparing for and dealing with water outages. “Water Emergency Roundtable—Outline for Discussion” describes a basic method for hosting a one-day workshop addressing a community water emergency.

“This is a low cost approach, which can be helpful in enhancing collaborative partnerships among state drinking water programs, water utility organizations, and the communities that they both support,” the ASDWA document states. “It also goes a long way toward helping those communities better engage with their own emergency and utility service providers to create an effective and efficient foundation for community resiliency. We hope that utilities, communities, and states will find it useful.”

Learn more about the guide by going to http://securitynotes.asdwa.org/2011/01/03/water-emergency-roundtable—outline-for-discussion/.

Water Demand Will Soon Exceed Supply

The American Association for the Advancement of Science (AAAS) expects water demand to exceed water supply by 40 percent in the next 20 years, according to a February 28, 2011, report from the association’s annual meeting.

Because close to 90 percent of the world’s fresh water supplies are consumed for food and energy production, the world’s water provisions are quickly drying up. And without some kind of change, water supplies will continue to shrink.

Currently, however, most of the products we use were made with the idea that water is limitless and abundant. But population growth and climate change have challenged this misconception. In 20 years, a third of the global population will only have half the amount of water they need, which will put even more strain on industry and agriculture.

Fortunately, there are some things we can do to conserve water. One of the major things we need to change is how infrastructure is designed to manage our water supply.

According to the U.S. Environmental Protection Agency (EPA), water conservation could easily reduce demand from households by 70 percent compared to today’s usage in countries like the U.S., through innovations available that radically reduce water used to flush toilets, wash clothes, and irrigate gardens.

But managing water use around the house can only get you so far. Scientists are developing better tools to understand the interplay between water systems and the environment, and are developing genetic tools that can assess the water quality to check for any microbial life that happen to be lingering in the water supply and to control the spread of water-borne diseases.

Unpredictable weather changes put a strain on our water infrastructure and cause it to fail and further spread infectious diseases in cities. Experts warn that more disasters like the floods in Pakistan and Australia will happen more frequently. The historical 100-year floods are now expected to occur every 20 years. From water shortages to waterborne diseases to water pollution, our water problems aren’t going away—especially as more people move into cities.

The global hydrological system is in danger. However, if we manage the water supply better, we can adapt to the changing climate conditions. Considering most infrastructure has been engineered for a single climate, future development should be designed to adapt to the changing environment.

For more information about this and other AAAS interests, go to www.aaas.org.

www.nesc.wvu.edu
A safe, reliable water supply is critical to the success of any community. It creates jobs, attracts industry and investment, and provides for the health and welfare of citizens in ways ranging from disease prevention to fire suppression. We often take water supply for granted until it is threatened, either by drought, water main breaks, or some other event. For more than 30 years, people around the country have celebrated Drinking Water Week—a unique opportunity for both water professionals and the communities they serve.

Volunteers from the U.S. and Canada comprise more than 60 committees focused on fundraising and increasing awareness. In addition, more than a hundred World Water Corps volunteers assist the organization every year in monitoring and evaluation, baseline assessments, and other research.

Water for People will continue its efforts for years to come. For more information about the organization, go to www.waterforpeople.org.

EPA Offers Watershed Tools

The U.S. Environmental Protection Agency (EPA) has information for watershed groups, including the Watershed Funding Tools Online and the Online Toolbox:

- Nonpoint Source Education

Committed watershed organizations and state and local governments need adequate resources to achieve the goals of the Clean Water Act and improve our nation’s water quality. To support these efforts, EPA has created a website to provide tools, databases, and information about sources of funding to practitioners and funders that protect watersheds.


The online Nonpoint Source (NPS) Outreach Toolbox is intended for use by state and local agencies and other organizations interested in educating the public on nonpoint source pollution or stormwater runoff. The Toolbox contains resources to help develop an effective and targeted outreach campaign. Features of the Toolbox include EPA’s Getting in Step Outreach Series, a searchable catalog of outreach materials on the state and local level, and surveys and evaluations of effective outreach campaigns.


Water For People Celebrates 20th Anniversary

On February 28, 2011, Water For People marked its 20th anniversary. In its 20 years, Water For People has learned many lessons and has had many successes in water and sanitation programs throughout the world. But the organization still has much work to do before all people have access to safe water and sanitation.

Throughout the years, the organization’s structure shifted to leverage the people, partners and resources in the communities where water projects were happening. Initially, water professionals from the U.S. served as volunteer project managers, and many traveled to the areas of work to observe and evaluate the projects. Now, Water For People has local staff in 10 countries who come from the communities they serve.

Volunteers from the U.S. and Canada comprise more than 60 committees focused on fundraising and increasing awareness. In addition, more than a hundred World Water Corps volunteers assist the organization every year in monitoring and evaluation, baseline assessments, and other research.

Water for People will continue its efforts for years to come. For more information about the organization, go to www.waterforpeople.org.
UA Project Could Bring Clean Water to Navajos

Many Navajos in northeastern Arizona have to drive 40 miles to haul well water back to their homes, says a March 2, 2011, article in the Green Valley News and Sun, an Arizona newspaper.

According to the article, almost a third of the Navajo Nation’s 200,000 inhabitants do not have direct access to clean water, often relying on supplies that contain unsafe concentrations of uranium, arsenic and saline. In addition, nearly 40 percent of the population lives off of the electrical grid so electricity is in short supply—a necessary component of conventional drinking water treatment technologies.

However, the University of Arizona’s Institute of the Environment, the U.S. Bureau of Reclamation and the Navajo Nation are working together to engineer a solar-powered desalination system that may be the solution. This system will use power from the sun and a membrane distillation process to purify the water.

Under the direction of Wendell Ela, a professor of engineering at the University of Arizona, a team of student researchers is testing a prototype system on the roof of the university’s civil engineering building to see if it could be used on the reservation. Currently in its infant stage, the purification system uses long rolls of tubing connected to a drum of water and a complex arrangement of heat exchangers and a membrane module.

At the simplest level, Ela said, the desalination system uses energy from solar panels to heat contaminated water. The hot water passes through a membrane module — an object about the size of a small melon. When the hot water moves into the system and cold water moves out, a partial pressure differential is created. This differential provides enough energy to move water vapor through the system, which, in the end, becomes pure water.

While the upfront costs of materials for membrane distillation are on par or slightly more expensive than reverse osmosis, the long-term costs of operating the UA’s system are much lower because of a lower energy need.

The team’s goal is to produce between five to 10 gallons of water per day on the roof of the UA engineering building. If the project is a success, the system will be moved to a field site for larger-scale testing. To meet the demands for livestock and people in the southwestern region of the Navajo Nation, the system will eventually need to produce 5,000 gallons of water per day.

For more information about this project or other UA projects, go to portal.environment.arizona.edu/
Today, people are bombarded with messages about what’s healthy, socially acceptable, or good for the environment—don’t smoke; eat five to nine servings of fruit and vegetables a day; conserve water. All of these messages require an individual, or a community, to change a behavior from one that’s unhealthy or otherwise unacceptable to one that will improve their quality of lives.

Sounds easy enough, doesn’t it? Who wouldn’t want his or her life improved? But let’s face it. If it were easy, we’d all be thin people who drive fuel efficient cars to markets where we buy locally grown organic food all while only watering our lawns twice a week after the sun goes down.

So, if it isn’t easy, what makes it so hard? The answer lies in recognizing that people aren’t willing to abandon deep-seated beliefs and attitudes easily—even if that means holding onto a behavior that may be harmful, negative, or even dangerous. Think about it. When was the last time you changed your behavior just because someone told you to?

Change Isn’t Quick or Easy

Change doesn’t come easy for most people. And when it does occur, it happens over long periods of time, often years, according to Philip G. Zimbardo and Michael R. Leippe, authors of the *Psychology of Attitude Change and Social Influence*.

With this in mind, let’s take a look at why some water conservation programs don’t succeed and how we imagine they should. First, telling people that saving water is the “right thing to do” is likely won’t get you very far. Doing so assumes that people’s attitudes and beliefs about water conservation are aligned with your own.

Jeff Hoffman, president of the Hoffman Agency, a Florida-based social marketing and public relations firm, agrees. “One water conservation specialist with a mid-level municipal water system wrote an article in a trade publication in which she said that it angered her that her neighbors over-irrigate their lawns when ‘they know better’ because ‘She’d worked hard to educate the public that what they are doing is wrong and they should stop.’”

I’ve Got the Answers

“A lot of people assigned the task of public outreach make the prime mistake of making a focus group of one, believing that if I feel a certain way, or have an understanding about how water should be used, then everyone else does, too,” says Hoffman. “Deriving a public outreach program from on the insights of a focus group of one is a conceit in which one can be easily trapped. Almost all of us have fallen prey to similar conceits at some point,” he continues. “However, reliance on a narrowly focused view disregards that other people don’t have similar knowledge, experiences, or similar priorities. Outreach programs like this fail to achieve their goals because they don’t start from the perspective of the general public and shift attitudes by helping people recognize what personal benefits are gained by forming good conservation habits.”

I Have Other Things to Do

As water professionals, we have adopted ideas and behaviors that support our cause. But what we don’t always understand is that the way we think often no longer reflects how our customers think, says Marketing Social Change, an online guide developed by the Priority Ventures Group. What we need to understand is that most people believe they have far more pressing matters to attend to.

In 2000, the Arizona Department of Water Resources partnered with the cities of Phoenix, Mesa, and Scottsdale to develop the Water—Use it Wisely campaign. To find out more about how the citizens rated water conservation in their daily lives, they surveyed citizens in the area.

They found that water conservation was ranked in importance below other local concerns such as air quality and traffic congestion. The research further revealed that people lacked knowledge about how to save water, and most people thought that their individual actions would not make a difference.

A recent study conducted by the Water Research Foundation had similar findings. While respondents said that saving money and doing right thing for the environment were motivators for participating in a water conservation program, most...
Breaking Tradition

The key to making water conservation programs work is to break out of traditional educational programs. And that means exploring what the audience or, in other words, what’s in it for them?

One of the cold, hard facts that we in the water industry must realize is that if we want other people to change, we may have to make some changes ourselves. This is where social marketing comes in, says the Basics of Social Marketing, a guide from the Social Marketing National Excellence Collaborative. Social marketing campaigns seek to bring about behavior change. And they do so in ways that address the audience’s need relative to the needs of the community. They create awareness long before they create the motivation to change. And they rely on the principles of commercial marketing to make their point.

Do you know what I need?

If you don’t address your customers’ wants and needs, you may end up wasting a lot of time and money. In Marketing Social Change, there is a story about a national organization that didn’t pay attention to its customers, and even its own research, and ended up paying a heavy price. “The association developed a software product for members to collect and analyze data, with goals to improve service quality and to help members reduce government regulation,” the guide reports. “However, the association did not conduct sufficient research on how the product should be designed, who would use it or how it should be promoted. Management did conduct a survey, but largely ignored data on how many members were willing to pay for the software. Hard work, the best of intentions and a useful product were not enough. The software was not widely adopted, the effort lost over a million dollars, and the venture was ultimately discontinued.”

In social marketing, you must know your audience well enough to understand what will motivate them to make changes in their lives. What benefits can you offer to help them over the hump? How can you make it easier for them? It also requires that you not look at your audience as a whole, but as subsets or segments who all have different priorities and motivations.

Focus on people as customers and understand their needs. What does it mean to treat people like customers? Think about a business where you feel like a valued customer. The quality of the product or service pleases you. Maybe the personnel are attentive and efficient. Perhaps the business offers convenient locations or hours. The prices charged are appropriate for what you receive. Each of these elements reflects a business that understands what’s important to you and delivers against these needs.

Be clear about what you’re asking them to do. And offer them something in return. Many campaigns fail to provide “an exchange.” Customers want a payoff for the proposed action you’re seeking. (See sidebar on page 13.)

What else could go wrong?

“Another failing that I’ve observed in public education programs is mistaking activity for productivity,” says...
Hoffman. “Public outreach programs are often conducted by people pressured by management (or public policy makers) to ‘get the word out’ so we can start conserving water. Flyers, bill stuffers, cute Facebook pages, blogs filled with droning information, and advertisements may all get done, but the only cohesion they may have is that they tell the public to stop using so much water and promote water audits or appliance rebates.” Hoffman says that when he asked whether appliance rebates and toilet retrofit programs altered water use behavior, one conservation manager with a major municipal system told him that while the answer was probably yes, he believed the program did little to change daily behaviors. The manager told him that the system got more participation by telling people they could get big cost breaks on new appliances—not that they would save water.

“One could argue that his goal (saving water through retrofits) was met,” says Hoffman. “But the long-term goal of creating new behaviors and contributing to a new social norm related to water wasn’t.”

**Did you get my message?**

Social marketing is more than messages, however. Not only are these messages coming from almost every media source imaginable, they are competing with each other.

“I once saw a public service ad that read ‘wasting water is a crime,’” says Hoffman. “I didn’t know that. But I wasn’t concerned. The message itself represented an empty threat to which no one would pay serious attention. While for those in the know—or those who gave it a second thought—the gist of the message was understandable: Don’t use more water than you should. For most, I’d venture a guess that they did not heed the message.

“Words can have different meanings for different people,” Hoffman continues. “Words like ‘efficient’ or ‘efficiently’ really chafe me. ‘Be efficient in your water use.’ ‘Only use the water you need.’ Really, now. How many people do you know who say ‘Gosh darn, they’re right—I use too much water.’ Messages like these automatically close the communication. ‘I only use the water I need—that message is for someone else.’ is the most common reaction.”

**So what do I do?**

Creating a good water conservation program using social marketing strategies requires not only knowing what to do, but what not to do. Developing messages based on what you think people want is a big mistake. To really know, you have to ask them.

While this article only touches on many of the items you must consider, it does provide a good starting point. Remember, your audience—your customers—want to be involved in the process.

“We must not constrain human power, but rather we unleash it,” say Ted Nordhaus and Michael Shellenberger, political strategists and opinion researchers, and authors of Break Through, Why We Can’t Leave Saving the Planet to the Environmentalists. And that means listening to what people really want rather than imposing your will upon them.

**More Information**

To learn more information about using social marketing, the following resources are available in pdf format:


What PRIVATE WELL OWNERS Need To Know About WATER TESTING

If you're the owner of a private water well, one of your most important ongoing responsibilities is testing the water. What you do with the results of a proper water test can make all the difference in the safety and quality of your water.

Water Testing

Public water systems are required to test for an array of potential contaminants under the provisions of the Safe Drinking Water Act (SDWA). Private household wells, however, are not regulated under the SDWA, so the household well owner needs to know what to test for and how to go about it. Of course, a household well owner could test for everything that public water systems are required to test, but to do so would be impractical, expensive and unnecessary for many.

There are, however, reasonable guidelines for water testing by the household well owner. Some key things to test are bacteria, nitrates, and contaminants that are unique to your location.

Bacteria

Testing annually for bacteria is on everyone's list because it is so common to the environment. Drinking water tests check coliform bacteria because these are a possible indicator of the presence of pathogens—microorganisms that can cause severe illness or even death.

If you have not had your well inspected in recent years, it may be advisable before testing your water to have a water well contractor determine whether your well needs to be cleaned. Accumulated debris in the bottom of a well can harbor bacteria, preventing effective disinfection of the well. A well inspection also can determine whether another problem such as a broken well cap or well casing is allowing bacteria into the well.

Well owners should also have their wells disinfected anytime the well is serviced,
because opening up the well and repairing or replacing a part can introduce bacteria. For this reason (and others), well owners should never try to service their own wells. A qualified water well contractor should perform the disinfection to ensure it is done properly.

Nitrates
Testing annually for nitrate also is near the top of everyone’s list because they are so common to the environment. Nitrates are found in fertilizer products, animal and human waste. Some studies indicate that nitrate in groundwater tends to increase in rural areas where fertilized crops, animal lots, and septic systems are commonplace.

Contaminants of local concern
Sometimes the specific locale where a well owner is located may suggest testing for a particular contaminant. For instance, arsenic can occur in certain geologic formations. Often, areas likely to have arsenic in the groundwater are known to the state or federal geological survey, local health officials, or water testing labs. Another local source of contamination could be an industrial site, landfill, or recent chemical spill. The well owner should check with local officials and do some basic research to determine if there is something particular to the locale that should be included in a water test.

Other water-quality issues
Some substances can affect water quality but not present a health risk. For instance, hydrogen sulfide is usually not a health risk, but its rotten egg smell can be objectionable. Hard water can cause corrosion of pipes and water treatment systems. Well owners should describe water quality symptoms to their water well contractor or a drinking water testing lab, and test accordingly.

Where should watersamples be taken?
Taking a water sample at the well or before the pressure tank will reflect the quality of the well water. However, a sample taken at the kitchen or bathroom tap can be affected by the house plumbing. This could be significant if, for instance, the house has water pipes containing lead. Also, testing a water sample at the tap can determine the effectiveness of point-of-use water treatment systems. The well owner needs to determine appropriate intervals for testing water treatment systems’ effectiveness.

How do I test the water?
The National Ground Water Association recommends that well owners use certified drinking water testing labs. Certification indicates that a lab has met certain requirements to receive that designation. Not all drinking water testing labs are certified, including some very competent ones. Well owners can get information on drinking water testing labs by calling their state certification officer. Well owners can also check with the local health department or Yellow Pages about drinking water testing labs. Some, but not all, local health departments test for the basics, such as bacteria and nitrates.

While certain water testing kits are available at retail stores, some may not provide the degree of specificity necessary to determine the proper water treatment system. Also, some tests, particularly those for bacteria, can easily be fouled if not taken properly.

How do I interpret the water test results?
When getting results from a drinking water testing lab, ask the lab to explain the results to you—particularly whether there is anything in the water that presents a health risk. If the lab cannot do so, check the results against the U.S. EPA’s Maximum Contaminant Level list.

How do I treat my water?
Two key factors in deciding the appropriate treatment for your water are knowing the substances that need to be treated and their respective concentrations. Sometimes an effective technology at one contaminant concentration is ineffective at a higher concentration. For example, hydrogen sulfide can be removed at extremely low levels by a carbon filter. However, higher levels of hydrogen sulfide require another technology such as an oxidizing filter or a chemical feed pump that injects chlorine into the inlet-supply line ahead of the pressure tank.

The following chart provides a sampling of contaminants found in untreated well water and corresponding treatment technologies.

How do I know I’m getting the correct treatment system?
Well owners should be diligent in making sure that any treatment systems they buy are designed to treat the desired substances and the concentrations of those substances. The best way to ensure this is to compare the systems’ specifications to your water lab results.

If a well owner has the correct treatment system, it is important to maintain the system according to the manufacturer’s recommendations. A failure to do so could result in an ineffective system or an overloaded one that actually contributes to health risks.

For more information about water quality and water testing, visit www.wellowner.org. The U.S. Environmental Protection Agency’s Contaminant List and other information about drinking water standards may be accessed at http://water.epa.gov/lawsregs/rulesregs/sdwa/currentregulations.cfm. Find a certified water-testing lab in your state by going to http://water.epa.gov/sctech/dinkingwater/labsert/index.cfm.
Water is critical to life. Ensuring that our drinking water sources are protected—now and in the future—not only means safe drinking water for us, but for our children and grandchildren.

Source water protection refers to the concept of protecting sources of drinking water, including water from lakes, rivers, and underground aquifers, from overuse and contamination. Source water protection plans can help drinking water systems and the communities they serve keep our drinking water safe. But that’s not the only reason for developing these plans. Consider the value of a dependable supply of clean, safe drinking water to the local economy, development opportunities, and quality of life. Or the importance of saving money on expensive water treatment costs, especially savings that can be realized from pollution prevention.

**Potential Threats to Local Water Sources**

Any substance that goes down the drain, runs off of urban or agricultural landscapes, or is buried or stored underground, could eventually end up in drinking water sources. A variety of activities or land uses could pose a threat to your local waters, including agricultural practices, logging, mining, military bases, active and abandoned industrial or commercial facilities, hazardous waste sites, solid waste landfills (especially older ones), oil and gas operations, construction sites, storm water runoff from urban areas, failing septic systems and deteriorating sewage treatment plant discharge, salt water intrusion (contamination) of coastal aquifers, forms of transportation that may create avenues for spills (railroads along rivers or creeks, storm water discharge from interstate highways, barges on rivers), underground tanks or wells that store waste disposal, and lawn care practices. The list could go on.

Another concern is the unsustainable use of groundwater from our aquifers. As our population increases, as a result of improved energy sources and technologies for pumping groundwater to the surface, this resource has become an important supply of water in the U.S. Approximately one-half of the population relies on groundwater for drinking water, and up to three-fourths of groundwater withdrawals are used for agricultural irrigation. Although groundwater supplies in the U.S. are vast, this water is essentially being pumped out of the ground faster than nature can replenish it. According to the U.S. Geological Survey, while the extent of depletion in groundwater levels due to increased pumping is not regularly monitored or analyzed, available information indicates that underground-water-level declines in the U.S. are widespread. The consequences of these declines include increased pumping costs, water quality deterioration, reduced amount of water in streams and lakes, and land subsidence.

**Current Measures That Protect Drinking Water Sources**

According to Robert Glennon in his book Groundwater Follies: Groundwater Pumping and the Fate of America’s Fresh Waters, groundwater withdrawal is regulated in different ways in different states. Many western states use the prior appropriation doctrine, which protects the rights of senior water users (those who were first to use the water). This doctrine generally means that water rights are not linked to land ownership, and senior users can continue to use it for beneficial purposes, subsequent users may use the remaining water only if it does not interfere with senior users’ rights. Some western states and most eastern states rely on the reasonable use doctrine, which allows pumping for any beneficial use but does not protect senior pumpers from newer pumpers. Some states rely on the English rule of absolute ownership, which allows property owners to pump unlimited amounts from beneath their property. Two states require that all landowners above the aquifer share the water. Although some states require groundwater pumpers to obtain a permit from their state agency, the general outcome of these practices is that most states regularly allow new wells to be developed.

For surface water use, two water rights doctrines generally apply. Most western states rely on the prior appropriation doctrine, most eastern states rely on the reasonable use doctrine, which allows property owners to pump whatever amount of water they can make reasonable use of. These rules can generate controversy and legal challenges, especially in times of drought or limited water availability.

Various laws are in place to manage the impacts of water pollution. For example, laws regulate the burial and monitoring of underground storage tanks (UST) that contain fuels, chemicals, or other hazardous substances that can leak out and pose a threat to groundwater. There are 640,000 USTs subject to regulation; many others are not. Other laws govern the injection of hazardous and nonhazardous wastes, including industrial, oil and gas production, radiological, and other waste, into deep or shallow wells or natural underground formations. Underground injection is used to dispose of more than 50 percent of these liquids generated in the U.S. While most underground injection wells are considered to be safe, some types of shallow wells that hold motor vehicle wastes or stormwater drainage, for example, are some of the most overlooked sources of groundwater contamination. An estimated 1.5 million of these wells are in existence.

Great strides have been made to curb the levels of pollution discharged into U.S. waterways from point sources. Point source pollution is wastewater from sewage treatment plants, power plants, manufacturing or other facilities that is treated and discharged through a pipe or ditch. Being able to trace the source of contamination helps to determine why or how the concentration or discharge limits for specific waterways.
Water Quality and Water Use Challenges

To be safe, public drinking water systems, which are regulated by another federal law, the Safe Drinking Water Act, are required to treat the water they draw from local water sources. The drinking water they produce for public consumption must not include contaminant levels higher than what the law allows, and public water systems in the U.S. have been very successful in protecting public health and providing safe water to drink. But given the fact that federal and state regulations allow certain levels of pollution to enter our water sources in the first place, local leaders and drinking water system personnel may ask: ‘Are our current water protection strategies adequate?’ Or, ‘What costs are imposed on the drinking water utility and the community to treat the water and remove contaminants?’

The issues surrounding current water use and water pollution practices are complex, but in the end, there are important questions at stake. Is it best to prevent or seek to control water pollution? Who has the right to pollute? Who is responsible for cleaning it up? To what extent do citizens have the right to a reliable supply of clean and safe water? At what point do economic, agricultural, or private property interests infringe on public health or water availability? What is the appropriate balance for protecting everyone’s rights? And finally, where do local governments and their public drinking water systems stand and what options are available at the local level?

Source Water Protection Planning Can Help

Source water protection planning involves a series of steps that can help a community, group of communities, or everyone in a watershed work toward preventing or limiting threats to the water sources. A watershed is an area of land that drains into a river, river system, or other body of water such as a lake. Watersheds and the water flowing through them may cross many boundaries such as city, county, state, and even national borders. Planning on a watershed level, rather than for a single community or body of water, has the potential to be more effective in protecting waterways. It’s not surprising that the most successful source water protection planning requires the combined efforts of many partners, such as local leaders; economic, energy, and agricultural interests; public and private water systems; resource managers, citizen groups; and the public. Local watershed organizations may already be working on source water protection and may have a lot of information available.

Initial planning steps include identifying the watershed or source water protection area, identifying contamination or threats to water availability, and evaluating how susceptible the water sources are to these threats. State drinking water agencies have already identified some of this information for every public drinking water system in their state. It is available in a document called a source water assessment. This assessment may need to be updated and developed in more detail, but it can be a good starting place.

The next steps include developing action plans detailing what will be done, when, and by whom; determining management measures to prevent, reduce, or eliminate threats (measures can include zoning, developing local ordinances, purchasing land near the water source, and public education); and identifying alternative sources of water in case of emergencies. There are many resources available to help with watershed or source water protection planning, and you may want to consider working with an outside facilitator, such as a technical assistance provider from the Rural Community Assistance Partnership or your state drinking water agency. Developing a source water or watershed protection plan is a voluntary activity that requires time, effort, resources, and local leadership. Important payoffs can include reduced costs for future infrastructure investment, more reliable water supplies, and increased public health, quality of life, economic opportunities, and environmental protection. Ultimately, ensuring we have safe and clean water to drink is everyone’s responsibility.

However, local decisions are critical for protecting water sources from pollution and overuse. Investigating the situation in your community, state, or watershed, bringing all parties to the table; discussing all perspectives; setting priorities; and enacting workable solutions at the local level offer the best chance to prevent contamination and ensure safer and more sustainable water sources for the long term.

Resources for Source Water or Watershed Protection

Be sure to check with your state’s drinking water agency, technical assistance providers, or local watershed groups for information and state-specific resources.

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National NEMO Network
(Nonpoint Education for Municipal Officials) Web site.
Originally developed at the University of Connecticut, now a cooperation of 32 educational programs in 31 states, with the goal of protecting natural resources through better land use and land use planning.
http://nemonet.ucconn.edu/
**SMART About Water** Web site. National Environmental Services Center (NESC). SMART About Water is a collaborative project of NESC and the Rural Community Assistance Partnership. The Web site provides a multitude of resources for protecting source water, especially from untreated wastewater from failing septic and sewer systems.
http://www.nesc.wvu.edu:16080/smart/index.cfm

**Source Water Protection** Web site. U.S. Environmental Protection Agency. Provides information and resources about ways that local leaders and organizations can plan for and implement source water protection.
http://cfpub.epa.gov/safewater/sourcewater/sourcewater.cfm?action=Protection&view=general

**Source Water Protection Case Studies** Web site. U.S. Environmental Protection Agency. Searchable list of successful source water protection programs from across the country.
http://cfpub.epa.gov/safewater/sourcewater/sourcewater.cfm?action=Case_Studies


**The Water We Drink** Web site. The Rural Community Assistance Partnership and the National Environmental Services Center. Offers free educational resources and an article about proper disposal of pharmaceuticals and personal care products.
http://www.nesc.wvu.edu/water-wedrink/

**Unmeasured Danger: America’s Hidden Groundwater Crisis** (July 2009). Food and Water Watch.

**Water Today... Water Tomorrow! Protecting Drinking Water Sources in Your Community: Tools for Municipal Officials.** New England Interstate Water Pollution Control Commission.
http://www.netwppc.org/sourcewateroutreach/

**Watersheds** Web site. U.S. Environmental Protection Agency. Provides information, resources, and links for watershed protection activities.
http://water.epa.gov/type/watersheds/index.cfm

**Your Water. Your Decision.** Web site that offers a customizable guide and other tools and information about source water protection to spur action among local leaders.
http://www.yourwateryourdecision.org/home

**References**


http://www.gwpc.org/calltoaction/

**Polluted Runoff (Nonpoint Source Pollution) Web site.** U.S. Environmental Protection Agency.
http://www.epa.gov/ouow/keep/nps/wnatis.html

http://water.epa.gov/pollwaste/nps/nonpoin1.cfm

http://www.epa.gov/ouow/NPS/Ag_Runoff_Fact_Sheet.pdf

**National Characteristics of Drinking Water Systems Served Populations Under 10,000 (July 1999).** U.S. Environmental Protection Agency.
http://www.epa.gov/ogwdw000/ndwac/smallsys/smallsys.pdf

**Source Water Protection Tech Brief (2008).** National Environmental Services Center.
http://www.nesc.wvu.edu/pdf/dw/pollutedrunoff/FlushDrains.pdf


**Sandra Fallon** is a training specialist with the National Environmental Services Center at West Virginia University.
Water is critical to life. Ensuring that our drinking water sources are protected—now and in the future—not only means safe drinking water for us, but for our children and grandchildren.

Source water protection refers to the concept of protecting sources of drinking water, including water from lakes, rivers, and underground aquifers, from overuse and contamination. Source water protection plans can help drinking water systems and the communities they serve keep our drinking water safe. But that’s not the only reason for developing these plans. Consider the value of a dependable supply of clean, safe drinking water to the local economy, development opportunities, and quality of life. Or the importance of saving money on expensive water treatment costs, especially savings that can be realized from pollution prevention.

Potential Threats to Local Water Sources

Any substance that goes down the drain, runs off of urban or agricultural landscapes, or is buried or stored underground, could eventually end up in drinking water sources. A variety of activities or land uses could pose a threat to your local waters, including agricultural practices, logging, mining, military bases, active and abandoned industrial or commercial facilities, hazardous waste sites, solid waste landfills (especially older ones), oil and gas operations, construction sites, storm water runoff from urban areas, failing septic systems and deteriorating sewer mains, wastewater treatment plant discharge, salt water intrusion (contamination) of coastal aquifers, forms of transportation that may create avenues for spills (railroads along rivers or creeks, storm water discharge from interstate highways, barges on rivers), underground tanks or wells that store waste disposal, and lawn care practices. The list could go on.

Another concern is the unsustainable use of groundwater from our aquifers. In the last few decades, as a result of improved energy sources and technologies for pumping, groundwater to the surface, this resource has become an important supply of water in the U.S. Approximately one-half of the population relies on groundwater for drinking water, and up to three-fourths of groundwater withdrawals are used for agricultural irrigation. Although groundwater supplies in the U.S. are vast, this water is essentially being pumped out of the ground faster than nature can replenish it. According to the U.S. Geological Survey, while the extent of depletion in groundwater levels due to increased pumping is not regularly monitored or analyzed, available information indicates that groundwater-level declines in the U.S. are widespread. The consequences of these declines include increased pumping costs, water quality deterioration, reduced amount of water in streams and lakes, and land subsidence.

Current Measures That Protect Drinking Water Sources

According to Robert Glennon in his book Groundwater Follies: Groundwater Pumping and the Fate of America’s Fresh Waters, groundwater withdrawal is regulated in different ways in different states. Many western states rely on the prior appropriation doctrine, which protects the rights of senior water users (those who were first to use the water). This doctrine generally means that water rights are not linked to land ownership, and senior users can continue to use it for beneficial purposes, subsequent users may use the remaining water only if it does not interfere with senior users’ rights. Some western states and most eastern states rely on the reasonable use doctrine, which allows pumping for any beneficial use but does not protect senior pumpers from newer pumpers. Some states rely on the English rule of absolute ownership, which allows property owners to pump unlimited amounts from beneath their property. Two states require that all landowners above the aquifer share the water. Although some states require groundwater pumpers to obtain a permit from their state agency, the general outcome of these practices is that most states regularly allow new wells to be developed.

For surface water use, two water rights doctrines generally apply. Most western states rely on the prior appropriation doctrine; most eastern states rely on the reasonable use doctrine, which allows property owners to pump water from the water body to make reasonable use of it. These rules can generate controversy and legal challenges, especially in times of drought or limited water availability.

Various laws are in place to manage the impacts of water pollution. For example, laws regulate the burial and monitoring of underground storage tanks (UST) that contain fuels, chemicals, or other hazardous substances that can leak out and pose a threat to groundwater. There are 640,000 USTs subject to regulation; many others are not. Other laws govern the injection of hazardous and nonhazardous wastes, including industrial, oil and gas production, radiological, and other waste, into deep or shallow wells or natural underground formations.

Underground injection is used to dispose of more than 50 percent of these liquids generated in the U.S. While most underground injection wells are considered to be safe, some types of shallow wells that hold motor vehicle wastes or stormwater drainage, for example, are some of the most overlooked sources of groundwater contamination. An estimated 1.5 million of these wells are in existence.

Great strides have been made to curb the release of pollution discharged into U.S. waterways from point sources. Point source pollution is wastewater from sewage treatment plants, power plants, manufacturing or other facilities that is treated and discharged directly into a water body through one point, such as through a pipe or ditch. Being able to trace the source of contamination helps to determine ways to reduce the contaminant’s concentration or eliminate it as a problem. Point source pollution is regulated by the Clean Water Act, the federal law that sets contamination and discharge limits for specific waterways.

This article was developed as part of The Water We Drink, a joint effort by the Rural Community Assistance Partnership (RCAP) and the National Environmental Services Center (NESC) to provide information and increase awareness about crucial water issues, especially for rural and small community decision-makers and water and wastewater board members. The article provides a brief overview of water pollution and water use problems in the U.S., discusses how we currently go about managing these problems, and poses some considerations for moving ahead.
Contaminants also enter water bodies through dispersed, or nonpoint sources. Nonpoint source pollution occurs when water that flows over the land or seeps into the ground carries pollutants into surface waters. Rain, snowmelt, or irrigation runoff containing human-made pollutants and makes it’s way into surface waters (rivers, lakes, streams) or underground aquifers. Pollutants can include chemicals, pesticides, sediment, animal waste, and in the case of faulty septic or sewer systems, human waste. This nonpoint source pollution process can occur in agricultural, urban, or forested areas, and on public or private property.

According to the U.S. Environmental Protection Agency, nonpoint source pollution is the primary cause of water quality problems, and is harmful to drinking water sources, recreation, fisheries, and wildlife. Water that runs off agricultural land is considered to be the number one source of water quality problems in the rivers and lakes assessed by federal and state governments. Faulty septic and other sewer systems have been identified as a leading cause of water pollution in small communities and rural areas.

Because there are so many types of nonpoint sources of pollution from so many dispersed locations across the country, it is considered to be difficult to regulate. For the most part, the Clean Water Act leaves the regulation of nonpoint pollution sources up to each state. While some states have adopted regulations, many states use other incentives to curb this pollution, such as facilitating local watershed and land use planning efforts, encouraging the use of best management practices (a wide variety of strategies, such as planting vegetation along a roadway to help remove or filter pollutants flowing from adjacent land), providing technical assistance, and sharing costs with local partners for implementing prevention and control measures.

**WaterQuality and Wate Use Challenges**

To be safe, public drinking water systems, which are regulated by another federal law, the Safe Drinking Water Act, are required to treat the water they draw from local water sources. The drinking water they produce for public consumption must not include contaminant levels higher than what the law allows, and public water systems in the U.S. have been very successful in protecting public health and providing safe water to drink.

But given the fact that federal and state regulations allow certain levels of pollution to enter our water sources in the first place, local leaders and drinking water system personnel may ask “Are our current water protection strategies adequate?” Or, “What costs are imposed on the drinking water utility and the community to treat the water and remove contaminants?”

The issues surrounding current water use and water pollution practices are complex, but in the end, there are important questions at stake. Is it best to prevent or seek to control water pollution? Who has the right to pollute? Who is responsible for cleaning it up? To what extent do citizens have the right to a reliable supply of clean and safe water? At what point do economic, agricultural, or public property interests infringe on public health or water availability? What is the appropriate balance for protecting everyone’s rights? And finally, where do local governments and their public drinking water systems stand and what options are available at the local level?

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Developing a source water or watershed protection plan is a voluntary activity that requires time, effort, resources, and local leadership. Important payoffs can include reduced costs for drinking water treatment, more reliable water supplies, and increased public health, quality of life, economic opportunities, and environmental protection. Ultimately, ensuring we have safe and clean water to drink is everyone’s responsibility.

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http://nemonet.unc.edu/


References


Distribution lines can accumulate all sorts of things that cause discolored water, taste and odor, or even hydraulic problems. To keep these situations from turning into complaints, distribution lines need to be flushed. Flushing a drinking water distribution system simply means opening fire hydrants in a specific order so fresh water replaces the water standing in the lines.

The operator or system employee assigned to the task regulates the flow rate from the hydrants so that debris, sediment, and biological material are removed from the line. In other words, line flushing is housekeeping for your distribution system that improves water quality and service. Flushing these lines can also keep disinfection by-products down.

Some systems only flush their lines after they receive a customer complaint—and then only in the problem areas. But like most other things in the drinking water business, a little preventive maintenance is always easier than trying to pacify angry customers after a problem occurs.

**Developing a Program**

Like other long-term programs, line flushing requires homework and planning.

*How often:* Most people agree that flushing lines two times a year, usually spring and fall, is sufficient and do-able for most smaller systems. However, system personnel may need to flush dead ends more often.

*Time of day:* The best time to flush the system is usually late at night between the hours of 9 p.m. and 5 a.m. Typically, there’s less vehicle traffic, and customers usually don’t need much water during these hours so there will be fewer complaints.

*Customers:* Developing a flushing program also requires an advance method of notifying your customers. Newspaper announcements, mass mailings, TV advertisements, or going house to house are all acceptable methods. However, you’ll want to make a special effort to notify customers who use dialy-
flushed out from damaging property. Never use a home-made diverter constructed from solid lengths of pipe with a bend or elbow. Due to leverage, the discharge through this type of solid diverter can generate very high torque on the hydrant. An important point to remember is that if you have a stream of water shooting across a roadway, you need a flagger to stop traffic.

Let's Get Started

From the beginning: Beginning at a hydrant that is at or near the source, remove one of the two-and-a-half inch caps and install a diffuser or diverter; make certain all caps are tight. At another nearby hydrant that’s on the same line that you are going to flush, replace one of its two-and-a-half inch caps with a cap that has a pressure gauge installed and securely tighten all caps. The hydrant with the pressure gauge should then be turned on slowly until fully charged and the gauge reads line pressure. This hydrant will be used to monitor residual pressure. Return to the hydrant you are going to flush and open slowly.

Pressures and flow rates: Although there are a wide variety of recommended flow rates, the minimum rate is two-and-a-half feet per second (ft/sec) and goes up to six ft/sec. In older systems, the higher rate can cause problems so you might want to use a lower flow rate, around five ft/sec. Because flow rates are important, a method to measure them is also important. Hydrant meters work very well, but are expensive. The pitot gauge is much less costly and also works well. Another method is to measure the trajectory of the hydrant discharge and estimate flow. If you do not have any equipment that measures flow, slowly open the hydrant to a full stream and run for five to 10 minutes while checking the residual pressure at a

Line Flushing with a Diffuser

sis units or business customers, such as laundromats, restaurants, and beauty shops that need water to maintain their services.

Temperature: If the outside temperature is near freezing (or below), it is a good to wait for warmer weather. When ice accumulates in the fire hydrant due to cold weather, it can be difficult to close the hydrant once you are done with the flushing. Snow and ice on roads and sidewalks can also make this work dangerous.

Accomplishing Your Goal

After you make the decision to implement a line-flushing program, devise a plan to accomplish your goal.

Water availability: Line flushing uses lots of water. So before you start, be certain you have enough water stored to finish each section.

Tools: In addition to the usual valve and hydrant wrenches, other equipment, such as a pressure and pitot gauges as well as diffusers or diverters, can be very useful. You can monitor residual pressure using a pressure gauge threaded into a hydrant cap. In addition, you can calculate the flow as gallons per minute (gpm) using a pitot gauge held into the water stream flowing from the hydrant. Also, diffusers or diverters should be used to direct the water stream and prevent property damage.

Maps: Take time to study your distribution system’s maps. If you plan to flush in sections, you will need to identify those sections and locate the valves that isolate them. Also, identify sections served by smaller diameter lines and flush these separately. In other words, don’t pull water through a two-inch line that serves a trailer park when you’re flushing a four-inch or six-inch main. Flush the trailer park separately and then continue with the main line.

Direction: Flushing typically follows the direction that the water flows, starting at or near the water plant, well, spring, etc., and moving out into the system toward the periphery.

Safety: Anytime you work along a highway, especially at night, everything and everyone needs to be marked or lighted. Use cones, signs, flashing lights, safety vests, and a flagman. The flushing crew should consist of two people at a minimum, more if the situation requires flaggers.

Property protection: Use diffusers, diverters, or even a length of hose to keep the water being

This pitot gauge is showing approximately 50 pounds per square inch (psi) of pressure or approximately 1,190 gallons per minute (gpm) of flow.

Line Flushing is Housekeeping

1. Flushing distribution lines is a two-person job.
2. A diverter protects property.
3. When finished, make sure to turn the hydrant securely off.

1. One person should always monitor traffic.
2. Dirty water is better than in your customer’s homes.
nearby hydrant using a psi gauge. Residual pressure is very important during line flushing and should never drop below 20 psi to prevent a backflow situation.

Observations and tests: Because you flush lines to remove sediment, iron and manganese deposits, organic material, or anything else that degrades the quality of the water you worked so hard to make clean, a few tests and your visual observations will tell you when you are successful.

Document the water that was flushed. This water should be included in the system water accountability report as water used for maintenance.

Collecting samples two or three minutes into the flush and again at the end—once the water has cleared up—will give you a visual before and after. Also as the water clears and just before the hydrant is turned off, collect another sample in case you want to check chlorine, turbidity, iron, manganese, or anything else that will cause water quality problems.

To help build a history, record any observations or tests for each hydrant. You also should make a record of the complete process from start to finish; it will help next time. Also, if you have measured the flow rates for each hydrant, that information will be very helpful to your fire department.

Line flushing isn’t as hard as it looks. However, many systems choose to put it off until customers are knocking at their door and then randomly turn on a few hydrants hoping the complaints will stop. Taking the time to develop a comprehensive flushing program will benefit any community.

References


Larry Rader has more than 25 years in the water and wastewater industry. He began his career in his hometown, Elizabeth, West Virginia, (population 1,100) operating both the water and wastewater plants. While employed there, he drove the trash truck, read meters, fixed leaks, and wrote parking tickets in his spare time. He has devoted the last 17 plus years to training operators and trouble-shooting treatment problems in small systems, first for the West Virginia Rural Water Association and now in his own consulting business. All of his education came from the School of Hard Work.
A key component of the National Environmental Services Center’s mission is to offer free and low-cost products related to drinking water and wastewater. We now have more than 1,500 products featured in an up-to-date list on our website. The online catalog lists products in the following drinking water and wastewater categories: case studies, design, finance, management, general information, public education, operation & maintenance, research, resilience, regulations, security, training and more.

Please give the item number and title of the product when you place your order and note that shipping charges apply. To order, send an e-mail to info@nsc.wvu.edu or call us toll free at (800) 624-8301 or locally at (304) 293-4191.

Download the complete 2010 NESC Products List at www.nesc.wvu.edu/products.cfm and order today!
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.

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 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 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](http://www.nesc.wvu.edu/pdf/dw/publications/ontap/magazine/OT_WI04.pdf)
- “Conservation Rates” (Spring/Summer 2010) is available at: [www.nesc.wvu.edu/pdf/dw/publications/ontap/magazine/OTSPSU10_features/Conservation_Rates.pdf](http://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](http://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](http://www.epa.gov/watersense/docs/title_508.pdf)

**References**


