# WISE WATER WORDS

The Newsletter of the Nebraska Section

American Water Works Association

Volume 49, Issue 1 Summer 2012

# **Enhance Small Water Systems With Automation**

**Auburn Plant Profile** 

Computer Modeling for Distribution Systems

**Legislative Report** 



**MEMBERSHIP** 

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American Water Works Association

AWWA MEMBERSHIP isn't just a great way to stay on top of the knowledge and skills you need in today's water industry. It's also the best way to make sure you don't miss out on good times with your fellow Nebraska water professionals. Tell a co-worker about the benefits of AWWA membership today!



American Water Works Association

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WISE WATER WORDS

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**On the cover:** Lake McConaughy's shores gleam in the setting sun, nine miles north of Ogallala. When the reservoir is full, it has a capacity of 1,740,000 acre feet (2.15 km<sup>3</sup>), covers 35,700 acres (144 km<sup>2</sup>) and has 76 miles (122 km) of shoreline, making it the largest reservoir in Nebraska.

# Chair's Corner

![](_page_3_Picture_1.jpeg)

#### Nebraska AWWA: Lots Going On, More to Come

by Rob Pierce, League of Nebraska Municipalities

C o far, 2012 has been an active year of for the Nebraska Section, with several events already, and more to come in the future. Just a short recap of some of the events that have occurred so far:

Jerry Obrist (Lincoln Water System), Milo Rust (City of Chadron) and Jim Shields (Metropolitan Utilities District) attended the AWWA Washington Fly-In on March 7.

On March 17, Eric Lee and Doug Woodbeck attended the Regional Meeting of Section Officers in Lawrence, Kan., where the south-central AWWA Sections met to share information, concerns and activities to aid in the success of the sections.

On April 3-4, education committee chair John Keith, along with his committee and others, set up an asset management workshop at Mahoney State Park. The event was well-attended, as a speaker from the EPA provided a presentation followed by discussion. The education committee has also co-sponsored 14 one-day workshops with the League of Nebraska Municipalities and have five more planned for the year.

The young professionals committee and chair Justin Stine have been active with events such as the March 9 water storage tank seminar at the Upstream Brewery in Omaha; E-Week on April 13, supporting the student chair Xu Li and the

![](_page_3_Picture_9.jpeg)

Omaha | 402.399.1000 Lincoln | 402.742.2900 and complies with regulations governing groundwater under the influence of surface water

student chapter; and on April 20, a tour of Flowserve in Hastings. Also, there are plans to again participate in the Children's Groundwater Festival in Grand Island.

The Water For People committee and chair Christian New hosted a golf scramble fundraiser on May 4 at the Pacific Springs Golf Course in Omaha.

Public information chair Mary Poe and her committee sent invitations to 45 mayors asking them to issue proclamations declaring May 6-12 as Drinking Water Week. They also are distributing new public service announcements about water to radio stations statewide.

The Section also was active at the 2012 Annual AWWA Conference and Expo (ACE12), with presentations and a Top Ops team in competition. Also, the city of Fremont represented Nebraska in the water taste-test as the Section winners (for the second year in a row) at the conference.

Rich Koenig and the Backflow Committee have scheduled four backflow workshops and are currently working on a couple of Section awards to recognize individuals and systems in the backflow field.

2012 Annual Conference chair Eric Lee and the Conference Committee are already working on an agenda and have sent out a call for papers. Anyone interested in providing a presentation, providing a topic or lending a helping hand at the conference should get a hold of Eric.

I encourage members to take an active part in the association, as new committee members are always welcome and new ideas are needed as the Section moves forward in making this year a success.

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# Director's Report

#### AWWA Board Meeting Recap by Tony Bilek, Mc<sup>2</sup>, Inc.

![](_page_4_Picture_2.jpeg)

G reetings AWWA Members and fellow water professionals!

I hope this newsletter finds you healthy and enjoying the start of Summer. It's amazing that only last year, we were facing the Spring runoff in the Missouri River watershed. Although the abundant snow pack in the northwest helped predict high river levels, significant rainfall did its fair share in contributing to the historical floods of 2011. Fast-forward one year and the mild and dry winter of 2011-2012 produced many below-average reservoir and river levels. What changes a year can bring.

The 2012 Winter Board meeting was held in San Juan, Puerto Rico, Jan. 21-22. Alberto Ortiz Diaz and the Puerto Rico Section were very gracious hosts. Accommodations were splendid and the weather cooperated in fine tropical fashion. The meeting began on Saturday with AWWA Executive Director David LaFrance addressing the board and executive committee. Lee Roberts provided the treasurer's report, reviewing the 2011 budget and fiscal year, and highlighted the 2012 budget, which would be voted on at the Sunday board meeting. Lee introduced Dave Rager as the incoming treasurer; Dave will begin his four-year term at the 2012 AWWA-Annual Conference and Exposition in Dallas.

Association bylaw updates were presented by committee chair Gene Koontz of the Pennsylvania Section, followed by a workshop conducted by the Membership Engagement & Development Committee (MEDC). Breakout sessions brainstormed, discussed and presented strategies to enhance membership in AWWA. Bringing quality deliverables to members was the key theme in promoting, recruiting and retaining members. Resources, such as publications, conferences and standards have provided these quality deliverables for years. Expanding webcasts, social networking and other new and innovative means of educating and communicating will be one of the focus points for the MEDC. Advocacy

will play a key role in promoting membership with utility members. Tom Curtis and the Washington, D.C., staff do an outstanding job of representing utilities. The MEDC compiled data and presenting recommendations at ACE12.

The board meeting on Sunday began with the election of officers. Jim Chaffee of Wisconsin was elected incoming president-elect. Three quality candidates were contending, including John Donahue of Illinois, Don Broussard of Louisiana and Jim. Nine candidates ran for four vicepresident positions; winners included Reid Campbell (Atlantic Canada), Mark Cline (South Carolina), Dave Koch (Michigan) and Rosemary Smud (American Ductile Iron Pipe). Three director-at-large candidates contended for one seat. Sean Osborne of New England won.

The 2012 budget was reviewed, discussed and approved. The consent agenda was approved. Confirmation of Dave Rager as the new association treasurer was approved. Ad-hoc committees reported on Life Member and Quality Program changes.

As a result of feedback and break-out discussions at previous board meetings, the AWWA website is being revamped. Stay tuned for an improved website in the very near future.

That's all for now, folks. Have a safe and happy summer!

# Think water. Think AWWA.

When it comes to water, no one has you covered like the American Water Works Association. From treatment to distribution to regulations to training, we're the water community's go-to source for information, education, and involvement. When you think water, think AWWA.

![](_page_4_Picture_15.jpeg)

The Authoritative Resource on Safe Water\*

## Nebraska News and Events

#### **Fall Conference Visiting Dignitary**

O ur visiting dignitary will be AWWA Vice-President Reid Campbell. He is Director of Water Services at Halifax Water, the water, wastewater and stormwater utility in Halifax, Nova Scotia. He is responsible for the operation "from source to tap" of a municipal water system serving 350,000 people, as well as corporate-wide SCADA and process communication services. Upon his university graduation in 1987, Reid worked for a large national consulting firm in Toronto, where he had the opportunity to work on all manner of water supply projects. He returned to Halifax in 1994, where he worked for a local consulting firm until joining Halifax Water in 1998.

Reid has a bachelor's degree in civil engineering from the Technical University of Nova Scotia (now part of Dalhousie University) and a master's degree in civil engineering from the University of Toronto. He is a registered professional engineer in the province of Nova Scotia.

Reid joined AWWA in 1989 and has been active in the association. He has served on the leadership team of the Atlantic Canada Section, including terms as chair and conference chair, and represented the Atlantic Canada Section on the board of the Canadian Water and Wastewater Association. He was awarded the Ira P. MacNabb Award for outstanding service to the section in 2008. At the national level, Reid is a member of the Canadian Affairs Committee, the Water Loss Control Committee and two utility standards committees.

Reid's employer, Halifax Water, is active in water quality research and water loss control, which has provided him several opportunities to present at ACE, Section confer-

![](_page_5_Picture_7.jpeg)

Reid Campbell

ences and other events. In 2011 he was privileged to be a coauthor of articles in *Opflow* and *Journal AWWA*.

Reid lives in Halifax with his wife, Eleanor, and their two teenage sons, David and Daniel.

#### Fall Conference Call for Papers by Eric Lee, Lincoln Water System

T his is a call for papers to be considered for presentation during the Nebraska Section Annual Fall Conference, to be held November 7-9 in Kearney at the new and exciting Younes Conference Center. All interested parties should submit a simple abstract, describing the project and how it would apply and be beneficial to all our conference attendees, to Eric Lee elee@lincoln.ne.gov, or call 402-323-3862.

The Fall Conference Planning Committee is especially interested in any small- to medium-size systems that have done projects with consulting engineers for treatment, wells or distribution system additions or improvements. Now is the chance for these systems to get with their engineers and show the attendees of the conference what you have going on in your particular area! All water-related topics are welcome, so please submit a topic for presentation this year!

Don't hold back if you're unsure how to make a presentation or if you're uncomfortable with public speaking—we can help you team up with a mentor who will guide you through giving a talk, or arrange for co-presenters to help share the work. Our biggest goal is to offer a wide range of informative presentations with valuable insights for systems of all sizes.

#### New Awards in 2012 by Dennis Watts, City of Norfolk

The Awards Committee has added five new awards this year:

- Water Treatment Plant Operator Award
- Cross Connection Control Program of the Year Award
- Cross Connection Specialist of the Year Award
- Longevity Award
- Outstanding Supervisory Operator Award

Nomination forms for all five awards are available on the committee's page of the Nebraska Section website at www.awwaneb.org/committees/awards. Please read through the new awards. All applications need to be submitted by July 15.

It is the committee's hope that people take a few minutes out of their busy day to look over these new awards. The WISA form is also available on the awards committee's page. There are many employees who should be recognized for the outstanding work they do. Please take a few minutes to recognize your peers and fellow workers for their dedication and hard work.

Questions or comments may be sent to awards@awwaneb.org.

![](_page_6_Picture_0.jpeg)

#### Water For People Golf Outing Raises \$5,300 by Christian New, Terracon

The Water For People Everyone Forever Golf Outing raised over \$5,300 in May, at Pacific Springs Golf Course in Omaha. A total of 72 golfers teed off on a beautiful sunny afternoon, and, after 18 holes, dined on flatiron steak.

First place went to the Black and Veatch team, who donated their \$200 prize money back to Water For People. Second place went to the Waterlogic team, and third place went to one of three teams from HDR.

#### Five individuals won flag prizes:

- Closest to creek without going in the water: John Miriovsky (Lincoln Water System)
- Wager hole: Keith Alexander (Metropolitan Utilities District)
- Longest drive: John Killips (Tetra Tech)
- Closest to pin from tee: Steve Noren (City of Hickman)
- Longest putt: Don Marek (Plant Services, Inc.)

HDR contributed three golf teams, a hole sponsorship and flag prizes. Olsson Associates and Terracon Consultants each contributed two golf teams, a hole sponsorship and flag prizes.

A heartfelt thanks to our golfers, sponsors and donors! Golf Teams:

- Black and Veatch
- Griffin Pipe
- HDR (3 teams)
- JEO
- Kirkham Michael
- Miller Mechanical Specialties
- Mission Clay Products
- Metropolitan Utilities District
- Olsson Associates (2 teams)
- Schuyler Department of Utilities
- TD2
- TetraTech
- Terracon Consultants (2 teams)

- Waterlogic
   Hole Sponsors:
- American Underground Supply
- Black & Veatch
- CH2M Hill
- Electric Pump
- Hanson Pressure Pipe
- HD Supply Waterworks
- HDR
- HTM Sales
- Layne Christensen
- $\square$  MC<sup>2</sup>
- Midwest Labs
  - Miller Mechanical Specialties
- Misson Clay Products
- Metropolitan Utilities District
- Olmsted & Perry
- Olsson Associates
- Schemmer Associates
- TD2
- Terracon Consultants
- Vessco, Inc.

#### Flag Prize Donations:

- Black & Veatch
- HDR
- Mission Clay Products
- Metropolitan Utilities District
- Olsson Associates
- Schemmer Associates
- Terracon Consultants
   Donations:
- Hanson Pressure Pipe
- Sargent Drilling

#### Safety Award Surveys Due July 31 by Milo Rust, City of Chadron

Does your water system has a good safety program? Does your water system have a good safety record? If so, let us help you recognize your water system's safety accomplishments by filling out the safety award application form at www. awwaneb.org/committees/safety and returning it to:

Milo Rust Public Works Director City of Chadron PO Box 390 Chadron, NE 69337 Surveys need to be submitted no later than July 31. Completed surveys can also be turned in to Milo or any one of the following safety committee members:

Rob Pierce (LoNM), Milo Rust (Chadron), Steve Kelley (Beatrice), Jack Satur (Scottsbluff), Pat Heath (Gering), Roger Coffey (HDR Engineering), Tony Martinez (NHHS), Eric Melcher (Aurora), Dale Kaliff (Stromsburg), Gerardo E. Martinez (Lincoln), Pete Neddo (MUD-Omaha), Doug Pollock (Seward) and Tom Menke (Chadron).

If you have any questions or concerns, I can be contacted at 308-432-0505 (office), 308-430-3361 (cell), 308-432-0503 (fax), or at publicworks@chadron-nebraska.com.

water for people

## Nebraska News and Events

#### **Stay Informed**

It's our goal to keep *Wise Water Words* interesting, informative, and useful to you—but since we only publish three times a year, there's a lot of activity that takes place between editions that you should know about.

When was the last time you visited our Section website, at awwaneb.org? The site is updated several times per month with news stories, announcements from committees and board members and details about Section events, like tours and socials.

If visiting the site slips your mind from time to time, we also offer an RSS feed of news updates. RSS stands for "really simple syndication," but what it means to you is that you can have updates sent to your computer automatically, either through your browser or through most e-mail services like Yahoo, Hotmail, and Gmail.

Are you receiving updates through our e-mail distribution list? It's been used about two dozen times so far this year to announce job openings and to extend invitations to events

#### **Build-Your-Own Press Release**

Y ou may recall "Mad Libs" from your childhood—the silly fill-in-the-blank stories that usually resulted in lots of guffaws on the playground. But we know that a lot of people are interested in getting the word out about their utilities, but have no idea where to start with writing a press release to send to the local newspaper and other media outlets.

So, for your convenience, here's a ready-to-issue press release ... just fill in the blanks, "Mad Libs"-style, print and send to your local media outlets. If something doesn't apply to you, just leave it out. You'll probably discover that editors and reporters are eager to hear from you. If you're successful in getting coverage, share your press clippings with Nebraska Section public information chair Mary Poe.

#### \* \* \*

#### "How Water Gets to the City/Village of \_\_\_\_\_

Last year, the \_\_\_\_\_ water utility delivered \_\_\_\_\_ gallons of safe drinking water to the community, checked the performance of \_\_\_\_\_\_ fire hydrants, and replaced \_\_\_\_\_\_ feet of water mains. Our staff underwent \_\_\_\_\_\_ hours of certified training to keep up on the latest technology and practices to keep you safe. Ongoing training is a state requirement to help ensure that you receive world-class drinking water without worries about safety or reliability.

Peak water demand is at \_\_\_\_\_\_ a.m. and \_\_\_\_\_\_ p.m. Our lowest demand is at \_\_\_\_\_\_ a.m., but our service never stops. Water lines are pressurized 24 hours a day, 7 days a week, thanks to the work of \_\_\_\_\_\_ booster stations and \_\_\_\_\_\_ elevated storage tanks. like the Water For People golf outing. Sign-up is easy: Go to awwaneb.org/mailinglist and follow the link. All you have to enter is your name and e-mail address.

If you're into sharing your own news and comments, join us on our Facebook page at facebook.com/awwaneb. More than 100 people have already "liked" us and are getting updates on water stories in the news, as well as information from the Section. Everyone who likes our Facebook page can help us spread the word to the customers, lawmakers and public officials who influence how our water systems are maintained, regulated and funded.

So, which of these can you check off your to-do list?

- Bookmark awwaneb.org
- Subscribe to the awwaneb.org news feed
- Sign up for the e-mail distribution list at awwaneb.org/ mailinglist
- Like the Nebraska Section on Facebook at facebook.com/ awwaneb

Our water plant was built in \_\_\_\_\_ and our last major upgrade took place in \_\_\_\_\_. We do our best to keep your rates as economical as possible, but we will need to upgrade \_\_\_\_\_ over the next \_\_\_\_\_ years, and it will cost an estimated \$\_\_\_\_\_. Most households in \_\_\_\_\_ are paying \_\_\_\_\_ cents per gallon of fresh water delivered. In other words, for the cost of a gallon of milk, you get \_\_\_\_\_ gallons of safe drinking water—and for the cost of a gallon of gas, you can have \_\_\_\_\_ gallons of water instead.

As you enjoy a clean shower, a refreshing glass of cold water, or a green lawn this summer, take a moment to think of your neighbors at the \_\_\_\_\_ municipal water utility, working hard every day to provide reliable service to everyone in the \_\_\_\_\_ area.

#### **Training Calendar**

#### Backflow Workshops:

September 4—Ogallala September 25—Grand Island September 26—Wayne September 27—Beatrice

#### **Conferences:**

November 8-9—Nebraska Section AWWA Annual Fall Conference—Younes Conference Center in Kearney

Summer 2012

**One-Day Workshops:** 

October 11—Wayne December 4—Falls City

December 6—Lincoln

December 5-Nebraska City

July 12-McCook

# **Plant Profile**

#### Facility Spotlight: Auburn by Ken Swanson, Auburn BPW

The city of Auburn entered the water business when the public voted in March 1909 to approve a bond to build a water and wastewater works. The current Auburn water treatment plant's total capacity is 2,100 gpm and construction started in October 2009. The plant went online in April 2011.

The water/wastewater crew consists of six employees. Ron Behrends is the senior employee, with 42 years; the newest members of the crew are Jeremy Griepenstroh and Jay Theye, who both started in July 2011. The other members of the crew are myself (40 years) and Bob Wintz (21 years).

Our biggest challenge is that we have a lot of equipment to maintain for a town of our size. We have 12 wells, a filtering plant, booster stations at the filter plant and at our 1.5 mg reservoir, and—like everyone else—an aging distribution system. We have a divided distribution system, with roughly half of the system having pressure maintained by the reservoir booster pumps. The thing that worries me the most for the next 10 to

20 years is the continued availability of an adequate water supply. All of our 12 wells are shallow and screened at less than 50 feet, and we have been deemed groundwater under the direct influence of surface water (GWUDI), which was one of the main reasons for having built our new filter plant.

The oldest components of our system are 66 fire hydrants and distribution mains and valves that probably date back to the early 1900s. In 2002-2003, the existing 150,000 gallon clearwell, built in 1914, was replaced with two new clearwells and increased the capacity to 0.4 million gallons. Our distribution system had a major upgrade in 2000, when Highway 75 was replaced from 9th to 23rd streets in town; all of the existing mains and services were replaced at that time.

One of the hardest messages to get across to our customers is the need for capacity development. We need to build reserves to meet infrastructure needs and upgrades, instead of giving the water away and not knowing where the funding will come from when major components fail and need replacement.

I suppose the most important thing we have learned as a water utility in the last 12 months is how to deal with the changes

![](_page_8_Picture_9.jpeg)

we needed to make to meet the GWUDI regulations. We now have to monitor and record turbidity, temperature and CT times, and we also have to maintain a higher chlorine level than before. The automation we have in our new plant has made this adjustment a lot easier.

#### Engineering America Aquastore<sup>®</sup> Glass-Fused-to-Steel **Tanks for Maintainable Water Storage** Customer: Lancaster County No. 1 Location: Bennet, NE Installed: 2010 Capacity: .5 Million Gallons Engineer: McIntyre Consulting **Contractor: Engineering America** 913-782-7774 LANCASTER Tony Grant Vice President & No.1 **Regional Manager Check Out Our New Online Quoting and Life Cycle** Analysis Systems for Real Numbers, Real Fast THINK TANK 18900 W. 158th Street, Suite E, Olathe, KS 66062 Ph: 913-782-7774 • www.engamerica.com

# Nebraska Legislative Report

#### Water Utility Council Report on Legislative Action

The Nebraska 102nd Legislature adjourned on April 18. The Nebraska Section AWWA followed the proposals listed below. In short summary, there was no action on any of the bills carried over from the 2011 session. To see the entire bill proposal, go to the Unicameral's website, www.nebraskalegislature.gov. The 103rd Legislature is scheduled to convene on January 9 of 2013.

**LB 189 (Sen. Brenda Council):** Prohibits public employers from asking about a **criminal record in a job application**. A criminal record could not be an automatic bar to employment. The bill allows the employer to consider a criminal record when an applicant is a finalist for a position. A public employer may refuse to hire an applicant (1) If the applicant's record involves a misdemeanor involving moral turpitude or a felony if either conviction "directly relates to the particular employment"; or (2) if the applicant's criminal record involves a misdemeanor involving moral turpitude or a felony not directly related to the particular employment and the employer determines after investigation that the applicant has not been sufficiently rehabilitated to warrant public trust. Completion of all aspects of a sentence would be regarded as a presumption that the applicant is rehabilitated.

Status: Was carried over from 2011, but no further action took place in 2012.

**LB 266 (Sen. Kate Sullivan):** Amends the **Open Meetings Act** to allow a closed session to evaluate the job performance of a nonelected official or employee. The amendment removes the requirement that the purpose of the closed session is to "prevent needless injury to the reputation" of the person.

Status: Was carried over from 2011, but no further action took place in 2012.

**LB** 444 (Sen. Bill Avery): Amends the Open Meetings Act to allow public bodies the option to provide **notice of meetings** by posting on the public body's website.

*Status: Was carried over from 2011, but no further action took place in 2012.* 

**LB 484 (Sen. Galen Hadley):** Excludes certain **soil sampling** from the One-Call Notification Act.

*Status: Was carried over from 2011, but no further action took place in 2012.* 

**LB 674 (Sen. Burke Harr):** Regulates the use of **electronic monitoring of employees** by employers. In the bill, "electronic monitoring" refers to the monitoring of employees' activities

or communications by any means other than

![](_page_9_Picture_13.jpeg)

Board meeting agendas and minutes are posted at awwaneb.org/board direct observation. An employer engaged in electronic monitoring must provide prior written and signed notice to employees. An employer need not give notice when monitoring an employee engaged in a violation of law, a violation of legal rights of the employer or another employee, creating a hostile work environment or a criminal investigation.

Status: Was carried over from 2011, but no further action took place in 2012.

**LB 682 (Sen. Heath Mello):** Creates the Major Gas, Water and Sewer Infrastructure Improvement and Replacement Assistance Act. Under the Act, beginning July 1, 2012, the sales tax levied upon all increases in the amounts that a gas or water utility operated by a political subdivision charges for water or gas infrastructure programs will be placed in a separate state fund, which will be available to such gas and water utilities for the **funding of infrastructure-replacement programs**. The bill provides a similar benefit relating to sewer use fees for the city of Omaha.

*Status: Was carried over from 2011, but no further action took place in 2012.* 

LB 683 (Sen. Heath Mello): Creates the Storm Water Management Commission. The Commission is required to study various aspects of storm water regulation, including the adequacy of storm water regulation, financing of storm water management and options for user-charge revenue mechanisms.

*Status: Was carried over from 2011, but no further action took place in 2012.* 

LB 723 (Sen. Dave Bloomfield): Revises the Nebraska Safe Drinking Water Act to remove references to "small systems" and replaces those with "public water system serving fewer than ten thousand persons."

Status: Approved by the legislature. Signed by the governor on March 14, 2012.

**LB 743 (Sen. Ken Schilz):** Enables natural resources districts to assess a **fee for requesting a variance from district rules** or regulations to cover the administrative cost for the consideration of the variance request.

Status: Approved by the legislature. Signed by the governor on April 10, 2012.

**LB 760 (Sen. Ken Schilz):** Reduces the number of **required meetings of the Environmental Quality Council** to two per year.

Status: Approved by the legislature. Signed by the governor on March 14, 2012.

**LB 782 (Sen. Beau McCoy):** Requires more than 250 regular reports to the legislature to be **sent electronically**, rather than in printed form.

Status: Approved by the legislature. Signed by the governor on April 5, 2012.

![](_page_10_Picture_0.jpeg)

**LB 798 (Urban Affairs Committee):** Revises language in the state statutes allowing natural resource districts, sanitary drainage districts, and other districts, as well as cities and villages, to **levy special assessments for improvements** made to benefit individual properties.

Status: Introduced on January 5, 2012. Indefinitely postponed on April 18, 2012.

**LB 868 (Sen. Amanda McGill)**: Allows first-class cities to adopt **biennial budgets**, rather than single-year budgets, if approved by local voters.

Status: Introduced on January 6, 2012. Indefinitely postponed on April 18, 2012.

**LB 877 (Sen. Norman Wallman):** Requires operators of **hydraulic fracturing ("fracking") wells** to disclose what hydraulic fluids are used in their wells.

Status: Introduced on January 6, 2012. Indefinitely postponed on January 31, 2012.

LB 902 (Sen. Ken Haar): Exempts purchases from sales tax when they are made by a non-profit corporation under a

lease-purchase agreement with a state or government unit. A vote on the project must be held in order for the exemption to apply.

Status: Introduced on January 9, 2012. Signed by the governor on April 5, 2012.

**LB 918 (Sen. Abbie Cornett):** Places **limits on tax-increment financing (TIF)** by municipal governments. Limits the total amount of property that a city or village can declare as "blighted" to 7 percent of the value of the property in the community.

Status: Introduced on January 10, 2012. Indefinitely postponed on April 18, 2012.

**LB 950 (Sen. Mark Christensen):** Increases the General Fund transfer to the **Water Resources Cash Fund** by \$1,400,000 in FY 2012-2013. The funds represent repayments from natural resources districts in the Republican River basin that were given funding assistance in 2008.

Status: Introduced on January 11, 2012. Signed by the governor on April 11, 2012.

![](_page_10_Picture_14.jpeg)

Lincoln . Grand Island . Holdrege . Hastings . Scottsbluff . South Sioux City . Omaha . La Vista

# **2012 Section Budget**

NEBRASKA SECTION AWWA BUDGET. YTD figures are s	shown as of May 3, 2012		
INCOME	2012 ACTUAL (YTD)	2012 PROJECTION	2012 BUDGET
Section Allotment	\$10,817.00	\$12,153.00	\$12,153.00
Association Allotment	\$4,183.00	\$2,847.00	\$2,847.00
Multi-Section Allotment	\$224.40	\$650.00	\$650.00
Annual Meeting	\$0.00	\$13,000.00	\$13,000.00
Interest on Accounts	\$180.16	\$900.00	\$900.00
Advertising Income	\$0.00	\$0.00	\$0.00
Education: Pipe workshop	\$6,405.00	\$5,000.00	\$5,000.00
Education: Preconierence	\$0.00	\$0.00	\$0.00
Safety Committee	\$0.00	\$1,300,00	\$1,300,00
Small Systems	\$0.00	\$250.00	\$250.00
Special Project Funding	\$0.00	\$0.00	\$0.00
SRF	\$0.00	\$0.00	\$0.00
WARN	\$0.00	\$0.00	\$0.00
Water for People: Golf Event	\$3,345.00	\$10,000.00	\$10,000.00
Water for People: Raffle - Fall Conference	\$0.00	\$2,300.00	\$2,300.00
Water for People: Irap Event	\$0.00	\$2,100.00	\$2,100.00
	\$0.00	\$1,150.00	\$1,150.00
EXPENSES	2012 ACTUAL (YTD)	2012 PROJECTION	2012 BUDGET
Annual Fall Conference	\$0.00	\$0.00	\$0.00
Annual Meeting at Fall Conference	\$0.00	\$850.00	\$850.00
Audit	\$0.00	\$0.00	\$0.00
Awards (non-safety)	\$0.00	\$1,000.00	\$1,000.00
Board Conference Calls	\$106.12	\$250.00	\$250.00
Bonds for Treasurers	\$112.00	\$125.00	\$125.00
Cross-Connection Workshop	\$0.00	\$2,470.00	\$2,470.00
Director's Spouse (meeting expense)	\$508.60	\$475.00	\$475.00
Education: Education Committee	\$0.00	\$750.00	\$750.00
Education: LONW/NSAWWA Seminars	\$0.00 ¢5.089.70	\$5,000.00	\$5,000.00
Education: Preconference	\$0,00	\$0,000.00	\$0,000
MAC Council	\$0.00	\$200.00	\$200.00
Membership	\$0.00	\$750.00	\$750.00
Miscellaneous (pens, postage, envelopes)	\$109.00	\$250.00	\$250.00
Nitrates Committee (ad-hoc)	\$0.00	\$250.00	\$250.00
Officer Training: Membership Summit	\$0.00	\$750.00	\$750.00
Officer Training: Regional Officer Meetings	\$897.25	\$1,500.00	\$1,500.00
Officer Training: Summer Leadership Workshop	\$0.00	\$1,500.00	\$1,500.00
Unicer Iraining: WFP Workshop	\$0.00	\$750.00	\$750.00
PU BOX Public Information Committee	\$4.45 \$0.00	\$55.00	\$55.00
Publications: Advertising	\$0.00	\$750.00	\$750.00
Publications: Membership Directory	\$0.00	\$8.000.00	\$8.000.00
Publications: Wise Water Words	\$0.00	\$0.00	\$0.00
Retreat	\$0.00	\$250.00	\$250.00
Safety Committee	\$0.00	\$1,525.00	\$1,525.00
Scholarships: Abel Wolman	\$0.00	\$1,000.00	\$1,000.00
Scholarships: Conference	\$0.00	\$0.00	\$1,000.00
Scholarships: Poster Board Competition	\$0.00	\$1,000.00	\$1,000.00
Scholarships: Students (Liesen)	\$0.00	\$300.00	\$500.00
Scholarships: Top Ops	\$449.10	\$3,255,00	\$3,000.00
Secretary of State	\$0.00	\$0.00	\$0.00
Small Systems Committee	\$0.00	\$1,000.00	\$1,000.00
SRF	\$0.00	\$0.00	\$0.00
Student Activity	\$0.00	\$300.00	\$300.00
Tax Preparation (annual)	\$0.00	\$575.00	\$575.00
WARN Conference	\$581.37	\$750.00	\$750.00
Washington Fly-In	\$2,131.89	\$2,000.00	\$2,000.00
Water For People (Event Expenses): Golf Event	\$200.00	\$5,500.00	\$5,500.00
Water For People (Event Expenses): Tran Event	\$0.00	\$300.00	\$300.00
Water For People (Payments to WEP): Golf Event	\$0.00	\$4,000,00	\$4,000,00
Water For People (Payments to WFP): Raffle - Fall Conference	\$0.00	\$1.500.00	\$1.500.00
Water For People (Payments to WFP): Trap Event	\$0.00	\$1,800.00	\$1,800.00
Water Research Foundation	\$0.00	\$1,000.00	\$1,000.00
Water Utility Council	\$780.00	\$780.00	\$750.00
Website: Hosting	\$0.00	\$250.00	\$250.00
Website: Registration	\$0.00	\$0.00	\$0.00
Young Professionals: YP Committee	\$0.00	\$500.00	\$500.00
Young Professionals: Donation to Charity	ΦU.UU \$0.00	\$450.00	\$450.00
TOTAL EXPENSE	\$11,212 50	\$63,410.00	\$64.380.00
NET INCOME	\$13,954,06	- \$11 760 00	. \$12 730 00

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- Banner Advertising Opportunities

#### Jobs posted on the Career Center

![](_page_12_Figure_7.jpeg)

#### **Résumés posted on the Career Center**

![](_page_12_Figure_9.jpeg)

Questions? Contact Sara Wrenn at 303.347.6235 or swrenn@awwa.org for details

## www.awwa.org/CareerCenter

![](_page_12_Picture_12.jpeg)

hink water jobs. Think AW

### Instrumentation and Control

This feature is an excerpt from *Opflow*, published November 2011 by American Water Works Association (www.awwa.org). Reprinted by permission.

Gregory A. Fron, PE, is an electrical, instrumentation, and controls engineer with CDM (www.cdm.com), Phoenix.

Challenges facing small public water systems—startup, maintenance, and customer service—play significant roles in balancing efficiency, affordability, and sustainability. With a broad knowledge of instrumentation, operators become a driving force for system improvements. BY GREGORY A. FRON, PE

# ENHANCE SMALL WATER SYSTEMS THROUGH AUTOMATION

N OPERATOR'S MAIN responsibilities are supervision and control. Supervision means examining system performance information and deciding if it's acceptable. If, in the operator's opinion, performance is unacceptable, the operator must change an element or make an adjustment to the system to bring performance back to an acceptable condition. This is called manual control. When instruments are provided to make the necessary change or correction without the intervention of an

operator, the system is under what's called automatic control.

Collectively, instrument systems can seem complex, but an operator who understands each device and its specific function will be able to use each instrument as an aid to efficient supervision and control. It isn't difficult to imagine that automation can improve any water system, regardless of size. However, such improvements must be evaluated by assessing an entire system and an ability to predict and plan for repairs or enhancements.

![](_page_14_Picture_0.jpeg)

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#### Instrumentation and Control

#### **HYPOTHETICAL SYSTEM**

Consider a hypothetical small water system for automation improvement options, including basic funding and operation and maintenance (O&M) costs. The system's major assets and process flow diagram are detailed in Table 1 and the figure on page 15, respectively. However, before examining system capacity or size, it's important to evaluate budgetary constraints and O&M costs, as well as agencies that may offer grants or low-interest loans. Table 2 outlines the system's revenue and expenses.

The system has 100 connections, each paying \$50/month. Assuming all customers pay on time, generated revenue is \$60,000/year. A part-time state-certified service/operations worker and an administrator organize and manage the water supply's daily and long-term operations.

Unfortunately, small communities often have outdated infrastructure, depressed economies, and a workforce unfamiliar with available programs, grants, reserves, funds, and technical assistance. However, the US Environmental Protection Agency (USEPA) has a well-organized, informative website with links to many items of interest to small system representatives. In addition, each state has a capacity-development program to help small systems find appropriate resources.

#### **EQUIPMENT AND CONTROLS**

The hypothetical system uses automatic control with gravity distribution, which is inexpensive to operate. Conductance probes and relays control the level in Tank 1, a 100-kgal ground storage tank, and operate a source well pump (WP-1). A metering pump pulls sodium hypochlorite from a drum and injects it into the well's discharge line to fill the tank.

A manually set sodium hypochlorite injection maintains desired system residual. An auxiliary contact on the well starter and a contact interlock with the valve actuator starts and stops injection when the well pump is filling the tank.

#### **Table 1. Hypothetical Small System Assets**

The system outlined here and in the figure on page 15 is appropriate for a rural or village community.

Asset	Description	Estimated Value
Tank 1	<ul> <li>100 kgal</li> <li>Located at or near grade of wells</li> <li>6 years old</li> <li>Conductive probe-style level switch controls only WP-1 directly</li> </ul>	\$86,000, including property
Tank 2	<ul> <li>100 kgal; delivers water to users by gravity</li> <li>Located at or near 120 ft above grade of wells, users, and Tank 1</li> <li>12 years old</li> <li>Pressure-type level monitoring with a one-way wireless start/stop command for transfer pump BP-1</li> </ul>	\$125,000, including property
BP-1	<ul> <li>200-gpm centrifugal pump with 3-phase 460 VAC, full-voltage magnetic starting motor with overload protection</li> <li>12 years old; housed in shed</li> </ul>	\$1,200
WP-1	<ul> <li>200-gpm, 150-ft-deep 4-in. submersible multi- stage pump with 3-phase 460 VAC, full-voltage magnetic starting motor with overload protec- tion and discharge to waste and tank are auto- mated with relay logic and control valves</li> <li>Automatically controlled by conductance probes and relays associated with Tank 1</li> </ul>	\$24,000, including property
WP-2	<ul> <li>100-gpm, 150-ft-deep 2-in. submersible multi- stage pump with 1-phase 240 VAC, full-voltage magnetic starting motor with overload protection</li> <li>Manually controlled and discharged to waste and Tank 1 when WP-1 is out of service</li> </ul>	\$18,000, including property
MP-1	<ul> <li>1.75 gal/hour variable-speed metering pump</li> <li>Manually set to operate and inject 12.5% sodium hypochlorite for disinfection and algae reducer when WP-1 is running to the system</li> <li>Housed with BP-1 in shed</li> </ul>	\$800, includ- ing all tubing and fittings
6-in. distribution pipe	<ul><li>6-in. PVC SCH40, 3 miles</li><li>20 years old</li></ul>	\$1.9 million, full replace- ment cost
6-in. flowmeter	<ul> <li>100 connections for 500 users/contributors</li> <li>Located at Tank 2</li> <li>With 4-20 mA output available but not used</li> </ul>	\$2,000
Truck	■ 6-year-old <sup>1</sup> ⁄ <sub>4</sub> -ton full-size pickup	\$12,000

Tank 2, an elevated 100-kgal tank, delivers gravity-fed water to the community and is equipped with a level-control booster/transfer pump (BP-1) via a pressure transmitter at the tank. The instrument is set up for level monitoring, and the 4–20 mA output signal to the booster/ transfer pump is transmitted over a wireless 900-MHz unidirectional signal and converted to dry contact control of the pump through a programmable relay that accepts the signal and includes contact outputs that can be triggered at any value scaled to represent Tank 2's level.

#### Identify and seek out nearby small systems that may have the resources and experience to provide regional support.

Security for the system's tanks and wells is usually provided by padlocks and fences. With minimal investment, security could be enhanced with intrusion circuits at all tank hatches and access points to the water supply. System needs can be met with a limit switch at each location and wiring to a local alarm panel or auto dialer for notification alerts.

Engineering firms and equipment vendors can help small systems determine system conditions, identify improvement opportunities, help locate funding sources, and prepare documentation. In addition, the USEPA website provides links to each state's environmental department.

#### **AUTOMATION TECHNOLOGIES**

A broad range of automation technologies—from simple tilt or float switches and relay logic to full-blown computer-based control systems—are available. For a small system, however, relay logic-based automation may be more realistic. As various electrical, automation, and monitoring products are developed and adopted for use, technology costs have decreased and reliability has increased, making automation and monitoring upgrades more feasible.

The amount of automation a system can justify should be determined by functional, financial, and regulatory requirements. However, without having a specific direction and goal in mind, enlisting the services of consulting engineers, salesmen, and contractors can be challenging. That's why USEPA developed a guide for selecting and working with engineers and vendors when a small system is required to make operational changes—for example, installing arsenic removal equipment.

Medium- to large-scale system operators commonly use supervisory control and data acquisition (SCADA) systems to navigate process controls (see Common SCADA Benefits, page 17). A processbased scheme with a graphical user interface (GUI) allows an operator to control processes through personal computers (PCs) and servers. Except for inspections

![](_page_16_Figure_7.jpeg)

and maintenance, a SCADA system allows data to be collected at an unattended site. When the SCADA system notifies an operator of system failure, the operator can review the alarm on a PC and determine how to proceed. For as little as \$10,000, a small water system can take advantage of a scaled-down version of such a scheme.

#### **RECOMMENDED ENHANCEMENTS**

Small water systems have several options for automating treatment and distribution facilities, but two are examined here to highlight how user needs affect system selection.

#### Option 1

**Programmable Logic Controller (PLC).** One master compact PLC—with a small industrial human-machine interface (HMI) at the central system site—will be the primary collector of data from other sites and provide PLC capabilities for all system equipment.

Compact PLCs—all-in-one with central processing unit (CPU), expansion capabilities, and network communication protocols—are offered by many manufacturers. The PLC power supply may be integral and supply bus power to expansion modules through plug adapters to accommodate modular assembly. In addition, compact PLCs use relatively little space within a control panel and can operate at temperatures of about 0–140°F with 90 percent noncondensing humidity.

A software and run-time license is usually required for a PLC. In addition, PLC programming services are offered by most manufacturers and electrical engineering/integration firms that design or build such systems.

An industrial HMI is programmed with the PLC to create a platform to monitor and control the system. The HMI may come preloaded with software and graphics symbols to build the screens needed to navigate the controls. The PLC and HMI share signals to display and execute status and commands.

Wireless Input-Output (WIO). Remote to a master PLC, WIO points located at each site contain controlled or monitored equipment and communicate with a master controller. The technology provides license-free unidirectional 900-MHz signal transmission so that a paired set of devices has a transmitter with discrete (on/off) and analog (4–20-mA) inputs and a receiver that produces a discrete analog output to complete the signals to the PLC.

A wireless radio network typically requires a radio-path study to determine feasibility, antenna height requirements, each radio's signal strength, and possible

#### Instrumentation and Control

local radio frequency (RF) interference of the selected transceivers.

The most reliable studies use physical readings generated by radios temporally located at each site. A reputable firm performing these surveys will provide a detailed report and recommendations. These systems have upfront costs but don't require monthly service provider fees that usually are required of licensed radio- or cellular-based transmission. A WIO is powered by 24-VDC, consumes around 100 mA/unit, and requires basic antenna placements and coordination.

**Estimated Cost.** The probable cost for Option No. 1 is \$33,200, consisting of

- Master compact PLC with 6-in. panelmounted HMI, \$4,500
- PLC software, \$3,500
- WIO hardware and associated materials, \$2,500
- PLC/HMI programming, \$3,000
- Miscellaneous materials, wire, conduit, etc., \$1,500
- Installation, \$12,000
- Training, \$1,200
- Permits, \$5,000 (may not be required, but assumed for local/USEPA guidelines)
   Option 2

**Data Management and Control.** This option uses one wireless data management control panel with digital control channel data transmission cellular modem/radio with integral IO preprogrammed for field connections. Commonly called remote terminal units (RTUs), these products are accessed remotely from any desktop computer with basic Internet access. Managed and maintained by the manufacturer, an individual point RTU system network can be reconfigured as needs change.

An RTU receives inputs for monitoring and provides outputs to remotely controlled equipment or pumps. A standard unit requires a basic 120-VAC, 15-amp grounded convenience receptacle, but optional sources (solar power or battery systems) can be used when a site is without power. RTUs usually have battery

### Table 2. Hypothetical Small System Revenue, Reserve, andExpenses

Appraise the budget available to operate and maintain a system.

Revenue/ (Expense)	Description	Balance in Reserve
\$5,000/month \$60,000/year	<ul> <li>Each user has contracted to pay \$50/ month</li> <li>100 connections</li> <li>6-year contract</li> </ul>	\$22,500 Three years of surplus income from users
\$(21,000)/year	<ul> <li>One part-time certified service/operations worker</li> <li>Operator certification sponsored by grants to small systems of 3,300 or fewer users</li> <li>One administrator (community leader or volunteer)</li> </ul>	
\$(25,000)/year	Various contracted services, materials, rent- als, general expenses, disinfection chemicals	
\$(4,000)/year	Accounting and yearly customer payment vouchers distributed annually	
\$(2,500)/year	Electrical power costs and fees to produce 2.1 mil gal/month (see Table 3)	
\$\$	<ul> <li>www.epa.gov/safewater/smallsystems/</li> <li>The USEPA website can help direct small systems to local, state, and federal assistance programs.</li> </ul>	
Increase to monthly collection	Community hall meeting to vote on user fee increase of \$15 to make improvements to the system and to adjust for inflation and system life-cycle costs	

#### Table 3. Small System Water Production and Cost

Option 2's electrical power cost and fees make it a viable option.

Water Produced	Description	Operation Cost	
21,000 gal/month per metered user	<ul> <li>Raw well water with disinfection</li> <li>Basic agreement; fixed rate</li> <li>6-year contract</li> </ul>	Tank 1 site with WP-1, MP-1, and BP-1	\$140/mo 12 hours/week
Total used:		Tank 2 site	\$60/month
21,000 × 100 connections = 2.1 mil gal/month		WP-2 site	\$25/month

backup to allow continued communications when the primary power source fails. Set up and organized to allow easy navigation, system websites use standard charts and graphical control interfaces—sometimes called "dashboards." When an alarm event occurs, the RTU notifies the website, which contacts the designated operator(s) through phone, pager, text, or voice messaging. Some services offer sequential or multiple callouts if several people need to be informed. An operator can check the secure website to identify what happened and take appropriate actions.

Manufacturers set up these systems and websites based on input and output information provided and system needs. The technology offers trending, run-time

The need to enhance small system automation is inevitable whether the community's population is stable or growing.

metering, reporting, and many features expected of most SCADA systems. The unit can be mounted indoors or out, but the signal must be verified indoors before the unit is mounted. Outside mounting is preferred to make electrical wiring easy and ensure good cellular signal integrity.

RTU manufacturers typically offer proprietary wireless connection packages ranging in price from \$50/month to \$20/ month for a 3-year service agreement. Each manufacturer can help identify regions of the country that have RTU coverage. However, the system should work if the RTU location accommodates basic personal cellular services from any service provider.

**Estimated Cost.** The estimated 3-year cost of Option No. 2 is \$14,850-\$17,850 (\$5,000 less if permits aren't required), with continued service for free firmware updates of \$600 for 3 years. The total consists of

- Cellular RTU, \$2,000-\$5,000
- Service contract for 3 years (renewable), \$600
- RTU programming, \$0
- Miscellaneous materials, wire, conduit, etc., \$1,500
- Contractor installation, \$5,000
- Permits, \$5,000 (may not be required but are assumed for local/USEPA guidelines)
- Training, \$750

#### **OPTION COMPARISON**

For this hypothetical system, Option 2 is more appropriate. The funds required to implement Option 2 are accounted for by reserves (Table 2), so it wouldn't be necessary to secure a loan. After implementation, the operator would reap the benefits of a SCADA system through more efficient system operation and management and more proactive maintenance scheduling and performance.

With no service provider fees, Option 1 is a viable alternative, but it requires more hardware, software, programming, and support over time. With PLC programming training classes, an operator can

#### DIGITAL CONTROL

#### **COMMON SCADA BENEFITS**

Modern water treatment plant control systems apply real-time digital control technology, such as a supervisory control and data acquisition (SCADA) system, to monitor and control system processes and performance. SCADA system benefits include the following:

- Remote control and monitoring by operators, maintenance, and management
- Expandability and optional redundant configurations
- Flexible, programmable logic controller programming environments
- Flexible distributive control systems
- Safe computer-based controls to manage redundant systems with ease and reliability
- User-friendly graphical user interface software
- Historical data storage, alarming, trending of process variables, and reporting
- Access control to the system through password permission
- Advanced technical service availability
- Maintenance scheduling to predict failure
- Affordability resulting from less operation and maintenance costs

learn to build a powerful, reliable program and modify it relatively quickly.

#### **FINANCIAL VIABILITY**

Financial viability is the ability to obtain adequate funding to develop and build and continuously operate, maintain, and manage a public water system in full compliance with local, state, and federal requirements. The Washington State Department of Health, Division of Environmental Health Office of Drinking Water, defined five steps to financial viability:

- Develop an operating budget.
- Evaluate rates.
- Create and make deposits into an operating cash reserve.
- Create an emergency fund reserve.
- Create and fund reserves for capital improvements and equipment replacement.

Because these steps could require some effort to implement, a small system representative must be informed of all programs and funding sources that support system reliability and equity. In addition, a representative must be aware of applicable tax codes and exemptions and budget revenue to build reserves and savings.

With proper guidance and research, a small system can safely operate continuously with community support, government-sponsored training, and partnering arrangements with neighboring systems. With appropriate rates, it's more likely the system's long-term capacity will effectively meet changing community needs.

The USEPA website provides links to various technical assistance programs, as well as publications, workshops, and literature to support system operators and representatives who need technical skills and knowledge about water chemistry and quality to manage safe, sustainable drinking water supplies.

Mentoring relationships are a good way to gain and pass on experience and skills. Many engineering and water organizations provide such mentoring and networking opportunities. Professional groups often answer questions related to specific needs and provide webinars and open discussions to promote the sharing of resources and skills.

Identify and seek out nearby small systems that may have the resources and experience to provide regional support. This type of networking can lead to partnerships that ensure greater success of all involved.

The need to enhance small system automation is inevitable whether the community's population is stable or growing. However, economics and regulation determine feasibility and requirements.

# **AWWA Bookstore**

#### AWWA Book Excerpt: M32, Third Edition

The following is an excerpt from AWWA Manual M32, *Computer Modeling of Water Distribution Systems*, third edition (AWWA Catalog No. 30032). The author of chapter 8, Transient Analysis, is Delbert "Skip" Martin. You can purchase M32 in the AWWA Bookstore at awwa.org/store.

#### SYNOPSIS

Transients can introduce large pressure forces and rapid fluid accelerations into a piping system. These disturbances may result in pump and device failures, system fatigue or pipe ruptures, and backflow/intrusion of untreated and possibly hazardous water. Many transient events can lead to water-column separation, which can result in catastrophic pipeline failures. Thus, transient events can cause health risks and can lead to increased leakage, interrupted service, decreased reliability and breaches in the piping system integrity. Transient flow simulation has become an essential requirement for assuring safety and the safe operation of drinking water supply and distribution systems.

This chapter introduces the concept and fundamentals of hydraulic transients, including the causes of transients, general rules to help determine whether or not the system may be exposed to unacceptable conditions under a transient event, governing transient equations, numerical solution methods, guidelines for control and suppression of transients, transient modeling considerations, and transient data requirements. Illustrative examples are also discussed and conclusions are stated.

The chapter is therefore geared toward engineers involved in the planning, design, and operation of water supply and distribution systems, and engineers who need an insight into the most common causes of hydraulic transients and suitable methods that can be applied to alleviate their consequences. Such capabilities will greatly enhance the ability of water utilities to evaluate cost-effective and reliable water supply protection and management strategies for preserving system hydraulic and water quality integrity, preventing potential problems, and safeguarding public health.

#### INTRODUCTION

Most people have been in an older house with pipes that rattle when someone turns off a faucet. When the faucet handle turns, closing the valve almost instantaneously, the pipes rattle against the walls. This is the called *water hammer*, which is also referred to as a *surge* or as a *hydraulic transient*. Water hammer refers to rapid and often large pressure and flow fluctuations resulting from transient flow conditions in pipes transporting fluids. Transient flow analysis of the piping system is often more important than the analysis of the steady state operating conditions that engineers normally use as the basis for system design. Transient pressures are most significant when the rate of flow is changed rapidly, such as rapid valve closures or pump stoppages. Such flow disturbances, whether caused by design or accident, may create traveling pressure waves of excessive magnitude. These transient pressures are superimposed on the steady-state conditions present in the line at the time the transient occurs. The total force acting within a pipe is obtained by summing the steady state and transient pressures in the line. The severity of transient pressures must thus be accurately determined so that the pipes can be properly designed to withstand these additional shock loads. In fact, pipes are often characterized by pressure ratings (or pressure classes) that define their mechanical strength and have a significant influence on their cost.

Transient events may be associated with equipment failure, pipe rupture, separation at bends, and the introduction of contaminated water into the distribution system via unprotected cross-connections or intrusion. High-flow velocities can remove protective scale and tubercles and increase the contact of the pipe with oxygen, all of which will increase the rate of corrosion. Uncontrolled pump shutdown can lead to the undesirable occurrence of cavitation and water-column separation, which can result in catastrophic pipeline failures due to severe pressure rises following the collapse of the vapor cavities. Vacuum conditions can create high stresses and strains that are much greater than those occurring during normal operating regimes. They can cause the collapse of thin-walled pipes or reinforced concrete sections, particularly if these sections were not designed to withstand such strains (e.g., pipes with a low pressure rating).

Cavitation occurs when the local pressure is lowered to the value of vapor pressure at the ambient temperature. At this pressure, gas within the liquid is released and the liquid starts to vaporize. When the pressure recovers, liquid enters the cavity caused by the gases and collides with whatever confines the cavity (i.e., another mass of liquid or a fixed boundary), resulting in a pressure surge. In this case, both vacuum and strong pressure surges are present, a combination that may result in substantial damage. The main difficulty here is that accurate estimates are difficult to achieve, particularly because the parameters describing the process are not yet determined during design. Moreover, the vapor cavity collapse cannot be effectively controlled. In less drastic cases, strong pressure surges may cause cracks in internal lining or damage connections between pipe sections and, in more serious cases, can destroy or cause deformation to equipment such as pipeline valves, air valves, or other surge protection devices. Sometimes the damage is not realized at the time

but results in intensified corrosion that, combined with repeated transients, may cause the pipeline to collapse in the future. Transient events in pipelines also damage seals, often leading to increased leakage and significant water loss.

Transient events can have significant water quality and health implications. These events can generate high intensities of fluid shear and may cause resuspension of settled particles as well as biofilm detachment. Moreover, low pressure caused by transients may promote the collapse of water mains, leakage into the pipes at loose joints, cracks, and seals under subatmospheric conditions, and backsiphonage at crossconnections and potential intrusion of untreated, possibly contaminated groundwater in the distribution system. Pathogens or chemicals in close proximity to the pipe can become a potential contamination source, where continuing consumption or leakage can pull contaminated water into the depressurized main.

Recent studies have confirmed that soil and water samples collected immediately adjacent to water mains can contain various levels of microorganisms, an indicator of fecal pollution (fecal coliforms, *E. coli, Clostridium perfringens*, coliphages) and in some cases enteric viruses (Besner et al. 2008; Karim et al. 2003; Kirmeyer et al. 2001). This is especially significant in systems with leaking pipes below the water table. Problems with low or negative pressure transients have been reported in the literature (Walski and Lutes 1994; LeChevallier et al. 2003). Gullick et al. (2004) studied transient pressure occurrences in actual distribution systems and observed 15 surge events that resulted in a negative pressure. Hooper et al. (2006) and Besner et al. (2007) also reported such events in full-scale systems.

The most often identified cause for the events reported in the literature was the sudden shutdown of pumps, either unintentional (power failure) or intentional (pump tests). Using a pilot-scale test rig, Friedman et al. (2004) confirmed that negative pressure transients can occur in the distribution system and that the intruded water can travel downstream from the site of entry. Locations with the highest potential for intrusion were identified as sites experiencing leaks and breaks, areas of high water table, and flooded air-vacuum valve vaults. Preliminary results by Besner et al. (2007) showed that significant concentrations of indicator microorganisms could be detected in the water found in flooded air-vacuum valve vaults. In the event of a large intrusion of pathogens, the chlorine residual normally sustained in drinking water distribution systems may be insufficient to disinfect contaminated water, which could lead to damaging health effects. A recent case study in Kenya (Ndambuki 2006) showed that in the event of a 0.1 percent raw sewage contamination, the available residual chlorine within the distribution network would not render the water safe.

Transient events that can allow intrusion to occur are caused by sudden changes in the water velocity due to loss of power, sudden valve or hydrant closure or opening, a main break, fire flow, or an uncontrolled change in on/off pump status (Boyd et al. 2004). Transient-induced intrusions can be minimized by knowing the causes of pressure surges, defin-

![](_page_20_Picture_5.jpeg)

ing the system's response to surges, and estimating the system's susceptibility to contamination when surges occur (Friedman et al. 2004). Therefore, water utilities should never overlook the effect of pressure surges in their distribution systems. Even some common transient protection strategies, such as relief valves or air chambers, if not properly designed and maintained, may permit pathogens or other contaminants to find a "backdoor" route into the potable water distribution system. Any optimized design that fails to properly account for pressure surge effects is likely to be, at best, suboptimal, and at worst, completely inadequate.

Pressure transients in water distribution systems are inevitable and will normally be most severe at pump stations and control valves, in high-elevation areas, in locations with low static pressures, and in remote locations that are distanced from overhead storage (Fleming et al. 2006; Friedman et al. 2004). All systems will, at some time, start up, switch off, undergo unexpected flow changes, and will likely experience the effects of human errors, equipment breakdowns, earthquakes, or other risky disturbances. Although transient conditions can result in many abnormal situations and breaches in system integrity, the engineer is most concerned with those that might endanger the safety of a plant and its personnel, that have the potential to cause equipment or device damage, or that result in operational difficulties or pose a risk to the public health.

Transient pressures are difficult to predict and are system dependent, including specific system layout, configuration, design, and operation. Engineers must carefully consider all potential dangers for their pipe designs and estimate and eliminate the weak spots. They should then perform a detailed transient analysis to make informed decisions on how best to strengthen their systems and ensure safe, reliable operations (McInnis and Karney 1995; Karney and McInnis 1990).

## **Certification Corner**

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#### WATER

- In general, a trench should be no more than how many feet wider than the diameter of the pipe?
  - a. 1–2 ft
  - b. 2–3 ft
  - c. 3–4 ft
  - d. 4–5 ft
  - -
- 2. Push joints shouldn't be used if the following condition exists.
  - a. Muddy water in the trench
  - b. Sandy soil
  - c. Large-diameter pipe
  - d. The pipe must be pushed on at an angle
- 3. What's the recommended minimum contact time when disinfecting water mains with the chlorine slug method?
  - a. 3 hr
  - b. 6 hr
  - c. 10 hr
  - d. 12 hr
- 4. The residual drawdown of a well is defined as the
  - a. water level in a well after a pump has operated over a period of time.
  - b. measured distance from the ground to the pumping level.
  - c. water level below the normal level that persists after a well pump has been off for a period of time.
  - d. measured distance between the water level and the top of the screen.

If you'd like to share something in the next edition of Wise Water Words, send your comments to publications committee chair Brian Gongol at brian@gongol.net

#### WASTEWATER

- L. What type of organisms would most probably be associated with clear plant effluent, low biochemical oxygen demand (BOD), and low amounts of suspended solids?
  - a. Free-swimming ciliates
  - b. Stalked ciliates
  - c. Amoebas
  - d. Rotifers
- 2. The detention time for primary clarifiers usually has a range of
  - a. 1.5-2 hr
  - b. 4–5 hr
  - c. 3–7 hr
  - d. 5-12 hr

- 3. Most trickling filters will remove BODcausing wastes and suspended solids from the influent at percentages ranging from
  - a. 30 percent to 50 percent.
  - b. 40 percent to 60 percent.
  - c. 70 percent to 85 percent.
  - d. 90 percent to 98 percent.

#### 4. Toxic solids should be disposed of in

- a. a digester to destabilize and break down the toxins.
- b. an approved sanitary landfill.
- c. an incinerator.
- d. a sludge pond for further aerobic breakdown.

#### **ANSWERS** Water: I. a., 2. d, 3. a, 4. c Wastewater: I. b, 2. a, 3. c, 4. b

![](_page_21_Picture_47.jpeg)

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