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Connecting people, businesses, and communities through local groundwater education and action, making us all part of the solution for clean, sustainable groundwater.

A Focus on Water Quality

Can a Focus on Quality Resolve Quantity Challenges?

by Kylen Hunt, CropMetrics

My granddaughter's favorite book, (God Made You Special Little One) shows an image of a momma duck watching her baby in a bubble bath. The momma duck laughs and says, "No one has your silly laugh when you splash in bubble baths!"

A few weeks ago, our 2.5 year-old granddaughter received bubbles from Nana and Papa. As soon as she saw the bubbles forming around her, she splashed, laughed, and yelled as only a 2-year-old can, "Look Papa! I splash in bubble baths!" I too laughed, and we had a great time as she splashed in her bubble bath.

As a grandfather, those memories are priceless. As a leader in the irrigated Ag industry, I'm reminded to take the importance of clean water resources seriously. If our family didn't have unlimited access to clean water, I wouldn't have this memory. So I've asked myself, "Is there more I can be or should be doing to ensure my granddaughter's granddaughters will have unlimited clean water?" I believe the answer is yes. There is more we can all do. But it won't be easy, and it'll take great leadership.

In irrigated agriculture water quantity occupies most conversations. The more we learn about water issues globally, I believe water quality should be our primary focus. Why? Because if we, as a society of citizens, focus on quality over quantity, many of the quantity issues take care of themselves. How is that possible? Well, follow along with me as I lead you through the why, how, and what process of achieving this goal.

Why - Quality is Important to Everyone

Now sure, this is obvious, right? But do we look at our water quality responsibilities first or do we point to others faults being more of an issue than our own? In October 2017, I had the opportunity to attend the Groundwater Foundation's National Conference in Boise, Idaho. At the conference, I listened to Adam Hutchinson with the Orange County Water District in Fountain Valley, California explain what California is doing to capture, clean, and reuse natural rain and waste-water. I was humbled and reminded there are things that others, like myself, could be doing to ensure everyone has clean water for drinking, cooking, and bathing. I saw images of how they are slowing down the water in water channels

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INSIDE...

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THIS & THAT

Alaska Earthquake Rattles Florida's Groundwater

At 12:32 am Alaska time on January 23, 2018, a magnitude 7.9 earthquake shook Alaska residents out of their beds and set off fears of a tsunami all down the West Coast. Fortunately, the tsunami was only a few inches in height, but within an hour of the earthquake in Alaska, waves of a different sort were hitting far away in Florida.

More than 3,500 miles from the Kodiak Earthquake's epicenter, water levels at the USGS groundwater well near Madison, Florida, spiked by about two inches, while levels at the USGS groundwater well near Fort Lauderdale, Florida, dropped by an inch and a half. Both recovered to their previous levels within an hour.

Hydrogeologic responses to earthquakes have been known for decades, and have occurred both close to, and thousands of miles from earthquake epicenters. Water wells have become turbid, dry or begun flowing, discharge of springs and ground water to streams has increased and new springs have formed, and well and surface water quality have become degraded as a result of earthquakes.

This is not even the first time a major Alaska earthquake caused groundwater effects far from its original epicenter. Water-level fluctuationscaused by the 1964 magnitude 8.5 Alaska earthquake were recorded in 716 wells in the United States; the earthquake also was registered on water-level recorders in many other countries.

What Happens?

One common type of observed groundwater response is an instantaneous water-level offset, or step, which may be either an increase or a decrease and may occur near or far from the epicenter. Recovery to the pre-earthquake water level can be so rapid that no change will be detected if the water level is measured infrequently, or it may take as long as days or months.

The other common type of groundwater response is a water level oscillation, which may occur during many earthquakes, but is rarely recorded because they do not last long enough for many groundwater monitoring systems to record them. In the few cases where oscillations have been recorded, they resemble long-period seismograms.

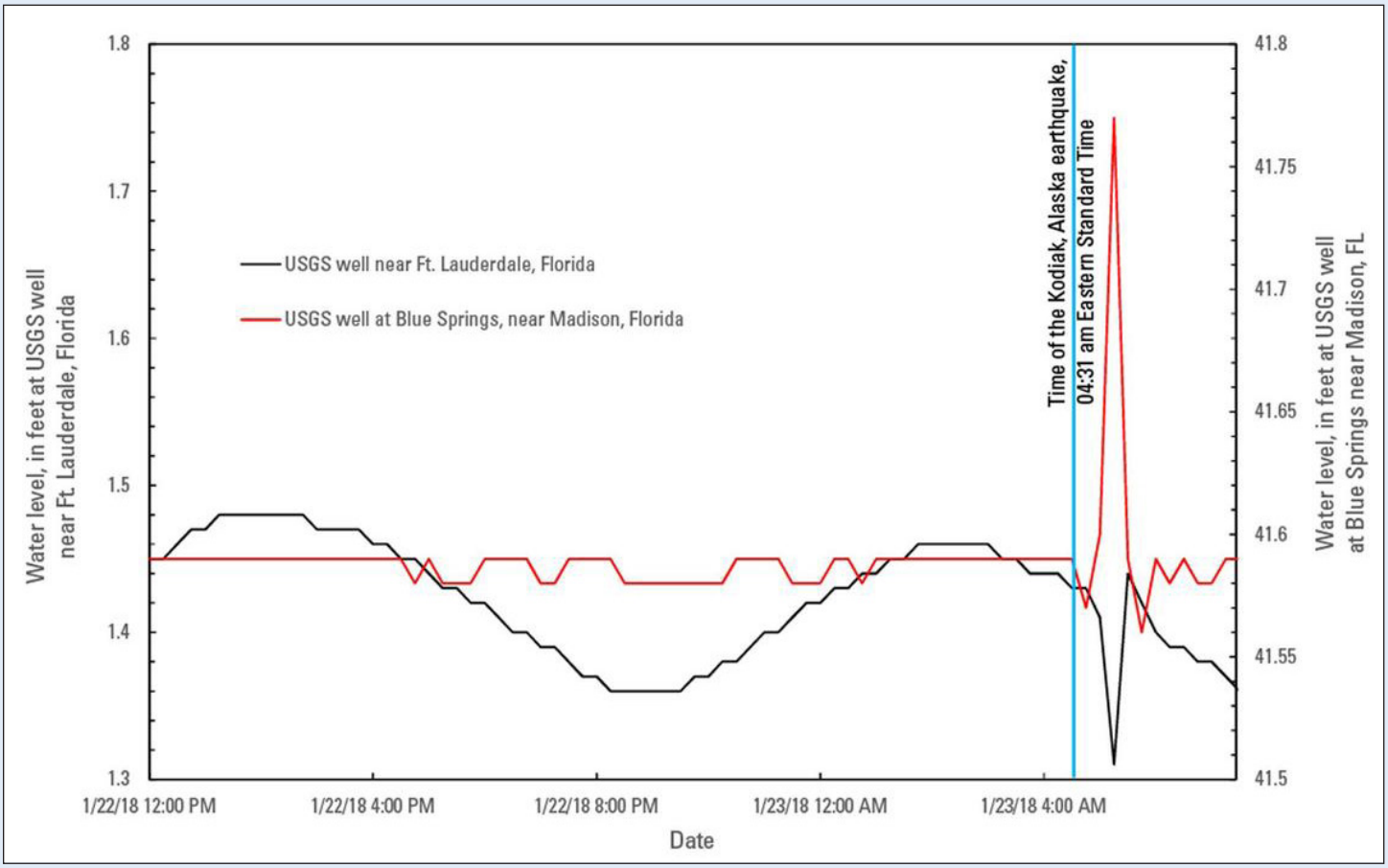
The change in water level can be small, measured in inches, or dramatic, measured in feet. However, the changes rarely exceed a couple of feet change.

So Why Does This Happen?

For the changes seen near Madison and Ft. Lauderdale, they are likely oscillations caused by the seismic waves. Think of it as the ripples in a glass of water on a table when a truck drives by outside.

Other causes for groundwater effects from earthquakes include the compaction of the overlying rock layer like what happens during liquefaction. That compaction can lead to temporary spikes in groundwater levels. Meanwhile drops in groundwater levels can be caused by the escape of gas from the rock layers. In a fractured rock environment, changes in groundwater levels can be caused by the unclogging, widening, or narrowing of a fracture, or the creation of new fractures.

USGS monitors groundwater levels all over the country through its Groundwater Watch network. These wells are located in rural, suburban, and urban areas, and are monitored regularly. Some even provide real-time data.



Wellhead Protection Network Hosts State Senators in Educational Session

On January 11, 2018 the Nebraska Wellhead Protection Network hosted a networking breakfast for State Senators at the Capitol. It was an opportunity for Senators to learn about groundwater and wellhead protection efforts in their districts, and ask questions to groundwater experts over pastries and coffee sponsored by the Nebraska Association of Resources Districts.

Over 25 Senators and staff attended the breakfast, along with members of the Wellhead Protection Network. John Heaston, the Aquamart, gave brief remarks about the prominent role groundwater plays in Nebraska communities. Approximately 85% of Nebraska residents drink groundwater. He also spoke about the benefits to proactively addressing nitrate pollution and the grants and low interest loans that Public Water Systems can apply for to keep their groundwater safe.

Network members also set up informational displays, maps, and graphics in the Capitol Rotunda the week of the breakfast. All Nebraska State Senators, whether present or unable to attend, received a packet with information and 2018 wall calendars containing images and information about groundwater and in Nebraska.

The Nebraska Wellhead Protection Network is facilitated by The Groundwater Foundation with funding from the Nebraska Department of Environmental Quality.

▲ *Nebraska State Senators and staff network with members of the Nebraska Wellhead Protection Network to learn more about groundater and wellhead protection efforts throughout the state.*

Study Identifies "Hot Spots" of Water Quality Violations

While serious violations like those in the Flint, Michigan, crisis are rare, ensuring reliable access to safe drinking water poses challenges for communities across the country, according to a study led by the University of California, Irvine.

Researchers found that between 1982 and 2015, 9 million to 45 million people annually were affected by water quality issues – and that low-income, rural regions were most vulnerable. Infractions were more numerous in "hot spots" in Texas, Oklahoma and Idaho, suggesting that these systems struggle with recurring problems.

For this first nationwide assessment of drinking water quality over several decades, trends in health-related incidents were evaluated along with vulnerability factors possibly influencing the frequency of violations since the 1974 passage of the Safe Drinking Water Act. Not all infractions pose immediate health concerns, but drinking water contaminants can cause short-term illnesses such as gastroenteritis, as well as chronic conditions including cancer and neurological disorders.

"We felt that in the aftermath of the Flint lead crisis, there was an urgent need to assess the current state of drinking water in the U.S.," said study author Maura Allaire, UCI assistant professor of urban planning & public policy. "Generally, the country's utilities deliver high-quality water, but every year, about 7 to 8 percent of community systems do not meet health-related standards. Identifying hot spots and vulnerability factors associated with violations indicates the types of communities that can benefit from greater regulatory oversight and assistance to help reduce quality issues, improve compliance and ensure safe drinking water across the nation."

Study results appear in the early online edition of the Proceedings of the National Academy of Sciences for the week of Feb. 12.

The research showed that rural areas tend to be less able to comply with quality regulations. Their community water systems experience financial strain due to declining populations, lower incomes, scarcity of technical expertise, and restricted access to loans and outside financing for infrastructure upgrades or major maintenance.

Compliance is associated with purchased water sources and private ownership. Purchased water is supplied by wholesale agencies, which have greater resources to meet federal standards, while private utilities have considerable assets at stake should they deliver poor-quality water and subsequently face lawsuits or takeover by a municipal government.

"Public policies that target underperforming utilities include prioritization of technical guidance and financial support," Allaire said. "Training can be expanded to address common operational deficiencies, such as protection of source water and better monitoring and maintenance. And, where feasible, purchased water contracts and consolidation of systems could provide a way to achieve economies of scale for improved treatment technologies."

Haowei Wu, Upmanu Lall, and Alan and Carol Silberstein of Columbia University contributed to the project, which received a NatureNet Science Fellowship, a National Science Foundation award (No. 1360446) and a grant from Columbia University's Earth Institute.

For more information about the University of California, Irvine visit www.uci.edu.

The U.S. Residential Water Well Market: An Overview

By Kevin McCray, CAE, Retired National Groundwater Association CEO

Although groundwater is extracted for use by nearly every sector of the American economy (including agriculture, aquaculture, public supply, industrial and commercial use, mining and thermoelectric power), the market for residential water wells is by far the largest in number of units in place and annually constructed. Today, some 13.168 million single-family residences and 34.19 million citizens (as estimated by the National Ground Water Association [NGWA] from average rural household size) depend on a household water well system for their source of water, according to the 2015 American Housing Survey's national plumbing, water and sewage disposal data (Table 1). Conducted every two years, the survey found 13.232 million in 2013 and 13.131 million in 2011.

In 1980, the U.S. Census pegged the number at 13 million. Table 2 shows a regional breakdown of the numbers, while Figure 1 displays the states that comprise each region. In 2015, there were 2.11 million more households served by private wells than in 1997. Table 3 shows the 2015 regional breakdown for residential wells in place.

A US Geological Survey report for 2005 estimated some 26 million people were served private well-supplied groundwater from the nation's 20 principal aquifers. The largest withdrawals, those more than 100 million gallons per day, came from three aquifers in four states: the Glacial aquifersystem in Michigan and Indiana, the Floridan aquifer combined with the overlying surficial aquifer system (shallow aquifers typically less than 50 feet [15 m] thick) in Florida and the Central Valley aquifer system in California.

Table 1. US households served by private wells: 1997-2015

Year	Number of households served by private well	Change in number	Percent of change
1997	11,055,000	—	—
1999	12,400,000	1,345,000	12.2
2001	13,245,000	845,000	6.8
2003	13,097,000	-148,000	-1.1
2005	13,131,000	34,000	0.26
2007	13,249,000	118,000	0.89
2009	13,429,000	180,000	1.36
2011	13,331,000	-98,000	-0.73
2013	13,093,000	-238,000	-1.78
2015	13,168,000	75,000	0.57

Table 2. Total household units served by individual private wells, by region, 1997-2015

Year	Northeast	Midwest	South	West	National
1997	2,511	3,392	3,995	1,157	11,055
1999	2,895	3,762	4,410	1,333	12,400
2001	3,032	3,901	4,833	1,479	13,245
2003	3,072	3,864	4,774	1,387	13,097
2005	3,079	4,008	4,648	1,396	13,131
2007	3,250	3,880	4,683	1,436	13,249
2009	3,275	3,878	4,821	1,455	13,429
2011	3,120	3,832	4,870	1,509	13,331
2013	3,210	3,986	4,356	1,541	13,093
2015	3,319	4,005	4,165	1,678	13,167

Multiply number by 1,000. Thus, 2511 = 2,511,000

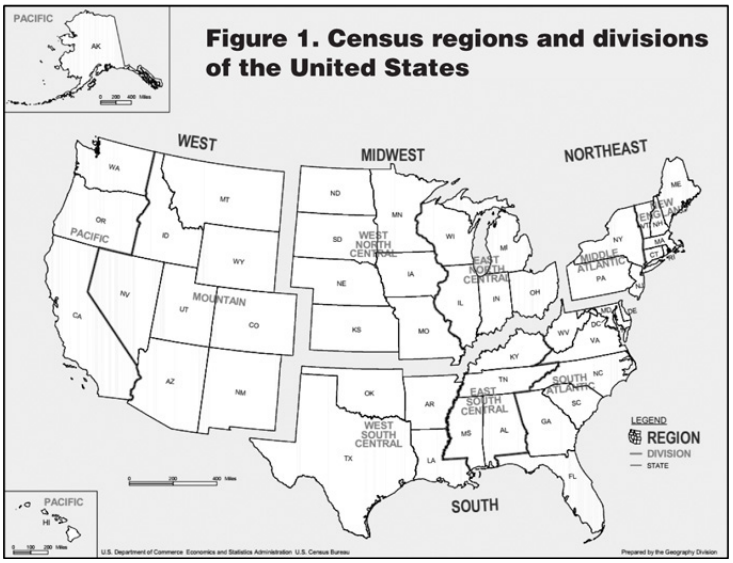


Figure 1. Census regions and divisions of the United States

As NGWA continues to compile 2016 data, we expect to see increases for 2015, 2014, 2013 and 2012. But, for the states and two Florida districts in Table 4, NGWA believes these are representative numbers now, subject to change when 2017 data are compiled. There are variations in what the state agencies may provide to NGWA and actual industry annually, since 1997. Though some new households get their drinking water from private wells every year, construction of well systems has been sluggish since 1980 and has experienced just a one-percent average annual rate of growth since at least 1997.

Private household wells constitute the largest share of all water wells in the United States, but they account for a small proportion of the groundwater Americans withdraw—only 3.54 billion gallons a day in 2010, based upon USGS estimates. For all uses, national, fresh groundwater withdrawals are estimated to be 76 billion gallons per day. At an average 2015 cost of $6,500 for a complete residential well and pumping system, per the results of a small sample of US water well system professionals surveyed for NGWA by Industry Insights Inc., annual new residential well construction may be valued at around $763 million a year.

Compiling data

For just 10 states and two water districts in Florida, for which the NGWA has so far compiled data on household wells each year from 2012 to 2016, there has been a reported decrease in construction of about three percent over this period. These numbers do not distinguish between new (first-time) wells or replacement wells for existing housing and they do not account for actual completed single-family house starts. NGWA is dependent upon state agencies to compile data from the drilling contractor reports or permits and the states are in turn dependent upon contractors to file timely reports. Each year in which NGWA conducts its annual well construction survey, we allow states to amend data from the previous year. Many states do amend their counts and almost every time the amendment is upward.

Estimating from biannual AHS data, it appears that approximately 117,000 new household wells on average have come online

activity. For instance, Pennsylvania retrieves numbers internally from its online WebDriller system, but state government representatives believe actual numbers to be much greater. Pennsylvania officials say they know more than half of licensed contractors have not been submitting records and there are probably wells being drilled by unlicensed contractors.

Residential well market growth is being constrained in some US markets by concerns such as exemption from a permitting process for residential wells (common among many of the western states), government-expressed concerns over public health and safety and the expansion of centralized public water distribution systems. Two recent examples of market constraints come from Minnesota.

In Alexandria, the city council this June adopted an ordinance prohibiting (with only very few exceptions) new private wells in the city, where only eight new wells have been drilled since 2011. Existing wells are allowed to continue to be serviced and to operate. In Ramsey County, a district judge ruled this year that the state had allowed excessive pumping of the Prairie du Chien aquifer and, therefore, impacted water levels in White Bear Lake. As a result, she ordered an end to new well permits within a five-mile radius of the lake until the sustainability of the aquifer and the lakecan be determined.

Market data indicate most residential water well installations generally do not include application of disinfection technology, although only 38,000 households served by wells had water deemed "not safe to drink." The 2011 AHS (updated in June 2014) found that across the nation, only about 31 percent of households served by wells reported the "well has been disinfected." The percentage was slightly higher for owner-occupied homes (32 percent) than for renter-occupied homes (29 percent). About 26 percent of new construction during the previous four years had disinfected wells and about 28 percent of manufactured/mobile homes met that condition. Elderly households showed 32 percent with disinfected groundwater supplies, Hispanic at 29 percent and African-American at 23 percent.

Table 3. Regional US distribution of installed residential wells: 2015

Region	New England	Middle Atlantic	East-North Central	West-North Central	South Atlantic	East-South Central	West-South Central	Mountain	Pacific
Households served by private wells	1,154,000	2,165,000	2,968,000	1,037,000	3,135,000	324,000	706,000	687,000	991,000

Table 4. Annual household well construction, state agency reported activity: 2012 to 2016

	2012	2013	2014	2015	2016	% change 2016-2012
Alaska	208	139	169	211	179	-14
Delaware	1,026	1,101	1,154	1,238	1,388	+35
St. John's Florida WMD	12	23	19	22	19	+58
Southwest Florida WMD	5,132	4,521	4,464	4,908	5,150	+0.35
Missouri	7,419	4,078	3,918	3,072	4,444	-40
Nebraska	1,173	1,113	1,047	964	864	-26
New Jersey	2,280	2,180	2,109	2,175	2,222	-3
Ohio	3,728	3,351	3,671	3,908	4,128	+11
Oregon	1,606	2,034	2,244	2,678	2,812	+75
South Dakota	414	392	388	499	491	+19
Texas	9,639	11,458	11,955	10,239	8,921	-7
Washington	2,089	2,247	2,448	3,082	3,073	+47
Totals	**34,726**	**32,637**	**33,586**	**32,996**	**33,691**	**-3**

Homeowner testing

In a 2016 Centers for Disease Control and Prevention-funded study led by NGWA, exploring private well-owner stewardship behaviors, several barriers to water well testing were identified, including:

- Inconvenience: relatively low participation in efforts directing well owners to test their water because well owners find the testing process inconvenient (obtaining testing services and kits, taking samples, dropping off samples).
- Cost: deters well owners who are not experiencing obvious water problems from testing their water.
- Lack of knowledge: well owners do not understand the cost of testing, what's involved in testing and why and when one should test.
- Mistrust: well owners' perception of government regulation prevents them from testing their water.

If, after testing, cause is found for treatment of groundwater from a residential well, there are also these identified barriers:

- Cost: well owners are deterred by water treatment costs.
- Lack of knowledge: most well owners do not know how to go about getting water treatment.
- Mistrust:
  - Well owners want an unbiased source of information when making decisions about water treatment.
  - Some well owners do not trust water treatment system companies.

Innovative approaches to address well owner reluctance may include:

- Providing objective information about water treatment systems and technologies
- Distributing lists of qualified water treatment service providers
- Personal follow-up if test results show a health risk present
- Developing partnerships that include private well owners, the water treatment industry and public health

Developing a message

At a private well conference convened in May 2017 at the Illinois State Water Survey, researchers and public health and outreach officials found through an examination of multiple private wellowner programs that water

▶ *See MARKET, p. 6*

▶ *QUALITY, continued from p. 1*

(an amazing concept) to allow more water to recharge the groundwater. I learned how it's only taking them 45 minutes to clean wastewater to drinking quality again. Unbelievable! The biggest takeaway for me? There is more I can be doing to ensure clean water sources in my own area of the world. I need to stop believing that others aren't doing enough and do more myself.

How - "Water Quality Assessment (WQA)" is A Concept Everyone Can Engage In

It simply says that when a process requiring water is complete (final), the quality of the water at the end should be the priority consideration in the process. Why? Because by default the ending water quality will become the beginning water quality for another operation. Will the current process improve or hinder human, plant, or animal life? If it can have an adverse effect, can we change the first method to improve the second? Here's an example from agriculture where I invest most of my time.

Farmers grow plants. Plants use water in the soil to pull nutrients and chemicals through the roots into the plant. The plants transpire (sweat) clean water back into the atmosphere through the leaves. The nutrients and chemicals are left in the plant to create and maintain plant health and reproductive potential. This is a natural process and is an example of highly efficient water use resulting in a high WQA. It's simply natural and super effective.

However, any water (rain or mechanically applied) when over applied moves water, nutrients, and chemicals past the root zone where it is wasted forever. Not only is the water wasted, but the nutrients and chemicals are also wasted. This is an extremely low WQA. Also, in this case, applying or preparing plants to take in only the water they need, WQA becomes a very profitable process!

Now this leaves a question. What must we as citizens improve to have higher WQA's every time we use water? For starters, becoming more aware of the water we use and how we use it. Second, it's a matter of interdependency. Living and working together. Not seeing ourselves as more important than someone else, but seeing ourselves as equal citizens in a world where everyone, everywhere wants and deserves clean, fresh water.

I look forward to working with others who have ideas on assuring that all future generations enjoy the occasional bubble bath!

About the Author

Kylen Hunt is Chief Sales Officer for CropMetrics (cropmetrics.com), a Precision Irrigation Solutions Company focused on Precision Irrigation Adoption. His background in Agriculture began as a teenager working with his family in Central Nebraska. He was taught to love the land and respect its natural resources. In seeing the profitable result through intense and precise irrigation management, Kylen became passionate about building sustainable precision water programs through the CropMetrics network. Through the study of truth based leadership, Kylen took this learned knowledge into the industry for the purpose of designing and growing profitable businesses built on purposed leadership. Today, in correlation with his role at CropMetrics, Kylen engages in events that equip leaders to recognize and utilize their unique, untapped potential. Reach him at kylen@cropmetrics.com.

▶ *MARKET, continued from p. 5*

well system professionals are key, credible stakeholders in developing effective messaging and in effectively reaching and motivating well owners to protect their drinking water quality. The NGWA survey of water well system professionals found 84 percent of the sample count water treatment/conditioning among their services. Most well owners will not chlorinate properly and many well owners cannot afford to hire a professional, according to conference participants. An estimated 11 percent of American households using a well system fall below the national poverty level and only 32 percent of them have disinfected groundwater supplies.

The participants generally agreed there is a dilemma over how to properly disinfect a well system and who should do it. Dr. Kelsey Pieper of Virginia Tech University said the school is currently conducting a well disinfection study that will be used to develop effective well disinfection protocols. NGWA and the Water Quality Association, however, have agreed on well disinfection practices and counsel. Additionally, NGWA offers best-suggested practices for water well system professionals to call upon for residential water well system inspection and residential water wellsystem cleaning. NGWA also offers a series of best-suggested practices for a wide range of naturally occurring constituents, such as arsenic, radon, boron and others.

Due to confusion among well owners about interpreting water test results, state programs are increasingly interested in developing their own online water-test interpretation tools that incorporate state-specific information. More states appear to be developing online groundwater quality tracking maps to help well owners and other groundwater stakeholders assess groundwater quality within a state.

Conclusion

After more than 30 years of activity, the US household water well market has grown slowly, but still represents a significant opportunity for the water treatment and conditioning professional.

About the author

Kevin McCray, CAE, retired as Chief Executive Officer of the 11,000-member National Ground Water Association after 22 years as NGWA's CEO and more than 38 years of working in the groundwater sector. He has served on a number of water-related advisory groups, including the US Department of Commerce Environmental Technology Trade Advisory Council. McCray has worked to increase international awareness of groundwater and of the association, which today has 17 foreign, mutual cooperation agreements. In addition to dozens of articles, he has authored or compiled six books for the groundwater industry.

About the association

NGWA is a community of groundwater professionals working together to advance groundwater knowledge and the success of its members through education and outreach, advocacy, cooperation, information exchange and enhancement of professional practices. www.ngwa.org

Easy Ways YOU Can Be Part of the Solution for Groundwater

By Jennifer Wemhoff, The Groundwater Foundation

There are countless ways in which we depend on groundwater in our daily lives. And countless ways in which our actions can affect groundwater, positively and negatively. As we've always said at The Groundwater Foundation, "It is because of people that groundwater must be protected, but it is only through the efforts of people that it can be accomplished.

Guess what - "people" includes you. You can take action to be part of the solution for clean, sustainable groundwater.

Find Ways to Use Less Water

Take Shorter Showers - A quick shower uses 20-30 fewer gallons of water than a bath. Challenge yourself to take just showers of just 5 minutes or less, then challenge your family members to do the same. Use a shower timer to help keep the time down.

Check the Plumbing - Proper maintenance is one of the most effective water savers. Faucet washers are inexpensive and take only a few minutes to replace. At home, check all water taps, hoses, and hose connections (even those that connect to dishwashers and washing machines) for leaks.

Don't Let It Run - It's simple really, before you turn on the tap, think of ways you can use less water to accomplish the same purpose. Always shut off the water when you brush your teeth, fill the sink when shaving instead of letting the water run, keep a pitcher of water in the fridge instead of running it til it gets cold.

Drip No More - There's no such thing as a little drip. A leaky faucet can waste 10 gallons of water every day. On a toilet, an average leak can add up to 60 gallons per day. Replace worn sink washers or valve seals to get rid of the drip, check for leaks in a toilet's tank or replace old toilets with low-flush units.

Fill It Up - Only run full loads in the dish and clothes washers. Get the most clean for the least amount of water!

Water Wisely - If you have a sprinkler system for your lawn, invest in a soil moisture sensor so you're not watering grass that's recently been rained on. Also, water deeply, but infrequently to create strong, deep root systems and resilient turf.

Track Your Use - Most people don't know where or how they use water. Download a water tracking app (The Groundwater Foundation's 30by30 free water tracking app is available in the Google Play Store and Apple App Store) and see where your water goes. Most Americans use 100 gallons of water a day! Track your use for 30 days and find ways you can use less.

Keep the Water Clean

Don't Flush Medications - Never flush old or unused medications down your toilet or the sink. Most wastewater treatment facilities can't remove these compounds. Find a local take-back location (Nebraskans - take medications back to a participating Nebraska MEDS Initiative pharmacy any time! leftovermeds.com), or utilize the DEA's take-back days in October and April.

Pick Up the Poop - Yep, it may be gross, but necessary. When it rains, runoff water picks up poop particles from your pet and it may be deposited into lakes, rivers, or streams. Nobody wants that - be a responsible pet parent and pick up your pet's poop.

Watch out for litter - We all know to avoid littering, but go a step further and keep an eye out for any litter wherever you go. Whenever possible, pick it up and put it in the proper disposable bin.

Follow Instructions When Using Chemicals - Pesticides and fertilizers can have a proper use, but avoid overusing them whenever possible. The chemicals can travel through runoff water and soil, thus contaminating ground water. Follow label instructions carefully!

Stay Phosphate-Free - Help save our lakes and rivers by choosing nontoxic household products, and using phosphate-free items like detergent.

Join or Spearhead a Cleanup Project - Be proactive by joining a local or national waterway clean up project. This is a great project for a Groundwater Guardian team! No team in your area? Get one started (find out more at www.groundwater.org/groundwaterguardian)!

Educate Yourself and Others - Educate yourself on what's actually in your water, the quality of your water, and how it can further be improved. Knowledge is power, and the more knowledgeable you are, the more you can make a difference. Share what you know to get others excited and involved.

See what else you can do by visiting www.groundwater.org, following The Groundwater Foundation on Facebook (groundwaterfoundation) and Twitter (@groundwaterfdn), and reading along with our blog (groundwaterfoundation.blogspot.com).

National Groundwater Awareness Week

TEST. TEND. TREAT.

March 11 - 17

Take Action for Groundwater During Groundwater Awareness Week

Groundwater – it's the water we drink and the water that grows our food. As the word suggests, it's the water that's hidden beneath our feet in the cracks and crevices in the rocks and sands beneath the Earth's surface.

Groundwater is important to everyone and everything. During National Groundwater Awareness Week, March 11-17, 2018, The Groundwater Foundation urges everyone to learn more about groundwater resources and find ways to protect it in your home and community.

According to National Groundwater Association (NGWA), sponsor of National Groundwater Awareness Week (#GWAW2018), the United States uses nearly 80 billion gallons of groundwater per day for public supply, private supply, irrigation, livestock, manufacturing, mining, thermoelectric power, and other purposes. Irrigation accounts for the largest use of groundwater in the United States, about 67.2 percent of all the groundwater pumped each day. Some 53.5 billion gallons of groundwater are used daily for agricultural irrigation, helping feed the world. Around 45 percent of the U.S. population depends on groundwater for its drinking water supply. More than 13.2 million households, or 34 million people, have their own well.

Established in 1999, National Groundwater Awareness Week is an opportunity for people to learn about the importance of groundwater and how it impacts lives. "Approximately 132 million Americans rely on groundwater for drinking water, so, simply put, the resource makes life possible," said Aaron Martin, public relations and awareness manager of NGWA.

"We all rely on groundwater in some way," says Jane Griffin, Groundwater Foundation President. "It's up to all of us to be part of the solution to protecting it. Collectively we make a difference!"

The 2018 Awareness Week theme is "Tend. Test. Treat." to encourage a holistic approach to sustain an adequate supply of quality water. Testing your water might prompt well inspection and maintenance, and water treatment can mitigate naturally occurring contamination revealed by the test. So, test your water, tend to your well system, then treat the water if necessary.

Groundwater is constantly threatened by overuse and contamination. You can be part of the solution by making small changes that cumulatively have a big impact:

- Conserve water inside and outside your home by taking short showers instead of baths, running full loads of dishes and laundry, checking for and repairing leaky faucets and fixtures, watering outdoors only when necessary, and using native plants in your landscaping that require less water.
- Track your daily water use to identify where you can use less. Try the free 30by30 app and start tracking today (www.groundwater.org/action/home/30by30.html).
- Always follow label instructions for household chemicals, and look for ways to decrease or eliminate fertilizer and pesticide usage.
- Dispose of chemicals properly by taking them to recycling centers or household hazardous waste collections.
- If you have a private well on your property, have the well inspected by a licensed water well contractor and the water tested once a year for coliform bacteria, nitrates, and any other contaminants of local concern.
- Find out about your community's drinking water source and mobilize to protect it. The Groundwater Guardian program (www.groundwater.org/groundwaterguardian) is a good place to get started.
- Teach others about ways to protect and preserve groundwater.

National Groundwater Awareness Week is a great time to start doing your part. For more information about The Groundwater Foundation and how you can get involved, visit www.groundwater.org or call 1-800-858-4844, or visit our friends at NGWA at www.ngwa.org or www.wellowner.org.

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Community Efforts to Educate Youth

Groundwater Guardian Teams Target Youth for Groundwater Education

by Jennifer Wemhoff, The Groundwater Foundation

▼ *Battle Creek, Michigan hosts an annual Water Fesitval.*

It's true - today's youth are tomorrow's leaders. They will be the ones in leadership positions making decisions regarding natural resources in the future, which is why it's important to build a strong foundation with education about groundwater when they're young.

Groundwater Guardian teams across the country focus on youth education in many ways. Groundwater Guardians are voluntary teams that represent a community or organization that implement groundwater protection and education activities.

In 2017, Groundwater Guardians focused on youth education in a variety of ways, successfully educating them and getting them excited about water.

The **Desert Hot Springs, California** Groundwater Guardian team has coordinated with the Wildlands Conservancy for years to provide field trips for 4th - 6th grade and high school students. The field trips expose students to desert wetland systems, while teaching them about the water cycle and water conservation.

Orange County Water District, California hosts a two-day water festival for over 7,500 4th - 6th grade students. This year, a mobile app was introduced as a promotion and companion to the festival, called OC Water Hero. Kids play games and learn about water as they navigate through the water system in the free app.

In **Rock Falls, Illinois**, the Groundwater Guardians provide groundwater presentations in four area schools and reached over 360 5th and 10th grade students. Second grade students participated in tours of the water plant to learn more about where the city's water comes from and how it's treated on its way to students' homes.

In **Independence, Missouri**, the Groundwater Guardians target 5th graders from all 18 schools in the school district. Over 1,100 students toured the water plant and learned and how the water department keeps groundwater safe, and finished by making Edible Aquifers for a yummy and educational treat.

The Groundwater Foundation's hometown Groundwater Guardian team of **Lincoln, Nebraska** hosts a water poster contest for over 300 5th grade students. The winning posters are featured on bookmarks distributed at city libraries, billboards throughout Lincoln, and busboards.

Springfield, Oregon works with high school students to test water from over 100 private household wells. This provides a valuable community service by providing free water well sampling, alerting them to potential contamination issues while teaching the students about groundwater and private wells.

The **Marshfield, Wisconsin** Groundwater Guardians have adopted the Let's Keep It Clean program from The Groundwater Foundation for local Girl Scout troops. The team helped more than 30 Scouts earn water patches.

Santa Clara Valley Water District, California's Groundwater Guardians implement a water education program, making classroom presentations, giving tours, and training teachers. Over 17,000 students and 638 educators were trained in the 2016-2017 school year.

A number of additional Groundwater Guardian teams not mentioned above also participate in or organize youth-focused water festivals, impacting tens of thousands of students and introducing them to groundwater.

Do you want to become a Groundwater Guardian? Find a complete list of Groundwater Guardian activities and more information www.groundwater.org/groundwaterguardian or call 402-434-2740 to find out more.

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◀ ***North Plains Groundwater Conservation District, Texas*** *has a multi-faceted youth education approach. In addition to a water festival, the team sponsors a water conservation artwork contest, gives classroom presentations for K-12 students, distributes a water conservation curriculum to 4th grade students in the district.*

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The Groundwater Foundation is a 501(c)(3) nonprofit that connects people, businesses, and communities through local groundwater education and action, making us all part of the solution for clean, sustainable groundwater.

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10 Facts About Groundwater Use

- Only 1 percent of the water on Earth is useable, 99 percent of which is groundwater.
- The United States uses 349 billion gallons of freshwater every day.
- Groundwater is 20 to 30 times larger than all U.S. lakes, streams, and rivers combined.
- Groundwater accounts for 33 percent of all the water used by U.S. municipalities.
- 44 percent of the U.S. population depends on groundwater for its drinking water supply.
- More than 13.2 million households have their own well, representing 34 million people.
- 53.5 billion gallons of groundwater are used for agricultural irrigation each day. In 1990 that number was 2.2 billion.
- The largest U.S. aquifer is Ogallala, underlying 250,000 square miles stretching from Texas to South Dakota. Scientist estimate it could take 6000 years to naturally refill the aquifer if it were ever fully depleted.
- California pumps 10.7 billion gallons of groundwater each day, a third more than the second-highest state, Texas.
- Groundwater is the world's most extracted raw material with withdrawal rates in the estimated range of 259 trillion gallons per year.

Facts provided by National Groundwater Association's Groundwater Awareness Week. www.groundwaterawarenessweek.com.