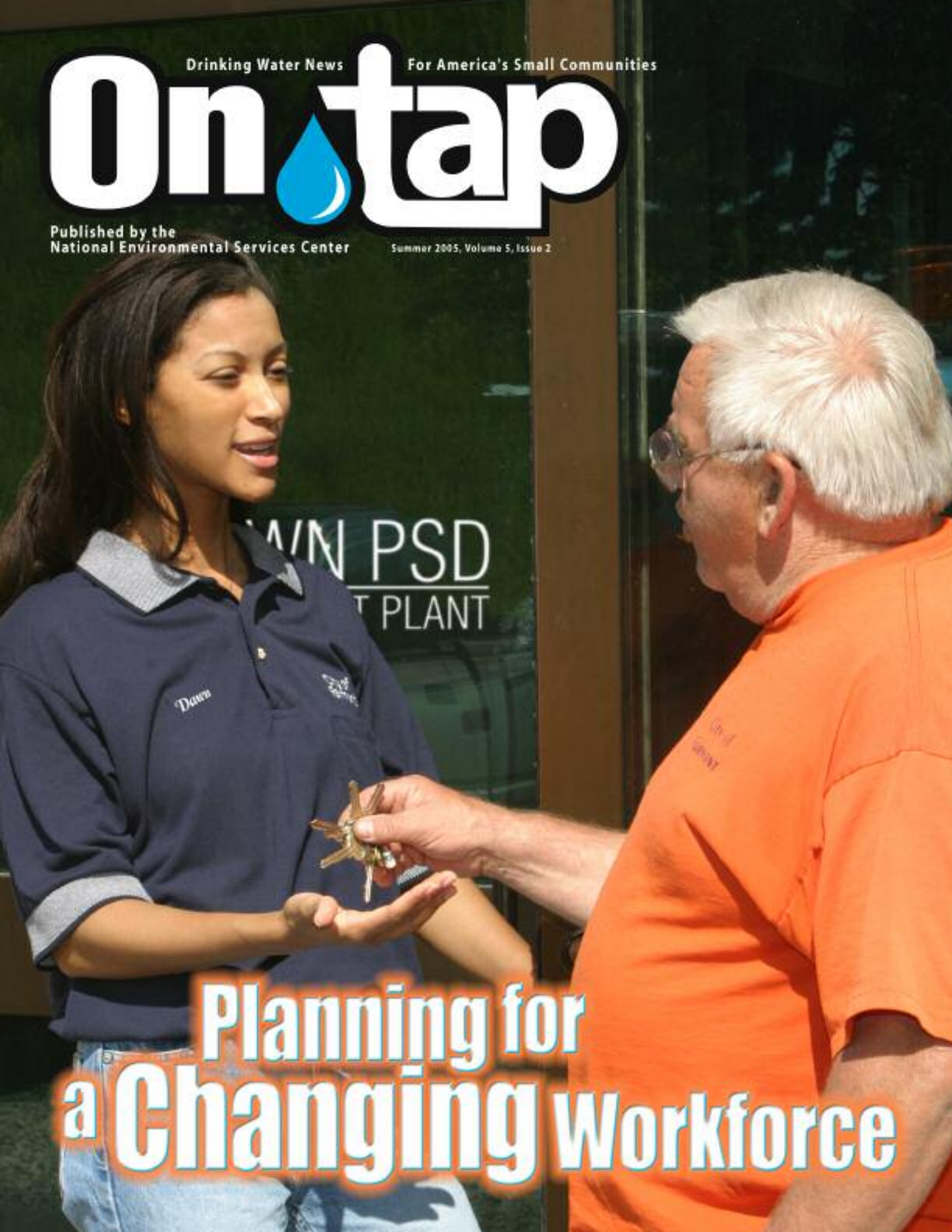
Drinking Water News For America's Small Communities

On tap

Published by the
National Environmental Services Center

Summer 2005, Volume 5, Issue 2



Planning for a Changing Workforce

On tap goes Back to School

On June 1, 2005, NESC Engineering Scientist Zane Satterfield visited East Dale Elementary School to teach third grade students—including his son Zachary—about the importance of clean, safe water. The photographs and notes here and on the inside back cover are from that visit.

National Environmental Services Center

NESC Assistance. Solutions. Knowledge.

On Tap MAGAZINE

Summer 2005, Vol. 5, Issue 2

Drinking Water News and Information for America's Small Communities

Features

In Every Issue

Tear Out Insert

Tech Brief • Quality Control

Utility systems need infrastructure to last as long as possible. One way to ensure longevity is through quality control. To have good quality control in construction projects is to perform good inspections. Remember, you can inspect it now or fix it later.

COVER STORY

Cover photo of Lynette Metzgar and Cyrus "Huffy" Huffman by Chris Metzgar.

Planning for a Changing Workforce

On Tap

Drinking Water News and Information for America's Small Communities

Summer 2005 • Volume 5 • Issue 2

Sponsored by USDA Rural Development

Curtis Anderson Acting Administrator
Randy Plum Loan Specialist

Rural Development

USDA's Rural Development Utilities Service strives to serve a leading role in improving the quality of life in rural America by administering its electric, telecommunications, and water and waste programs in a service-oriented, forward-looking, and financially responsible manner. Founded in 1947 as the Farmer's Home Administration, Rural Development has provided more than $20 billion for water and wastewater projects. For more information, visit their Web site at *www.usda.gov/rus/*.

The National Environmental Services Center

The National Environmental Services Center (NESC) is a nonprofit organization providing technical assistance and information about drinking water, wastewater, infrastructure security, utility system management, solid waste, and environmental training to communities serving fewer than 10,000 people.

To achieve this mission, NESC offers a toll-free technical assistance hotline, hundreds of low-cost or free products, quarterly magazines and newsletters, and several searchable databases. We also sponsor conferences, workshops, and seminars. Visit the NESC Web site at *www.nesc.wvu.edu* or call toll-free (800) 624-8301 and request an information packet.

NESC is located at West Virginia University, one of the nation's major doctoral-granting, research institutions.

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The Director's Perspective

The Director's Perspective

In the summer 2004 issue of *The Connector*, a publication of the Rural Water Association of Utah, Russ Donoghue, executive director, recalls a meeting several years ago with then-Governor Michael Leavitt (now U.S. Secretary of Health and Human services). At this event, Leavitt predicted that people would move to rural Utah over the next 50 years for three primary reasons:

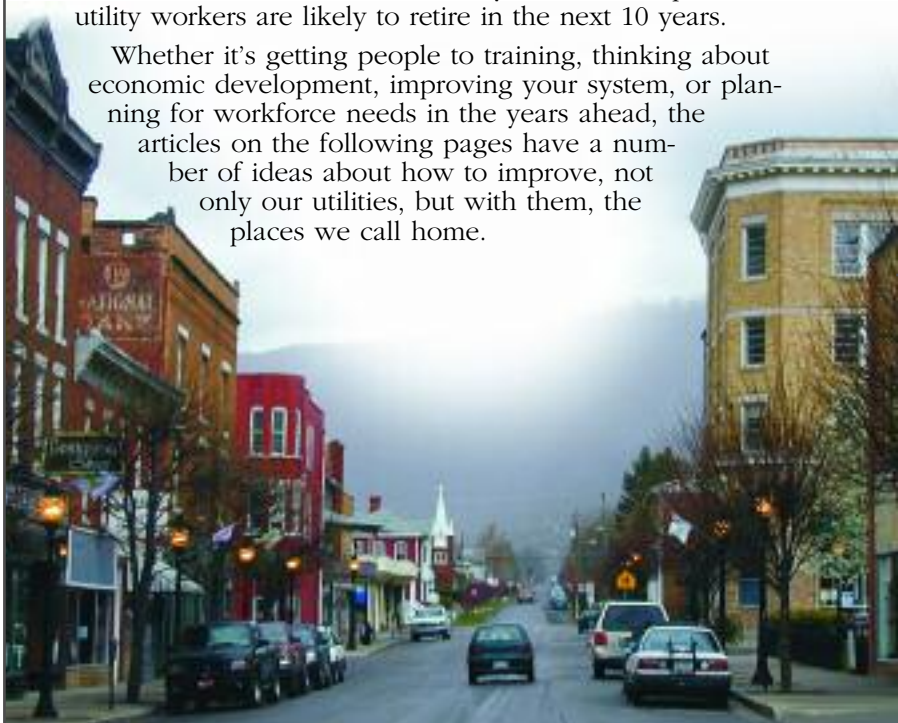
- they will want to feel safe;
- they will want to have a sense of community; and
- they will want to do business on the Internet.

A review of population trends might declare Mr. Leavitt a successful prognosticator in this regard, not just for Utah, but for many parts of rural America. Speaking from experience, I believe that these communities offer a quality of life that is increasingly appealing in our hectic world.

But we all know that people won't move to our small towns and rural areas unless there are good jobs. And most of us in this business realize that local economic development cannot occur without adequate water and wastewater infrastructure. Indeed, funding these projects creates jobs. "Investment in water infrastructure makes sound economic sense," says Peter DeFazio, U.S. congressman from Oregon. "For every billion dollars we invest in environmental infrastructure, we create over 30,000 new jobs."

Similarly, it is extremely important that we invest in what some call "human capital." Without a significant investment in people and their development, rural parts of the U.S. are in danger of falling further behind. This situation becomes particularly acute when we look at the number of people in our utilities who will be eligible to retire in the near future. Estimates show that as many as a third of present utility workers are likely to retire in the next 10 years.

Whether it's getting people to training, thinking about economic development, improving your system, or planning for workforce needs in the years ahead, the articles on the following pages have a number of ideas about how to improve, not only our utilities, but with them, the places we call home.



National Environmental Services Center
NESC Assistance. Solutions. Knowledge.

All You Have to do Is Ask

As you go about the important work of building and strengthening your community, please keep in mind the various services we offer at the National Environmental Services Center:

- Toll-free assistance from our staff of certified operators, engineers, and scientists;
- Quarterly publications (*On Tap*, the magazine you're now reading; *Small Flows Quarterly*, a magazine about wastewater treatment; *E-Train*, a newsletter about environmental training; and *Pipeline*, a newsletter about wastewater topics for the general public);
- A comprehensive Web site including online discussion groups;
- Thousands of information resources organized in easily accessible databases;
- Demonstration projects at more than 100 sites around the country that show the latest onsite sewage technology and/or management at work;
- Training sessions, including the annual Environmental Institute for Small Communities; and
- More than 1,000 free and low-cost educational products.

If you have a question related to drinking water, wastewater, environmental training, solid waste, infrastructure security, or small utility management, we may have the information you need. Our slogan, "Assistance. Solutions. Knowledge," forms the acronym ASK and that's exactly what I encourage you to do: ask NESC.

With warm regards,

Rick Phalunas

Interim Executive Director
National Environmental Services Center

Contact Us

To contact individual staff, refer to the listing above.
Contact the National Environmental Services Center at:

P.O. Box 6064
West Virginia University
Morgantown, WV 26506-6064

(800) 624-8301 • (304) 293-4191
FAX (304) 293-3161
info@mail.nesc.wvu.edu
www.nesc.wvu.edu

Who We Are

A number of people are responsible for putting *On Tap* magazine together each quarter. We encourage our readers to contact us with ideas and suggestions. An e-mail address is provided for each staff member below, as well as their phone extension. Call our main number toll free at (800) 624-8301 and enter the appropriate extension at the prompt.

On Tap Staff

Rick Phalunas, Ed.D. *rphaluna@mail.wvu.edu*	Interim Executive Director Phone extension: 5514
John L. Mori, Ph.D. *jmori2@mail.wvu.edu*	Director Emeritus Phone extension: 5540
Mary Stewart *mstewar2@mail.wvu.edu*	Senior Program Administrator Phone extension: 5511
Mark Kemp-Rye *mkemp@mail.wvu.edu*	Editor Phone extension: 5523
Kathy Jesperson *kathy.jesperson@mail.wvu.edu*	Associate Editor Phone extension: 5533
Michelle Moore *michelle.moore@mail.wvu.edu*	Promotions Phone extension: 5545
John Fekete *jfekete@mail.wvu.edu*	NESC Senior Graphic Designer Phone extension: 5505
Chris Metzgar *cmetzgar@mail.nesc.wvu.edu*	Graphic Designer Phone extension: 5571
Julie Black *jblack@mail.nesc.wvu.edu*	Graphic Designer Phone extension: 5503
Jamie Bouquot *jbouquot@mail.nesc.wvu.edu*	Graphic Designer Phone extension: 5397
Vipin Bhardwaj *vbhardw2@mail.wvu.edu*	Engineering Scientist Phone extension: 5509
Zane Satterfield *zsatterfield@mail.nesc.wvu.edu*	Engineering Scientist Phone extension: 5393
Sheila Anderson *sanders3@.wvu.edu*	Administrative Associate Phone extension: 5517
Lori Stephens *lori.stephens@mail.wvu.edu*	Administrative Associate Phone extension: 5522

Student Workers:
Molly Cunningham
Rachel Dunn

Calendar of Events

Denotes an event where the National Environmental Services Center will have a booth or that staff will attend. Look for us at these conferences.

If you are sponsoring a water-related event and want to have it listed in this calendar, please send information to Lori Stephens, National Environmental Services Center, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064. You also may call Lori at (800) 624-8301 or (304) 293-4191 ext. 5522 or e-mail her at *Lori.Stephens@mail.wvu.edu.*

September

National Association of Towns and Townships Annual Conference

September 7–9
Hyatt Capitol Hill
Washington, DC

Contact: Sharon Blanchard
Phone: (202) 624-3555
Fax: (202) 624-3554

www.natat.org

American Public Works Association Annual Conference

September 11–14
Minneapolis Convention Center
Minneapolis, MN

Contact: Dana Priddy
Phone: (800) 848-2792

www.apwa.net

October

Annual National Rural Water Association Convention

October 9–12
Sacramento Convention Center
Sacramento, CA

Contact: Dawn Meyers
Phone: (580) 252-0629
Fax: (580) 255-4476

www.nrwa.org

Association of State Drinking Water Administrators Annual Conference and Exposition

October 16–20
Adam's Mark Hotel
St. Louis, MO

Contact: Tom Maves
Phone: (202) 293-7655
Fax: (202) 293-7656

www.asdwa.org

Water Environment Federation

WEFTEC '05
October 29–November 2
Washington Convention Center
Washington, DC

Phone: (800) 666-0206 or (703) 684-2452
Fax: (703) 684-2492

www.weftec.org

November

Groundwater Foundation Annual Groundwater Conference

November 3–4
Lied Conference Center
Nebraska City, NB

Contact: Zoe McManaman
Phone: (800) 858-4844
Fax: (402) 434-2742

www.groundwater.org

December

National Ground Water Association Annual Conference

December 13–16
Cobb Galleria Centre
Atlanta, GA

Contact: Kathy Butcher
Phone: (800) 551-7379
Fax: (614) 898-7786

www.ngwa.org

Order On Tap magazine today. It's free!

Sign up and have *On Tap* magazine delivered to your door four times a year. To order, call us toll free at **(800) 624-8301**, send an e-mail to *info@mail. nesc.wvu.edu*, or write to: National Environmental Services Center, West Virginia University, P.O. Box 6064, Morgantown WV, 26506-6064.

20/20 Compares Bottled, Tap Water

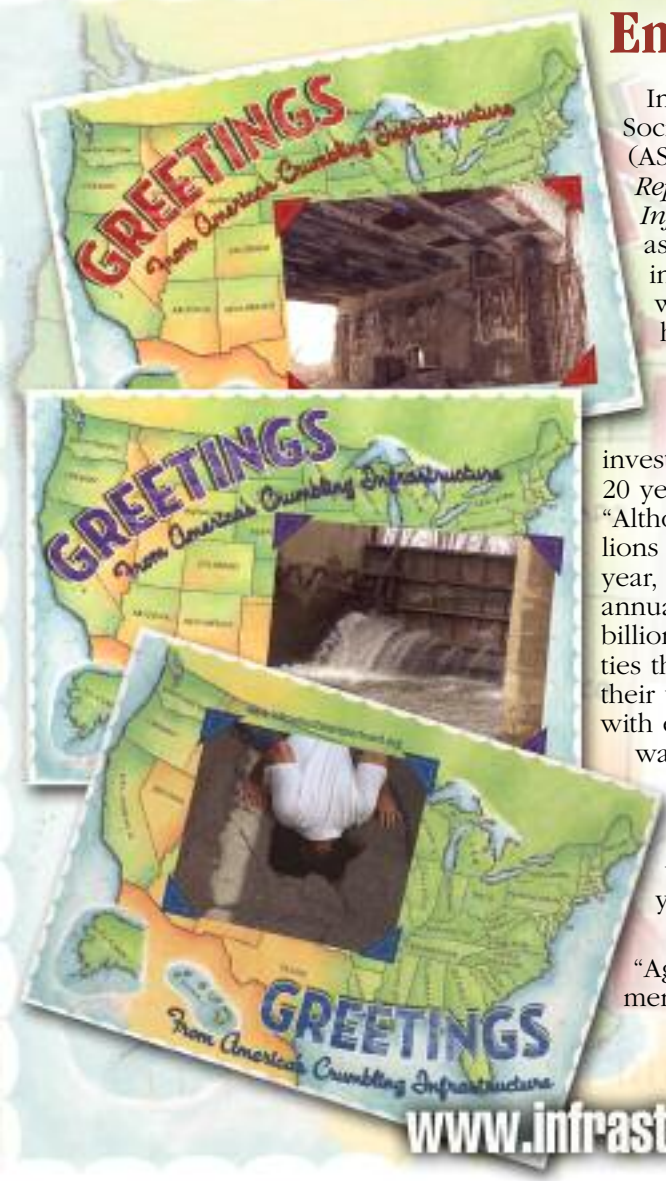
A May 6, 2005, segment of the ABC news show *20/20* examined why people buy bottled water, whether it's healthier than tap water, and if it tastes better. Why, they asked, would people pay as much as five dollars a gallon for something that's virtually free?

Most people cited a belief that tap water is unhealthy and that bottled water tastes better. But when *20/20* had a microbiologist test five national bottled water brands against water from a New York City drinking water fountain, they found no difference.

Similarly, when participants in a blind taste test sampled five different bottled waters, including mineral water from France and Iceland, the New York water again rated very highly.

20/20 concedes that the tests weren't scientific but postulates that advertising and marketing are the reason people think bottled water is better than tap.

To learn more about 20/20's *water comparison, go their Web site at* abcnews.go.com/2020/print?id=728070



Engineers Rate Infrastructure

In April 2005, the American Society of Civil Engineers (ASCE) released the *2005 Report Card for America's Infrastructure*, their annual assessment of infrastructure in the U.S. Most categories were rated "poor," as they have been since 2001.

"The nation's 54,000 drinking water systems face staggering public investment needs over the next 20 years," the report states. "Although America spends billions on infrastructure each year, drinking water faces an annual shortfall of at least $11 billion to replace aging facilities that are near the end of their useful life and to comply with existing and future federal water regulations. The shortfall does not account for any growth in the demand for drinking water over the next 20 years."

On the wastewater side, "Aging wastewater management systems discharge billions of gallons of untreated sewage into U.S. surface waters each year. The EPA estimates that the nation must invest $390 billion over the next 20 years to replace existing systems and build new ones to meet increasing demands. Yet, in 2005, Congress cut funding for wastewater management for the first time in eight years," the report states.

Both drinking water and wastewater infrastructure received a grade of D– in the ASCE report.

To address these problems, ASCE proposes several solutions, among them: creating an infrastructure trust fund, developing a federal capital budget, and increased funding for state revolving loan funds.

For more information about the 2005 Report Card for America's Infrastructure, *visit ASCE's Web site at* www.asce.org *or call (800) 548-2723. You may also write to American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA, 20191.*

EPA Announces Funds

On April 8, 2005, the U.S. Environmental Protection Agency (EPA) announced appropriations for the drinking water state revolving fund (DWSRF) and for the public water system supervision program.

For fiscal year 2005, the DWSRF appropriation is $843.2 million, slightly less than the previous year and down from FY 2002's $850 million level. The FY 2005 includes national set-asides totaling more than $14 million: $12.6 million for American Indian and Alaska Native Villages and $2 million to monitor unregulated contaminants. Both of these set-asides are comparable to previous years. No funding is provided for operator certification or small systems technical assistance.

The allotment of DWSRF state grants is derived from state drinking water needs identified in the most recent *Drinking Water Needs Survey* (published in February 2001). Each state must receive a minimum of one percent of the national appropriation. As mandated in the Safe Drinking Water Act Amendments of 1996, American Indian and Alaska Native Village water systems are funded at 1.5 percent of the total appropriation.

EPA also announced funds for the Public Water System Supervision (PWSS) Grant Program. Funded by Congress each year, state drinking water programs use these grants to monitor drinking water quality, conduct sanitary surveys, enforce drinking water standards, and provide technical assistance to local communities. The FY 2005 funds total $99.7 million, down from $102 million in FY 2004.

PWSS funding levels are determined on the basis of state population, state land area, the number of community and non-transient water systems, and the number of transient non-community water systems. As with DWSRF allotments, no state receives less than one percent of the total appropriation.

For more information about the DWSRF or PWSS, visit EPA's Office of Ground Water and Drinking Water Web site at www.epa.gov/OGWDW *or call (800) 426-4791.*

New Operator Basics CD Available

The Montana Water Center has released a new version of their Operator Basics training series. The CD—*Operator Basics 2005*—has several new features, including courses on surface and groundwater systems, wastewater lagoons, video tours of common system configurations, and free access to print and copy content.

The CD updates and expands several items from the original, including:

- operator contact resources;
- 500 math problems for wastewater and drinking water calculations;
- 500 practice quiz questions;
- a glossary with added clickable terms from the reading; and
- a glossary game for fun ways to learn terminology.

The information is designed to prepare small water system operators for certification and to provide training to meet continuing education requirements for water professionals. Check with your state to see if the CD is approved for CEU credits.

The CD is distributed free by the National Environmental Services Center. To obtain a copy, call (800) 624-8301 or send an e-mail to info@mail.nesc.wvu.edu. *Request product #DWCDTR18. If you need multiple copies, please call first. This training may also be downloaded from the Montana Water Center Web sit at* water.montana.edu/training/ob2005/.

Drinking Water with Silica May Prevent Alzheimer's

Could silica in drinking water help prevent Alzheimer's disease? The results of a French study, published in the April 2005 *American Journal for Clinical Nutrition*, suggest just that.

Epidemiologists studied more than 7,500 women age 75 and older in five different French cities. An initial cognitive baseline was established at the start of the study and the subjects were examined again seven years later. Among other things, the researchers determined what kind of water the women drank (i.e., tap or mineral water) and obtained data on silica, calcium, and aluminum in drinking water from local water companies.

The study found that women who drank water with high silica content (defined as more than 11.25 mg/L) had higher mental function at the start of the study and were less likely to develop impairment such as that found in Alzheimer's patients. The study corroborated a previous study, although the authors cautioned that more research should be undertaken.

Silica is the water-soluble, oxidated form of silicon, the second most common substance on earth (after oxygen). In water and foods, silica is dissolved in the form of silicic acid, absorbed during digestion, and excreted in urine. It is an important component of bone formation and increases bone mineral density.

The complete report is available on the American Journal of Clinical Nutrition *Web site at* www.ajcn.org. *Search on the word "silica" to get the report.*

Cousteau Starts Water Project

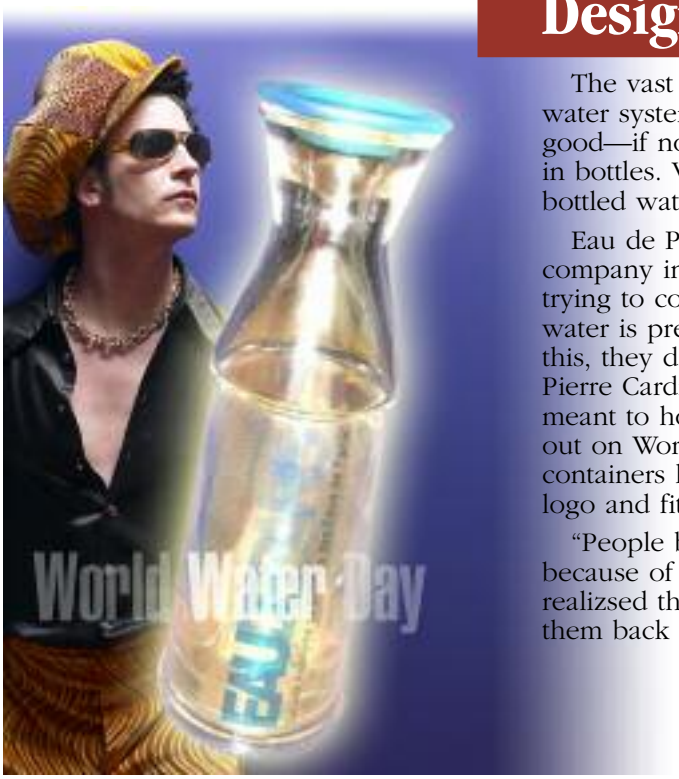
Jean-Michel Cousteau, marine environmentalist, film-maker, and son of ocean exploer Jacques Cousteau, has started a global non-profit organization that hopes to solve the world water crisis.

The Water Culture Network plans to bring together individuals, organizations, and business and government leaders to implement innovative, proven technologies and solutions. A large-scale mobile water filtration system, capable of purifying 60,000 gallons of water daily at crisis locations, is one of the Network's first projects.

Learn more about the Water Culture Network by visiting their Web site www.waterculturenetwork.org.

WATER CULTURE NETWORK℠

Designer Water



The vast majority of municipal water systems have water that is as good—if not better—than that sold in bottles. Why, then, do sales of bottled water continue to skyrocket?

Eau de Paris, the public water company in the French capital, is trying to convince Parisians that tap water is preferable to bottled. To do this, they distributed 30,000 free Pierre Cardin-designed carafes meant to hold tap water. Handed out on World Water Day, the glass containers have the Eau de Paris logo and fit in a refrigerator door.

"People buy bottled water because of the marketing and we realizsed that if we were to win them back to the tap we would have to do some marketing of our own," says Franck Madureira of Eau de Paris in a March 22, 2005 BBC News article. "It's all about giving Paris water an image and explaining why it is good for you."

By encouraging more tap water consumption, officials also hope to cut down on the number of plastic bottles in the trash.

For more information about Paris water, visit the Eau de Paris Web site at www.sagep.fr/cgi/bo_accueil.php. *Note: Google will provide a translation if you search on the term "Eau de Paris." The BBC story about the designer carafes is available at* http://news.bbc.co.uk/2/hi/europe/4373205.stm.

Underground Water Storage

In arid Southern California, having a reliable source of water is a challenge that has been vexing engineers and public officials since the 19th century. The latest wrinkle in this ongoing quest is to store water during wet years in a vast series of underground basins that cover 420 square miles southeast of downtown Los Angeles.

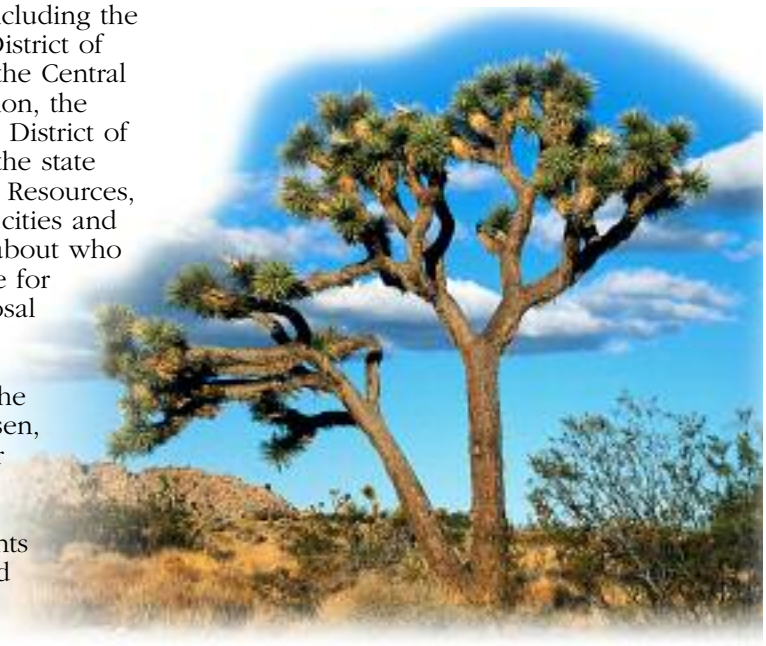
Currently, water is pumped out of the basin for local customers. Water from rain, recycling, and purchased from other sources is used to recharge the basin at about the same rate.

Proponents of the new recharge plan say that these underground basins can hold at least twice what they now do, according to a May 16, 2005, article published in the *San Gabriel Valley Tribune*. During a relatively wet year, such as this one, extra water could be stored in the basin until it's needed in a dry year.

Others, however, are concerned that this extra storage could lead to well contamination or even to a loss of water for neighboring areas. Small communities are also concerned about who would be in charge of the process.

Several groups—including the Metropolitan Water District of Southern California, the Central Basin Water Association, the Water Replenishment District of Southern California, the state Department of Water Resources, as well as individual cities and towns—are arguing about who would be responsible for overseeing the proposal if it's approved. "We believe the storage capacity belongs to the cities," says Don Jensen, public works director for Santa Fe Springs, one of the smaller cities. Public comments on a draft plan ended on May 4, 2005.

To learn more, visit the following Web sites: Metropolitan Water District of Southern California (www.mwdh2o.com); *Water Replenishment District of Southern California* (www.wrd.org); *and California Department of Water Resources* (wwwdwr.water.ca.gov).



USDA Funds $143 Million for Infrastructure

U.S. Department of Agriculture (USDA) Secretary Mike Johanns announced more than $143 million for water and wastewater loans and grants at an April 22, 2005, press conference. The investment—$76.2 million in loans and $67.1 million in grants—will benefit 59 rural communities in 29 states.

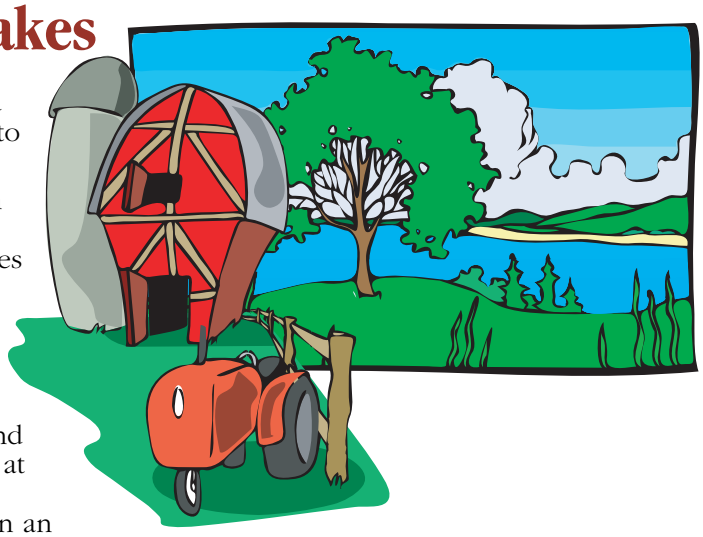
Since 2001, USDA has provided loans and grants totaling $6.5 billion to assist with community water and wastewater infrastructure. Many of the 5,475 communities receiving the funding are struggling to address environmental concerns brought on by improper treatment of sewage or unsafe or unreliable water, and many are among our nation's poorest rural communities.

To learn more about USDA water and wastewater loans and grants, visit the USDA Rural Development Utilities Service Web site at www.usda.gov/rus *or contact your state Rural Development office. 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.

USDA Rural Development

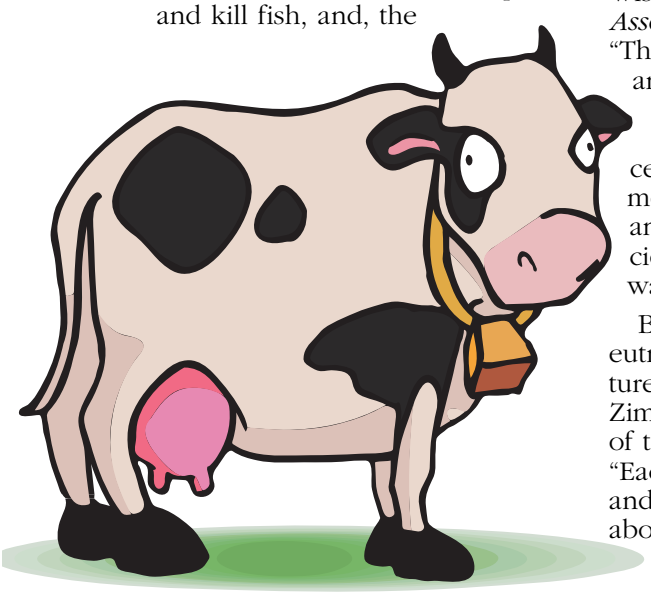
Committed to the future of rural communities.

Fertilizers and Freshwater Lakes



A paper published in the June 22, 2005, *Proceedings of the National Academy of Sciences* suggests that the application of chemical fertilizers and manure to farmland poses a significant danger to freshwater lakes.

Phosphorus in fertilizers and manure builds up in the soil and eventually ends up in lakes where it aids plant and algae growth in the water, a process known as eutrophication. This environmental problem can turn water into weed-filled swamps and kill fish, and, the study suggests, could pose problems far into the future.



"The concentration could cause the eutrophication of lakes for centuries as the treated soil slowly washes into lakes and streams," says Stephen Carpenter, the report's author and professor of zoology at the University of Wisconsin–Madison in an *Associated Press (AP)* article. "The problem leads to fish kills and growth of toxic algae that can make lakes unsuitable for swimming. A very small percentage of the phosphorous moves into the lake each year and that small amount is sufficient to cause a great deal of water pollution."

But, it isn't fair to blame eutrophication solely on agriculture practices says Paul Zimmerman, executive director of the Wisconsin Farm Bureau. "Each year we're getting better and better," Zimmerman says about soil conservation in the *AP* article. "The eutrophication didn't happen overnight and it's not going to be solved overnight either."

A task force has formed in Wisconsin to investigate solutions to phosphorus entering bodies of water.

Read the AP *article on the Environmental News Network Web site at* www.enn.com/water.html?id=194. *The complete report is available in pdf format from the National Academy of Sciences Web site. Go to* www.pnas.org *and enter "Eutrophication of Aquatic Ecosystems: Bistability and Soil Phosphorus" in the search engine.*

RDUS Loans: Poverty Rate Unchanged; Others Down

Interest rates for Rural Development Utilities Service (RDUS) water and wastewater loans have been announced. The market and intermediate rates are down slightly, while the poverty rate is unchanged.

RDUS interest rates are issued quarterly at three different levels: the poverty line rate, the intermediate rate, and the market rate. 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. As of April 1, 2005, the federal poverty level was $19,350 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 issued from July 1 through September 30, 2005, are:

- poverty line: 4.5 percent (unchanged from the previous quarter);
- intermediate: 4.25 percent (down 0.125 from the previous quarter); and
- market: 4.125 percent (down 0.125 percent from the previous quarter).

For this quarter, all loans may be made at the lower market rate. 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.

On the Web

Rural Assistance Center

www.raconline.org

Established in 2002 as a rural health and human services information portal, the Rural Assistance Center (RAC) helps those working with rural communities to learn about available programs, funding, and research that provide quality health and human services to rural residents.

The dozens of available topics include community development, economic development, workforce development, and state and federal legislation. Each topical area provides more information about funding opportunities, organizations involved in the area, contacts, news, events, and more.

RAC information specialists are also available by phone (800-270-1898) or via e-mail at *info@raconline.org* from 8:00 a.m to 5:00 p.m. Central time, Monday through Friday.

www.raconline.org

Safe Drinking Water Trust e-Bulletin

www.watertrust.org

The Safe Drinking Water Trust *e-Bulletin* is a free resource on security, regulations, and safe and efficient operation of small water and wastewater plants.

Subscribers receive a free e-mail bulletin every three weeks containing informational articles on practical subjects, written in plain English. The *e-Bulletin* contains articles on different security and regulatory issues and provides tools about financial, managerial, and technical capacity.

Readers may request free technical assistance or ask questions about a variety of topics, including vulnerability assessments, regulations, or the operation and maintenance of their facilities.

The *e-Bulletin* and the Safe Drinking Water Trust are programs of the Rural Community Assistance Partnership.

Natural Resources Conservation Service

www.nrcs.usda.gov

Originally called the Soil Conservation Service, the Natural Resources Conservation Service (NRCS) helps America's private land owners and managers conserve their soil, water, and other natural resources.

NRCS has several water-related activities:

- provides assistance to rural and urban communities to help reduce erosion, conserve and protect water, and solve other resource problems;
- offers technical assistance to farmers and ranchers to improve water quality, including improving nutrient and pesticide management and reducing soil erosion;
- provides onsite technical assistance to plan and use conservation practices and to help control nonpoint source pollution of surface and groundwater;
- helps urban and rural communities protect, improve, and develop the water and land resources of watersheds up to 25,000 acres through watershed protection and flood prevention projects; and
- provides estimates of annual water availability, spring runoff, and summer stream flows.

NRCS maintains offices at state and county levels, as well as in the Caribbean area and Pacific Basin.

For more information about NRCS activities or to find the location of these offices, visit the NRCS Web site or write to U.S. Department of Agriculture, Conservation Communications Staff, P.O. Box 2890, Washington D.C., 20013 or call (202) 720-3210.

W. K. Kellogg Collection of Rural Community Development Resources

www.unl.edu/kellogg/main.html

Based at the University of Nebraska–Lincoln, this collection has seven categories of materials: community development, strategic planning, telecommunications/education, leadership development, economic development, land use/natural resources, and healthcare. Hundreds of different materials are listed and annotated.

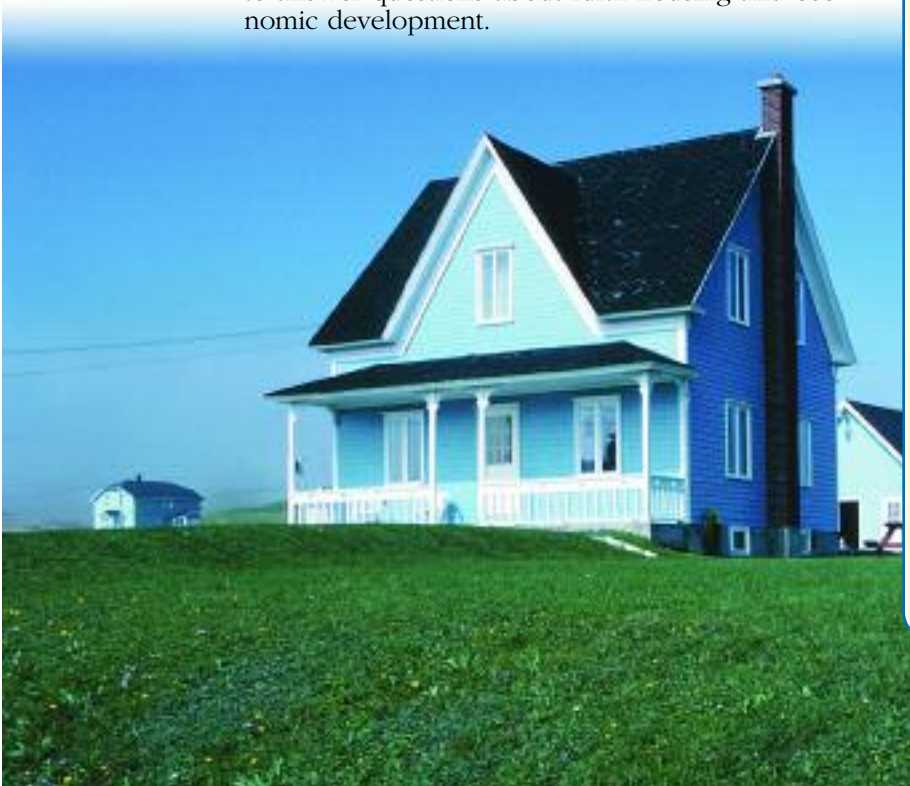
The site is designed so that users locate information by title, category, or through a key word search. Users then contact the source directly for more information or copies of particular publications. Many of these resources are free or available for a nominal fee.

Rural Housing and Economic Development Gateway

www.ruralhome.org/gateway

The Rural Housing and Economic Development Gateway site connects rural organizations with information, technical assistance, training, and investment capital to help them develop, rebuild, and preserve affordable housing, local economies, and essential infrastructure. It focuses on developing the capacity of local leaders in nonprofit organizations to help their own communities.

Funded by the U.S. Department of Housing and Urban Development, and developed by the Housing Assistance Council, the Rural Community Assistance Partnership, and the National Congress for Community and Economic Development, this project also provides a toll-free phone service (877-787-2526) and e-mail *gateway@ruralhome.org* to answer questions about rural housing and economic development.



Funding Resources Guide

www.nal.usda.gov/ric//ricpubs/funding/fundguide.html

The Rural Information Center (RIC)—part of the U.S. Department of Agriculture's National Agricultural Library—has information about community and economic development, water quality, and technology transfer, as well as other topics of interest to those in rural areas.

RIC's *Guide to Funding Resources* provides an overview of the funding process. The site also includes links to searchable databases offering funding opportunities from government and private sources to local governments, community organizations, and individuals. The site also has links to more than 60 full-text online guides, manuals, and tips to help grantwriters prepare successful proposals.

More information about RIC is available on their site at www.nal.usda.gov/ric *or by writing to USDA, Rural Information Center, National Agricultural Library, 10301 Baltimore Ave., Room 304, Beltsville, MD 20705-2351. You may also e-mail the center at* ric@nal.usda.gov *or call (800) 633-7701.*

www.nal.usda.gov

Ask the Experts

Each issue, we ask members of the *On Tap* Editorial Advisory Board to answer a drinking water-related question. We then print as many responses as space permits. The opinions expressed are not necessarily those of NESC.

Over the next several years, water and wastewater utilities will have to deal with large numbers of their workforce reaching retirement age.

What are some things your organization is doing (or is planning to do) to prepare for this exodus?

Reach Out to Bring Them In

There is no substitute for experience and replacing those who have been around for a while is a daunting task. However, what I can't seem to explain, but I am encouraged by, is the high quality of people who are interested in entry-level positions in the water and wastewater treatment fields.

When I interview people, they claim that their interest stems from news coverage of problems and challenges facing those working in our profession. What we are finding out is that the water and wastewater treatment fields are attracting talented prospects from engineering, biology, chemistry, mathematics, and environmental science disciplines.

We have experienced great success by participating in career nights at the local high schools and community colleges and have actually found several employees from these venues. We also host tours of our facilities for local college, high school, and elementary school groups. These students usually find the facilities and operations fascinating once inside the gates. Sharing our time and experiences can and will inspire the next generation of utility operators and managers.

Frank DeOrio
Director of Municipal Utilities
Auburn, New York

Keep a Long-Term Perspective

Most of the federal environmental laws (including the Safe Drinking Water Act) were first enacted in the 1970s. The passage of those laws and new requirements for both water and wastewater treatment resulted in many people entering the treatment arena as certified operators. Thirty years later, those experts in the treatment field are approaching retirement age. As they retire over the next few years, there will be a problem finding new certified operators, especially with experience, to replace them.

The recent federal requirement for drinking water treatment and distribution operators has caused some amount of upswing in the number of people seeking certified operator status. However, many of these "new" operators are people who have been in the field for years but never needed to be certified. The number of young workers seeking water and wastewater certification is on the rise, but at a level far below the rate of personnel leaving the field. Additionally, for small systems in particular, there is the problem of operator retention. As a "lowly" operator becomes trained and certified, there is always a better position available at another utility. A crisis is in the offing.

Utilities need to start bringing young people into the realm of certified operator. This means finding those who are interested

in making a career of utility work. It means stimulating them by making the job both interesting and challenging. It means pushing them and encouraging them to gain knowledge in the field and move up the levels of certification. It also means paying them according to the importance of their position.

Certified operators are one of the poorest paid groups of public employees. Quite often they are not appreciated for their important role in society. These people protect public health by making sure the drinking water is safe for all citizens to drink. They protect the waters of our nation by adequately treating wastes so that pollution is minimized and water quality maximized. They are on call around the clock, in any kind of weather, to repair, rebuild, and react to every emergency that threatens water and wastewater systems. Until proper recognition—including adequate pay—is achieved there will continue to be shortages of trained and certified operators.

Once a utility admits the importance of its operators (not just for regulatory compliance), it can start looking to them as the future of their operations. Adequate pay, a chance for advancement, continued training and learning opportunities, and a challenging level of responsibility will not only bring young people into the field, but also assure their interest and loyalty to the job. Utilities must create the proper atmosphere to bring interested employees into the field, and more importantly, keep them there.

Jerry Biberstine
Senior Environmental Engineer
National Rural Water Association

Craft Training to Meet Needs

People working in the water/wastewater industry are well aware of this problem, or they should be. Unfortunately, I think conditions will get very uncomfortable before they improve. There is a reason people are not entering the industry—it's called money. Most operators are not paid appropriately for the amount of knowledge needed and the job duties they perform. Supply and demand has a way of working these things out eventually. I've seen this happen in other industries.

Those of us involved in the creation of training materials and those providing technical assistance in the field should be able to paint an accurate picture of what operators and managers need to know. Amorphous guidelines and thick manuals will not work for small system operations. State-specific training tools will be very important to new operators. Sure, they'll need to know in general how to operate and maintain systems, but they also need access to specific documents or templates that help them perform their day-to-day job duties.

If the operator of a system retires before passing on his experiences to another, then case-study applications will become more important. There must be an obvious path for a new or aspiring operator to follow. We should not inundate an operator with unrealistic expectations. If he is certifying to operate a small ground water system with no treatment, then teach him according to that configuration with an appropriate case study. Don't bury him with topics he will not deal with. If his system changes, such as addition of disinfection with the Ground Water Rule, then his certification requirement would change too, and he would need that additional training.

The best way to learn how to operate a system is hands-on. How do we motivate experienced operators to pass that information down to the newbie? If I were a system owner, I would insist on an up-to-date operations' manual. If that manual does not exist or if it has not been updated in a year or two, then that task should be made a high priority. It is imperative that the body of knowledge from the retirees be handed down to the new people. Whether this information is scratched onto crumpled paper or neatly printed from a computer program does not matter. It just better be there.

One training application that could help solve this problem is what I refer to as a "win-win" activity. This application would

Do you have a suggestion? *On Tap* editors are always eager to learn from you. Here's how to contact us:

Mark Kemp-Rye, e-mail:
mkemp@mail.wvu.edu
phone: (800) 624-8301 ext. 5523

Kathy Jesperson, e-mail:
Kathy.Jesperson@mail.wvu.edu
phone: (800) 624-8301 ext. 5533

On Tap

make it easy for a seasoned operator to assemble a very informative and complete operations manual. This is a win for the system owner and the new operator that eventually replaces the seasoned operator. If the seasoned operator is able to earn credit toward maintaining his license for performing this task, then he is more likely to do this, a "win" for him. If we wait too long, then seasoned operators will not care about maintaining their certification and this is a non-issue. So let's get to work all you training developers and providers. There's plenty to be done.

Kevin Kundert
Training Director
Montana Water Center

Consider Various Options

At my company [Peninsula Light Company], the average age of our employees is approximately 48. Fortunately, people in upper management positions are not all set to retire at the same time, and at least one of the three is a younger, experienced professional. We recognize that there is a need to plan for a significant portion of our workforce nearing retirement. This month at our annual strategic planning session, one of the action items to be discussed is a succession plan for retiring employees.

One advantage to existing (and often younger) employees is the greater opportunity for advancement within the company, but it also means an increase in hiring and training new employees. The obvious downside is the history and experience that leaves with the outgoing retirees.

Another way my company has retained at least one employee (me) is to offer a more flexible schedule and reduced hours. This may also work for some retirees who are not ready to fully leave the job market.

As a company, we also have a pretty good record for hiring high school and college interns. One of these interns, after coming back each summer, finally moved into a permanent position. I began my career during college as an intern for a large municipal water system, and I'm still involved today in the water industry.

I was previously active in a water organization where age was a concern and also diversity (minorities and females). As the first female chair (and under age 40 at that time), my first message to the membership addressed this particular issue. At that time, there were only 30 women under the age of 35 and not that many more men in the same age category for an organization with more than 2,000 members. This organization today has over 3,000 members. The strategic plan, which was reviewed annually, was modified to target this issue and it appears that these goals are coming to fruition. The strategies outlined to achieve these goals included expanding the types of committees and conference activities that would attract a more diverse membership. It also included promoting the young-professionals' group.

Actions that can reduce the knowledge drain or ease transitions include job shadowing, cross training of positions, mentoring, and good historical documentation of important decisions and actions that can be replied upon if they arise again after the experienced employee has left.

If there is not an adequate pool of candidates with relevant experience, it could mean the industry might have to rely more on outsiders (i.e., those not previously connected with the water industry) being brought into the fold. This has the potential for creating more employee stress or anxiety than would normally happen with any transition, but it can also increase creative avenues for getting business accomplished. Change is inevitable; it is only a matter of time.

Lisa Raysby, P.E.
Water Engineer
Peninsula Light Company

We're all ears!

Have you benefitted from information you've read in *On Tap*? Have you used any of our other services? We're always interested in learning how what we do helps you. Here's how to contact us:

Mark Kemp-Rye
e-mail: *mkemp@wvu.edu*
phone: (800) 624-8301 ext. 5523

Kathy Jesperson
e-mail: *kjespers@wvu.edu*
phone: (800) 624-8301 ext. 5533

Or write to us at:
National Environmental Services Center
West Virginia University
P.O. Box 6064
Morgantown WV 26506-6064

Letter to the Editor...

To the Editor,

While I am a strong believer that we need to work toward wastewater reuse (Winter 2005 *On Tap*), there are several areas of concern that need to be addressed. I will focus my comments on one simple problem: the sodium content of the discharged water. While the sodium content is not detrimental to human health, it is detrimental to the health of the soil if the water is used for irrigation.

Businesses, especially meat packing plants and homeowners with water softeners, add significant amounts of sodium to their wastewater. Sodium is a dispersing agent that will cause a seal to develop on the soil surface. In the semi-arid and arid areas of the world, these conditions are called alkali soils or slick spots. They are non-productive. We can make soils alkali by adding sodium.

The city of Huron, South Dakota, tried disposing of wastewater by giving it to farmers as irrigation water. It soon became apparent that it wasn't working because of the sodium in the water. The soil was sealing up and the water was running off or ponding on the land. That was more than 20 years ago.

A city might get by using wastewater for irrigation if there isn't much salt added to the water and especially if the area receives more rainfall than evaporation loss so that salts can leach down in the soil profile. However, water softening is becoming more popular and the problem is increasing.

I believe this caution concerning sodium should appear along with articles of this nature.

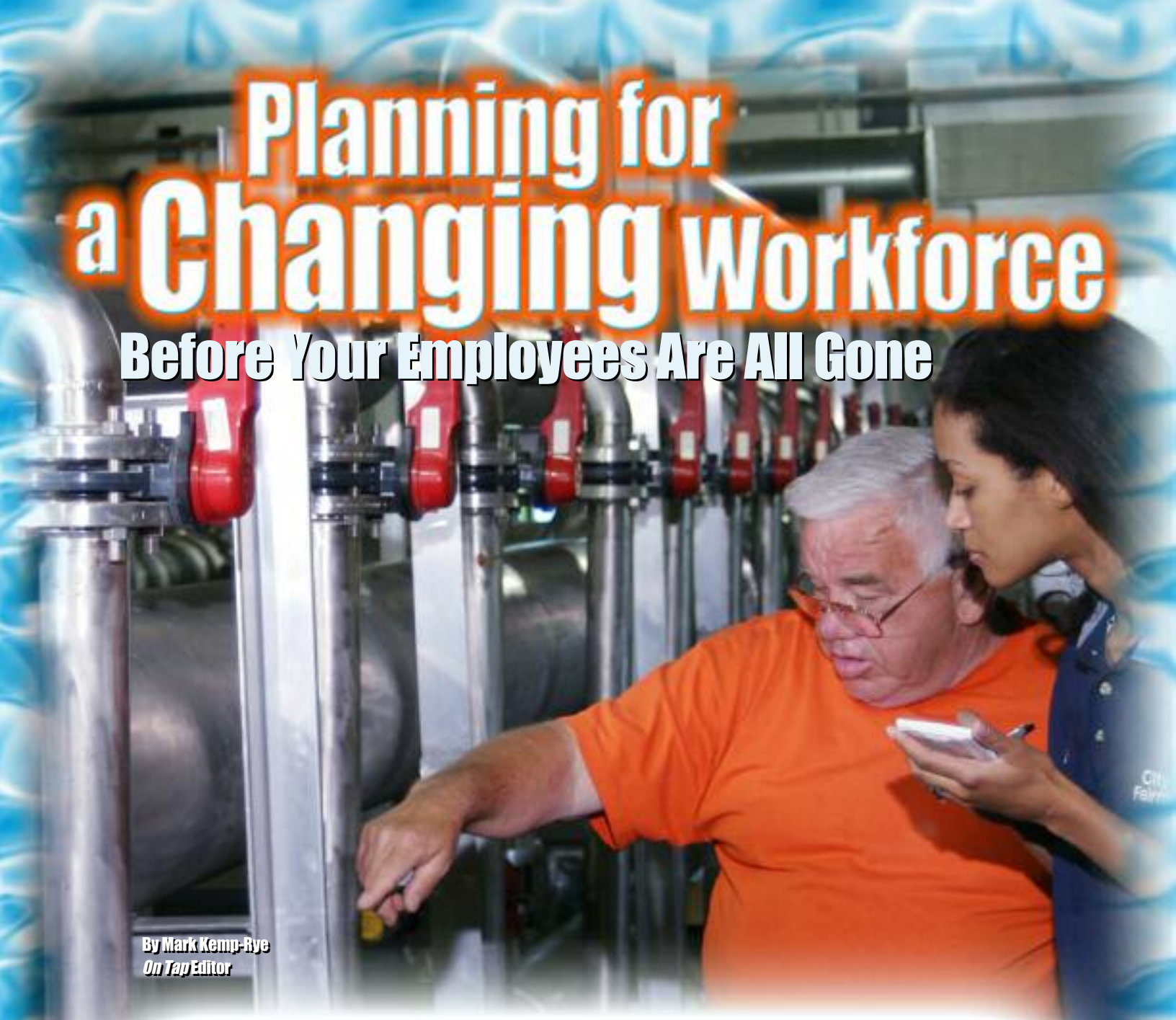
The article also mentioned that Woodburn, Oregon, decided to irrigate trees to get rid of wastewater due to high ammonia content. Woodburn has an annual evapotranspiration of about 25 inches and an annual rainfall of about 40 inches. Adding water at an extra 0.6 inches per day does not mean much extra will be evaporated. This will have to soak through the soil profile and emerge as pumped water or lateral flow to rivers. The project will have to rely on maintaining a good infiltration rate. Hopefully, any sodium will be flushed through the system before it can cause soil dispersion.

Sincerely,

Robert Kohl
Professor of Plant Science
South Dakota State University

Planning for a Changing Workforce

Before Your Employees Are All Gone



By Mark Kemp-Rye
On Tap Editor

By now, we've all heard about the droves of baby boomers getting ready to retire. It's an issue that will affect all workplaces, to one degree or another, and it looks to be particularly severe for the public sector, including water and wastewater utilities. Unfortunately, it's an issue that most organizations haven't considered adequately and aren't equipped to handle.

"The challenge of replacing talented employees has become a major national crisis that must be addressed by not only the public works profession but also by elected officials and public managers in every state, city, and county in America," writes John Luthy, president of The Futures Corporation in the December 2004 *APWA Reporter*.

This pending crisis poses two central challenges: (1) how do we replace the workers who will leave over the next several years and (2) how do we capture the knowledge and experience that these people have? The answers to these questions and the way we address these challenges will have long-standing implications for our utilities.

Workforce Crisis Looms

The federal government estimates that as many as one-third of its workforce will retire in the next five years. Similarly, a survey of 116 utilities conducted by the Black and Veatch Corporation for the American Water Works Association Research Foundation (AwwaRF) and the Water Environment Research Foundation (WERF) found that these utilities expected to lose 14 percent of staff to retirement within five years and 27 percent in 10 years.

The immediate challenge, then, is to replace retiring workers—a task that's much easier said

than done. The general public, as a rule, has little idea about the importance of public works or what has to happen in order to provide clean, safe water to our homes. Couple this with the fact that salaries are, according to Luchy, often 25 to 40 percent below similar industry positions, and it isn't surprising that workers aren't flocking to town hall looking for jobs.

"As I see it, the recruitment question is a public education issue," says Bob Blanco, a rural development specialist with the Rural Community Assistance Corporation. "If entry level and more complex skills were competitive and properly compensated, the industry would be able to attract and retain an ample talent pool. This means raising rates or generating revenues at the local community to meet this need. To succeed in establishing rate levels that will sustain financially healthy wastewater and drinking water facilities that include compensating operators appropriately will require public or user support."

For many communities, this could translate into "rate shock." Faced with more stringent regulations, aging infrastructure, and the need to be financially secure both now and in the years ahead, most systems are already looking at sizable rate increases. Adding in even more money for market-rate salaries and decent benefits only compounds this situation. A good tactic is to start talking to the public about the importance of good water and wastewater. (An article titled "Rate Increases: Dealing With the Public" is available on the NESC Web site at *www.nesc.wvu.edu*.)

"Community leaders must invest time on the public relations front to educate, in a sincere and trusting manner, that investment is necessary for the safety and health of the residents and the economic vitality, growth, and quality of life within the community itself," Blanco says.

"How do we create a market?" he continues. "To some extent it exists in the regulator's role. Those facilities not getting the job done and those given ample time to do so should not be rewarded the same way as those who comply with state and federal laws and regulations. The other dimension is the public's role. If the demand or pressure is not at hand, competing economic priorities may prevent positive steps from being taken. So the future of the community can hinge on the community's water infrastructure and the capacity of that community to support utility services through its technical, managerial, and financial skills. Operator recruitment and retention is a key element."

Recruitment Is Just the Beginning

Finding and retaining employees and coming up with the money to do it is a big challenge in and of itself. And the pending loss of personnel isn't news to most systems.

"But," Luchy warns, "awareness often compounds the true challenge—replacing seasoned professionals who have gained the bulk of their institutional memory through many years on the job with continuous training during years of extraordinary technical innovation. Simply placing ads to replace retiring talent does not address issues of lost institutional knowledge, acquired skills, and community-wide collaborative relationships."

To put this in perspective, a March 7, 2005, *Fortune* article provides a dramatic example. "Way back in the 1960s, [the National Aeronautics and Space Administration (NASA)] spent $25 billion (in 1960 dollars)—and at one point employed 400,000 people—to send 12 astronauts to the moon," writes Anne Fisher. "But in the 23 years since the Apollo program ended, the engineers who carried crucial know-how in their heads, without ever passing it on to colleagues, have retired or died (or both).

"At the same time," Fisher continues, "important blueprints were catalogued incorrectly or not at all, and the people who drew them are no longer around to draw them again. So, to fulfill the Bush administration's promise to return to the moon in the next decade, NASA is essentially starting all over again. Estimated cost to taxpayers in current dollars: $100 billion."

While small utilities aren't working on projects this massive, the situation is remarkably similar and perhaps more critical when considering that large organizations can more easily create or depend on some redundancies across personnel. This is not the case with a one operator water system or a multi-system operator.

Capturing Tacit Knowledge

Those who work for small water and wastewater systems often have what's known as "tacit" knowledge. The vast majority of what they know about the system is in their heads and not documented.

"The nature of the utility workplace lends itself to methods that aren't written down,"

observes Myron Olstein, director of organizational strengthening with Black and Veatch Corporation and one of the investigators on an AwwaRF/WERF study of the Frederick County Sanitation Authority in Winchester, Virginia. "You're not going to go running to a book."

For many workplaces, capturing this tacit knowledge has become an important endeavor. Some have gone to considerable lengths to make this a reality.

The San Francisco Bay Area Rapid Transit District, for example, is developing a sophisticated management system so that employee knowledge can be accessed in the future. Departing employees transfer information on their computers to an intranet site, which also houses employee discussions about how they solve various problems. These discussions and additional information are being used to create online courses to train new workers.

The AwwaRF/WERF project was based on a two-day field study. Project investigators came up with 600 processes typical in a medium-sized water or wastewater plant and tried to develop ways to document the knowledge and experience involved in carrying out these activities.

"The knowledge capture process was designed to cover situations where an impending loss of personnel would happen too quickly for classic knowledge management techniques to be applied effectively," says Jason Jennings, a project manager with Black and Veatch and part of the AwwaRF/WERF project. "As the project team found out in working with the pilot utility, the highest risk of tacit (undocumented) knowledge involved infrequent and/or non-routine events, which are unlikely to be targeted by knowledge management.

"In addition to proving useful in prioritizing and capturing important tacit knowledge," Jennings continues, "the methodology also provided the additional benefits of training for junior staff who did not always understand why they did what they did or what their supervisors did and as a vehicle for process improvement. Also of importance to utilities, the pilot utility was able to continue the knowledge capture process without outside assistance on their own following the two days of onsite assistance."

Small System Solutions

Not every workplace can adopt such high-tech solutions. What are some things that small systems can do to capture knowledge and help future employees?

"Documentation is the answer," says Kevin Kundert, training director with the Montana Water Center and a licensed water operator. "Operators need to know specifications and historical data about the system—what's gone right and what's gone wrong with the system in the past. Where are all the controls, parts, valves, etc.?

"I know of numerous cases of operators walking off the job after multiple years of service as the only operator of a system and taking much of the knowledge with them when they go," Kundert says. "Not good! System owners must document operational records that can help a new operator

acclimate to the system. Red flags should be popping up for system owners if only one person has all the pieces of the operations puzzle."

Kundert recommends using the system's sanitary surveys as a resource. These reports contain a great deal of information about the nuts and bolts of the system as well as its strengths and weaknesses.

Blanco suggests that retired workers might become part of the solution. "If we could hire the retired operators and train them to be trainers, this would be a good start," he says. "Operating facilities is about some science and a grasp of the fundamentals, coupled with the art of operating a specific facility through years of familiarity with its uniqueness." An AARP survey supports this idea, finding that most pre-retirees plan to work at least part-time after retiring and that half foresee working into their 70s and beyond. (See the sidebar on page 22 for more about this idea.)

Training Is Key

Mississippi has developed an operator-in-training scholarship fund to help small systems attract new personnel. Administered by the Mississippi State Department of Health (MSDH) with U.S. Environmental Protection Agency operator training set-aside funding, the program helps small communities with salary assistance while a new operator gains the necessary experience, acquires the necessary certification, and is then able to take over the reins as an operator.

"The program began in 2003 with a statewide mailing announcing the program," says Dan George, training branch director with MSDH's Bureau of Water Supply. "To date we have had 26 water systems submit applications to participate in the training program, and we've had 18 people complete the required training and pass the certification exam."

Any public water system serving a population of 3,300 or fewer may participate in the program. Individuals seeking to become an operator must be U.S. citizens and have a high school diploma or GED. More than one system may jointly sponsor an operator in the program.

The scholarship pays the participating system or systems $15,000 over 12 months, $7,500 over two years, or $5,000 over three years. "Although there is no minimum salary threshold, we (MSDH) strongly encourage participants to pay the operators the highest possible salary," George says. "As we all know, the higher the salary you pay a trainee, the more likely it is that you can employ a motivated, highly qualified, and capable person as your operator."

George also encourages people to recruit trainees who show interest in a career as an operator and to get a commitment in writing. "Water systems should be sure that their selected operator trainee wants to be a waterworks operator, can learn the business, and pass a certifying exam," he says. "I would also recommend a personal services contract of some type with the waterworks' operator. This contract should be written to guarantee the trainee understands the requirements of the scholarship, works to complete the training (including successful completion of the certifying exam), and then agrees to stay with the water system for a period of time."

"Keep in mind that training isn't just for new water operators or managers," Kundert says. "The rules are changing and technology is moving at such a fast pace that recurrent training is needed to just keep from falling behind. New training tools are available and continue to be produced. These allow operators to maintain proficiency without even leaving their home or workplace.

"Another option is to meet continuing education by attending in-person workshops," he continues. "These training sessions help you maintain a network of contacts who can assist you from time to time—whether they be your peers or technical assistance providers."

Workforce Planning in Five Steps

There are five critical areas where progress is needed [to plan for worker retirements]. Each requires collaboration with and support from elected officials, personnel managers, and human resource departments, but all offer the means to break the cycle that will otherwise continue to plague the public works profession

1

Provide a clinical assessment of employee retirement, turnover, and retention issues. Prepare a clear, concise, and clinical assessment of employee retirement with schedules showing loss of institutional memory as well as essential technical knowledge and skills. Consider this a discussion paper that outlines the situation pertaining to talent loss, rate of turnover, declining tenure, and recruitment difficulties. Review the status of professional development and training programs, indicating their value and your department's current level of formal employee development. Discuss salary surveys, with supportable data related to comparable salaries in similar industries and government agencies. Inform decision makers of the issues with documented impact on program and project delivery, service quality, and cost to the community

2

Focus on employee training and development. For many technical disciplines, half of what is learned in college or in specialized training is obsolete within five to eight years. State and local government have been extraordinarily myopic about continuing professional development, often cutting the very training and development programs that would otherwise help sustain desired quality and service levels. Public works leaders must address this through honest discussions with elected leaders and policy makers. Establish mentoring programs, develop internal orientation and training programs for core competencies and specialized skills, and create your own development systems. Research tells us that new recruits and established employees will increasingly demand career and professional development. Remember, the only thing worse than training people and having them leave is not training them and having them stay.

3

Use retired technical talent. Recent AARP surveys report that fully 80 percent of retiring baby boomers plan to work in retirement. This will provide and is already providing a huge talent repository replete with every technical specialty and type of experience needed in most departments. The only barriers involve existing policies that might not accommodate individuals who want to work part-time or have flexible hours. Forward-thinking leaders will recognize this cadre of talented professionals and immediately begin to develop personnel policies that allow flexible contracts. Combined with sensible recruitment and succession planning, using capable retirees will ensure adequate staffing for scheduled projects, provide more senior talent to use as mentors, and will moderate staff costs.

4

Conduct succession planning. Similar to private industry, it is essential that every public works department have a clear management development and succession plan. Take time to analyze the management structure and determine how retirement or resignations might impact service delivery, institutional memory, and operating effectiveness. For those considered top leadership candidates, provide a formal development program that will allow them to grow professionally while preparing for potential management openings. Invite broad participation—every learning opportunity pays dividends for both the community and your department.

5

Accelerate recruiting. Public works must establish itself as a wise professional career choice. This cannot be done without a totally revamped recruiting system that actively seeks new talent, both early and mid-career. Learn to showcase your department and what it means to the community. Establish a team of employees who visit local high schools, junior colleges, and universities during career fairs, explaining to prospective candidates the exciting challenges associated with public works. Talk about your history, contributions, projects, career opportunities, job variety, and other aspects of public service.

Adapted from the December 2004 issue of the *APWA Reporter*, a publication of the American Public Works Association. Reprinted by permission.

Don't Wait to Get Started

Admittedly, the prospect of simultaneously getting new personnel on board and trying to capture the collected wisdom of those leaving is a daunting one. The demographic changes we face are complex and won't necessarily be remedied through simple steps. Nevertheless, it is important to get started sooner than later.

The solutions we begin crafting today will result in an easier transition down the road. When it's all said and done, hard work now will result in a deeper understanding of our utilities, a better experience for system personnel (those on the way out as well as those on the way in), and confidence that we won't compromise the public health of our communities.

For more information

The summer 2004 *On Tap* featured a series of articles—including one on rate setting and another on retaining employees—based on the theme "Running Your System Like a Good Business." This issue is available on the National Environmental Services Center Web site at *www.nesc.wvu.edu* or may be ordered in hard copy by calling (800) 624-8301 or e-mailing *info@mail.nesc.wvu.edu*.

The federal government's Office of Personnel Management has information about topics such as workforce retirement and succession planning. For more information, visit their Web site at *www.opm.gov/employ* or send an e-mail to *esmarketing@opm.gov*. You may also write to Office of Personnel Management, 1900 E Street NW, Washington, DC 20415-1000 or call (202) 606-1800.

The AARP has a wealth of information about retirement and related issues. Visit their Web site at *www.aarp.org* to learn more.

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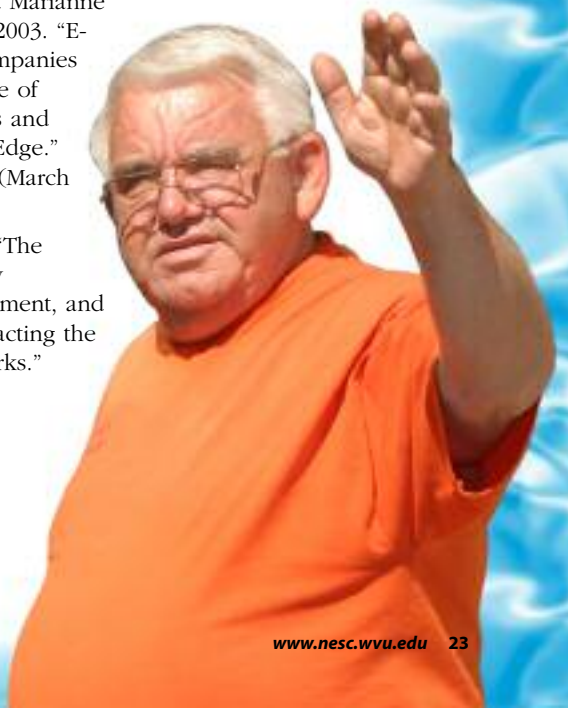

Infrastructure and Economic Development

Water and Sewer Projects Provide Foundation for Community Growth

By **Mark Kemp-Rye** • *On Tap* Editor

Photos and Layout by **Chris Metzgar** • Graphic Designer

Everyone is interested in economic development, it seems. Universities and institutes study the subject, politicians of all stripes promise it during campaigns, and citizens hope development schemes work so that their children and grandchildren can remain in the community.

Like building a lasting structure, economic development must have a solid foundation. Though too often overlooked, an integral part of any economic growth plan is the water and sewer infrastructure that will support such plans.

"Water and sewer service is a fundamental building block of the physical infrastructure of a community," says Louis Segesvary, public affairs director with the Appalachian Regional Commission (ARC). "Water and sewer projects have clearly helped retain business and attract new development. The quality of life a community will experience is dependent on it." In fact, a prominent goal in the ARC's strategic plan is that communities will have adequate infrastructure for economic development.

Access to utilities isn't just a concern in the Appalachian region, it's a priority almost everywhere. "The National Association of Development Organization (NADO) Research Foundation's 2000 survey of regional development organizations revealed that water infrastructure is one of the top economic development needs," reports Joseph Dunn, NADO legislative representative, "accounting for 123 responses or 42 percent of the regional development organizations surveyed."

Various studies and anecdotal evidence show that adequate water and wastewater systems must be in place before embarking on any grand development scheme.

Averting Tragedy in Alabama

If five major employers in a rural county closed within a two-year period, it would be an insurmountable setback for most places. Rather than roll over and die, though, local leaders in DeKalb County, Alabama, decided to attract new industry to replace the closed textile plants.

Leaders from the towns of Rainsville and Section, in the northeastern part of the state, focused their efforts on the Rainsville Industrial Park. By improving the park's water and sewer capacity, they were able to construct a $10 million facility and attract a company that makes parts for a Honda car assembly plant in nearby Lincoln. The new company—Rainsville Technology, Inc. a subsidiary of Moriroku Company Limited of Japan—created more than 120 new jobs.

According to the ARC report *Best Practices in Water and Wastewater Infrastructure Development*, "The new plant would not have been possible

without the cooperation of two municipal governments—the town of Section, which owned the water system, and the city of Rainsville, which ran the sewer system. Although some municipal governments can be territorial about their water and sewer services, these two municipalities agreed to work together to develop the new plant. As a result, both communities are now enjoying the benefits of that cooperation." (For more information about regionalization, see the articles "Regionalization: Forced, Voluntary, and Somewhere in Between" and "Regional Water Authority Helps Western New York" on the NESC Web site at *www.nesc.wvu.edu*.)

Research Supports Investment

As with the DeKalb County, Alabama, story, creating jobs (or preserving existing ones) is a key goal for most economic development strategies. However, not all economic development leads to more jobs.

"Whether rural employment rises or falls with productivity-enhancing infrastructure depends on whether infrastructure and labor are complements or substitutes in the production process," note William R. Fox and Sanela Porca in "Investing in Rural Infrastructure," published in the June 2002 *Economic Development Digest*.

"If businesses hire more workers as the infrastructure is improved," Fox and Porca explain, "infrastructure and labor are complements; and if they hire fewer workers, they are substitutes. Infrastructure can indirectly stimulate employment as it attracts entrepreneurs, a quality labor force, and investment capital into rural areas."

Despite the reality that some improvements can result in labor substitution, most development schemes are tuned into the need for jobs and are geared toward making a positive impact in the community—and most do just that.

A 2002 U.S. Department of Agriculture (USDA) study of 87 water and sewer projects titled *Economic Impact of Water/Sewer Facilities on Rural and Urban Communities* found that businesses involved in these upgrades "saved, on average, 212 permanent jobs, created 402 new permanent jobs, made private investments of $17.8 million, leveraged $2.1 million of public funds, and added $17 million to the local property tax base. Indirect beneficiaries saved, on average, 31 permanent jobs, created 172 new permanent jobs, attracted $3.34 million in private-sector investment, leveraged $905,000 of public funds, and added $3 million to the local property tax base. This enlarged property tax base, at a mere one percent tax rate, would yield $200,000 in annual property tax to the community."

"Every dollar spent in constructing an average water or sewer project generated almost $15 of private investment, leveraged $2 of public funds, and added $14 to the local property tax base," says Fagir S. Bagi, an economist with USDA's Economic Research Service and author of the study.

One Small Town, Two Industrial Parks

Federalsburg, Maryland, is a small community east of the Chesapeake Bay within a few miles of the Delaware state line and seemingly miles from the hustle and bustle of D.C. and Baltimore. But looks can be deceiving. This quiet town of 3,000 is home to not one but two thriving industrial parks.

"The first park—the Federalsburg Industrial Park—was built more than 20 years ago," says Steve Dyott, Federalsburg's public works director, "and the Caroline Industrial Park was built about 10 years ago. A new section of the older park opened two years ago."

Initially funded by grants from the state economic development agency, the two parks have an occupancy rate of more than 95 percent. A 1994 water and wastewater upgrade resulted in a 750,000 gallons per day system capacity. Currently, both parks are using about half that amount, meaning that businesses can expand production if needed.

"Large businesses use a lot of water and discharge a lot of wastewater," Dyott observes. "Most of them don't want to operate their own treatment systems. Having these services in place is a huge benefit in attracting companies to the parks."

Federalsburg's two industrial parks are home to a variety of light industrial and service-sector businesses, including Solo Cup and Maryland Plastics (both of whom employ more than 300 workers), Yale Sportswear, and Jack and Jill Ice Cream. Most of the employees of these companies live in the area.

Dyott attributes much of the success of the two industrial parks to a good business climate and an excellent quality of life. "The local economic development board has worked hard to fill the parks," he says, "and the town has a lot to offer the people who work there."

What are some of the factors small communities should consider when planning economic development activities? "Do your homework," Dyott recommends. "Figure out what the community needs in terms of businesses and don't upset the balance. If, for example, you have a big company come in but don't have the workforce, then the employees have to come from somewhere else and that doesn't really

Which Development Is Right for Your Community?

Economic development is not a one-size-fits-all proposition. What works in one place will not necessarily work in others.

Keenan Patrick Jarboe of the Athena Alliance, a nonprofit organization dedicated to public education and research on the emerging global information economy, encourages communities to explore the things that make them unique. What is there in your town that makes it special? What combination of local talent, geography, leadership, alliances, reputations (and a score of other intangible things) can you build on for economic development?

In the Rural Community Assistance Partnership magazine *Rural Matters* (Summer 2004), Jarboe cites several examples: "The Appalachian Center for Economic Networks in Athens, Ohio, has created a local economic cluster centered on the specialty food products industry," he writes. "Other examples are film-making around Wilmington, North Carolina; windsurfing-related sporting goods and apparel in Hood River, Oregon; fishing gear in Woodland, Washington; snowmobile manufacturing in northern Minnesota; and houseboat manufacturing in Kentucky."

The best people to decide what will work in a community are those who live and work there.

Inflatable Boats in Western Maryland

How can someone who loves whitewater rafting make a decent living from what most consider a hobby? If you're Dave Demaree, you turn your passion into a business manufacturing the very rafts you used to ride.

Founded in 1982, Demaree Inflatable Boats is based in an old school building (shown below) in Friendsville, Maryland, not far from three of the East's best whitewater rivers. "The school had been abandoned for 12 years or so when we got it," says Demaree. "The town and the county worked to make it happen and we've been here ever since."

From its start making whitewater rafts, Demaree now supplies inflatable craft for operations ranging from rescue to industry to the U.S. military. The company employs two dozen workers.

help the town. Similarly, if you don't have the quality of life factors—such as schools, restaurants, cultural amenities, recreation—people won't want to stay in the area." (See the sidebar on the facing page for more about discovering what type of economic development is right for your community.)

A community's quality of life and other supporting institutions are extraordinarily important for economic development to succeed. "Infrastructure is essential to accommodating growth," write Fox and Porca, "but it is unlikely to stimulate self-sustaining growth that would not otherwise occur. In other words, infrastructure is a

Community Development First

In the rush to implement grand economic development schemes, leaders can sometimes overlook a community's greatest asset: its people. A highly regarded community development scheme based on lessons learned in Tupelo, Mississippi, (now known as "The Tupelo Model") posits that, without a significant investment in a region's people, even the best economic plans are hard to sustain.

The Tupelo Model is based on 12 guiding principals:

1. Local people must address local problems.
2. Each person should be treated as a resource, so the community development process begins with the development of people.
3. The goal of community development is to help people help themselves.
4. Meet the needs of the whole community by starting with its poorest members, not just as targets for top-down efforts, but as full partners in helping design those efforts.
5. Community development must help create jobs.
6. Expenditures for community development are an investment—not a subsidy—and will return gains to the investors. So people with money have both the responsibility and an interest in investing in the development of their own community.
7. Community development must be done both locally and regionally if the full benefits are to be achieved.
8. Start with a few tangible goals and measure the progress in meeting them.
9. Build teams and use a team approach.
10. Leadership is a prime ingredient, but community development cannot be achieved without organizations and structure.
11. Never turn the community development process over to any agency that does not involve the people of the community.
12. Persistence is essential and programs must be continually updated.

Source: The Aspen Institute, Rural Economic Policy Program

necessary, but not sufficient, condition for growth. An inadequate infrastructure can inhibit growth, but its availability does not overcome other limitations that may exist in rural communities." (See the sidebar at the left for more information about community development.)

That said, the importance of good infrastructure should not be overlooked. "I strongly encourage communities who are thinking about developing an industrial park to have adequate water and wastewater systems," Dyott says. "If you don't have adequate capacity in place, you'll be behind the 8-ball from the start. You don't want to continually have to upgrade these facilities to accommodate each new customer. Federalsburg is very fortunate that the economic development people two decades ago had the vision to develop the capacity we now have."

The success of Federalsburg's development planning is testament to foresight and the benefit of good planning.

More Than Money

Economic development is usually measured in terms of money generated and jobs created. In fact, the International Economic Development Council defines these activities as "the process of creating wealth through the mobilization of human, financial, capital, physical, and natural resources to generate marketable goods and services."

Certainly wealth creation is a compelling reason to engage in development efforts. But there are other, non-monetary benefits derived from these projects.

"Rural and urban water and sewer projects both generate much greater economic benefits than their total construction cost," Bagi says. "In addition, water and sewer projects help teach communities to plan, prepare applications, obtain grants, manage construction projects, work with government agencies at every level, and negotiate with existing and relocating businesses." These lessons serve to make the community stronger and often produce more opportunity.

Whether your community is trying to expand upon local business success or attract new development to the area, keep in mind that economic

Federal Funds for Infrastructure and Development

The Economic Development Administration (EDA) has a program called Grants for Public Works and Development Facilities. Aimed at economically distressed areas, these grants are for public works projects such as water and wastewater infrastructure development. Projects must promote economic development, create long-term jobs, and benefit low-income residents. These grants cover up to 50 percent of project costs with as much as 80 percent available for severely distressed communities. For more information, call EDA at (202) 482-3081 or visit their Web site at *www.doc.gov/eda/*.

The Community Development Block Grant (CDBG) program administered through the U.S. Department of Housing and Urban Development (HUD) offers grants directly to states, which then provide funds to small cities and non-urban counties. The program requires 70 percent of CDBG funds be used to help low- and moderate-income people. On average, these grants cover 50 percent of project costs. For more information, contact your state or local HUD office or you may call HUD headquarters at (202) 708-1322. HUD's Office of Community Planning and Development Web site is located at *www.hud.gov/offices/cpd/*.

development is a never-ending process. And don't forget that having good water and sewer systems in place is a vital first step.

For More Information

The National Center for Small Communities (NCSC) recently published Economic Development for Small Communities: A Handbook for Economic Development Practitioners and Community Leaders. This 100-page overview is available from NCSC for $24.50 and may be ordered by calling (202) 624-3551 or through their Web site *www.smallcommunities.org*.

The National Association of Development Organizations (NADO) provides training, information, and representation for regional development organizations serving small metropolitan and rural America. Learn more about NADO by visiting their Web site *www.nado.org*.

Other Web sites devoted to rural economic development may be found in the Web Resources section on pages 10 and 12 of this magazine.

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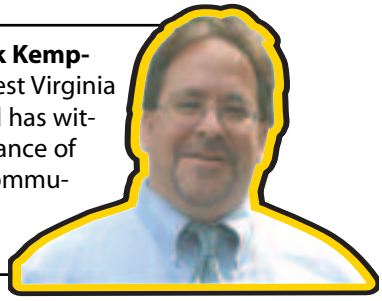

On Tap Editor **Mark Kemp-Rye** has lived in West Virginia most of his life and has witnessed the importance of infrastructure in community development projects.

Executing Your Game Plan

Managing Capital Improvement Projects

By **Nancy Zeilig**
NESC Contributing Writer

Behind every successful capital improvement project—like every winning sports team—there's a good coach. Whether the goal is winning a game or completing a capital project on time and within budget, the coach's role is essentially the same: creating a savvy game plan and assembling a team of experts with the skills to do the job.

When a small water system tackles a capital improvement project, the system manager often shoulders the role of project manager or coach. The first step in creating a game plan is to ensure that all stakeholders (regulatory agencies, city council members or other decision makers, system employees, and customers) understand why the project is needed and what it will entail. Capital improvement projects are generally driven by long-term system needs, such as those stemming from projected population growth and timely replacement of depreciating infrastructure, but regulatory compliance is sometimes a factor as well.

Although some municipalities have longstanding relationships with legal, financial, and engineering professionals, small water systems often must sign up "free agents," or outside contractors, to get the skills required for a specific project. Putting together a project team can involve hiring professionals, such as an attorney, financial advisor, engineer, designer, and construction contractor.

Executing your utility's game plan also involves calling the plays during each phase of the project, assiduously managing its progress from conception through final inspection. In this article, the managers of several small systems that have recently completed or are currently involved in capital improvement projects offer some advice for their fellow coaches.

Communication Is Paramount

Project managers unanimously stress the importance of good communication with all stakeholder groups. Kody Van Dyk, city engineer with the Sandpoint Water Department in northern Idaho, emphasizes the value of involving your regulatory agency early on. Sandpoint completed two capital projects five years ago. First, it constructed a clearwell to increase disinfectant contact time at its direct filtration plant. Then, it reconfigured two large, outdated filters at its conventional plant, increasing efficiency and installing a modern backwash system. Van Dyk reports that the regional state drinking water coordinator voluntarily came to Sandpoint's city council meetings to help convince council members that system improvements were necessary to meet the

requirements of the Enhanced Surface Water Treatment Rule, even though no specific water quality problems had been identified. When it comes to regulators, Van Dyk says, "Involve them early and involve them often."

Treatment plant operators are another group of stakeholders who should be involved from the project's outset. "Ask your operators what they need," advises Lynn Light, water treatment plant supervisor at the Pigeon Forge (Tennessee) Water Department. "Our engineer gathered all the plant operators together to get their opinions."

Pigeon Forge, a resort town southeast of Knoxville, bills itself as a gateway to Great Smoky Mountains National Park. The water system recently tripled the size of its filtration plant from four million gallons per day (mgd) to 12 mgd and kept the existing plant running while the new one was being constructed. The award-winning expanded facility, which went online in 2002, was finished two months ahead of schedule and 17 percent below budget.

Steve Robinson, director of public works in Folly Beach, South Carolina, echoes this recommendation. "Don't try to figure everything out by yourself," he cautions. "Involve your city council or governing board from the beginning, and take them your knowledge of system needs."

Folly Beach, a barrier island on the Atlantic coast just south of Charleston, recently finished two capital projects. In 2002 the system completed a buried 16-inch-diameter pipeline connecting its distribution system with that of the city of Charleston, its wholesale supplier. The eight-inch main that previously connected the two systems was attached to a bridge over the Folly River, which separates the island from the mainland, making the pipeline vulnerable to damage by bridge traffic. The following year, Folly Beach replaced a 50-year-old, 100,000-gallon elevated storage tank with a new 150,000-gallon pedestal tank, increasing storage capacity for both fire protection and population growth as well as gaining some head pressure (the new storage tower is 70 feet taller than the old tank). Extra capacity from the new main helped the system deal with temporarily having no elevated storage facility.

Cooperate With Neighboring Utilities

In addition to underscoring the role of good communication, Robinson pays tribute to the advantages of working cooperatively with neighboring utilities. The city of Charleston, which also serves several other nearby beachfront communities, agreed to suspend any capital improvements at that end of its distribution system until Folly Beach finished its new main. "This minimized the chance of breaks or other service interruptions and ensured constant line pressure," Robinson said.

Cooperation is also alive and well on the opposite side of the country. In south central Arizona, where arsenic concentrations in some groundwater supplies require treatment for compliance with the lower arsenic standard going into effect in January 2006, more than 20 water systems joined forces to form Arizona's Arsenic Remediation Coalition (ARC). Coalition members—including utilities serving various suburban communities west of Phoenix and the Tohono O'odham and Yavapai Apache nations—share legal services and benefit from economies of scale associated with RFP development and other services. "The vendors benefit, too," says Bob Prince, president of coalition member Valley Utilities Water Company. "We tell them if they do a good job on one project, they can have the business of all ARC members."

Valley Utilities, which collaborated with nearby Litchfield Park Service Company on some arsenic pilot studies in 2003, will soon construct arsenic removal stations at two of its six production wells. The arsenic removal systems will consist of above-ground pressure vessels containing ferric hydroxide, an adsorptive filter media. Funding will come from the drinking water state revolving fund. Because of Valley Utilities' small customer base, the $2 million project is expected to cause a 68-percent rate increase—an extra $25 to $100 per month per customer, depending on consumption.

Deal With Rate Issues First

In Idaho, Van Dyk confesses he learned one lesson the hard way: "Raise rates before you start the project," he warns. "Otherwise, you're scrambling to raise them after the fact." Before Sandpoint's most recent capital improvements, the system was unmetered. Although installing meters was a requirement attached to the system's getting funds from Rural Development Utilities Services (RDUS), the city council didn't know meters were being installed until near the end of the project. "It's easy enough to justify meters," Van Dyk says, "but the problem here was timing. I took some heat for that."

Even though Sandpoint's improvement projects were completed only five years

ago, its service population has recently grown so rapidly that the city is about to hire a consulting engineer to redesign the entire treatment system (a switch to membranes is being considered). In the meantime, reports Van Dyk, who isn't inclined to repeat past fumbles, another consulting firm has already designed a new rate system for the city.

Consider a Financial Consultant

In addition to relying on contract services for rate design, project managers sometimes hire financial consultants to help secure project funding. When Valley Pioneers Water Company, just west of Kingman, Arizona, applied for RDUS funds to purchase a new well field and construct a 1.5-mile-long main connecting the new wells with the existing distribution system, the utility found a consultant who had previously worked for RDUS to help with the paperwork. John Clayton, the utility's general manager, says hiring the consultant made the loan process far easier. "We paid him two percent of the total value of the loan, and it was well worth it," Clayton said. "Applying for those loans can be overwhelming. He saved us time because he knew the proper procedures, and he minimized our attorney costs."

Demolishing the old water tower and constructing a new one meant inconvenience for residents of Folly Beach, South Carolina. Through a combination of good communication and temporary solutions, complaints were kept to a minimum.

Carefully Pick a Consulting Engineer

Choose a consulting engineer like you'd pick a quarterback—with utmost care. You and your governing body may be comfortable using a firm you've worked with in the past, or the nature of your project may prompt you to seek a company with different skills. Either way, project managers claim, the effort devoted to selecting this team member is a good investment. Network with other utilities. Check references. Check out other projects completed by the firms you're considering. Before making a final decision, Prince's utility in southern Arizona visited with its leading candidate's office and field personnel and talked at length with the firm's other clients.

Light has high praise for the consulting firm chosen to oversee his project in Pigeon Forge. The company not only scored points for technical expertise but also earned appreciation for going the extra mile—literally. "The consulting engineer and the designer drove out from Nashville, more than 200 miles away, for weekly meetings with the public works director and city manager," Light reports. "They also attended city council meetings twice a month."

As a result of its performance, the engineering firm continues to be involved in operations and future planning at Pigeon Forge. The filter plant's new SCADA [Supervisory Control and Data Acquisition] system includes dial-up capability to the firm's offices in Nashville, allowing its engineers to go online and make corrections quickly and efficiently. In addition, "whenever a developer wants to tap into our system," Light says, "the development goes through our engineer's modeling program to determine whether we can support the new taps or if a booster station is needed."

Pay for a Resident Engineer

Both Light and Van Dyk attribute a substantial portion of their projects' success to the presence of a resident engineer. "We had a resident engineer on site all the time," says Light. "If the contractor was here 16 hours a day, the resident engineer was here 16 hours a day, too. If the contractor needed to do something that disrupted service, the resident engineer came to us, and we figured out a way to deal with it. When the contractor had to reroute the raw water source coming into the plant to keep the old plant in service during construction, we discussed our options, closed down the system for eight hours, and gave the contractor time to accomplish the rerouting."

Van Dyk concurs: "You pay dearly to have an on site engineer—we paid about five percent of our total project cost—but it's worth the price." He complimented Sandpoint's resident engineer, saying, "He knew when to negotiate nicely and when to throw his hard hat against the wall to make his point with the contractor. His interpersonal skills generated mutual respect."

Valley Pioneers Water Company hired a consultant to help them with the loan application for a distribution line extension. Because the consultant had experience working with rural development loans, the process went smoothly.

"It's up to the project manager to ensure that a resident engineer is part of the process," Van Dyk points out. "Some engineering firms might suggest cutting costs by having a part-time person on site, but on a major construction project, it's important to have someone there all the time. Without that, questions don't get asked or answered." (For more information about onsite inspectors, see the *Tech Brief* insert "Quality Control in Construction Projects: Inspect it Now or Fix it Later" in this *On Tap*.)

Involve Your Customers

Another point on which project managers agree is the importance of treating customers well. Customers can be a water system's greatest fans. Inform them early about problems and proposed solutions, use various methods of communicating with them, involve them in decision-making, and consider their needs and interests during construction projects.

One of the methods Van Dyk used to select a consulting engineer was having candidate firms interview with a selection committee composed of city council and community members, including a local engineer and a local activist with a special interest in drinking water quality. He plans to use the same strategy and mix of committee members in selecting an engineer for the upcoming system redesign.

In Folly Beach, the utility warned customers early about the inconveniences expected during construction of the new water storage tower. The community temporarily lost access to city-owned tennis and basketball courts adjacent to the storage tank site because several cellular phone panels that had been attached to a leg of the old storage tank had to be relocated on "COWs" (communications on wheels) and stored on the courts until a new monopole could be constructed specifically for them. In addition, several families had to be evacuated for about a week while the old tank was demolished. "We relocated them to a beachfront hotel," says Robinson, "so they weren't too unhappy."

Crossing the Goal Line

A savvy game plan executed by a carefully chosen team led by an effective coach—these are the tactics most likely to ensure a successful capital improvement project. A water system that pays attention to these strategies has a good chance of finishing its project on time and within budget, as well as an opportunity to score extra points with its fans.

For More Information

Getting the Most From Your Experts, a guide published by the Kansas Rural Water Association (KRWA), is the fifth volume in the association's seven-volume *Water Board Bible* series. Copies of this and other volumes in the series may be obtained from KRWA by writing to, P.O. Box 226, Seneca, KS 66538; phone 785-336-3760; fax 785-336-2751. To order online, visit *www.krwa.net* and click on the link "General Store." A copy of *Getting the Most From Your Experts* costs $12.50.

The articles "Communicating Your Message," "Getting the Most Out of a Project," and "How will the Long Term 1 Enhanced Surface Treatment Water Treatment Rule affect my system?" are available on the National Environmental Services Center Web site at *www.nesc.wvu.edu*.

Acknowledgement

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Nancy Zeilig, an independent writer and editor based in Denver, was editor of the *Journal AWWA* for 19 years.

Question & Answer: Lead and Copper Rule Revisions

By Vipin Bhardwaj
NESC Engineering Scientist

***Editor's Note**: In October 2004, the* Washington Post *ran an article describing how different cities were manipulating test results so that lead levels appeared to be within federal limits. This article prompted the U.S. Environmental Protection Agency to investigate lead sampling practices and to develop a drinking water lead reduction plan.*

Why are lead and copper regulated?

Lead is a toxic metal that causes health problems, even at low levels. In infants and children, exposure to lead can adversely impact their physical and mental development and cause learning disabilities. In adults, exposure to lead over many years can cause kidney and nervous system problems and high blood pressure.

Lead is usually not present in water sources, but enters drinking water through corrosion of pipes and plumbing materials and from lead service lines. Before 1986, homes had copper pipes and solder containing lead. The most common problem is with brass or chrome-plated brass faucets and fixtures, which can leach significant amounts of lead into the water.

Like lead, copper is not usually found in water but leaches out of other materials. Ingesting copper can cause vomiting, diarrhea, stomach cramps, and nausea. The seriousness of these effects increases with increased copper levels.

What is the history of the Lead and Copper Rule?

In 1991, the U.S. Environmental Protection Agency (EPA) published the Lead and Copper Rule (LCR) to minimize exposure to lead and copper in drinking water. According to EPA, the LCR has four main functions:

1. requires water suppliers to optimize their treatment system to control corrosion in customers' plumbing;
2. determines tap water levels of lead and copper for customers who have lead service lines or lead-based solder in their plumbing system;
3. rules out the source water as a cause of significant lead levels; and
4. if action levels are exceeded, requires the suppliers to educate their customers about lead and suggests actions they can take to reduce exposure to lead through public notices and public education programs

The LCR established an action level of 0.015 mg/L for lead and 1.3 mg/L for copper. An action level is not the same as a violation but means that if amounts of lead or copper are detected above the action level, the utility may have to take certain actions (see number four above). The LCR rule is applicable to all community and non-transient community water systems.

If a water system, after installing and optimizing corrosion control treatment, still doesn't meet the lead action level, it must begin replacing lead service lines. Systems serving more than 50,000 people were required to conduct studies of corrosion control and to install state-approved optimal corrosion control treatment by January 1, 1997. Small and medium-sized systems are required to optimize corrosion control if samples taken at consumers' taps show lead or copper exceeding the action level.

In January 2000, EPA adopted the Lead and Copper Rule Minor Revisions (LCRMR), which streamline requirements, promote

Lead and Copper Tap Sampling Requirements

First draw samples must be collected by all CWSs & NTNCWSs at cold water taps in homes/buildings that are at high risk of Pb/Cu contamination as identified in 40 CFR 141.86(a). Number of sample sites is based on system size. Systems must conduct monitoring every six months unless they qualify for reduced monitoring.

Table 1: Pb and Cu Tap and WQP Tap Monitoring

Size Category	System Size	Number of Pb/Cu Tap Sample Sites		Number of WQP Tap Sampling Sites	
		Standard	Reduced	Standard	Reduced
Large	> 100K	100	50	25	10
	50,001-100K	60	30	10	7
Medium	10,001 - 50K	60	30	10	7
	3,301 - 10K	40	20	3	3
Small	501 - 3,300	20	10	2	2
	101 - 500	10	5	1	1
	# 100	5	5	1	1

Table 1

consistent national implementation, and in many cases, reduce burdens for water systems. The LCRMR do not change the original action level.

What are other key parts of the LCR and LCRMR?

The original LCR specified the number of sample sites based on system size. (See Table 1.) Systems are required to take samples every six months, unless they have readings lower than action levels over two consecutive monitoring periods, in which case, they qualify for reduced monitoring.

The revisions to the original LCR rule make clearer what is expected from water systems:

- Systems are required to operate and maintain optimum corrosion control parameters.
- Even after the systems are deemed to have optimized corrosion control, they are required to conduct water quality parameter monitoring.
- The revisions specify the number and location of tap water sampling sites.
- Spell out what will trigger re-sampling for composite source water samples.

The effective date of LCR revisions is April 11, 2000. However, systems should check with their state primacy agencies because not all provisions may apply in their state.

If the samples show lead levels greater than the action level, the LCR mandates that systems take the following steps:

Water Quality Parameter Monitoring—adopt more stringent testing, including in the distribution system and for pH.

Corrosion Control Treatment—develop methods for making the water less corrosive and, therefore, less likely to leach lead or copper into drinking water.

Source Water Monitoring and Treatment—sample source water to rule out supply as a source.

Lead Service Line Replacement—replace at least seven percent of lead lines each year and more if the state requires it.

Public Education—inform customers when action levels are exceeded and about ways to reduce lead levels in homes.

These requirements are discussed in more detail in the guidance manuals and products listed at the end of this article.

What's different for small systems?

The LCRMR takes into account the limitations for small systems and, hence, grants them some flexibility. Accommodations made for small systems include:

- Systems that can demonstrate that their lead and copper levels are less than the action levels are not

Where can I find more information?

EPA has a great deal of information about lead on their Web site. A good place to start is their "Lead in Drinking Water" page at **www.epa.gov/safewater/lead/index.html**.

The National Environmental Services Center has several products about lead and copper in drinking water.

"Lead in Drinking Water: An Annotated List of Publications" provides an annotated list of selected publications about lead in drinking water from organizations such as the EPA, the NESC, and the American Water Works Association. Product #DWBLGN19

"Lead Ban: Preventing the use of Lead in Public Water Systems and Plumbing Used for Drinking Water" discusses the lead ban provisions of the Safe Drinking Water Act Amendments of 1986. It addresses ways to prevent lead's use in public water systems. Product #DWBRGN02

"Lead in Drinking Water" explains how even moderate levels of lead can be harmful to human health and particularly to the health of small children and developing fetuses. This factsheet discusses lead in the environment and in drinking water. Recommendations are included for correcting lead contamination in water, including private wells. Product #DWFSGN60

"Lead and Copper Rule Decision Diagram" shows a step-by-step process for small community water systems to follow in complying with the Lead and Copper Rule. Product #DWPSPE10

required to do continuous monitoring. EPA recognizes that small systems have tight budgets and there is little value in requiring them to spend resources on frequent monitoring.

- Small and medium-sized systems can avoid corrosion control steps if readings for samples are below the action level in two consecutive six-month monitoring periods.
- Water quality parameter monitoring is less stringent for systems that have water below the action level.
- If, after two consecutive six-month monitoring periods, samples show levels of 0.005 mg/L for lead and 0.65 mg/L for copper (or lower), small systems can collect tap water samples every three years (also known as accelerated, reduced tap monitoring).
- Small systems have more flexibility in language for doing public education.

What did the EPA find in its review and what's in store?

EPA conducted an extensive study in 2004-05. They found that the LCR had been effective in more than 96 percent of systems serving 3,300 or more people. Nevertheless, EPA decided to launch a *Drinking Water Lead Reduction Plan* to "strengthen, update, and clarify existing requirements for water utilities and states to test for and reduce lead in drinking water."

By early 2006, EPA plans to propose regulatory changes to the LCR in the following areas:

- *Monitoring*—To ensure that water samples reflect the effectiveness of lead controls, to clarify the timing of sample collection, and to tighten criteria for reducing the frequency of monitoring.
- *Treatment Processes*—To require that utilities notify states prior to changes in treatment so that states can provide direction or require additional monitoring. EPA will also revise

Lead in School Drinking Water provides information about the effects lead has on children. It explains how to detect lead in school drinking water supplies and how to pinpoint its source. Ways to reduce or eliminate lead in drinking water and personnel training for sampling and remedial programs are included. Product #DWBLPE06

Monitoring Guidance Documents for the Lead and Copper Rule—Product #DWBLRG12 (Systems serving 3,301-10,000); #DWBLRG13 (Systems serving 501-3300); #DWBLRG14 (Systems serving 101-500); and #DWBLRG15 (Systems serving fewer than 100).

"Lead Leaching from Submersible Well Pumps" explains various aspects of submersible pumps, including lead leaching from brass components and available treatment options to reduce lead levels in drinking water. Product #DWBLPE154

Control of Lead and Copper in Drinking Water discusses regulatory and monitoring issues for lead and copper. It also explores tests that can be conducted to assess corrosion control and presents recommendations to utilities for performing corrosion control studies. Product #DWBKRE11

To order any of these products, call NESC at (800) 624-8301 or fax (304) 293-3161, or e-mail *info@mail.nesc.wvu.edu*. Make sure to include the products you want and their corresponding product number, and your name, organization, address, and phone number with each order. Quantities are limited to one each per order. If you need bulk copies, please call to make arrangements.

Call us toll-free at 800-624-8301 ext. 5500

existing guidance to help utilities maintain corrosion control while making treatment changes.

- *Customer Awareness*—To require that water utilities notify occupants of the results of any testing that occurs within a home or facility. EPA will also seek changes to allow states and utilities to provide customers with utility-specific advice about tap flushing to reduce lead levels.
- *Lead Service Line Management*—To ensure that service lines that test below the action level are re-evaluated after any major changes to treatment that could affect corrosion control.
- *Lead in Schools*—The agency will update and expand 1994 guidance on testing for lead in school drinking water. EPA will emphasize partnerships with other federal agencies, utilities, and schools to protect children from lead in drinking water.

"We need to free people from worrying about lead in their drinking water," says Ben Grumbles, EPA assistant administrator for water. "This plan will increase the accuracy and consistency of monitoring and reporting, and it ensures that where there is a problem, people will be notified, and the problem will be dealt with quickly and properly."

NDWC Engineering Scientist **Vipin Bhardwaj** has a bachelor's degree in chemical engineering and master's degrees in environmental engineering and agriculture from West Virginia University.

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Disinfecting Private Wells

Editor's Note:
Technical specialists with the National Environmental Services Center (NESC) field hundreds of calls each year. One topic that comes up on a regular basis is how to disinfect a private well. The following information is based on advice we give to callers with this question.

The National Ground Water Association recommends that private well owners have their water tested on an annual basis. A common water quality test will note the presence (or absence) of a group of bacteria called coliform.

Members of the coliform group are found in the intestinal tract of warm-blooded animals, as well as in soil. Coliform bacteria in a drinking water supply indicates that contamination may be present, and the water is not safe for human consumption. For private well owners, a common and fairly simple solution to this problem is to shock chlorinate the well.

Disinfecting Your Well

Shock chlorination is a method of sanitizing a well with chlorine (most often household bleach). The table at the right shows the amount of chlorine needed for disinfecting various well sizes.

For a common, six-inch diameter well with 150 feet of water, use three quarts of bleach added to four gallons of water. Pour this solution directly into the well.

In the house, open one faucet at a time and run them until you detect the smell of chlorine, then turn the faucet off. If you do not smell chlorine at each tap, add more chlorine solution to the well.

Let the chlorinated water sit in the well and lines for 12 to 24 hours. Flush the system by letting each faucet run until the smell of chlorine dissipates. If your home has an onsite wastewater system, open outside faucets first and let the water run on the ground to reduce the load on the septic system.

Retest the well water after waiting one to two weeks. If the bacteria problem persists, you may need to have continuous disinfection.

Upgrade Your Well

To protect your well from contamination, proper construction is essential. (See the Tech Brief titled "Preventing Well Contamination" in the fall 2003 *On Tap*—available online at *www.nesc.wvu.edu*—for more information about well construction.)

According to "Shock Chlorination of Wells and Springs," an Ohio State University Cooperative Extension Services (OCES) fact sheet, "although well pits were the common method of construction several years ago, they are no longer considered sanitary construction. The well casing of a properly protected well extends above the surface of the ground. The ground slopes away from the well to prevent water from collecting around the casing." (See the diagram on page 40.)

"Develop a properly protected spring underground and channel the water to a sealed spring box. At no time should the water be exposed to the ground surface," the OCES publication continues. "It is important to keep the plumbing system clean to maintain a sanitary water supply. Each time work is done on the plumbing or pump, the entire water system should be disinfected with chlorine. Simply pulling the pump out of the well, setting it on the grass to work on it, and returning it to the well is enough to contaminate the well with bacteria."

Amount of chlorine needed for shock chlorination.

Laundry bleach (about 5.25% Hypochlorite)

Depth of water in well	Casing diameter				
	4-inch	*6-inch*	*8-inch*	*10-inch*	*12-inch*
10 feet	1/2 cup	1 cup	1 1/2 cups	1 pint	2 pint
25	1 cup	1 pint	2 pints	3 pints	4 1/2 pts
50	1 pint	1 quart	2 quarts	3 quarts	1 gal
100	1 quart	2 quarts	1 gal	1 1/2 gal	2 gal
150	3 pints	3 quarts	1 1/2 gal	2 gal	3 gal

High-Test Hypochlorite (HTH 65-75% Hypochlorite)

Depth of water in well	Casing diameter				
	4-inch	*6-inch*	*8-inch*	*10-inch*	*12-inch*
10 feet	–	–	–	–	–
25	–	–	–	1/4 lb	1/2 lb
50	–	–	1/3 lb	1/2 lb	3/4 lb
100	–	1/3 lb	3/4 lb	1 lb	1 1/2 lb
150	1/4 lb	1/2 lb	1 lb	1 1/2 lb	4 lb

Source: http://ohioline.osu.edu/aex-fact/0318.html

What about springs?

"Shock chlorination of a spring is more difficult," states OCES. "If possible, divert spring water away from the spring box. Mix about 1/2 cup of household bleach in five gallons of water and scrub the walls of the spring box or holding tank or both. Return the flow of spring water back into the spring box and let the fresh water carry the chlorine through the pipeline to disinfect the plumbing."

Other Considerations

Chlorine is a potentially dangerous material. Wear rubber gloves, eye protection (such as goggles), and a protective apron when disinfecting the well.

Never mix chlorine with other cleaning materials, particularly ammonia, because toxic gases will form. Do not use scented bleaches; use only the plain kind.

In addition to the well, it is important to disinfect water treatment equipment such as water softeners, iron filters, and sand filters. However, do not chlorinate carbon or charcoal filters; doing so will use up their capacity. Check the manufacturer's literature before chlorinating any treatment units.

For More Information

If you have a question about drinking water matters, including shock chlorination, call NESC's technical staff toll free at (800) 624-8301 and select option "3."

NESC also has several products related to well care, operations, and maintenance:

EPA's *Manual of Individual and Non-Public Water Supply Systems*. (Product # DWBKDM06)

EPA's *Manual of Water Well Construction Practices*. (Product # DWBKDM01)

The brochure "Iron Bacteria Problems in Wells." (Product # DWBROM28)

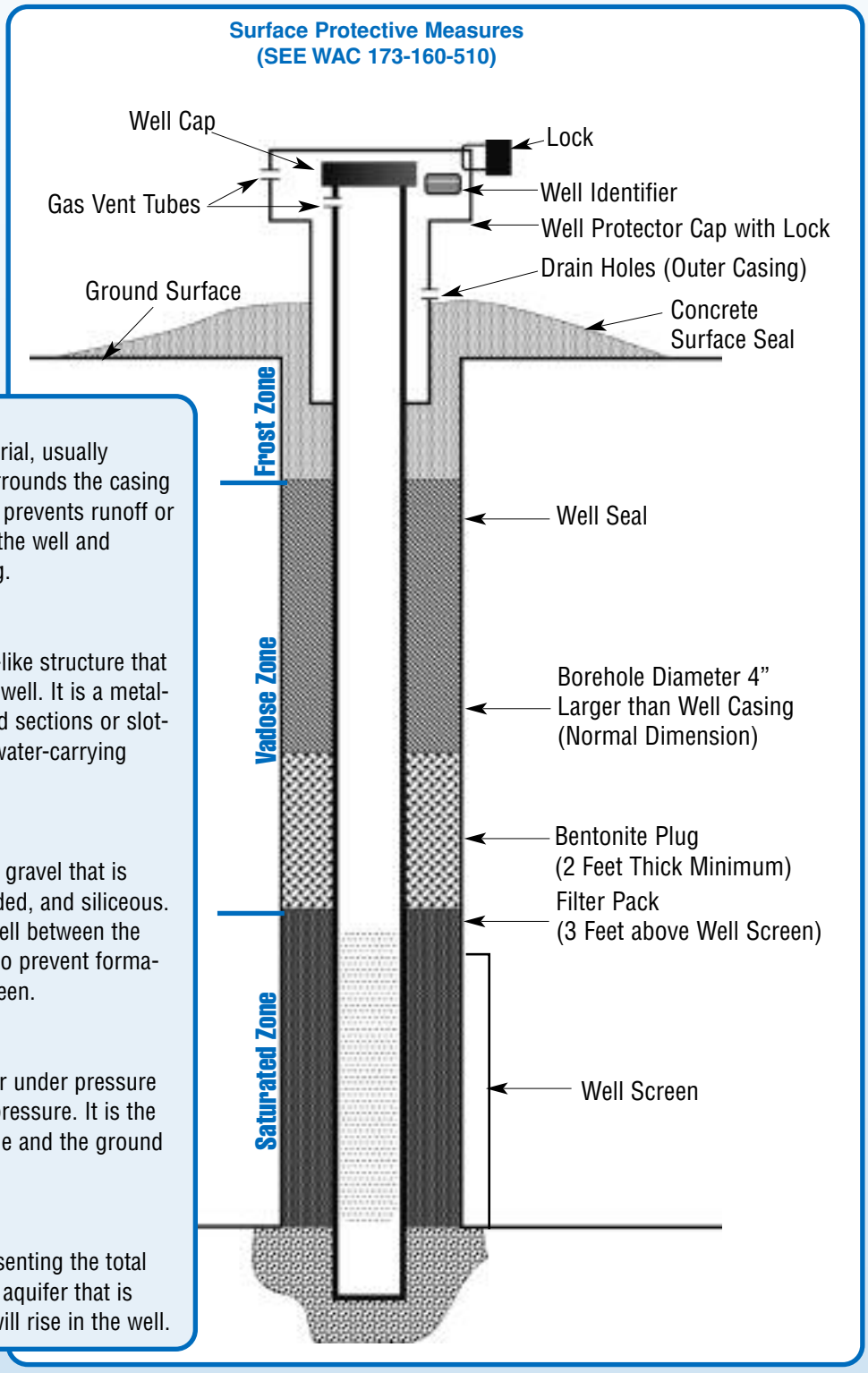
The factsheet "Shock Chlorination of Wells and Springs." (Product # DWBLOM05)

To order any of these products, call NESC at (800) 624-8301, fax (304) 293-3161, or e-mail *info@mail.nesc.wvu.edu*. Please indicate the product number, title, and quantity needed. Be sure to include your name, organization, address, and phone number with each order.

The Water Systems Council provides information about private wells. Call their Wellcare hotline at (888) 395-1033 or visit their Web site at *www.watersystemscouncil.org*.

In October 2004, the U.S. Environmental Protection Agency (EPA) launched a Web site devoted to private drinking water wells at *www.epa.gov/OGWDW/privatewells/index2.html*.

Figure 1: General Resource Protection Well–Cross Section



Adapted from *Groundwater and Wells, Second Edition* by Fletcher G. Driscoll, Ph.D.

Figure 1: Definitions

Well seal:
A seal is a cylindrical layer of material, usually cement, bentonite, or clay, that surrounds the casing up to a certain depth in the well. It prevents runoff or other contaminants from entering the well and serves to further protect the casing.

Well Screen:
A well screen is a cylindrical sieve-like structure that serves as the intake portion of the well. It is a metallic pipe that has holes or perforated sections or slotted sections that is placed on the water-carrying zones of the aquifer.

Filter pack:
A filter pack is made up of sand or gravel that is smooth, uniform, clean, well-rounded, and siliceous. It is placed in the annulus of the well between the borehole wall and the well screen to prevent formation material from entering the screen.

Vadose Zone:
This is the zone that contains water under pressure less than that of the atmospheric pressure. It is the layer of soil between the water table and the ground surface.

Potentiometric surface:
This is an imaginary surface representing the total head of groundwater in a confined aquifer that is defined by a level to which water will rise in the well.

Technology Troubling You?

Give Us A Call!

National Environmental Services Center (NESC) staff are available to answer your drinking water, wastewater, and training questions when you call our toll-free number, (800) 624-8301. Our technical assistance specialists are knowledgeable about financing resources, regulatory changes, water treatment processes and alternatives, and low-cost wastewater treatment and management options. NESC staff can also refer callers to other organizations or agencies that may be able to help.

Our technical assistance specialists maintain extensive databases that house wastewater and drinking water information from trade magazines, professional journals, government documents, and our own quarterly publications.

Whatever your question may be, our staff of certified operators, engineers, and scientists will help you find an answer.

All you have to do is ASK!

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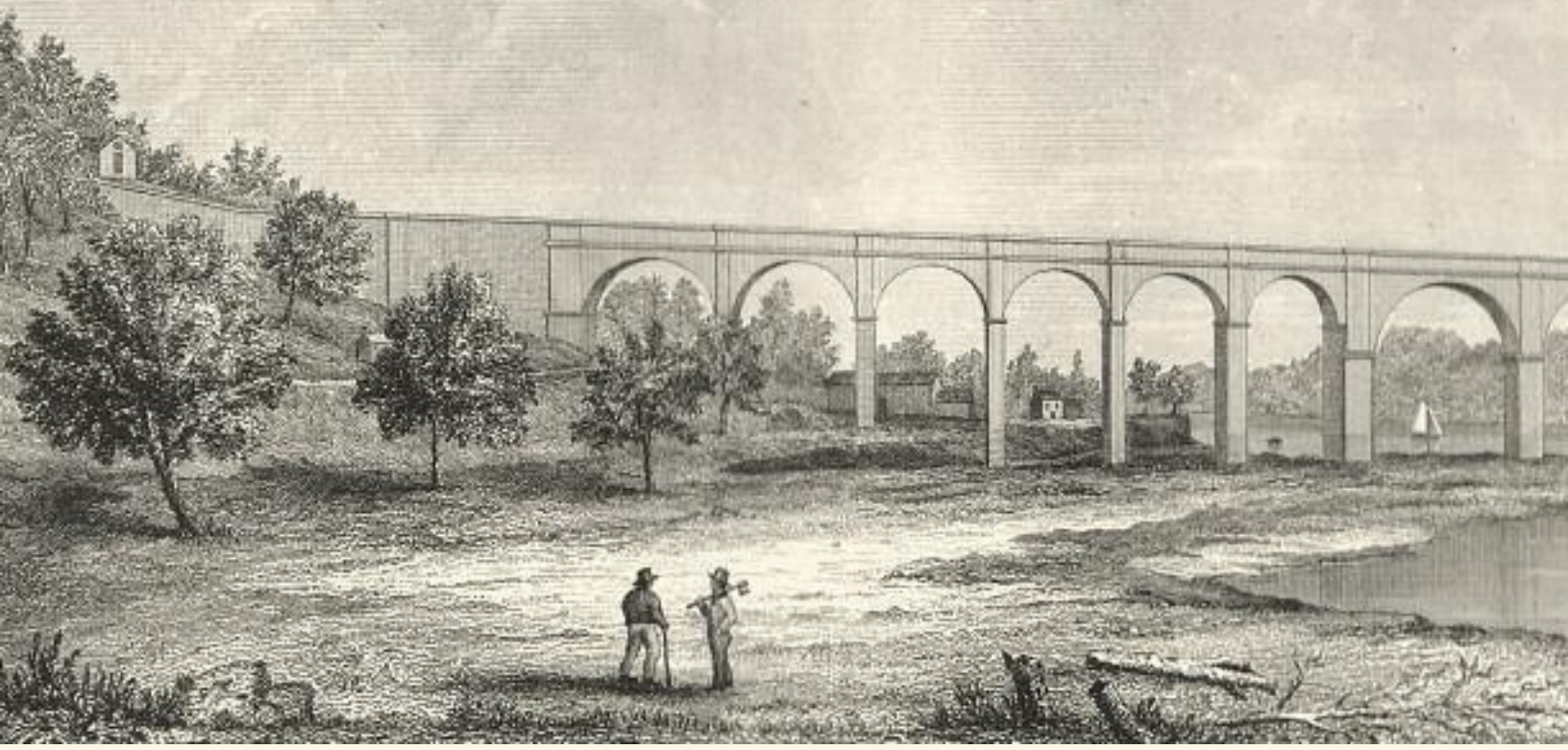
A Century of Water

By **Edward H. Winant**, Ph.D., PE, NESC Engineering Scientist



Mention Scotland, and images of castles, moors, or craggy coastlines spring to mind. The country's reputation tends more toward the romantic than scientific. But the period from 1740 to around 1800 marked the Scottish Enlightenment, a time of intense philosophical and economic debate. Substantial scientific, intellectual, and aesthetic achievements continued into the next century. Amongst these contributions was the development of public water treatment practices.

In Paisley, Scotland, the first municipal water treatment plant was constructed in 1804. Treatment there consisted of concentric sand and gravel filters, and distribution was by horse cart. Nearly a century later, in Middlekerke, Belgium, the first permanent chlorination treatment was used to disinfect drinking water.

The changes made during the 19th century—from Paisley to Middlekerke—were revolutionary. Medical and scientific advances led to alterations in engineering design and construction and changed public opinion relating to public water supply.

Aesthetics Prompted Treatment

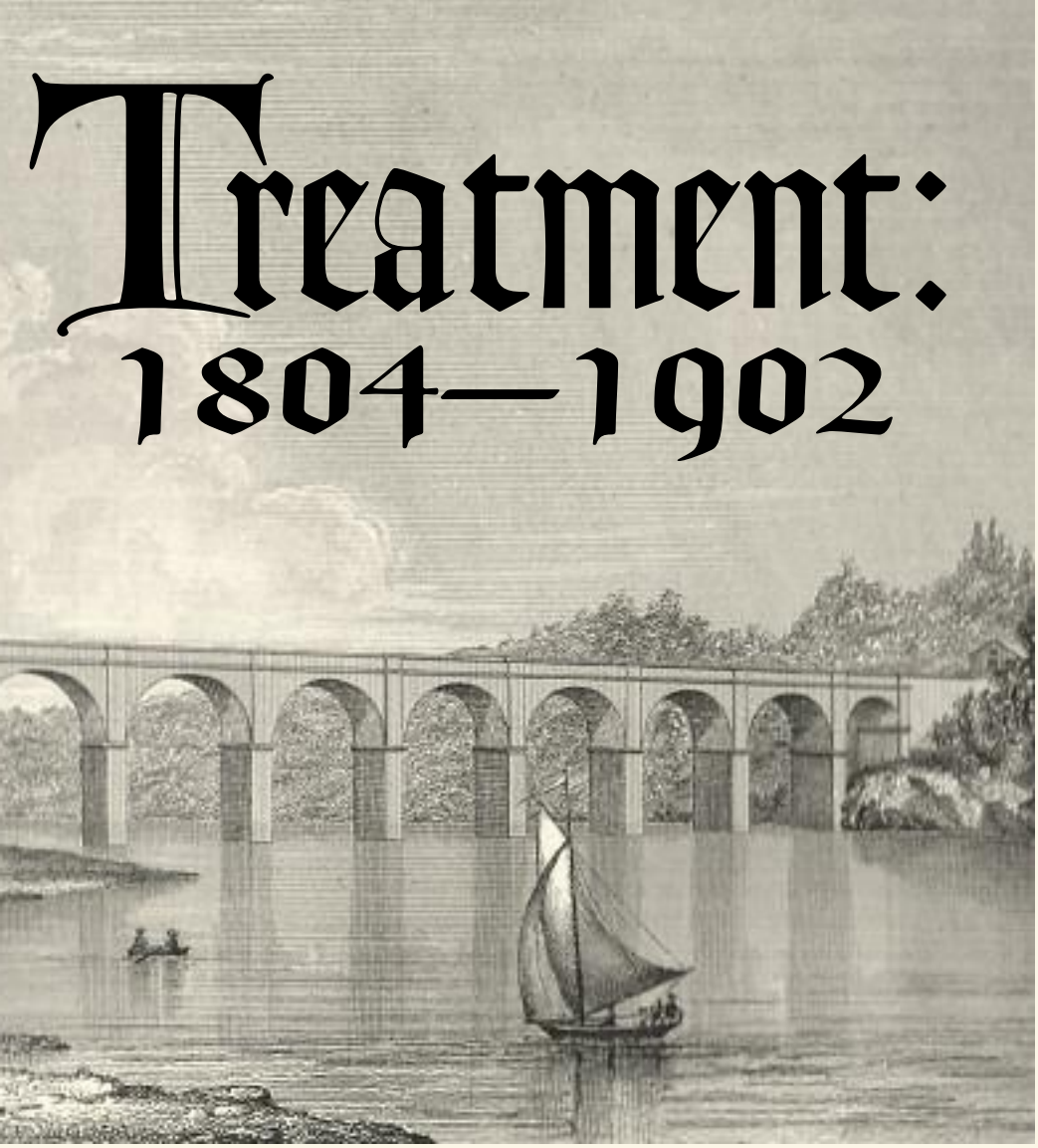
Paisley's water treatment was initiated to clarify the River Cart, which contained a great deal of municipal waste and was unsuitable for bleaching operations of the local textile industry. The river water was treated by passing it through concentric rings: the outermost being a settling basin, then through a gravel filter, and finally a sand filter, before being stored in the central pool. An interesting note is that the Paisley filter may be described as vertical, because the water passed horizontally through the upright filter media. Subsequent slow sand filters were constructed of horizontal media beds with the water draining vertically through them.

Most of the treatment plants in the early 19th century were constructed to remove sediment or to improve taste and odor. No one was yet aware of the disease-carrying capabilities of water. Prevailing medical views had descended from Hippocrates and the primary view was that atmospheric conditions, foul odors, or noxious gasses escaping from marshy land caused epidemic diseases.

Discussing Water Quality Theories

There were some tests of water quality, even at this early stage. Dr. Joseph Brown of New York stated that clear water with a good flavor, able to boil legumes tender, and dissolve soap was good water. Softness was an important aspect, as a New York

Treatment: 1804—1902



scientific report from 1831 stated that the contamination of water supplies with high concentrations of minerals by runoff from graveyards and privies was counteracted by the presence of urine, which acted as a water softener. According to Nelson Blake in the book *Water for Cities*, the report went so far as to claim that:

> This liquid, [urine] when stale or putrid, has the remarkable property of precipitating the earthy salts from their solution, or in other words, it makes hard waters soft. Although the fastidious may revolt from the use of water thus sweetened to our palate, it is perhaps fortunate that this mixture is daily taking place, for otherwise the water of this city would become, in a much shorter space of time than it actually does, utterly unfit for domestic consumption.

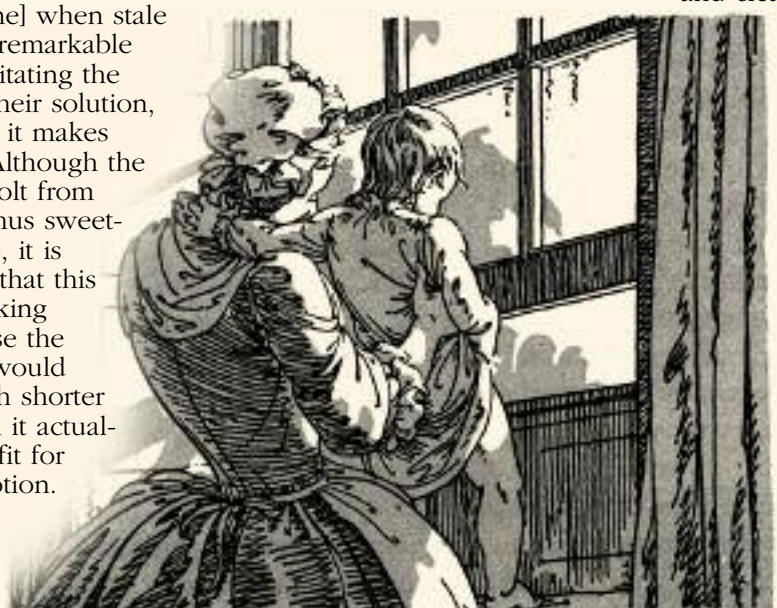
In keeping with the perceived need to remove only sediment from the water, treatment plants in the early 1800s consisted of various reservoirs used as settling basins with sand and gravel filters in between. In times of normal river flows, this type of treatment worked satisfactorily, but flood waters with increased sediment loads were little affected by filtration. One other method was the filtration gallery, which made use of natural filtration in drawing water from a river through existing soils into a storage gallery.

In Boston, circa 1834, the debate on water quality centered around the observance of minute organisms in the water, some visible with the naked eye but some seen only with the aid of a microscope. These "animalcules" as they were called, were noted to abound in Long Pond, a source water supply for the city. According to *Water for Cities*, John Wilkins advised drawing water from the Charles River because, "animalcules are much less likely to be found in running, or river water, than in pond water." There was some debate over this point. Certain experts postulated that the presence of animalcules was evidence of the purity of the water since these delicate creatures could not be expected to live in polluted water.

Lead piping, used for service connections between houses and main water lines, was another concern, as the lead would dissolve in certain waters. Lead had long been known to be poisonous but was still used for house connections because it was highly malleable and easily jointed.

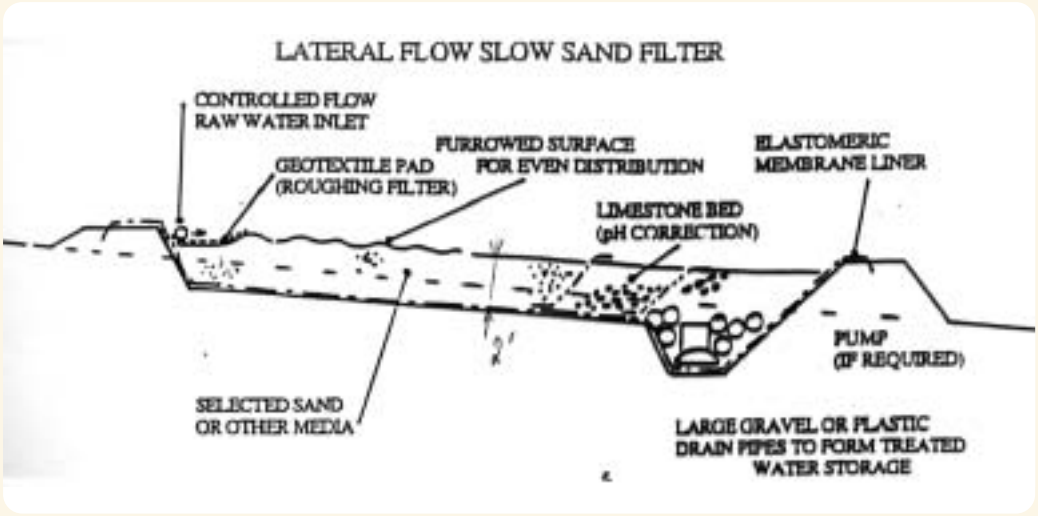
Filtration Begins

The slow sand filter continued to be the mainstay of water treatment for most of the 19th century, although it had its drawbacks. The sand beds, two to four feet thick, covered acres of ground, and cleaning was only accomplished by shoveling off the dirty sand and replacing it with clean sand. The large area was needed because the dosing rate of water through sand was approximately three gallons per square foot per hour.



As an example, the combined water companies of London treated 44.4 million gallons per day (mgd) in 1849. This volume would have required treatment beds

covering 12 acres. While 12 acres may not sound like much, the rapid increase in city size during this century placed land at a premium, and the expanding population would need even more water. As the population grew, so did the daily demand for water per person. The increased need for supply water soared. By 1901, London's water requirements had grown to 215 mgd, an increase of 380 percent. Clearly the land requirements of slow sand filters could not keep pace with the growing need for clean water.



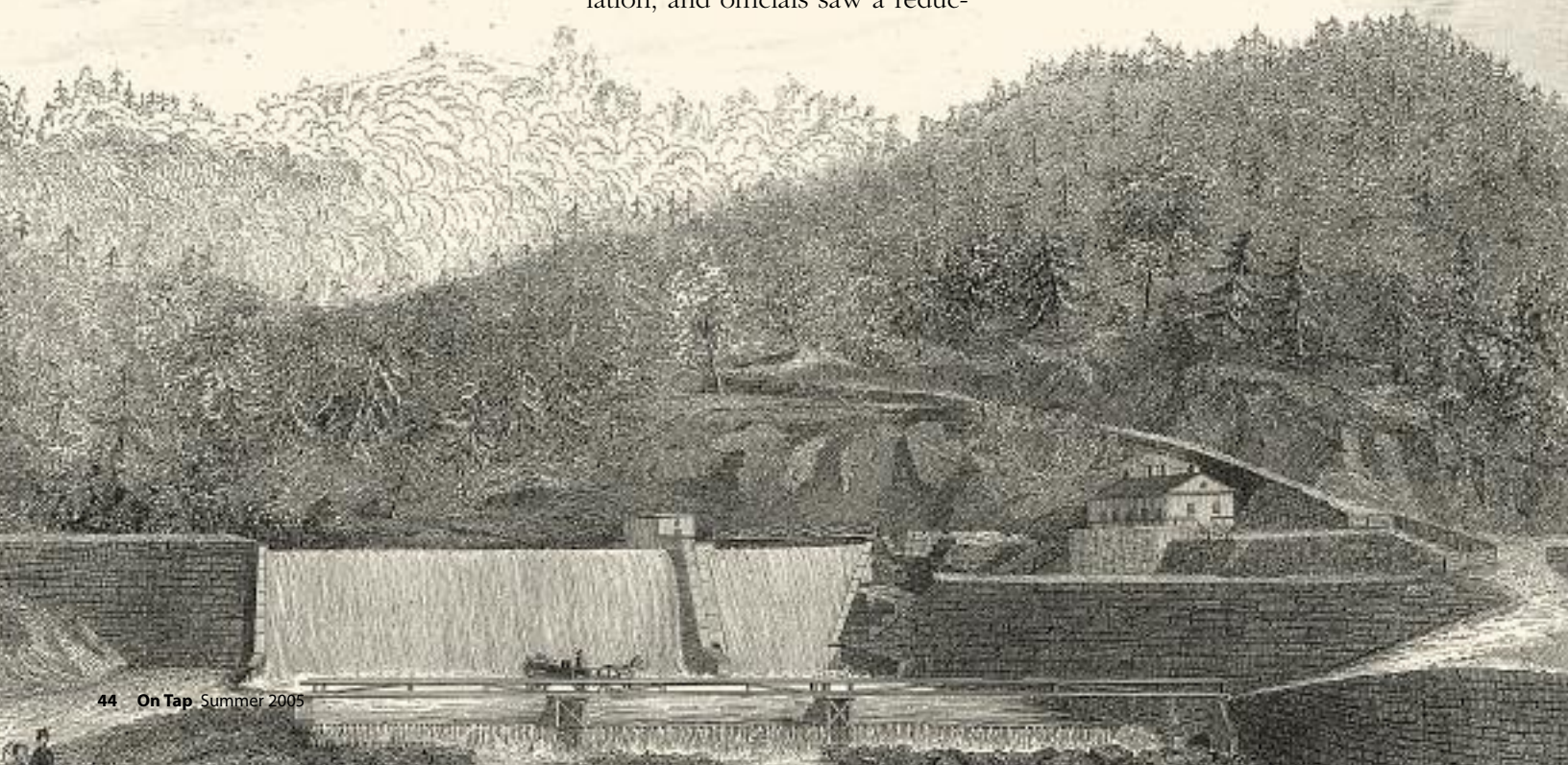
To fill this need, the rapid sand filter was developed, oddly enough, in America where land was more plentiful. Rapid or mechanical filters used backwash to automatically clean the filter media and mechanical agitators to loosen it. The rapid filter greatly increased treatment capacity, thus reducing size requirements. However, the new procedure depended on pretreatments, such as coagulation and settling, to reduce the sediment load to the filter.

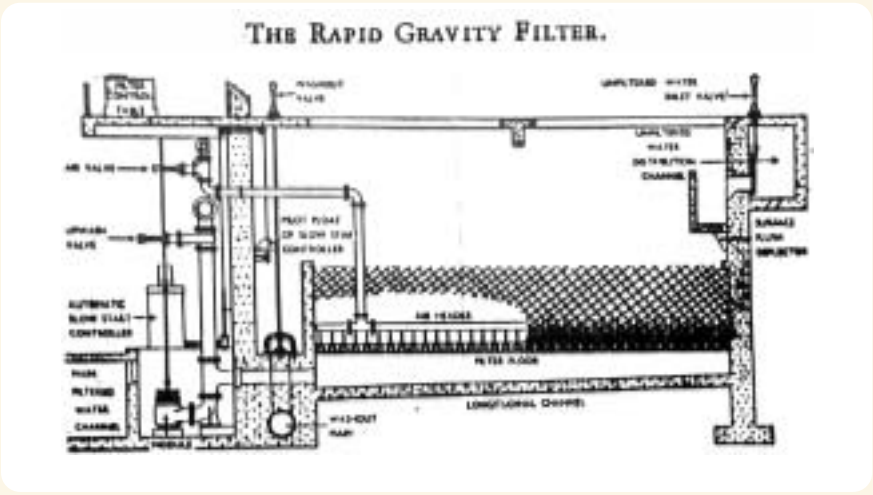
Treatment to improve taste and odor was achieved by using charcoal filtration. This practice, like many early treatment procedures, evolved from long-used water treatment methods for personal supplies. The practice of charcoal filtration was not widespread, though, as it was judged unfeasible for large supplies and was generally restricted to treating water for shipboard use. Where it was used, the common practice was to install the charcoal filter between two gravel filters.

Linking Water Quality and Public Health

The first ties of water quality to public health were noted in London around the mid-19th century. London had slow sand filters for at least part of the population, and officials saw a reduction in cholera victims in areas thus served in the epidemics of 1849 and 1853. Even more convincing was John Snow's tracing of multiple cholera deaths to a single pump in Soho where the sump was contaminated by leakage from a nearby sewer. Ironically, many of the users of the Broad Street well water came from other sections of town and used this water because they preferred the taste. This is a most telling indictment against the use of subjective standards of water quality like taste or clarity.

Following the epidemics and taking note of Snow's study, Parliament passed the Metropolitan Water Act of 1852 requiring filtration of all water supplied to London. In addition, the act required that water sup-





plies be drawn from cleaner, nontidal reaches of the River Thames. This act was one of the first instances of governmental regulation of public water supply.

This legislation leads to the question of locating the water supply, as raw water quality greatly affects the treatment needed. Cities located along rivers for transportation purposes had a ready supply, but these sources could be easily contaminated by industry, upstream cities, or the tides. Further, as noted earlier in the Boston water debate, was the question of preferring running water to standing water. Since antiquity, water authorities had observed that standing water was more prone to putrification than running water.

On the other hand, reservoirs provide a more certain supply of water, especially for river-less cities. However, reservoirs require a good deal of land and must often be located some distance from the cities they serve.

For example, Manchester, England, drew water from a reservoir 96 miles away, and Liverpool required a 77-mile-long aqueduct for their supply. New York City, in a quest to find pure source water rather than providing treatment, located their reservoir 40 miles from the city.

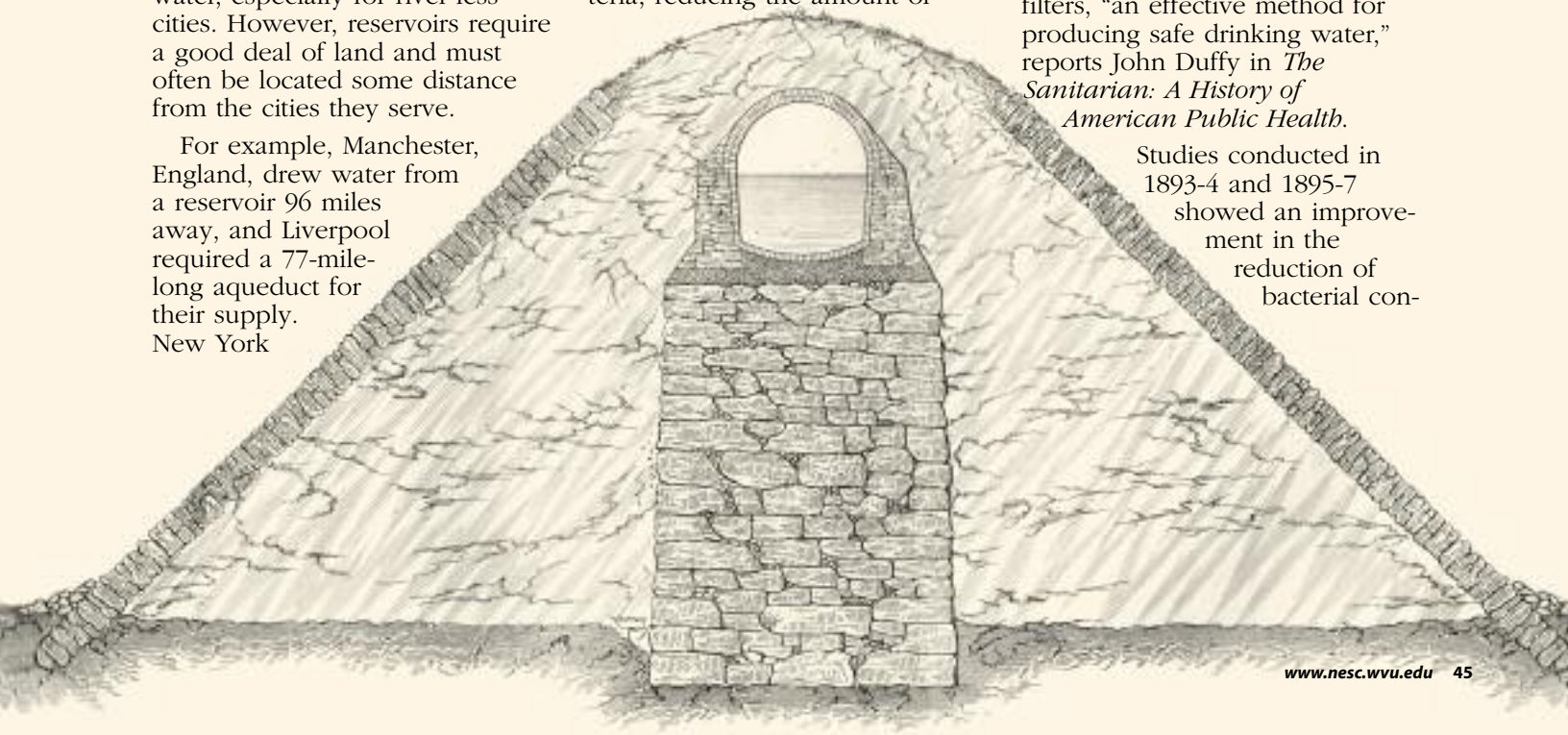
Reservoirs and aqueducts were constructed both to ensure a steady supply of water and to obtain a better quality from the source. Locating reservoirs further from the city usually led to higher quality sources because they were separated from population centers. Quality issues also affected the design of aqueducts, since covered channels or pipes provided more protection than open channels. The extra expense was offset by the fact that the water would be kept pure.

One of the great miracles of modern water engineering is that suspended solids removed from the water and trapped in the sand filters support cleaning bacteria, reducing the amount of *E. coli* in the water by up to 98 percent. Further, while engineers noticed these bacterial growths, the law requiring filtration predated germ theory development and the isolation of bacteria as disease culprits by about a decade. *E. coli* was tested for after the development of germ theory instead of more virulent strains of bacteria, because testing for *E. coli* is easier, and there is a linkage between the presence of this pathogen and the contamination of a water source with sewage. Thus, *E. coli* is known as marker bacteria for testing purposes.

Standards for water quality became more objective in the later part of the 19th century. Instead of relying on subjective matters, such as clarity or taste, a chemical standard was developed. This standard stated that water was pure if the nitrogen was in an oxidized form, but it ignored the presence of organic material in water as a test of purity.

The drawback to chemical standards was that treating for mineral salts did nothing to help prevent epidemics. It was not until the work of Louis Pasteur and Robert Koch in the 1860s that the role of bacteria in disease was determined. Furthermore it was not until 1880 that the typhus bacillus was isolated. As late as 1890, disinfection as a component of water treatment was empirically based and mostly occurred through the use of sand filters, "an effective method for producing safe drinking water," reports John Duffy in *The Sanitarian: A History of American Public Health.*

Studies conducted in 1893-4 and 1895-7 showed an improvement in the reduction of bacterial con-



The photo above shows decaying 20th century-water supply pipe. To the left, a water sump for a 19th century wind-powered system is shown.

centrations with coagulation. Coagulants had been used for personal water treatment since 2000 B.C.E. and were first used in municipal treatment in 1881 in Bolton, England, as a pretreatment for rapid sand filtration.

Earlier in the century, many prominent authorities, including Francois Arago, director of the Paris Observatory, and the Massachusetts Board of Health, protested the use of coagulants in water treatment. These authorities objected to the unknown effects caused by adding a chemical to drinking water. Their fears were somewhat alleviated by two studies performed in France (in 1838 and 1865) on aluminum sulphate, commonly known as alum, which is still the most widely used coagulant.

The Science of Treatment

It was not until chlorination became an accepted practice, though, that water treatment reached its scientific peak. Empirical engineering practice predates scientific discovery even here. As early as 1850, bleach solutions were used to treat well water under the assumption that diseases were transmitted by odor. Chlorination had been an accepted practice in sewage treatment since 1830. In 1896, chlorine was first used to disinfect water at the Louisville, Kentucky, experiment station and also used to combat a typhoid epidemic around the Adriatic Sea. These were temporary measures, and the first permanent use of chlorine occurred in 1903 in Belgium when Dr. Maurice Duyk added it before the filtration process.

Thus, during one century of development, water treatment progressed from a crude craft to a scientifically based discipline of engineering. Throughout these years, treatment methods improved from simple sand filters to an integrated, multi-step process. The philosophy behind water treatment evolved from providing the textile industry with clear water to a societal duty of protecting public health. Water quality standards improved from subjective methods to objectively determining concentrations of suspended solids and organics and keeping these concentrations below accepted allowable levels.

Interestingly, many of these advances in water treatment occurred as attempts at progress with scientific justification coming later. Indeed, some engineering advances were based on prevailing medical opinions that were flat-out wrong and yet yielded viable treatment procedures. Even more miraculous is the fact that most of the empirical attempts were evaluated on the basis of their ability to clarify water and not on potentially harmful side effects. In spite of this, the treatment methods chosen were benign and even healthful.

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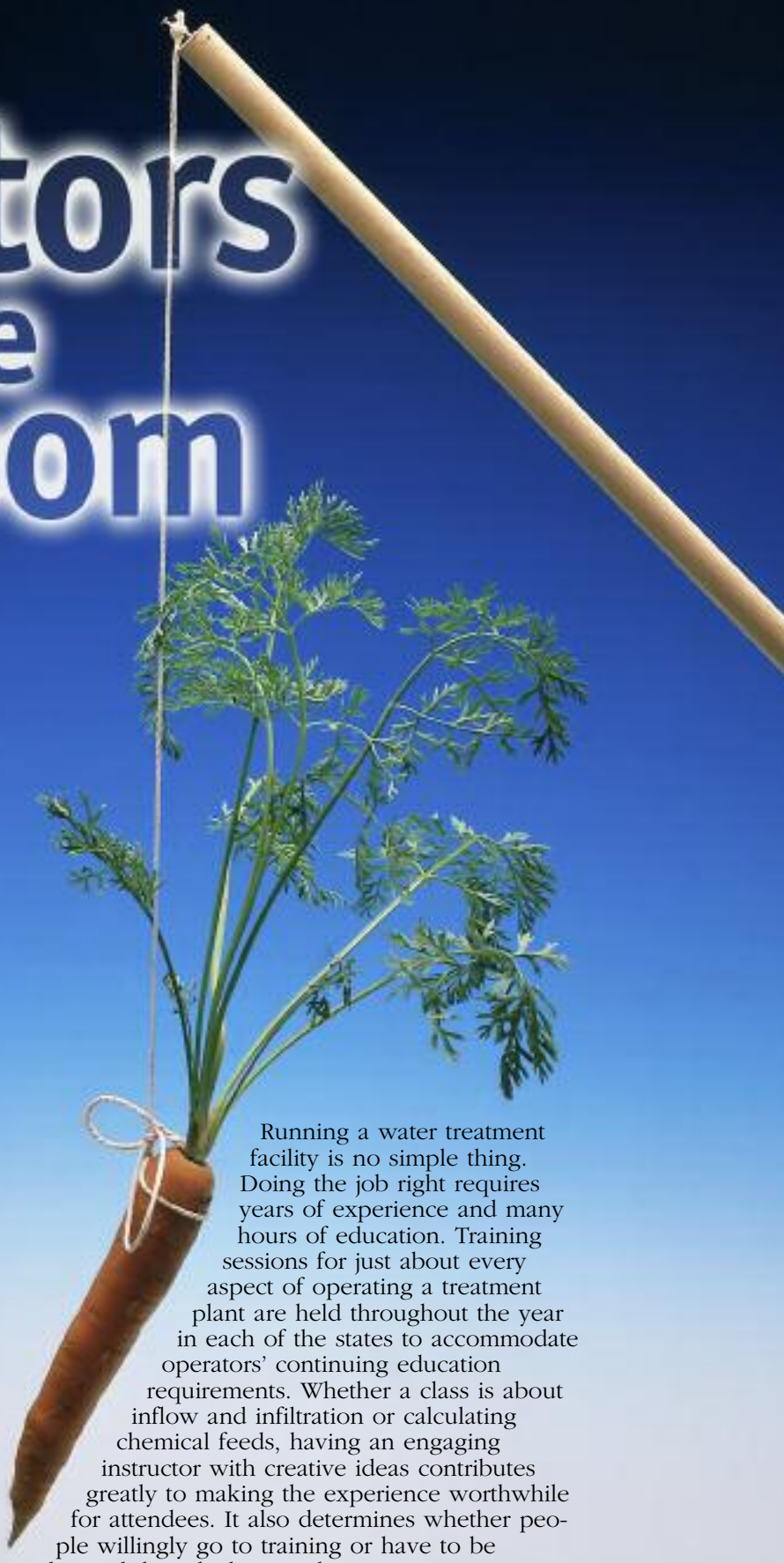
Ed Winant, a member of the National Environmental Services Center technical staff, has a Ph.D. in the history of technology. This paper was originally written for work he did as a graduate student.

Getting Operators into the Classroom

By **Michelle Moore,**
On Tap Associate Editor



Running a water treatment facility is no simple thing. Doing the job right requires years of experience and many hours of education. Training sessions for just about every aspect of operating a treatment plant are held throughout the year in each of the states to accommodate operators' continuing education requirements. Whether a class is about inflow and infiltration or calculating chemical feeds, having an engaging instructor with creative ideas contributes greatly to making the experience worthwhile for attendees. It also determines whether people willingly go to training or have to be dragged there kicking and screaming.

How can we fill those seats?

While continuing education is mandatory for operators to remain certified, trainers know that they fill seats better when there is some incentive to attend. In this article, several trainers and assistance providers offer ideas for bringing operators into sessions and then getting them to come back for more. Foremost among the suggestions, not surprisingly, is making sure there is food. We all have to eat—many of us love to eat—and a snack at break time or a full-blown buffet lunch gives the attendees an opportunity to relax and talk more with their colleagues.

Providing food is one way to entice people to training sessions.

Having food and holding the training in an unusual location works even better for attracting attendees. Byron Ross, state director of the U.S. Department of Agriculture's Rural Development office in Pennsylvania, tells of a training his organization held for engineers at a large sporting goods retailer, Cabela's.

"We had toyed around with the regular room-at-the-Holiday-Inn type of thing or a public library or even here at our office center in our training room," he says. "But, both of our engineers are big outdoors people—a lot of hunting and hiking and things like that. They thought it would be a good idea to have it at Cabela's, and, they found that Cabela's has a free room, a very nice room, that accommodates 50 to 60 engineers."

Tom Arnbrister, training coordinator for Wyoming's Association of Rural Water Systems (WARWS), says that the food lure is definitely the way they get folks to their class sessions. WARWS always makes sure there is plenty to eat. "Offer them a free lunch, and they will come."

WARWS also goes the extra mile in promoting classes prior to their delivery date. Arnbrister says they try to embellish upon the details of the training they offer and describe how it will directly benefit operators in their daily work.

"Another enticement we use is hands-on training," he says. "Operators love to come to training where they are actually involved. It has better results, I believe, than six or eight hours of straight lecturing. Operators are a hands-on type of people and would rather be problem solving than reading from a book or having somebody read a *PowerPoint* to them."

Because operators are busy professionals, it's important that training courses have clear objectives. "Be sure you know who your audience is and what they need to learn," suggests John Hoornbeek, director of training for the National Environmental Services Center. "What is it you want them to take away from the session? What two or three things do you want attendees to remember or be able to do six months or a year down the road? The answers to these questions will help focus the training and make it more effective."

Laughing in Class is Allowed

Humor plays a big role in keeping students engaged, whether they are 16-year-old kids or middle-aged adults. Instructors should be natural performers to be comfortable and to effectively interact with their students. Ice-breaking jokes, open and active discussions, and insightful games help loosen up a class and get everyone thinking and ready to learn the topic of the day.

Motivating the Adult Learner

The following suggestions enhance motivation by developing a student's positive attitude.

Promote self-determination—Because adults are more independent than traditional learners, providing the opportunity for them to direct their own learning helps foster a positive attitude. Adult students should be involved in planning and goal setting as much as possible.

Make learning successful—Adult educators can ensure successful learning by providing quality instruction, concrete evidence that effort makes a difference, and feedback on learning progress.

Make the learning experience interesting—Research shows that first impressions make a lasting impact. It's imperative that initial training sessions be made as interesting and unthreatening as possible so the students will be enthusiastic about attending future sessions.

State expectations—A positive statement about the quantity and quality of effort required to accomplish a task gives adult students a feeling of control. Emphasizing learner responsibility increases perseverance and reduces feelings of helplessness.

Develop clear learning goals—Design written materials with clearly stated goals and objectives and provide written or projected outlines for individual sessions. Explicit directions help to avoid unnecessary confusion.

State evaluation criteria—Adult learners tend to be self-directed, so detailing evaluation criteria gives them the scope of what they need to learn and do for evaluating their own progress.

Source: Adapted from the National Environmental Services Center's *Basics of Environmental Systems Management* curriculum.

Penny McCoy, training coordinator with the Pennsylvania Rural Water Association (PRWA), knows well how important it is for operators to enjoy the courses her organization offers. With upwards of 100 training providers across the state, there is plenty of competition for training funds.

"To keep them coming back to us, we have to make sure that the training is useful to their systems, that they can use it in their day-to-day jobs, and that it's not only interesting and useful, but it's also fun," she says.

Having some kind of an entertainment strategy helps to ensure that operators want to return for PRWA's training. And, establishing a casual, pleasant atmosphere sets the stage for any comedians in the class to reveal themselves.

Adults, Traditional Students Differ

Adults actually learn differently from the younger, traditional student. They also have different needs and plenty more distractions. Adults want course content to be presented "with a minimum of theoretical background and a maximum of interpretation through everyday workplace examples" according to the National Education Association's *Advocate* newsletter (April 2005).

The Rochester Institute of Technology's guide "How to Teach Adult Students," suggests several strategies for those who teach adults that include:

- giving an overview of what will be covered and class objectives,
- trusting students to be serious about what they are learning,
- being fair and flexible with them,
- being open and accessible to them,
- using real-life, applicable examples as opposed to being theoretical, and
- mixing activities to keep up interest (older adults can tire more readily).

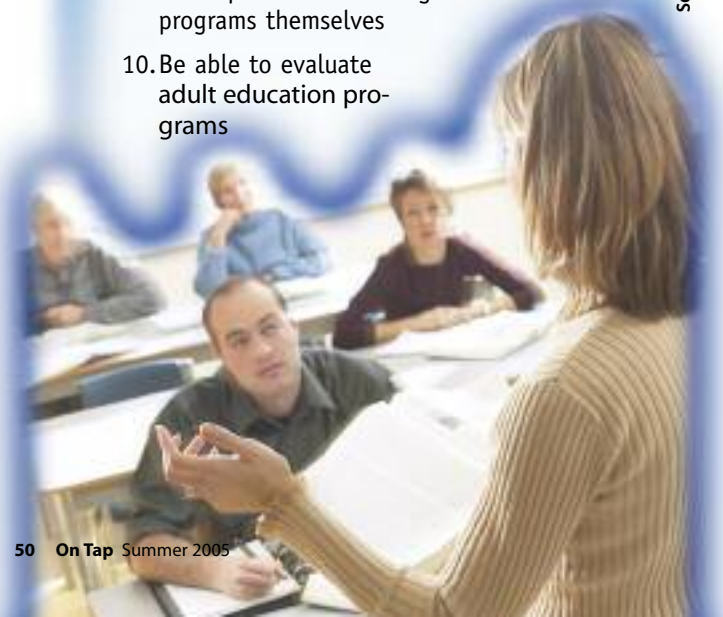
"You're dealing with adult students, and a lot of these guys have been out of school for a long time," McCoy says. "They're all kind of 'we have to do this,' and some of them aren't real happy

Ten Skills Needed to Teach Adults

Once a good strategy has drawn people into a training session, working with these adults requires different techniques from working with traditional students. Trainers need to be aware of basic principles of adult learning, because adults bring an entirely different attitude to a class. To be effective, instructors must:

1. Understand motivation and participation levels of adults in a training program
2. Understand and provide for the needs of adult learners
3. Be competent in the theory and practice of adult learning
4. Be familiar with the community and interests of the students
5. Use a variety of methods and techniques of instruction
6. Possess adequate communication and listening skills
7. Use appropriate educational materials
8. Be open-minded about allowing adult students to pursue special interests
9. Participate in continuing education programs themselves
10. Be able to evaluate adult education programs

Source: Adapted from the National Environmental Services Center's *Basics of Environmental Systems Management* curriculum.



about it, so you want to make it as pleasant an experience for them as you can."

This means that if an instructor drones on about regulations without giving some real world basis for the rules, the students will be daydreaming within a matter of minutes. Hands-on exercises and a variety of activities keep a class awake and interested.

"Trainers have to know their material very well," says Ross. "They need to incorporate humor in a presentation and have a lot of participation in order to keep it interesting. I've attended training, particularly dealing with federal regulations and things like that, that just become extremely boring. Group exercises are under-utilized."

McCoy tells of a pumps and motors class she taught where she used group discussion to get things going. After having everyone introduce themselves, she divided the class up into small groups to talk about the five biggest challenges they had as operators.

"When they got done with the five biggest challenges," she says, "I wanted to know what their three most rewarding things were. That sparked some really interesting conversation. It kind of loosened everybody up, and they got to talking to each other."

At PRWA trainings, McCoy says that they always try to present some activity where the class breaks into groups to work on a project or just talk to each other about problems that another system may have had before. She tries to leave a little time during the day so the students can talk about whatever they need to talk about, whether it's a problem with a treatment process or their governing body or just with how many hours they have to work.

Training is Serious Business

Aside from the food and the fun of making continuing education palatable, as McCoy notes, it's important to remember that operating a system is serious business. Training, after all, is mandated to help operators do their jobs.

"The operators are dealing with the public's health and welfare, but, it's not a high paying job," she says, "and, it's not a highly respected job, although it should be.

Whether it's in the classroom, in the field, or at a conference, face-to-face interaction is vital to the learning process.

"You don't want to just have them in a class shooting facts at them. You want them to have the opportunity to network with other systems, to get to know the other operators there, and to establish some friendships while they're at training, not only with the other operators but also with the trainers. You try to keep it as serious and on target as you need it to be, but you don't want to try to be like a school teacher."

"Good training programs tend to generate interest," Hoornbeek says. "If you provide practical information in an easy-to-understand format and make the experience enjoyable, people will appreciate it and tell others. As the old saying goes, there's no better publicity than good word of mouth."

Successful trainers take time to learn what their students need and give them additional information to keep one step ahead of ever-changing technologies and new regulations. Arnbrister says that most of the operators in his state are very "regulatory conscious," so they enhance their training sessions by including regulatory updates about forthcoming regulations, such as the Ground Water Rule.

Those little extras—plus good, solid information in the classroom—go a long way to fill seats and to keep people coming back for more.

For More Information

The training unit of the National Environmental Services Center has additional tips for teaching adults at *www.nesc.wvu.edu/netcsc/netcsc_tips.htm*. NESC also lists a number of training and education links at www.nesc.wvu.edu/netcsc/netcsctraining&edlinks.htm

The Rochester Institute of Technology has an online guide titled "Effective Teaching Techniques for Distance Learning" that provides an overview of different teaching methods and ways of learning. Go to *www.rit.edu/~609www/ch/faculty/effective.htm* to review this guide.

Michelle Moore, *On Tap* associate editor, welcomes reader feedback—both positive and negative—on her articles. Contact her at *michelle.moore@mail.wvu.edu*.

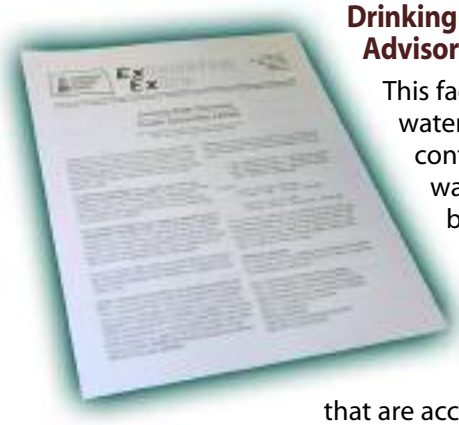
Featured Products

To order, call the National Environmental Services Center at **(800) 624-8301** or **(304) 293-4191**. You also may send an e-mail to *info@mail.nesc.wvu.edu*.

Complying With the Revised Drinking Water Standard for Arsenic: Small Entity Compliance Guide

Long-term exposure to arsenic in drinking water has been linked to several forms of cancer, especially bladder and lung cancer, and to other health problems, such as diabetes and heart disease. This guide can help your small system protect customers' health by providing information about the Arsenic Rule and how it affects your system, funding for compliance, monitoring and reporting responsibilities, and preparing for compliance dates.

Item # DWBLOM6



Drinking Water Standards, Health Advisories Levels

This fact sheet discusses drinking water standards (maximum contaminant levels) for public water systems that also can be applied to private systems and drinking water wells. The sheet also lists health advisory levels, the guidelines for chemical concentrations that are acceptable for drinking water.

Item # DWBLPE203

Xeriscape, Landscape Water Conservation

Xeriscaping uses seven principles to help preserve water in the landscape: planning and design, soil analysis and preparation, practical turf areas, appropriate plant selection, efficient irrigation, use of mulches, and appropriate maintenance. This booklet discusses these principles to help homeowners and landscapers learn how to use less water to care for plantings. A list of suggested plants for dry, southern climates is included.

Item # DWBLPE163

Pesticide Properties That Affect Water Quality

Pesticides, including insecticides, herbicides, and fungicides, have many uses in modern society. Unfortunately, these materials can endanger water quality. This booklet discusses pesticide classes; their properties, formulations, toxicity, doses and effective doses; and their persistence in the environment, plus how they can enter surface water or groundwater and how water quality can be protected.

Item # DWBLPE164

The Water Guardian, A Guide to Good Water Quality

Water quality can be defined as the "health" of the water. Good or bad, water's health comes from a complex mix of physical, chemical, and biological parts. People need to know that all kinds of activities affect water quality. This illustrated, pocket-size booklet discusses the many risks that can affect water's health.

Item # DWBLPE206

Drinking Water Products List

All of the products listed are free!

NESC

Quantities are limited to one each per order. If bulk copies are needed, please call for availability.

To order these free products, please use the **product order form on page 59** or call the National Environmental Services Center at **(800) 624-8301** or **(304) 293-4191**.

You also may send an e-mail to *info@mail.nesc.wvu.edu*.

Our newest products are highlighted in **blue**.

ITEM NUMBER BREAKDOWN

First two characters of item number:
(Major Product Category)

DW	Drinking Water
FD	Funding

Second two characters of item number:
(Document Type)

BK	Book, greater than 50 pages
BL	Booklet, less than 50 pages
BR	Brochure
CD	Compact Disk/ROM
FS	Fact Sheet
PK	Packet
PS	Poster
QU	Quarterly
SW	Software
VT	Video Tape

Third two characters of item number:
(Content Type)

DM	Design Manual
FN	Finance
GN	General Information
MG	Management
NL	Newsletter
OM	Operation and Maintenance
PE	Public Education
PP	Public-Private Partnerships (P3)
RE	Research
RG	Regulations
TR	Training

Last two characters of item number:
(Uniquely identifies a product within a major category)

DESIGN

DWBKDM16	Improved Protection of Water Resources from Long Term and Cumulative Pollution
DWBKDM14	Manual for the Certification of Laboratories Analyzing Drinking Water; Criteria and Procedures Quality Assurance: Fourth Edition
DWBKDM06	Manual of Individual and Non-Public Water Supply Systems
DWBKDM05	Manual of Small Public Water Supply Systems
DWBKDM01	Manual of Water Well Construction Practices
DWBKDM12	Radionuclide Removal for Small Public Water Systems
DWBLDM02	Rainwater Cisterns: Design, Construction, and Water Treatment
DWBKDM08	Regionalization Options for Small Water Systems

FINANCE

DWBKFN15	Catalog of Financial Support Sources for U.S. - Mexico Border Water Infrastructure
DWFSFN16	Community Facilities Loans and Grants
DWFSFN36	Drinking Water Costs & Federal Funding
DWBKFN09	Drinking Water Infrastructure Needs Survey: First Report to Congress
DWBKFN33	Drinking Water Infrastructure Needs Survey: Second Report to Congress
FDBKFN34	The Drinking Water State Revolving Fund: Financing America's Drinking Water—A Report of Progress
DWBKFN14	Financial Accounting Guide for Small Water Utilities
DWBKFN05	Financing Models for Environmental Protection: Helping Communities Meet Their Environmental Goals
DWBLFN38	Guide to Using EPA's Automated Clearing House for the Drinking Water State Revolving Fund Program
DWBLFN07	Innovative Options for Financing Nongovernmental Public Water Supplies' Needs
DWFSFN35	Partners in Healthy Drinking Water Grants
DWSWFN01	PAWATER Users Manual: Financial Planning Model New, Small Community Water Systems (Version 2.2)
DWFSFN37	Protecting Drinking Water with the Clean Water State Revolving Fund
FDBLFN15	Road to Financing: Assessing and Improving Your Community's Creditworthiness
DWBKMG45	Small Water System Byproducts Treatment and Disposal Cost Document
DWBLFN42	Sources of Technical and Financial Assistance for Small Drinking Water Systems
FDBLFN14	State and Local Government Guide to Environmental Program Funding Alternatives
DWFSFN17	**Using DWSRF Funds to Comply with the Filter Backwash Recycling Rule**
DWFSFN32	Using DWSRF Funds to Comply with the New Arsenic Rule

DWFSFN18 Using DWSRF Funds for Transmission and Distribution Infrastructure Needs

DWFSFN39 Use of the Drinking Water State Revolving Fund (DWSRF) to Implement Security Measures at Public Water Systems

FDBLFN13 Utility Manager's Guide to Water and Wastewater Budgeting

FDBLFN03 Water and Wastewater Manager's Guide for Staying Financially Healthy

GENERAL INFORMATION

DWBRGN58 Arsenic in Drinking Water

DWVTPE25 Careers in Water Quality

DWVTGN20 Clean Ground Water: Virginia's Endangered Inheritance

DWFSGN53 Community Involvement in Drinking Water Source Assessments

DWBKGN28 Designing a Water Conservation Program: An Annotated Bibliography of Source Materials

DWBKTR12 Directory of Drinking Water Training Materials

DWBRGN56 Drinking Water Academy Training for Federal, State, and Tribal Drinking Water Professionals

DWCDGN50 Drinking Water. Know What's In It For You.

DWPSGN49 Drinking Water. Pour Over the Facts.

DWBLGN24 Drinking Water Glossary: A Dictionary of Technical and Legal Terms Related to Drinking Water

DWFSGN47 Drinking Water Treatment

DWBLGN67 EPA'S Role in Water Security Research

DWFSGN66 Extension Extra: Drinking Water Standards, Household Water Treatment Equipment

DWFSGN44 A Guide to Home Water Treatment

DWBLGN61 Healthy Water, Healthy People

DWFSGN52 The History of Drinking Water Treatment

DWBKGN06 Improving the Viability of Existing Small Drinking Water Systems

DWFSGN46 Iron in Drinking Water

DWBRGN02 Lead Ban: Preventing the Use of Lead in Public Water Systems and Plumbing Used for Drinking Water

DWFSGN60 Lead in Drinking Water

DWBLGN19 Lead in Drinking Water: An Annotated List of Publications

DWBKGN48 National Water Quality Inventory: 1998 Report to Congress—Ground Water and Drinking Water Chapters

DWBLGN43 Nutrient Management to Protect Water Quality

DWBKGN36 Outreach Resource Guide

DWBLGN41 Providing Solutions for a Better Tomorrow: A Progress Report on U.S. EPA's Drinking Water Treatment Technology Demonstrations in Ecuador, Mexico, and China

DWBLMG41 Public-Private Partnerships for Environmental Facilities: A Self-Help Guide for Local Governments

DWBRGN03 Public Water Systems: Providing Our Nation's Drinking Water

DWBLGN55 The Quality of Our Nation's Waters—A Summary of the National Water Quality Inventory: 1998 Report to Congress

DWBKGN64 Safe Drinking Water Act Section 1429 Ground Water Report to Congress

DWFSGN51 Safe Drinking Water Information in Envirofacts

DWBKOM35 Summary Report: Small Community Water and Wastewater Treatment

DWPSGN21 The Hydrologic Cycle

DWBKGN20 Technical & Economic Capacity of States & Public Water Systems To Implement Drinking Water Regulations

DWBRGN45 Using Water Wisely in the Home

DWBRGN59 Volatile Organic Chemicals in Drinking Water

DWFSGN54 Water Facts

DWBLGN17 Water Quality Self-Help Checklist

DWBLGN63 The Water Story

MANAGEMENT

DWBLMG54 Asset Management: A Handbook for Small Water Systems

DWBKMG22 Consolidated Water Rates: Issues and Practices in Single-Tariff Pricing

DWBLMG55 Delineation of Source-water Protection Areas in Karst Aquifers of the Ridge and Valley and Appalachian Plateaus Physiographic Provinces: Rules of Thumb

DWCDMG61 Des Moines Water Works' Project: Providing Timely Drinking Water and Source Water Quality Information to Your Community

DWBKMG39 Disinfection Profiling and Benchmarking Guidance Manual

DWBKMG09 Drinking Water Handbook for Public Officials

DWCDMG60 Effective Risk Management of Endocrine Disrupting Chemicals Workshop New Media CD

DWBLMG20 Ensuring Safe Drinking Water for Tribes

DWCDMG57 Environmental Management Suite: Tools for Local Government Officials and Those Who Help Them

DWBKMG14 Environmental Planning for Small Communities: A Guide for Local Decision Makers

DWBKGN09 Environmental Pollution Control Alternatives: Drinking Water Treatment for Small Communities

DWBLMG58 Getting in Step: A guide to effective outreach in your watershed

DWBLMG50 Guidance for Water Utility Response, Recovery & Remediation Actions for Man-Made and/or Technological Emergencies

DWBLMG26 Handbook for Capacity Development: Developing Water System Capacity Under the Safe Drinking Water Act as Amended in 1996

DWBLMG12 Helping Small Systems Comply With The Safe Drinking Water Act: The Role of Restructuring

DWBKMG21 Information for States on Implementing the Capacity Development Provisions of the Safe Drinking Water Act Amendments of 1996

DWBLMG32 Institutional Solutions to Drinking Water Problems: Maine Case Studies

DWBLMG52 Instructions to Assist Community Water Systems in Complying with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002

DWBLTR13 Methods for Assessing Small Water System Capability: A Review of Current Techniques and Approaches

DWBLMG31 National Characteristics of Drinking Water Systems Serving Populations Under 10,000

DWBLMG40 NDWC Consumer Confidence Report

DWBKMG30 Optimizing Water Treatment Plant Performance with the Composite Correction Program

DWBLMG27 An Owner's/Operator's Handbook for Safe Drinking Water for Transient Noncommunity Public Drinking Water Systems

DWBKMG15 Practical Personnel Management for Small Systems

DWBKMG19 Preparing Your Drinking Water Consumer Confidence Report: Guidance for Water Suppliers

DWBLMG33 Protecting Sources of Drinking Water: Selected Case Studies in Watershed Management

DWBKMG36 Protocol for Conducting Environmental Compliance Audits for Public Water Systems Under the Safe Drinking Water Act

DWBLMG42 Risky Waste Disposal Practices Can Cost You Plenty: A Manager's Guide to Protecting Community Drinking Water

DWBLMG48 Safe Drinking Water: How can we provide it in our community?

DWPKMG37 Securing Water Package (RUS)

DWBLMG01 Self-Assessment for Small, Privately Owned Water Systems

DWBKMG43 Self-Evaluation Guide for Decision Makers of Small Community Water Systems

DWBLMG44 Small Systems Guide to Risk Management and Safety

DWBLMG34 State FOIA Laws: A Guide to Protecting Sensitive Water Security Information

DWBKMG25 State Programs to Ensure Demonstration of Technical, Managerial, and Financial Capacity of New Water Systems

DWBKMG28 State Strategies to Assist Public Water Systems in Acquiring and Maintaining Technical, Managerial, and Financial Capacity: A Comprehensive Summary of State Responses to Section 1420(c) of the Safe Drinking Water Act

DWBLMG59 Strategic Planning: A Handbook for Small Water Systems

DWBKMG46 Strategies for Effective Public Involvement: Drinking Water Source Assessment and Protection

DWBLMG38 System Partnership Solutions to Improve Public Health Protection

DWBKMG62 Taking Stock of Your Water System: A Simple Asset Inventory for Very Small Drinking Water Systems

DWBKMG47 Water Conservation Plan Guidelines

DWBLTR05 Water Rates: Information for Decision Makers

DWBLMG51 Water Security Strategy for Systems Serving Populations Less than 100,000/15 MGD or Less

DWBLMG03 Water System Self-Assessment for Homeowners' Associations

DWBLMG02 Water System Self-Assessment for Mobile Home Parks

ON TAP MAGAZINE

DWQUNL03 *On Tap*, Volume 1, Issue 3; Fall 2001

DWQUNL04 *On Tap*, Volume 1, Issue 4; Winter 2002

DWQUNL05 *On Tap*, Volume 2, Issue 1; Spring 2002

DWQUNL06 *On Tap*, Volume 2, Issue 2; Summer 2002

DWQUNL07 *On Tap*, Volume 2, Issue 3; Fall 2002

DWQUNL08 *On Tap*, Volume 2, Issue 4; Winter 2003

DWQUNL09 *On Tap*, Volume 3, Issue 1; Spring 2003

DWQUNL10 *On Tap*, Volume 3, Issue 2; Summer 2003

DWQUNL11 *On Tap*, Volume 3, Issue 3; Fall 2003

DWQUNL12 *On Tap*, Volume 3, Issue 4; Winter 2004

DWQUNL13 *On Tap*, Volume 4, Issue 1; Spring 2004

DWQUNL14 *On Tap*, Volume 4, Issue 2; Summer 2004

DWQUNL15 *On Tap*, Volume 4, Issue 3; Fall 2004

DWQUNL16 *On Tap*, Volume 4, Issue 4; Winter 2005

DWQUNL17 *On Tap*, Volume 5, Issue 1; Spring 2005

OPERATION AND MAINTENANCE

DWBKOM32 Alternative Disinfectants and Oxidants Guidance Manual

DWBKOM17 Arsenic Removal from Drinking Water by Coagulation/Filtration and Lime Softening Plants

DWBKOM12 Arsenic Removal from Drinking Water by Ion Exchange and Activated Alumina Plants

DWBKOM33 Arsenic Removal from Drinking Water by Iron Removal Plants

DWBKOM66 Arsenic Treatment Technology Evaluation Handbook for Small Systems

DWBLOM63 Complying with the Revised Drinking Water Standard for Arsenic: Small Entity Compliance Guide; One of the Simple Tools for Effective Performance (STEP)

DWSWOM61 Consumer Confidence Report Writer V3.0

DWBKOM03 Control of Biofilm Growth in Drinking Water Distribution Systems

DWBKOM16 Controlling Disinfection By-Products and Microbial Contaminants in Drinking Water

DWBKRE11 Control of Lead and Copper in Drinking Water

DWFSOM30 Drinking Water Security and Emergency Preparedness: Top Ten List

DWPKOM59 Emergency Response Planning Pack (ERPP)

DWBLOM55 Hydrogen Sulfide in Drinking Water: Causes and Treatment Alternatives

DWCDOM71 Illinois Source Water Protection: Guide to Developing A Source Water Protection Plan

DWBLRE01 Impact of Pipe Coatings on Drinking Water Quality

DWCDOM72 Indiana Source Water Protection Plan: Guide to Developing A Source Water Protection Plan

DWFSOM65 Inspection of Water Storage Facilities

DWFSOM10 Interim Enhanced Surface Water Treatment Rule: A Quick Reference Guide

DWSWOM34 Leak Audit Software for Water Utilities to Quantify Distribution System Water Losses

DWCDOM70 Ohio EPA: Developing A Drinking Water Source Protection Plan

DWCDTR18 Operator Basics Training Series: Ground Water Systems-National Version 2005

DWBKOM09 Optimizing Water Treatment Plant Performance Using the Composite Correction Program: 1998 Edition

DWBLOM13 Oxidation of Arsenic (III) by Aeration and Storage

DWPKOM69 Preventive Maintenance Card File for Small Public Water Systems Using Ground Water

DWPKOM24 Preventive Maintenance Tasks for Tribal Drinking Water Systems

DWFSOM19 Safety Tips: Hazard Communications

DWCDTR19 Sanitary Survey Fundamentals Prep Course

DWCDOM62 Small Public Water Systems Technology Guide: Vol. 1--Slow Sand Filtration Iron and Manganese Control Arsenic Removal

DWFSOM11 Stage 1 Disinfectants and Disinfection Byproducts Rule: A Quick Reference Guide

DWPKOM36 *Tech Brief* Package

DWFSOM68 Tech Brief: Chlorination

DWFSOM52 *Tech Brief*: Corrosion Control

DWFSOM58 *Tech Brief*: Cross Connection and Backflow Prevention

DWFSOM39 *Tech Brief*: Diatomaceous Earth Filtration for Drinking Water

DWFSOM50 *Tech Brief*:: Disinfection

DWFSOM51 *Tech Brief*: Filtration

DWFSOM46 *Tech Brief*: Ion Exchange and Demineralization

DWFSOM42 *Tech Brief*: Iron and Manganese Removal

DWFSOM73 Tech Brief: Jar Testing

DWFSOM38 *Tech Brief*: Leak Detection and Water Loss Control

DWFSOM41 *Tech Brief*: Lime Softening

DWFSOM43 *Tech Brief*: Membrane Filtration

DWFSOM47 *Tech Brief*: Organic Removal

DWFSOM44 *Tech Brief*: Ozone

DWFSOM48 *Tech Brief*: Package Plants

DWFSOM31 *Tech Brief*: Point-of-Use/Point-of-Entry Systems (POU/POE)

DWFSOM57 *Tech Brief*: Preventing Well Contamination

DWFSOM56 *Tech Brief*: Pumps

DWFSOM45 *Tech Brief*: Radionuclides

DWFSOM60 *Tech Brief*: Repairing Distribution Line Breaks

DWFSOM15 *Tech Brief*: Reservoirs, Towers, and Tanks–Drinking Water Storage Facilities

DWFSOM74 Tech Brief: Sanitary Surveys

DWFSOM40 *Tech Brief*: Slow Sand Filtration

DWFSOM20 *Tech Brief*: System Control and Data Acquisition (SCADA)

DWPSOM37 *Tech Brief*: Treatment Technologies for Small Drinking Water Systems

DWFSOM53 *Tech Brief*: Ultraviolet Disinfection

DWFSOM21 *Tech Brief*: Valves

DWFSOM27 *Tech Brief*: Water Hammer

DWFSOM67 Tech Brief: Water Meters

DWFSOM25 *Tech Brief*: Water Quality in Distribution Systems

DWFSOM49 *Tech Brief*: Water Treatment Plant Residuals Management

DWBKOM26 Technologies and Costs for the Removal of Radon From Drinking Water: Public Comment Draft

DWBKOM18 Treatment of Arsenic Residuals from Drinking Water Removal Processes

DWCDOM23 Troubleshooting Guide for Small Ground Water Systems with Hypochlorination

DWBKOM54 Water Audit and Leak Detection Guidebook: Water Conservation Guidebook No. 5

PUBLIC EDUCATION

DWFSPE60 21 Water Conservation Measures for Everybody
DWBLPE150 America's Priceless Ground Water Resource
DWBRPE124 Answers to your Questions about Groundwater
DWBLPE130 Answers to Your Questions on Well Abandonment
DWFSPE188 Atrazine
DWPKPE78 Bacteria and Water Wells
DWBLPE129 Better Homes & Groundwater
DWBLPE146 Big Rivers
DWBRPE04 Bottled Water: Helpful Facts and Information
DWBLGN62 Celebrate Wetlands
DWBRPE104 Children and Drinking Water Standards
DWBLPE198 Children and Drinking Water Standards (Spanish)
DWBLPE32 Citizen Monitoring: Recommendations to Household Well Users
DWBLPE37 Citizen's Guide to Ground-Water Protection
DWBRPE103 Class V Injection Wells and Your Drinking Water
DWBKPE53 Cleaner Water Through Conservation
DWBLPE136 Consider the Source: A Pocket Guide to Protecting Your Drinking Water
DWFSPE230 Consumer Fact Sheet on: Cyanide
DWBLPE117 Contaminants and Drinking-Water Sources in 2001: Recent Findings of the U.S. Geological Survey
DWFSPE30 Copper, Drinking Water, and You
DWVTPE69 Creator's Gift: Good Water
DWBRPE201 Cryptosporidiosis and Drinking Water
DWBLGN21 Cryptosporidium
DWBRPE162 Cryptosporidium and Drinking Water
DWBRPE171 Cryptosporidium and Drinking Water (Spanish)
DWBLPE212 Cryptosporidium in Drinking Water
DWBLPE193 Cryptosporidium: Drinking Water Health Advisory
DWCDPE138 Desdemona's Splash
DWBRPE28 De sus Ninos del Plomo en el Agua Potable (Protecting Your Kids from Lead in Drinking Water)
DWBLPE152 Discover Ground Water & Springs
DWFSPE200 Disposal of Backwash from Water Treatment Devices at Single Family and Duplex Residences
DWFSPE144 Distillation For Home Water Treatment
DWPKPE39 Drinking Water Activities for Teachers and Students
DWBLPE123 Drinking Water and Health: What you need to know!
DWBLPE209 Drinking Water and Health: What you need to know! (Spanish)
DWBLPE184 Drinking Water and MTBE: A Guide for Private Well Owners
DWBLPE05 Drinking Water from Household Wells
DWFSPE131 Drinking Water Monitoring, Compliance, and Enforcement
DWFSPE122 Drinking Water: Past, Present, and Future
DWFSPE118 Drinking Water Quality in Indian Country: Protecting Your Sources
DWFSPE120 Drinking Water Quality Reports—Your Right to Know
DWFSPE219 Drinking Water Treatment
DWBLPE196 Emergency Disinfection of Drinking Water (Spanish)
DWFSPE226 EPA Environmental Education: Role of Plants in Water Filtration
DWFSPE225 EPA Environmental Education: Water Purification by Evaporation and Condensation
DWFSPE57 Emergency Disinfection of Water Supplies
DWFSPE203 Extension Extra: Drinking Water Standards, Health Advisory Levels
DWFSPE204 Extension Extra: Water for Emergency Use
DWBLPE96 Fact Sheet on Home Drinking Water Treatment
DWBLPE74 Fact Sheet: Water Conservation Measures
DWBLPE199 Frequently Asked CCR Questions
DWBLPE179 The Further Adventures of Captain Hydro Brings You "Water Magic!" (Teacher Activity Guide)
DWBLPE180 The Further Adventures of Captain Hydro Teacher's Guide
DWBKPE216 Getting up to Speed: The Water Cycle and Water Conservation
DWFSPE213 Giardia: Drinking Water Fact Sheet
DWBLPE190 Giardia: Drinking Water Health Advisory
DWFSPE172 Giardiasis
DWFSPE173 Giardiasis (Spanish)
DWPKPE49 Give Water a Hand Action Guide
DWBKPE115 Ground Water and Surface Water: A Single Resource
DWFSPE36 Ground Water Protection: A Citizen's Checklist
DWFSPE153 Groundwater Contamination & Your Septic System
DWBLPE206 Groundwater Guardian: A Guide to Good Water Quality
DWPSPE40 Groundwater Protection Begins at Home
DWBRPE03 Home Water Treatment Units: Filtering Fact from Fiction
DWFSPE127 Home Water Treatment Using Activated Carbon
DWFSPE46 Household Hazardous Waste: Where it Goes in Monongalia County
DWBKPE95 How to Conduct an Inventory in Your Wellhead Protection Area
DWFSPE68 How to Protect Your Well
DWBLOM55 Hydrogen Sulfide in Drinking Water: Causes and Treatment Alternatives
DWBLPE77 Improving Home Water Quality
DWBLPE112 Interpreting Drinking Water Quality Analysis: What Do the Numbers Mean?
DWBRPE91 Is Your Community's Drinking Water at Risk?
DWBLPE113 It's YOUR Drinking Water: Get to know it and protect it!
DWBLPE174 Water Games (Spanish)
DWPSPE10 Lead and Copper Rule Decision Diagram
DWFSPE187 Lead Contamination in Water Wells
DWBLPE195 Lead in Drinking Water: What You Need to Do to Reduce the Lead (Spanish)
DWBLPE06 Lead in School Drinking Water
DWBLPE16 Lead in Your Drinking Water: Actions You Can Take To Reduce Lead in Drinking Water
DWBLPE154 Lead Leaching from Submersible Well Pumps
DWFSPE191 Legionella: Drinking Water Fact Sheet
DWBLPE189 Legionella: Drinking Water Health Advisory
DWBLPE181 Legionella: Risk for Infants and Children
DWFSPE202 MTBE and Other Volatile Organic Compounds--New findings and implications on the quality of source waters used for drinking water supplies
DWFSPE183 Mycobacteria: Drinking Water Fact Sheet
DWBLPE192 Mycobacteria: Health Advisory
DWBLPE197 National Primary Drinking Water Standards (Spanish)
DWFSPE126 Nitrate–A Drinking Water Concern
DWBLPE177 The Official Captain Hydro Water Conservation Workbook (Spanish Version)
DWFSPE233 Ohio State University Fact Sheet: Hydrogen Sulfide in Drinking Water
DWBLPE164 Pesticide Properties That Affect Water Quality
DWBLPE210 Pesticides in Drinking Water
DWPKPE221 Physicians for Social Responsibility Primer Series
DWBLPE86 Pesticides in Drinking Water Wells
DWBRPE166 Plugging Abandoned Water Wells
DWBLPE121 Protect Our Health From Source to Tap: National Drinking Water Program Highlights
DWFSPE208 Protect Water Resources . . . Understand Pesticide Movement
DWBKPE66 Protect Your Ground Water: Educating for Action

DWBLPE133 Protecting Drinking Water Through Underground Injection Control
DWBLPE33 Protecting Local Ground Water Supplies Through Wellhead Protection
DWFSPE143 Reverse Osmosis for Home Treatment of Drinking Water
DWFSPE142 Safe Drinking Water Act: Glossary
DWPSPE125 Safe Drinking Water Act: Protecting America's Public Health
DWPSPE132 Safe Drinking Water Act: Underground Injection Control (UIC) Program—Protecting Public Health and Drinking Water Resources
DWPKPE116 Safewater: Tap Into It!
DWBLPE155 Safeguarding Wells and Springs from Bacterial Contamination
DWFSPE160 Sampling for Bacteria in Wells
DWFSPE161 Sampling for Bacteria in Wells (Spanish)
DWBLPE220 Save Water with the Conservation Kids
DWBLPE194 Setting Standards for Safe Drinking Water (Spanish)
DWBRPE185 Seven Water Smart Tips to Lower your Water Bill and Save Water in Your Home
DWBLPE02 Science Demonstration Projects in Drinking Water (Grades K–12)
DWBLFN13 Source Water 2000: Funding and Assistance Programs To Protect Small Town and Rural Drinking Water
DWBLPE182 Source Water Protection Practices Bulletin: Managing Highway Deicing to Prevent Contamination of Drinking Water
DWBLPE89 Springs: Early Warning Systems for our Groundwater
DWBLPE156 SPRINGS: Their Origin, Development, and Protection
DWBLPE38 Student Activity Sheets for Drinking Water Projects
DWBLRE17 Summary Results of EPA's National Survey of Pesticides in Drinking Water Wells
DWPKPE215 Tap into Prevention
DWBKMG18 Tapping Your Own Resources
DWBLPE137 Teaching Soil and Water Conservation: A Classroom and Field Guide
DWBLPE165 TEX-A-SYST: Reducing the Risk of Ground Water Contamination by Improving Well-Head Management and Conditions
DWBLPE214 The Story of Drinking Water
DWFSPE227 Thirstin's Ground Water Movement Activity
DWBLPE232 Thirstin's Wacky Water Adventure
DWFSPE229 Thirstins Water Cycle Activity
DWFSPE231 Thirstin's Water Cycle Adventure
DWFSPE54 Update on Lead Leaching From Submersible Well Pumps and Private Drinking Water Systems
DWBRPE157 Volatile Organic Chemicals: Are VOCs in your drinking water?
DWBLPE211 Volatile Organic Compounds in Drinking Water
DWBLPE105 Water and Me
DWBLPE109 Water Around Us: The Hydrologic Cycle and Conservation
DWBLPE149 Water Conservation In Your Home
DWBLPE217 Water Drop Patch Project
DWCDPE207 The Water Guardian: Chopper Ride: An interactive computer adventure about water quality
DWBKPE92 Water on Tap: A Consumer's Guide to the Nation's Drinking Water
DWBLPE174 Water Play
DWBLPE175 Water Play (Spanish)
DWBLPE90 Water Protection at Home: What You Can Do To Prevent Water Pollution in Your Community
DWBLPE119 Water Quality for Private Water Systems
DWBLPE94 Water Quality Improvements for Farmstead and Rural Home Water Systems
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DWFSPE205 Water Wells: FARM*A*Syst-Farm/Ranch Self-Assessment System for Arizona
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DWBLPE159 Wellhead Protection in Confined, Semi-Confined, Fractured, and Karst Aquifer Settings
DWBKMG06 Wellhead Protection: A Guide for Small Communities
DWBLPE148 When You Need a Water Well
DWBRPE223 Word Scramble
DWBLPE163 Xeriscape...Landscape Water Conservation
DWFSPE128 You & Your Well
DWFSPE169 Your Actions Can Help Preserve Drinking Water Quality
DWFSPE170 Your Actions Can Help Preserve Drinking Water Quality (Spanish)
DWBLPE167 Your Guide to Public Drinking Water
DWBLPE168 Your Guide to Public Drinking Water (Spanish)
DWBRPE45 Your Home Could Contain Hazardous Waste: What You Need To Know
DWBRPE224 Youth Activity: How People Get Their Water

REGULATIONS

DWBLRG64 25 Years of the Safe Drinking Water Act: History and Trends
DWBLRG76 25 Years of the Safe Drinking Water Act: Protecting our Health from Source to Tap
DWFSRG86 Arsenic and Clarifications to Compliance and New Source Monitoring Rule: A Quick Reference Guide
DWFSRG69 Arsenic in Ground-Water Resources of the United States
DWBLRG96 Arsenic Rule Planning and Monitoring Worksheets
DWBRRG70 Class II Injection Wells and Your Drinking Water
DWFSRG91 Class V Injection Wells: EPA Announces New Regulatory Requirements for Certain Class V Injection Wells
DWFSRG67 The Class V Rule
DWPKRG31 Compilation of Quick Reference Guides
DWFSRG99 Consumer Confidence Report Rule: Quick Reference Sheet for State Review of CCRs
DWBLRG52 Drinking Water Contaminant Candidate List
DWBLRG44 Drinking Water Regulations and Health Advisories
DWCDRG103 Drinking Water Resources: A Collection of Drinking Water Reference Documents & Materials
DWBKRG50 Drinking Water Standard Setting Question and Answer Primer
DWBKRG82 Enhanced Coagulation and Enhanced Percipitative Softening Guidance Manual
DWFSRG102 Extension Extra: Secondary Drinking Water Standards
DWFSRG68 Filter Backwash Recycling Rule: A Quick Reference Guide
DWBLRG100 Filter Backwash Recycling Rule: A Summary for Systems
DWBLRG62 Final Drinking Water Public Notification Regulations
DWBKRG81 Implementation Guidance for the Arsenic Rule: Drinking Water Regulations for Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring
DWBLRG104 Implementation Guidance for the Interim Enhanced Surface Water Treatment rule
DWBLRG89 Interim Enhanced Surface Water Treatment Rule: Frequently Asked Questions
DWFSRG106 Lang Term 1 Enhanced Surface Water Treatment Rule: A Quick Reference Guide
DWFSRG98 Lead and Copper Rule: A Quick Reference Guide
DWBKRG22 Lead and Copper Rule Guidance Manual
DWBLRG87 Lead and Copper Rule Minor Revisions: Fact Sheet for Public Water Systems that Serve 3,300 or Fewer Persons
DWFSRG94 Lead and Copper Rule Minor Revisions: Fact Sheet for Public Water Systems that Serve 3,301 to 50,000 Persons
DWFSRG95 Lead and Copper Rule Minor Revisions Fact Sheet for State Primacy Agencies
DWBLRG88 Lead and Copper Rule Minor Revisions: Fact Sheet for Tribal Water System Owners and Operators

DWBKRG21 Lead In Drinking Water Regulation: Public Education Guidance

DWBKRG101 LT1ESWTR Disinfection Profiling and Benchmarking Technical Guidance Manual

DWBKRG61 Microbial and Disinfection Byproduct Rules: Simultaneous Compliance Guidance Manual

DWBLRG12 Monitoring Guidance Document for the Lead & Copper Rule (Systems serving 3,301–10,000 people)

DWBLRG13 Monitoring Guidance Document for the Lead & Copper Rule (Systems serving 501–3,300 people)

DWBLRG14 Monitoring Guidance Document for the Lead & Copper Rule (Systems serving 101–500 people)

DWBLRG15 Monitoring Guidance Document for the Lead & Copper Rule (Systems serving less than 100 people)

DWFSRG77 National Primary Drinking Water Standards

DWVTRG34 Nontransient Noncommunity Drinking Water: Requirements for Suppliers

DWCDTR20 Point-Of-Use Reverse Osmosis--Complying with Arsenic Regulations in Small Drinking Water Systems

DWFSRG60 Proposed Ground Water Rule: Questions and Answers

DWBKRG105 Public Notification Handbook

DWFSRG83 Public Notification Rule: A Quick Reference Guide

DWBKRG84 Radionuclides Notice of Data Availability Technical Support Document

DWFSRG66 Radionuclides Rule: A Quick Reference Guide

DWBLRG58 Regulations on the Disposal of Arsenic Residuals from Drinking Water Treatment Plants

DWBLRG90 Report to Congress: Small System Arsenic Implementation Issues

DWBKRG80 Research Plan for Arsenic in Drinking Water

DWPKRG25 Safe Drinking Water Act and 1996 Amendments

DWBLRG30 Safe Drinking Water: Health/Safety Requirements and Resulting Costs

DWPKRG47 Safe Drinking Water Is in Our Hands

DWPKRG65 A Small Systems Guide to the Total Coliform Rule

DWBLRG63 Small System Regulatory Requirements Under the Safe Drinking Water Act as Amended 1996

DWFSRG92 Stage 1 Disinfectants and Disinfection Byproducts Rule

DWBLRG93 Stage 1 Disinfectants/Disinfection Byproducts Rule: Frequently Asked Questions

DWBKRG46 State Source Water Assessment and Protection Programs Guidance (Final Guidance)

DWFSRG73 Technical Fact Sheet: Final Rule for Arsenic in Drinking Water

DWFSRG59 Technical Fact Sheet: Proposed Ground Water Rule

DWFSRG97 Total Coliform Rule: A Quick Reference Guide

DWBLOM04 Training Guide: Introduction to Water Loss and Leak Detection

DWFSRG85 UCMR: Screening Survey for Aeromonas at Selected Public Water Systems

DWBLRG79 Unregulated Contaminant Monitoring Regulation Guidance for Operators of Public Water Systems Serving 10,000 or Fewer People

DWFSRG78 Using DWSRF Funds to Comply with the Radionuclides Rule

DWFSRG75 Using DWSRF Funds to Comply with the Stage 1 Disinfectants and Disinfection Byproducts Rule

DWFSRG107 Variances and Exemptions : A Quick Reference Guide

DWBLRG04 Your Drinking Water: From Source to Tap, EPA Regulations and Guidance

RESEARCH

DWBLRE06 Benefits of Water and Wastewater Infrastructure

DWBKRE13 Community Water System Survey Volume 1: Overview

DWBKRE29 Drinking Water and Ground Water Data Within the 305(b) Program

DWBKRE26 Drinking Water Progress Review Workshop for the 1995-1998 Science to Achieve Results (STAR) Grants

DWBLRE20 Drinking Water Treatment for Small Communities: A Focus on EPAs Research

DWBLRE24 Estimating the Likelihood of MTBE Occurrence in Drinking Water Supplied by Ground-Water Sources in the Northeast and Mid-Atlantic Regions of the United States

DWBKRE27 A Field Study to Compare Performance of Stainless Steel Research Monitoring Wells with Existing On-Farm Drinking Water Wells in Measuring Pesticide and Nitrate Concentrations

DWBKRE21 Laboratory Study on the Oxidation of Arsenic III to Arsenic V

DWBKRE25 Methods for the Determination of Organic and Inorganic Compounds in Drinking Water: Volume 1

DWBLRE18 National Pesticide Survey: Update and Summary of Phase II Results

DWBLRE19 Occurrence and Distribution of Methyl tert-Butyl Ether and Other Volatile Organic Compounds in Drinking Water in the Northeast and Mid-Atlantic Region of the United States, 1993-98

DWBLRE30 Occurrence of Selected Radionuclides in Ground Water Used for Drinking Water in the United States: A Reconnaissance Survey, 1998

DWBLRE22 Occurrence and Status of Volatile Organic Compounds in Ground Water from Rural, Untreated, Self-Supplied Domestic Wells in the United States, 1986-99

DWBKRG49 Providing Safe Drinking Water in America: 1996 National Public Water Systems Compliance Report and Update on Implementa-tion of the 1996 Safe Drinking Water Act Amendments

DWBLRE07 Radium Removal from Water by Manganese Dioxide Adsorption and Diatomaceous Earth Filtration

DWBLGN65 Strengthening the Safety of Our Drinking Water: Report on Progress & Challenges & Agenda for Action

DWBKRE15 Ultraviolet Light Disinfection Technology in Drinking Water Application: An Overview

TECHNOLOGIES

DWBKDM15 Corrosion Manual for Internal Corrosion of Water Distribution Systems

DWBLDM03 Cross-Connection Control Manual

DWBKDM07 Nitrate Removal for Small Public Water Systems

DWBLRG48 Small System Compliance Technology List for the Surface Water Treatment Rule

DWBKDM04 Technologies for Upgrading Existing or Designing New Drinking Water Treatment Facilities

DWBLGN11 USEPA Fact Sheets on POU/POE Units and Home Water Testing

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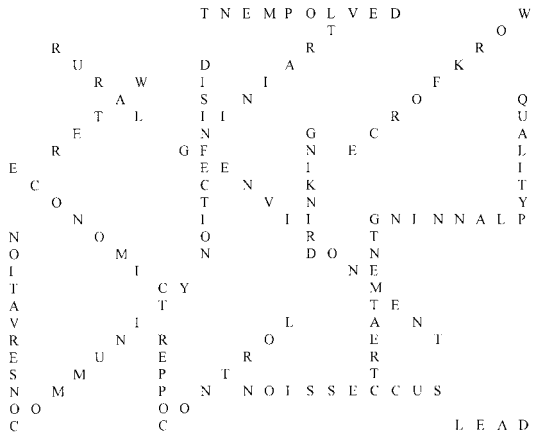
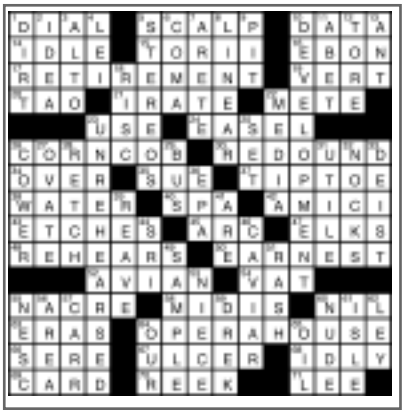
Fun Time Puzzle Solutions



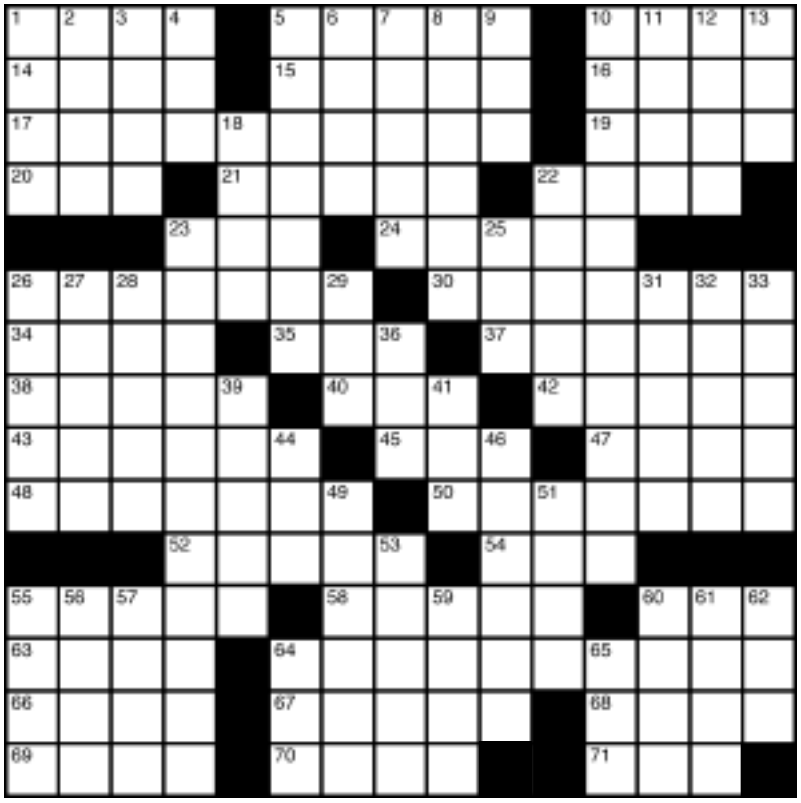


Hmmm...
A two percent drop in body water can cause fuzzy short-term memory, trouble with basic math, and difficulty focusing on a computer screen or printed page. Drinking at least two liters of water each day may reduce the risk of certain diseases, including colon, bladder, and breast cancer.
Source: *National Kidney Research Fund (United Kingdom)*

Crossword

ACROSS

1. Clock face
5. Sell illegally
10. Information
14. Out of work
15. Twins center fielder Hunter
16. Black to poets
17. Status of baby boomers in the near future
19. Spine bone (abbr.)
20. The way, according to Lao-tse
21. Livid
22. Apportion
23. Employ
24. Artist's tripod
26. Snuffy Smith's pipe
30. Predominate
34. Concluded
35. Take to court
37. Walk quietly
38. Necessity for life on Earth
40. Health resort
42. Italian friends
43. Draws on metal with acid
45. Circle part
47. Large deer
48. Tries a case anew
50. The Importance of Being _____ (Wilde play)
52. Pertaining to birds
54. Large container
55. Mother-of-pearl
58. Noons in Nice
60. Nothing
63. Distinctive periods
64. Place to hear Aida
66. Withered
67. Stomach trouble
68. Lazily
69. Part of a deck
70. Stink
71. Confederate general



Solution on page 39

Crossword by Mark Kemp-Rye

DOWN

1. Soil
2. Thought
3. Choir member
4. Hawaiian wreath
5. Hi-Fis
6. Unconscious state
7. Ridge
8. Relating to a line
9. Quarry
10. Economic _____
11. Aid in a crime
12. Ripped
13. Picnic pest
18. Type of microprocessor
22. Magazines, newspapers, TV, radio, etc.
23. Off-the-cuff
25. Hardened
26. Cringe
27. Egg-shaped
28. Upchuck
29. Public vehicle
31. Useful
32. Marks
33. Believer in God
36. Water regulations agency
39. Ransack
41. Area unit
44. ___ Lanka
46. Delicacy made from fish eggs
49. Taste
51. Reckless
53. Brother's daughter
55. *On Tap* publisher
56. Region
57. Detective fiction writer John Dickson ____
59. Drench (Yiddish)
60. Naked
61. Man or Wight
62. Pasture (var.)
64. Belonging to us
65. Lubricate

Find the following words in the puzzle.

economic
development
workforce
planning
training
disinfection
lead
copper
quality
control
treatment
succession
community
rural
drinking
water
environment
conservation

A	F	Z	W	X	P	J	I	I	T	N	E	M	P	O	L	V	E	D	H	C	G	F	A	W
H	R	O	J	E	E	V	A	H	Z	F	D	K	S	E	T	Z	X	P	R	O	M	K	O	E
V	E	R	T	F	R	S	O	E	J	T	B	O	N	R	H	O	L	L	V	S	V	R	J	B
M	D	B	U	I	N	S	H	O	D	T	E	D	A	P	V	Q	A	Y	T	P	K	W	I	G
T	A	M	N	R	L	W	A	T	I	L	W	I	A	S	L	S	N	O	P	F	J	E	E	H
W	T	A	E	L	A	U	M	C	S	W	N	O	F	J	W	D	H	T	O	I	G	F	D	Q
C	L	R	W	T	T	L	O	U	I	I	C	A	H	F	I	R	M	R	U	N	T	R	Q	U
Z	K	K	E	F	F	D	E	R	N	X	I	V	P	G	D	O	C	P	T	B	N	U	U	A
X	P	R	Z	A	N	E	N	G	F	P	T	M	W	N	Q	E	J	G	V	I	P	I	N	L
E	B	J	C	R	O	W	G	S	E	E	J	A	D	I	M	C	T	S	I	R	H	C	L	I
I	C	K	E	M	P	A	L	C	C	L	N	H	U	K	O	N	L	L	E	N	H	O	J	T
G	A	O	M	I	A	M	E	L	T	K	K	V	S	N	U	T	G	O	N	N	J	A	R	Y
J	N	S	N	O	I	D	S	E	I	Z	R	L	I	I	S	M	G	N	I	N	N	A	L	P
N	T	L	O	O	V	P	B	D	O	A	T	V	K	R	I	X	T	N	H	B	O	N	Z	I
O	L	A	R	K	M	K	R	R	N	I	D	H	E	D	O	D	N	F	U	N	F	D	S	K
I	O	A	O	C	Z	I	S	W	I	E	R	C	L	G	O	N	E	R	A	C	H	E	L	V
T	A	N	Y	S	R	L	C	Y	H	G	M	Q	U	X	G	I	M	A	L	F	P	U	E	W
A	D	U	N	N	N	P	T	D	T	O	T	W	V	I	W	N	T	E	E	I	L	U	J	A
V	U	K	L	Q	E	I	A	O	I	B	U	P	L	E	I	R	A	N	N	T	O	M	U	X
R	O	F	V	N	N	Q	R	Q	L	G	Z	O	S	X	C	F	E	K	E	T	E	M	M	C
E	B	F	O	U	L	U	E	L	O	N	R	D	O	L	U	Z	R	S	B	N	A	H	P	J
S	B	U	M	E	S	R	P	S	I	T	N	G	N	A	I	H	T	I	Q	I	D	G	N	F
N	T	M	S	O	G	E	P	X	N	F	N	O	I	S	S	E	C	C	U	S	P	M	Z	B
O	O	S	W	A	N	Z	O	O	M	M	F	U	G	E	R	A	A	N	W	R	U	T	X	H
C	G	B	D	L	V	K	C	G	E	R	A	R	D	M	I	C	H	E	L	L	L	E	A	D

Solution on page 39

Wordsearch by Sheila Anderson

Water Fact

The annual global investment in public water supplies exceeds $90 billion.

Source: *Grist Magazine.*

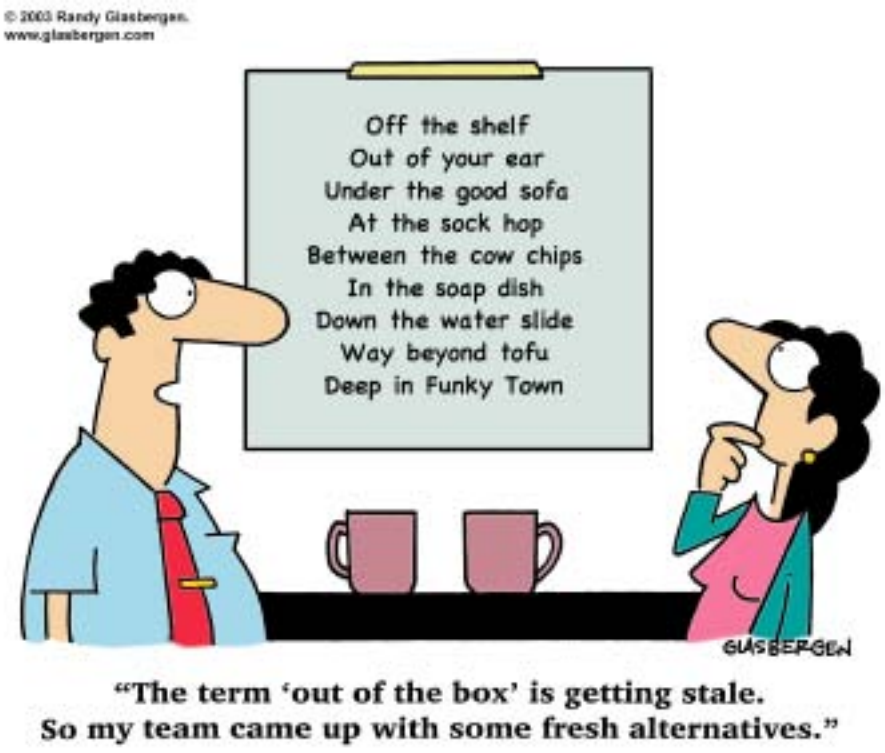
Water Trivia

A community has a water tank that holds 2,340 gallons. If this tank fills in 15 minutes, what is the rate of flow?

a) 156 gallons per minute
b) 172 gallons per minute
c) 196 gallons per minute
d) 202 gallons per minute

Source: *Northeast Rural Water Association*

Answer: 156 gallons per minute (2,340 divided by 15)



QUOTES

How far that little candle throws its beams! So shines a good deed in a naughty world.
William Shakespeare (1564–1616)

Talent alone won't make you a success. Neither will being in the right place at the right time, unless you are ready. The most important question is: "Are your ready?"
Johnny Carson (1925–2005)

Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts.
Rachel Louise Carson (1907–64)

It is a common experience that a problem difficult at night is resolved in the morning after the committee of sleep has worked on it.
John Steinbeck (1902–1968)

An education isn't how much you have committed to memory, or even how much you know. It's being able to differentiate between what you do know and what you don't. It's knowing where to go to find out what you need to know; and it's knowing how to use the information you get.
William Feather (1908–76)

Water Infrastructure Trickles Down to Economic$

By **Matthew Chase**, Executive Director, National Association of Development Organizations

Americans are increasingly acknowledging the importance of a safe, clean water supply and the health and economic impact it can have. A February 2004 survey conducted by the Association of Metropolitan Sewerage Agencies showed that people believe the nation's water quality should be a national priority.

The survey also revealed that:

- 91 percent of the public are concerned that America's waterways will not be clean for their children and grandchildren;
- 90 percent believe that a federal investment to guarantee clean water is a critical component of our nation's environmental well being; and
- 83 percent support legislation that would create a national clean water trust fund for infrastructure improvements.

The Congressional Budget Office, the General Accounting Office (GAO), and the U. S. Environmental Protection Agency (EPA) all agree there is a national funding gap estimated to be as high as $1 trillion for water infrastructure over the next 20 years. Without a federal recommitment to clean water, 30 years of water quality progress could be lost.

These statistics are quite different from just a few years ago. The November 2001 GAO report, *Water Infrastructure—Information on Federal and State Financial Assistance* showed that from fiscal years 1991 to 2000, nine federal agencies made about $44 billion available for drinking water and wastewater capital improvements. EPA's financial assistance came from grants to the states to capitalize the drinking water and clean water state revolving funds (DWSRF and CWSRF), which are used to finance improvements at local drinking water and wastewater treatment facilities. The 46 states that responded, reported that they made $25 billion available to local communities and utilities for drinking water and wastewater improvements between fiscal years 1991 through 2000.

It is clear that providing a safe, secure, and dependable water infrastructure extends beyond safety and health. It also reaps economic rewards. This is evident in rural and small metropolitan communities, which sometimes lack the very basic, safe water supply that most take for granted.

The economic benefits of a coordinated effort between regional development organizations and state and local entities to provide access to a cleaner water supply are significant. For example, one of the major water quality concerns in rural areas is the discharge of untreated household wastewater directly into nearby streams, also called "straight-piping."

In North Carolina's Appalachian region, the National Association of Development Organizations (NADO) reported in 2001 how the High Country Council of Governments worked with the Appalachian District Health Department on a revolving loan fund program to improve the quality of life in the area. Through this effort, eligible households in two counties with straight pipes applied for low-interest loans or grants for the cost of a new septic system. The recipients made payments, and the money was then used to help similar families in need.

Regional planning and development organizations are also helping local water systems with costs associated with protecting source waters. NADO's *2002 Regional Development Organization Survey* revealed that 22 percent of America's regional organizations are already administering these source water-related programs. And, the number of regional organizations administering CWSRF and DWSRF monies, regional water planning, total maximum daily load monitoring, and other watershed planning is expected to rise.

To operate a thriving water infrastructure in every community, it is imperative to provide adequate funding. There is no source more important than the availability of a safe, clean water supply. In order to achieve this goal, a sound, well-funded infrastructure is necessary not only for rural and small metropolitan communities, but for the nation as a whole. It will not only quench human thirst but also provide a well of economic opportunity for communities nationwide.

Matthew Chase is the chief executive officer of NADO and the NADO Research Foundation. Previously, he served as the organization's deputy executive director and director of legislative affairs.

The Learning Never Ends

On Tap Magazine
Drinking Water News for America's Small Communities

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