WEST VIRGINIA RURAL WATER ASSOCIATION

Every drop counts.

Mountain State Water Line

A Publication of the West Virginia Rural Water Association

Fall 2024

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West Virginia Rural Water Association

Fall 2024

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Articles and Features

West Virginia Rural Water Association, WVRWA, is a non-profit organization of rural and small publicly owned water and wastewater systems. The vision of the WVRWA is to be the recognized leader and respected voice for water and wastewater systems. The mission or purpose of WVRWA is to provide and promote the highest level of utility service, technical assistance, training, and advocacy for all West Virginia water and wastewater systems.

WVRWA is affiliated with the National Rural Water Association.

Online Training Classes

WVRWA has teamed up with SunCoast Learning Systems, Inc. to bring online computer-based water and wastewater training to operators throughout the state. Through WVRWA Online Learning, you now have the freedom to learn from home, the office, or your local library. Training can be accessed directly from your personal computer using your internet connection.

Water and wastewater operators registering for e-Learning courses will have a menu of courses from which to choose. We are constantly adding and updating courseware to reflect changing industry needs and regulations. For more information, you can visit www.wvrwa.org or contact the office at 800-339-4513. Some of the available courses are shown below.

Course	CEH Hours	Approved for	Price
Drinking Water Mathematics	10	Water/WW	$180
Surface Water Treatment	10	Water	$180
Basic Environmental Chemistry	10	Water/WW	$180
Small Water Systems I	5	Water	$100
Chlorinator Systems & Chemical Handling	10	Water/WW	$180
Water Transmission and Distribution	10	Water	$180
Practical Personnel Management	7	Water/WW	$125
Water Utility Calculations	10	Water	$180
Pumps & Motor Maintenance	10	Water/WW	$180

By Todd Grinstead, Executive Director

From Your Executive Director

2024 Annual Technical Conference

The Water on the Mountain 2024 Annual Technical Conference was held in Mid-August, at the beautiful Oglebay Resort in Wheeling. Fun times were had by all with the many exciting events such as the Sunday picnic, game competitions, Awards of excellence presentations, Water Taste Test competition, training classes, Making Waves Women in Rural Water event and ever important networking with your fellow water and wastewater professionals.

At the opening session we heard a few words from Michael Preston, Deputy Director of legislative Affairs of the National Rural Water Association. Michael spoke about things that is currently going on in Washington D.C. that has an impact on our industry.

Election of officers was held at the Board of Directors meeting. Eric Bennett, President, Brian Shade, Vice-president, and Porter Robertson, Secretary/Treasurer, were all re-elected as your board leadership.

We are so very proud of the hard work and dedication of every professional within our industry. Many were recognized for their outstanding achievements during the "Awards of Excellence luncheon".

Those receiving awards were;

Office Manager of the Year: Ethel Jordan, Mason County PSD

System Manager of the Year: Tina Lancaster, Tyler County PSD

Water Operator of the Year: Will Miller, Putnam PSD

Water System of the Year: Ravencliff–McGraws–Saulsville PSD

Wastewater Operator of the Year: Les Adkins, Putnam PSD

Wastewater System of the Year: Parkersburg Utility Board

Every year the Association selects two college students to receive a $1,000 scholarship each, to help with the cost of achieving their education. This year the recipients of the WVRWA Scholarships were:

Jenna Lynn Rice, Wheeling, WV

Brook Miller, Hurricane, WV

There were two deserving individuals recognized for completing our Apprenticeship program as Certified Class 2 drinking water operators in July 2024.

Travis Howard, City of Lewisburg

Mitchell Henson, Berkeley County PSWD

Thank you everyone for making Water on the Mountain 2024 a big success.

We look forward to celebrating the associations 40th year anniversary at Water on the Mountain 2025! ■

By Brian Arthur, Training Specialist

Becoming a Water or Wastewater Operator in West Virginia

As the demand for clean water and effective wastewater management continues to grow, the role of water and wastewater operators is more crucial than ever. For those interested in starting a career in this essential field, West Virginia offers a unique set of opportunities and challenges. Here's a guide to help you understand some things you will experience within your first few weeks.

- Keep your mouth closed when cleaning a probe on a lift station, those are under pressure!
- Be a team player, don't talk about your co-workers; it has a way of getting back to them.
- The balloons at the sewer plant aren't from a birthday party???
- Ask questions from those you work with; they have a wealth of experience.
- Be proud of what you do and do it well.
- Take training, you will never know it all.
- Take a change of clothes, something always goes wrong.
- Be honest, never lie on the reports.
- Kimwipes can be used for tissues but never toilet paper (to thin).
- Finally, corny jokes never get old.

But in all seriousness, operators have a significant job and should be taken very seriously.

Understanding the Role

Water and wastewater operators play a pivotal role in maintaining the quality and safety of the state's water supply. Their responsibilities include monitoring water quality, operating and maintaining treatment facilities, and ensuring compliance with environmental regulations. In West Virginia, operators are essential for safeguarding public health and protecting natural resources.

Educational Requirements and Certifications

To become a water or wastewater operator in West Virginia, you'll need to meet specific educational and certification requirements:

1. **Educational Background:** While a high school diploma or GED is typically the minimum requirement, pursuing additional coursework in environmental science, chemistry, or engineering can be advantageous. Some community colleges and technical schools in West Virginia offer relevant programs.
2. **Certification:** The West Virginia Office of Environmental Health Services (OEHS) oversees the certification process. Operators must pass an exam to become certified. The OEHS offers certification for various levels, from entry-level to advanced, depending on your experience and the complexity of the systems you'll be managing.
3. **Experience:** Practical experience is crucial. Many operators start with entry-level positions to gain hands-on experience. On-the-job training is essential for understanding the specific needs of West Virginia's water systems.

Training Programs and Resources

West Virginia provides several resources for aspiring water and wastewater operators:

1. **WVOEHS Training Programs:** The OEHS offers training sessions and workshops to help candidates prepare for certification exams and stay updated on industry best practices.
2. **Professional Associations:** Joining organizations like the West Virginia Rural Water As-

sociation (WVRWA) can provide networking opportunities, access to industry news, and additional training resources.

Job Outlook and Opportunities

The demand for skilled water and wastewater operators is expected to remain strong in West Virginia due to ongoing infrastructure needs and regulatory requirements. Operators may find opportunities in various settings, including municipal utilities, industrial facilities, and private sector companies.

1. **Municipal Utilities:** Many operators work for city or county utilities, managing public water and wastewater systems.
2. **Industrial Facilities:** Industries with large water usage or wastewater production often employ operators to manage their systems.
3. **Private Sector:** Private companies may hire operators for specialized or contract-based services.

Challenges and Rewards

Working as a water or wastewater operator in West Virginia comes with its own set of challenges. Operators must deal with complex systems, stringent regulations, and occasionally harsh weather conditions. However, the rewards are substantial. The job provides a sense of accomplishment from contributing to public health and environmental protection, along with job stability and opportunities for advancement.

Conclusion

Becoming a water or wastewater operator in West Virginia is a fulfilling career choice that combines technical skills with a dedication to public service. By meeting educational requirements, obtaining necessary certifications, and gaining practical experience, you can embark on a rewarding career path that plays a critical role in your community. With the right training and resources, you'll be well-equipped to contribute to the vital work of maintaining the state's water and wastewater systems.

See you in class!

Brian ■

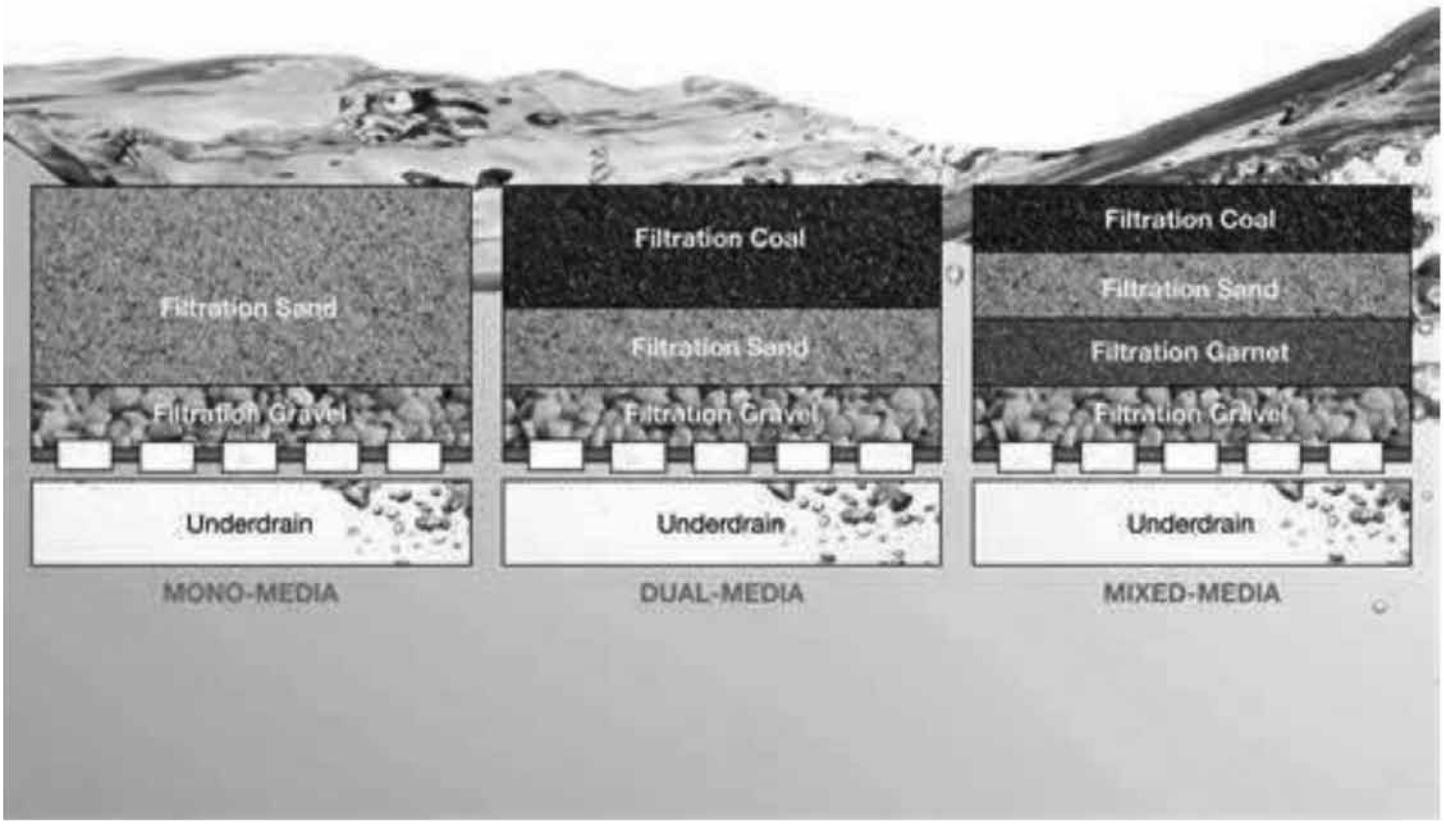
By Charlie Cooper, Emerging Contaminants Technician

When Do You Need to Replace Your Filter Media

Deciding when to replace your filter media can be difficult, especially when your filter continues to remove contaminants to acceptable levels. However, periodic media replacement is an essential part of your filter's asset management plan in order to ensure optimal equipment performance and life cycle. Filter media to have an average life of 15 years with a range of 10 to 20 years depending on site-specific factors, like backwash type and frequency, operational frequency, media type and condition, and overall filter performance. Unless there is a major issue, filter media does not simply fail. Rather, it changes over time in properties like size distribution, roughness, depth, and composition (solids buildup), all of which can impact filter run length and effectiveness. As these changes occur gradually over months and even years, it is difficult to discern differences in operation and performance. For this reason, we recommend planning for media replacement every 10 to 20 years even if it does not seem obvious based on performance alone.

If you are considering changing your filter media, here are some signs that would support the decision:

- Filter performance has decreased, such that contaminants are detected at higher concentrations than normal throughout the filter run.
- Contaminants are breaking through sooner, requiring more frequent backwashing.
- Media depth is significantly different from the original specification.
- Up to one inch of loss per year is considered normal; however, media depth can also grow from build-up of solids over time.
- Filter is building differential pressure faster than normal or very little before seeing breakthrough. ■



By Jerry Dotson, Sourcewater Specialist

Forest Land and Drinking Water

The US Forest Service completed a study a couple years ago and Dr. Cynthia West said this about the results of that study. "Over a century of research has demonstrated that forested lands provide the cleanest and most stable water supply compared to other land types. Within the lower 48 states, over 99% of people who rely on public drinking water systems receive some of their drinking water from forested lands." There are over 736 million acres of Forested Land in the US. Most of the drinking water in the Western portion of the US is influenced by National Forests under the supervision of the US Forestry Service. Over 60 million Americans get their drinking water from National Forests. Back here in the East, some of the land is National Forests, but much of it is privately owned forested land, owned by either corporations or individuals. There are twelve million acres of forest in West Virginia. Some is National Forest, some is State Forest, some is owned by cities or counties; but most is privately owned by large corporations or individuals.

Forested land is good for drinking water because the forest and ground vegetation that goes with it improve water quality and quantity. They act as natural filters to prevent sediment and chemicals from reaching waterways. Trees serve as natural sponges, collecting and filtering rainfall and releasing it slowly into streams and rivers. They are the most effective land cover for maintaining water quality. The ability of forests to aid in the filtration of water provides benefits to our health and the health of the watersheds, but it can also decrease treatment cost. Forest cover has been directly linked to treatment costs, so the more forest in a source water watershed, the more potential for a lower cost to treat that water.

Forests provide these benefits by filtering sediments and other pollutants from the water in the soil before it reaches a water source, such as a stream, lake or river. Having a buffer of forestland by streams and riverbanks also helps prevent the erosion of sediment into the water.

They also help to recharge the water table by allowing water to soak into the ground. Also, the shade of trees helps to retain that water and reduce evaporation. Trees collect and absorb water, and then release it slowly into the environment. That allows water table recharge, reduces erosion, and, as an added bonus through photosynthesis, produces the air we need to breath. So, Forested land is a natural filter and purification system. And it provides a means for storing water to recharge aquifers and surface waters. Forested Land is the best land use for a source water recharge area for providing good quality and quantity of water for a public water system, regardless of whether we are talking about surface water or groundwater.

However, there are some potential hazards that come with forested land.

Some types of land use that forests attract do present some risk for the watershed. Forest management, recreational use, and timbering and wood processing operations all present certain opportunities for water quality problems.

1. Foresters utilize chemicals to manage the forests that can create the potential for contamination. Pesticides, herbicides, and other chemicals necessary for forest management create a risk of contamination for water sources.
2. Forests attract people for Recreational Activities – camping, lodging and boating and other activities can create some risk of contamination.
    a. Lodges bring a concentration of people who come to enjoy the facilities and those people create waste. Human waste or sewage – whether from treatment plants, holding tanks, pit toilets, or other facilities can pose a risk for pollution.
    b. There is the risk of various chemical contaminations. There can be fuel spills or chemical contamination from boating, or ATVs, or maintenance equipment, or timbering operations. There are household chemicals used in cleaning and laundry and other work. Again, there are pesticide, herbicide, fertilizers, other chemicals used in park maintenance. All the chemicals used to manage the park and run the facilities, and all the things that attract people to the park or forest create some risk of contamination.
3. And then there is Silviculture, which is a fancy word for logging

and lumber processing activities. While it may not be as dangerous as chemical or fuel contamination. The most common problem caused by timbering operations is sediment from erosion.

Sediment, as you probably know is the cloudiness in your raw water that is caused by floating particles. Sediment can carry nutrients, contaminants and bacteria. All things that we don't want in the water we provide for people to drink. Sediment can be removed in the conventional drinking water treatment process through coagulation, flocculation, sedimentation, and filtration processes. To the water treatment plant operator, sediment is turbidity. And we measure that in Nephelometric Turbidity Units (NTUs). The target is 0.3 NTUs maximum in at least 95% of samples per month, and it should never exceed 1.0.

The problem is, when the timbering operation upstream is not properly managing their work, and a big rain event comes. Then erosion occurs, and the normal sediment in our raw water is replaced with abnormally high sediment. And your turbidity goes from 10 or 20 to 500 or 1000. This may cause a problem if it exceeds the treatment ability of the plant. Every plant is different, and designed to provide treatment at a certain level. If the stream conditions exceed that level, the plant may not be able to remove the sediment to the required level. But, even if it can, more chemicals will be required to treat the water. The loading on the filters will require more frequent backwashing causing water that would have been sold to customers to be wasted. And it may require the operators to run the plant longer to make an adequate supply to meet demands. All of these things translate to an increase in treatment cost. More chemicals, more man-hours, more energy, all equal more cost.

There is good news, however. To help ensure your water quality is safe before, during and after a logging operation, the West Virginia Legislature passed the Logging Sediment Control Act in 1992. This law sets guidelines for logging companies to use when timbering. Part of the Act states logging operations are to be registered and supervised by individuals who have completed the Division of Forestry certification program. The law also requires loggers to follow Best Management Practices (BMPs) that prevents useless soil erosion or runoff that could potentially cause problems in nearby bodies of water. So, sediment pollution by a timber company is against the law. If you experience high turbidity and suspect the cause is a timbering operation, you can contact the West Virginia Division of Forestry, who issues the permits for logging operation, and report the problem.

So, even with the potential problems they bring, forested land is still by far the best land use for a water source recharge area. And it is important that those forested lands are protected. There are a number of things that can be done to protect those forests. And there are opportunities to obtain funding for measures that can establish and protect those forested land tracts in West Virginia. The US Forestry Service has several programs. There is the Forest Stewardship Program that partners with the West Virginia Division of Forestry to provide technical planning for family landowners. The Forest Legacy Program protects forests by purchasing land or conservation easements to ensure land parcels remain forest lands and are not developed into residential or commercial use. And the Community Forest and Open Space Conservation Program works with local governments, tribes and nonprofit organizations to purchase land for public access.

The United States Department of Agriculture's Natural Resources Conservation Service (NRCS) also has programs and funding to protect forests. Much of what NRCS does is provide expert technical assistance to aid landowners in making informed decisions to keep their forested land healthy and working properly. One example is their Environmental Quality Incentives Program (EQIP) which provides technical and financial assistance to landowners to develop conservation practices and activities with goals like improving water and air quality, conserving ground and surface water, reducing soil erosion and sedimentation, and mitigating against drought.

There are programs and funding to help conserve and manage forested lands. But it takes willing participants. If your source water protection area contains any forested land, it may be worth the effort to establish a relationship with the owners and have a conversation about the importance of managing their land and direct them toward the experts that are available to help them, like the WV Division of Forestry. It can help keep and maintain the best land there is for drinking water recharge areas.

To learn more about conservation efforts for forested lands in West Virginia, the West Virginia Forest and Drinking Water Partnership holds an in-person forum every year. The forum brings together stake-holders from all aspects of forestry and drinking water to discuss ways and to look for opportunities to protect drinking water sources influenced by forested lands. For more information about the Partnership or Forum or for any other questions or needed assistance concerning source water, contact Jerry Dotson, your WVRWA Sourcewater Specialist at jerrydotson@wvrwa.org. ■

By Bertis M. McCarty, Water Circuit Rider

A.F.F.
Available Fire Flow

Available Fire Flow (AFF) is the amount of water expressed in gallons per minute available in the test fire hydrant when the residual pressure in the water main supplying the test fire hydrant is 20 psi.

The above definition is the typical one found in all the manuals.

I will expand on this definition by telling you there are two different AFFs.

1. The first is the AFF at the flowing hydrant nozzle, as explained in the definition above.
2. The second is the AFF at the main line near the flowing hydrant.

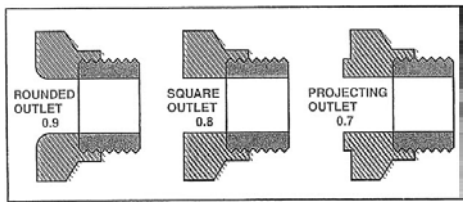
As you can imagine the second one is a higher value and probably more important in my personal opinion.

Pitot Gauge

The pitot gauge above does give you the flow rate at a given pressure. This is one valuable piece of information you will need to get the AFF value. There are a few others that I will explain.

Here's the list of all you will need.

1. Static Pressure at the nearest upstream fire hydrant (Test Hydrant).
2. Residual Pressure at the nearest upstream fire hydrant (Test Hydrant), while the flow hydrant is wide open.
3. The type of nozzle on the flow hydrant. (examples below)



4. Size of the flowing nozzle.
5. Pitot Pressure/Flow Rate
6. The number of nozzles flowing water.

Just reading that list, sure does bring up some questions!

Let's start at the beginning.

Static Pressure: I always remember this by the beginning letter, "S". The word Still also begins with "S" which reminds me that water standing still is in static mode.

The very 1st step when starting to gather your data for an AFF calculation is going to be getting the Static Pressure at the Test Hydrant. Since we are in West Virginia and there isn't an abundance of level ground like the book calculations are based on, I would advise a person to get a Static Pressure at the Flow Hydrant also. Why, you ask. Because it lets us, as operators know the elevation difference. One of the first lessons we learned in the water industry is every foot of elevation is 0.44 psi.

With those two numbers written down, we would move on to setting up the pitot, diffuser, and de-chlorination system to move water out of the Flow Hydrant. Before putting any equipment on the 2.5" nozzle, you would determine the type of nozzle using the diagram above.

Now that we have our nozzle type written down, we can set up and flow water. To follow the WV Rule for Hydrant Flow Testing, the pressure at the test hydrant must drop 10% while the flow hydrant is wide open. If it doesn't, another 2.5" nozzle will have to be opened while flowing water. If the second nozzle doesn't drop the pressure at least 10%, then a second flow hydrant will have to be used. It is a learning environment the first time out, but, with proper notes the next time, it should be more of a

routine.

Residual Pressure: The measured pressure while water is Running. I used the letter "R" this time to remember what it meant.

While the water is flowing, a person would collect the rest of the data needed for the AFF calculation.

A. Pitot Pressure and Flow Rate at the Flow Hydrant.
B. Residual Pressure at the Test hydrant

The Pitot Gauge does the first calculation for you and, if you had to use two nozzles on the same flow hydrant, the flow rate would be doubled. The Gallons Per Minute that came out of the Flow Hydrant while it was wide open is the number that we needed from the first part of our formula.

Using the flow rate, we will look at the next step.

Formula:

$AFF=Q(((S-20)^{0.54}/((S-R)^{0.54})))$

Example 1

If I used a Static of 70 psi and a Residual of 58 psi with a Flow Rate of 919 gpm, my AFF would be calculated at 1,986 gpm.

To explain the different AFF, I will run these numbers as if I didn't have a fire hydrant upstream to get any pressure readings from. The way most of us have done in the past.

Note: It doesn't have to be a hydrant. You can use a meter setting in a pinch.

Example 2

If I used a Static of 70 psi and a Pitot reading of 30 psi with a Flow Rate of 919 gpm, my AFF would be calculated at 1,037 gpm.

In Example 1, we used the Test Hydrant data for pressure drop, which was measuring the system pressure. This calculation doesn't tell us what you think it does. You would think this would tell us what the flowing hydrant could or would flow at 20 psi, but that's not true. The truth is that the Flow hydrant was used as a tool to measure the pressure drop in the distribution system. The AFF in this case is the Available Fire Flow in the Main Water Line at 20 psi near that location. If the fire department used 3 nozzles to fight a fire, they would have available to them about 662 gpm at each nozzle.

Example 2 lets us know what the AFF is from a single nozzle of the Flow hydrant at 20 psi.

In the WV Rule, there is no designation of which AFF is needed, however, since they want the Test Hydrant data, you should use it when you can. I tried to make contact with the appropriate engineer and had no response.

Since you now know the difference between the calculations, it may help you understand why the test hydrant is used when flowing hydrants.

I made a spreadsheet to match the new rule as best I could and to take into account the elevation changes we have in this state. Mike Hersman is working on a Policy Template that should be done soon.

The spreadsheet can be found at WVRWA.ORG.

Tips and Tricks for ALL:

Always communicate with the public before Flow Testing.

Get the Static Pressure from the Flow Hydrant before and after flowing water to make sure there isn't a large pressure drop when you are finished. This is a simple test that can tell you if a main line has been compromised.

Run a pressure gauge on the opposite side of the hydrant when using a pitot. It will read the same pressure as your pitot and is a good backup if a rock takes out your pitot knife or tube. (It happens)

Check pressure gauges before starting each day. (Put both on one hydrant and see that they read the same with the hydrant open)

PRVs will flow backward! If a PRV is in the area, either above or below where you are flow testing, be sure to check it after you are finished for the day. If it happens to have flowed backward, a rock could be caught in it, holding it open. A proper installation with a screen on both sides is very uncommon. ■

By Marybeth Altizer, Lead and Copper Program Technician

The Importance of Water Operators in Rural America

In rural America, the role of water operators is crucial, yet, often underappreciated. These professionals ensure that communities have access to safe, clean drinking water—a necessity that underpins public health, economic development, and quality of life.

Ensuring Public Health

Water operators are the frontline defenders against waterborne diseases. In rural areas, where water systems might be older and more susceptible to contamination, their work is vital. Operators routinely test water quality, monitor for contaminants, and maintain treatment systems. This vigilance helps prevent outbreaks of illnesses, ensuring the community remains healthy.

Supporting Economic Development

Reliable water supply is a cornerstone of economic stability and growth. Agricultural activities, which are predominant in rural America, depend heavily on water. Water operators manage irrigation systems, ensuring that crops receive adequate water, which in turn supports local economies. Additionally, businesses, schools, and healthcare facilities all require a dependable water supply to operate effectively. By maintaining this supply, water operators help create a stable environment for economic activities to thrive.

Enhancing Quality of Life

Beyond health and economic stability, the presence of skilled water operators contributes significantly to the overall quality of life in rural communities. Consistent access to clean water allows residents to engage in daily activities such as cooking, cleaning, and bathing without concern. This reliability is particularly crucial during extreme weather conditions, where disruptions in water supply can exacerbate hardships.

Addressing Unique Challenges

Rural water systems face unique challenges that require specialized knowledge and adaptability. These systems often cover large geographical areas with fewer resources compared to urban counterparts. Water operators in rural settings must be adept at managing these expansive systems efficiently, often with limited funding and personnel. Their ability to troubleshoot and innovate is essential for overcoming the logistical and technical hurdles that rural water systems present.

Bridging the Knowledge Gap

In rural America, water operators often serve as educators and advocates for water issues. They provide valuable information to residents about water conservation, safety practices, and the importance of infrastructure investment. By fostering a well-informed community, operators help ensure that everyone plays a part in maintaining the integrity of the water supply.

Last, but not Least

The importance of water operators in rural America cannot be overstated. These professionals are the unsung heroes who work tirelessly to ensure that communities have access to safe, clean water. Their efforts support public health, economic development, and overall quality of life. As rural areas continue to face unique challenges, the role of skilled water operators will remain indispensable in safeguarding one of our most vital resources.

If you are one of these operators, you should be proud of the work you do. WVRWA values you and thanks you for your hard work to keep our rural water safe. ■

WWW.WVRWA.ORG

By Jamie Nichols, Lead and Copper Program Technician

Lead Can Alter Personalities, Pose Lifelong Risks. It's Still in America's Water Pipes.

The Environmental Protection Agency s proposal to rid the country of all remaining lead pipes in the next ten years has brought renewed attention to the harmful health effects of lead in drinking water. Among those dangers, a growing body of research suggests that years of lead exposure could impact a person's personality.

One study from the University of Texas found childhood lead exposure was linked to being less agreeable and less considerate among other personality traits. Researchers looked at 1.5 million U.S. and European participants between 20 and 30 and discovered residents who grew up in areas with higher levels of atmospheric lead were more likely to exhibit neurotic behaviors, even after accounting for socioeconomic status, according to the 2021 study published in the Proceedings of the National Academy of Sciences.

It's difficult to accurately capture an unbiased link between something as ambiguous as personality to lead exposure, but the data indicates an overall "damping down of an individual's potential," said Natalie Exum, an environmental health scientist at Johns Hopkins Bloomberg School of Public Health. "What that's indicating is the neurotoxic nature of lead – especially for children."

Contaminated drinking water
Lead water pipes still pose a health risk across America. The EPA wants to remove them all

Other health impacts of lead exposure:

Lead exposure can affect every tissue in the body, experts say. The heavy metal inserts itself in cellular processes common to every single cell type involved in major bodily functions such as bone development, and organs such as the gastrointestinal system, kidneys and eyes, said Dr. Roopa Thakur, a pediatrician at the Cleveland Clinic. But lead's biggest impact on children is on their neurodevelopment. Exum said children's blood-brain barrier, which protects the brain from harmful substances, isn't fully developed until they're about seven. Heavy metals can move around more easily in blood vessels and enter the brain. This could cause damage to the brain and nervous system, slow growth and development, and trigger learning and behavior problems.

Lead poisoning is typically gradual, showing up long after a child may have been exposed, said Thakur, who also serves as medical director of the Lead-Free Ohio program, operated by the Ohio chapter of the American Academy of Pediatrics. "The time when kids are actively ingesting or inhaling lead is usually when they're in infancy, when they're crawling around and picking up lead dust and ingesting it," she said. "It's later when they're growing and developing that we see deficits or physical manifestations."

The EPA says there's no safe level of exposure to lead. Even a low level of lead in children's blood is associated with delayed puberty, decreased hearing, impaired cognitive performance, and delayed postnatal growth, according to the National Institute of Environmental Health Sciences.

Lead exposure is more harmful to children 6 and younger because their bodies are still developing. Young children are likelier to put contaminated objects into their mouths. But adults can also suffer health issues due to lead exposure, the EPA says, including:

- Reproductive problems;
- High blood pressure and hypertension;
- Nerve disorders;
- Memory and concentration problems;
- Muscle and joint pain.

Lead poisoning symptoms:

The CDC says lead exposure in children is often difficult to see because most people don't show any obvious or immediate symptoms. If a parent or guardian suspects a child was exposed to lead, the agency recommends talking to a doctor about getting a blood test, which is covered by public insurance and many private insurance companies. While signs don't generally appear until dangerous amounts of lead have accumulated, the Mayo Clinic says that

some symptoms in children may include:

- Developmental delay;
- Learning difficulties;
- Irritability;
- Loss of appetite;
- Weight loss;
- Sluggishness and fatigue;
- Abdominal pain;
- Vomiting;
- Constipation;
- Hearing loss;
- Seizures.

Newborns exposed to lead before birth could be born prematurely, have lower birth weight or exhibit slowed growth.

Is lead poisoning treatable?

There is no treatment for lead poisoning, Thakur said.

Once lead is deposited in the body's cells and a patient begins to show symptoms, however, it's important to take action, namely, to find and eliminate the source of lead, continue to monitor the child's health and implement interventions, such as occupational speech therapy to ensure the child's development is on track, she said. Although the AAP does not recommend universal screening or blood lead level tests for all children, Thakur said early detection is key because there are treatments that can bring lead levels down in young children and are likely to mitigate lasting impacts. Prevention is the best policy. The EPA's new proposal would compel local utilities across the United States to dig up and replace about 9 million aging pipes. The agency estimates it could generate as much as tens of billions of dollars in annual economic benefits because there would be less cognitive impairment in children and fewer health disorders.

Contributing: Eric Lagatta, USA TODAY. Send tips to Adrianna Rodriguez: adrodriguez@usatoday.com

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RURAL WATER Loan Fund

About The Program

The NRWA Rural Water Loan Fund (RWLF) is a funding program specifically designed to meet the unique needs of small water and wastewater utilities.

The RWLF provides low-cost loans for short-term repair costs, small capital projects, or pre-development costs associated with larger projects. The RWLF was established through a grant from the USDA/RUS, and repaid funds used to replenish the fund and make new loans.

Apply today by contacting your State Rural Water Association or NRWA!

Reasons to Apply

- Reasonable interest rates
- No administrative or processing fees
- Straightforward application process and quick turnaround
- Systems must be public entities serving up to 10,000 persons, or in rural areas with no population limits
- Loan amounts may not exceed $200,000 or 75% of the total project cost, whichever is less
- Emergency loans are 90-day no interest, with immediate turn around on applications

Eligible Projects

- Pre-development (planning) costs for infrastructure projects
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- Disaster recovery or other emergency loans available

Applications, information and forms can be downloaded from the NRWA website at nrwa.org or by scanning the QR Code above. For help, please call 1.800.332.8715 or email nrwarwlf@nrwa.org.

USDA Rural Development

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National Rural Water Association is an equal opportunity provider and employer. This material is based upon work supported by the Rural Utilities Service, United States Department of Agriculture.

By Shawn Strain, EPA Wastewater Specialist

Wastewater Utilities Face Shrinking Budgets, Stricter Regulations, and Workforce Shortages

The wastewater utilities in the country are facing an unprecedented convergence of challenges. These utilities are struggling with shrinking budgets and increasing financial pressures. They must comply with more stringent environmental and operational regulations. At the same time, a significant portion of the workforce is retiring, leaving behind a void with few qualified replacements.

One of the most critical issues facing wastewater utilities today is the shrinking of operational budgets. Federal and state funding for infrastructure projects has not kept pace with the growing needs of aging wastewater systems. Many utilities are operating with outdated and failing infrastructure, and the funds required to maintain, upgrade, or replace these systems are becoming increasingly scarce.

Compounding this issue is the fact that many municipalities and Public Service Districts are reluctant to raise rates for customers, fearing political backlash. As a result, utilities are forced to do more with less, stretching already tight budgets to cover essential maintenance, emergency repairs, and regulatory compliance. This financial strain is leading to making maintenance issues not so important, which can cause more severe and costly problems in the long term, including system failures and environmental contamination.

While budgets are tightening, the regulatory limits for wastewater utilities are becoming more stringent. The Environmental Protection Agency (EPA) and state agencies are imposing stricter requirements to protect public health and the environment. New regulations often mandate reductions in nutrient discharges, stricter effluent limits, and enhanced monitoring and reporting.

For instance, the push to reduce nitrogen and phosphorus levels in wastewater effluent, driven by concerns about nutrient pollution and its impact on water bodies, requires utilities to invest in advanced treatment technologies. These technologies are expensive to implement and maintain, further straining already limited budgets.

Utilities are expected to meet these stricter standards without any significant increase in federal or state funding. This creates a scenario where utilities must balance compliance with regulations against the financial realities of their operations, often leading to tough choices about where to allocate limited resources.

Adding to the financial and regulatory pressures is the workforce shortage. The wastewater utility sector is experiencing a wave of retirements. Many experienced operators, managers, and engineers are reaching retirement age, leaving behind a significant gap in knowledge and expertise. Even negotiating with retirees to return to work on a part time basis.

This issue is made worse by a lack of qualified replacements. The wastewater industry has struggled

to attract new talent, particularly younger workers, who may be unaware of the career opportunities within the sector. Additionally, the specialized skills required for wastewater treatment operations are not easily transferable from other industries, making it difficult to find qualified candidates.

The shortage of skilled workers poses a serious risk to the continuity of operations. Without experienced personnel, utilities may face challenges in maintaining compliance with regulations, responding to emergencies, and effectively managing their systems. The loss of certified operators could also hinder efforts to implement new technologies and optimize operations.

Despite these challenges, there are several strategies that wastewater utilities can consider to navigate this difficult period.

- **Innovative Funding Mechanisms:** Utilities may need to explore alternative funding sources, such as public-private partnerships (PPPs), grants, and low-interest loans. Adopting a more aggressive approach to rate adjustments, while politically sensitive, may be necessary to ensure the long-term sustainability of the utility.
- **Technology and Efficiency Improvements:** Investing in automation and smart technologies can help utilities optimize their operations and reduce costs. For example, real-time monitoring systems can improve process efficiency, while predictive maintenance can reduce unexpected equipment failures and associated costs.
- **Workforce Development Programs:** To address the workforce shortage, utilities should invest in training and apprenticeship programs to develop the next generation of operators and engineers. Partnerships with local community colleges and vocational schools can also help attract new talent to the industry.
- **Collaboration and Regionalization:** Smaller utilities may benefit from collaborating with neighboring utilities or consolidating services to achieve economies of scale. Regionalization can reduce costs, improve service delivery, and enhance access to specialized expertise.

The challenges facing wastewater utilities are significant, but they are not insurmountable. By adopting innovative strategies, investing in technology, and focusing on workforce development, utilities can navigate these turbulent times. However, it will require a concerted effort from all stakeholders—utilities, regulators, and the public—to ensure that these critical services continue to protect public health and the environment for future generations. ■

By Shane Altizer, Water Circuit Rider

Proposed Fire Hydrant Rule in West Virginia: Key Details and Implications

In July, the West Virginia Public Service Commission (PSC) proposed new regulations for fire hydrants. This article provides a detailed overview and the potential impact on water systems. The proposed rule, accessible through the PSC's website, is designed to standardize and improve fire hydrant maintenance and operational procedures. Here are the main components:

Rule 150-X-4: Recordkeeping and Reporting

Rule 150-X-4 requires detailed recordkeeping and reporting for fire hydrants. Utility providers must maintain comprehensive records of all inspections, maintenance, and repairs performed on hydrants. These records must be submitted regularly to the PSC, ensuring transparency and accountability. Proper documentation helps track the condition of each hydrant, facilitating timely maintenance and identifying issues before they affect emergency response.

Rule 150-X-5: Annual Inspection and Flushing

Under Rule 150-X-5, fire hydrants must be inspected and flushed at least once per year. The annual inspection involves checking the hydrant's operational condition to ensure it is functioning correctly. Flushing the hydrant clears out sediment and debris, ensuring that water flows effectively. Regular inspection and flushing help maintain hydrant performance and prevent issues that could impair emergency response capabilities.

Rule 150-X-6: Flow Testing

Rule 150-X-6 mandates regular flow testing for fire hydrants. Hydrants must undergo flow tests every five years to measure their water flow capacity and pressure. This testing is crucial for determining whether a hydrant can provide an adequate water supply during firefighting operations. Results from these tests must be documented and reported to the PSC, ensuring that hydrants meet performance standards and are reliable when needed.

Rule 150-X-7: Color Coding Based on Flow Capacity

Rule 150-X-7 establishes a color-coding system for fire hydrants based on their flow capacities. Hydrants will be painted in specific colors to indicate their water flow rates, making it easier for firefighters to quickly assess the available water supply during emergencies. This standardized color-coding system aims to streamline emergency response efforts by providing immediate visual information about each hydrant's capabilities.

Rule 150-X-8: Penalties for Non-Compliance

Rule 150-X-8 addresses penalties for non-compliance with the proposed hydrant rules. This rule outlines the fines and sanctions that utility providers may face if they fail to adhere to the maintenance, inspection, and reporting requirements set forth in the previous rules. The penalties are intended to enforce compliance and ensure that fire hydrants are maintained to the required standards. This rule aims to hold utility providers accountable and ensure that hydrants remain functional and reliable.

The proposed rules 150-X-4 through 150-X-8 by the West Virginia Public Service Commission represent a significant effort to improve fire hydrant management and safety. By focusing on detailed recordkeeping, regular inspections, flow testing, color-coding, and enforcing penalties, these rules aim to ensure that fire hydrants are consistently reliable and effective in emergency situations. The implementation of these regulations is expected to enhance firefighting operations and contribute to public safety across West Virginia. ■

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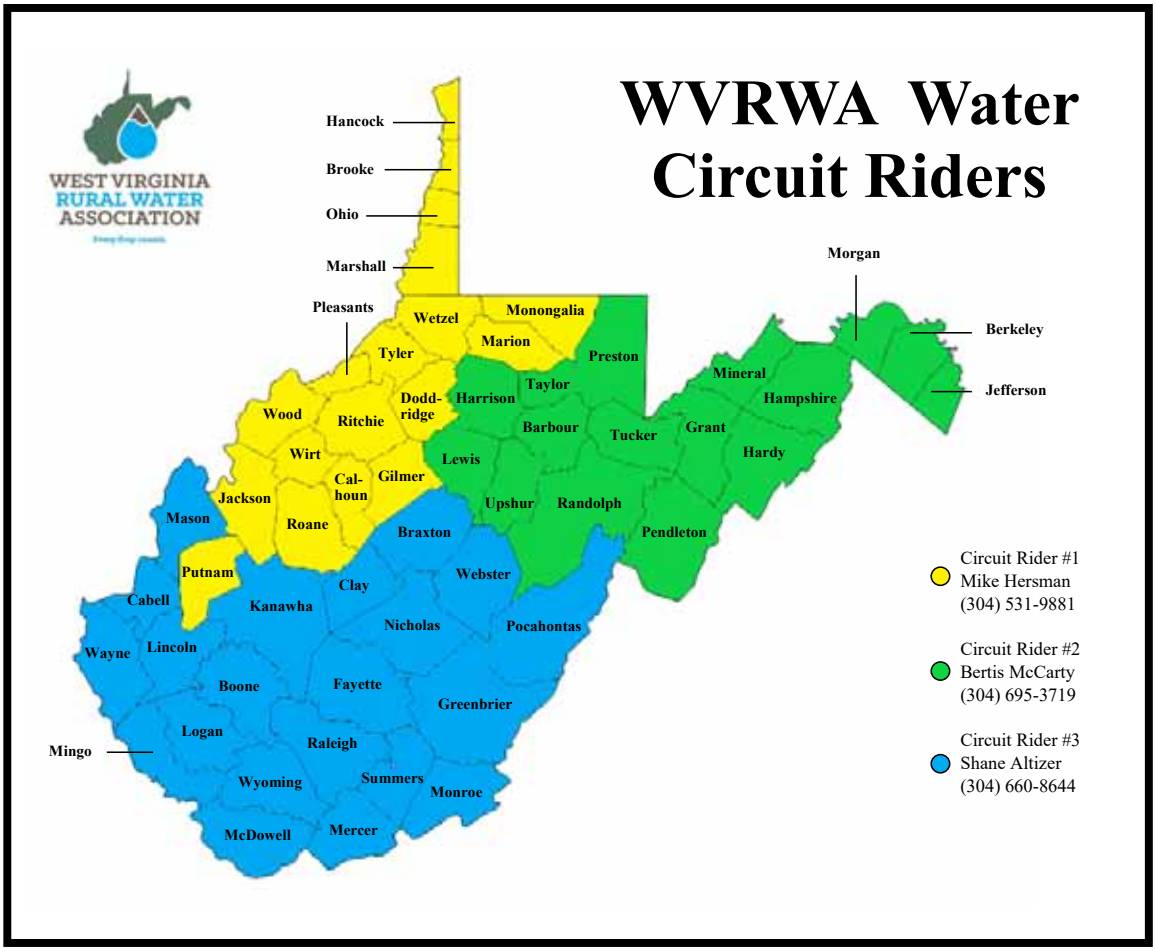
By Cory Weese,Apprenticeship Coordinator

West Virginia Rural Water Apprenticeship Update

The Apprenticeship Program has been going on for around 3 years now. I am pleased to announce we have had 4 graduates with a projected 3 graduates this January 2025. That will be a total of 7 graduates in just 3 years, considering this is a 2-year program, I think that is a success. The apprenticeship graduates have all been Water Treatment Operators with the projected first Wastewater Treatment Operator graduating in January of 2025. The apprenticeship program currently has 21 active apprentices, with over 90 applicants. There are currently 20 active employers and 39 mentors in the program statewide. The program is a mixture of in-person training, bookwork, and online classes for a total of 288 hours of technical instruction within 2 years. All apprentices will take the Utility Management Certification as they complete the program. ■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West Virginia Rural Water Association

Don't Miss Out on Available Services

Our little to no-cost, two-year, nationally recognized Water/Wastewater Apprenticeship Program matches candidates with employers.

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This program starts as a job and emerges as a solid and secure career as either a water operations specialist or wastewater operations specialist.

Our Circuit Riders provide training and technical assistance to operations specialists, water utility managers, and boards. On-site help is available upon request when a system needs it.

- Leak detection and water audits
- Sampling and testing
- System troubleshooting
- CCRs

Our Source Water Protection Specialist provides on-site help for systems to assess, delineate sources of water, and reduce/eliminate the potential of contamination.

- Source water protection plans
- Emergency response plans
- Measure well draw downs
- Perform TV inspection of wells

Training is available to obtain continuing education hours (CEHs) for license renewals.

As part of this training endeavor, training videos have been developed to help bring about compliance with safe drinking water regulations and to enhance system operations.

Videos and study material are available upon request.

Our ARC Specialist provides technical, training, financial, and managerial assistance for water and wastewater systems in economically distressed Appalachian counties.

- Asset management plans
- Rate analysis
- Leak detection
- Preventing inflow & infiltration (I&I)

Our Wastewater Technicians provide assistance to enhance and maintain financial sustainability of wastewater systems through technical support and/ or training.

- Smoke testing and camera inspections
- Nitrogen problems
- Solids handling
- Compliance issues

Our Energy Efficiency Technician provides assistance to rural and small community water and wastewater utility systems to help in becoming more energy efficient.

- Evaluates energy needs, consumption, and costs
- Recommends measures to reduce energy consumption
- Identifies potential funding sources for improvements

Our EPA Water Technical Assistance Specialist provides training and technical assistance to water systems that struggle to achieve compliance with regulations.

A key priority is assisting small systems with their technical, managerial, and financial capacity to achieve long-term sustainability and resiliency.

By Shannon Cochran, Lead and Copper Program Technician

History of Lead in Drinking Water

October 16 has come and gone and I hope everyone developed and submitted their lead service line inventories. For years now, all we've heard about is the Lead and Copper Rule (LCR), Lead and Copper Rule Revisions (LCRR), and Lead and Copper Rule Improvements (LCRI). Since we're going to be headed down this road for years to come, I thought I'd give a brief history of lead in drinking water.

Lead is a naturally occurring metal that has been a part of human society for thousands of years. Aside from its abundance and accessibility, lead was an attractive material due to its soft and malleable quality, low melting point, ability to hold pigments, ability to withstand the outside weather elements, high level of resistance to corrosion, and its low cost. The Romans were the first to mine lead on a massive scale and they used lead pipes to carry water to their cities. In modern times, lead was commonly used in water service lines from the late 1800s through much of the 20th century. Due to material shortages, the World War II era (1940-1950) was a higher lead-risk decade with increased lead pipe use.

On December 16, 1974, President Ford signed the Safe Drinking Water Act (SDWA) into law, which made provisions for national drinking water regulations, including the determination of maximum contaminant levels. The SDWA was amended in 1986, which prohibited the new installation or sale of lead pipes for use in drinking water. Thus, lead-free pipe, solder, and flux became the standard in the installation or repair of any public water system. Previously, solders used to join water pipes contained approximately 50 percent lead. After the ban, solders and flux were considered to be lead-free if they contained less than 0.2 percent lead and pipes and pipe fittings had to contain less than 8 percent lead.

In response to Congress' amendments to the SDWA, the EPA issued the Lead and Copper Rule in 1991. The LCR was designed to reduce the levels of lead in tap water through corrosion control treatment and the removal of some lead service lines. Over the years, there were some minor revisions to the LCR; however, we can all agree that things didn't really get kicked up until April 25, 2014 with the water crisis in Flint, Michigan. To save money, the city switched its drinking water supply from Detroit's system to the Flint River, which would have disastrous consequences. Poor testing and treatment of the water gave way to a series of major water quality and health issues for residents. In response to the Flint water crisis, the EPA writes to states in February 2016 about the necessity of enhancing drinking water regulations.

On January 15, 2021, the EPA published the Lead and Copper Rule Revisions. The revised requirements were intended to provide more effective protection of public health by reducing exposure to lead and copper in drinking water. Some of the main factors included identifying sites with significant sources of lead, increasing the reliability of tap sampling, public education, and requiring sampling at schools and child-care facilities. Five days later, it was determined that the action required review; therefore, the effective and compliance dates of the LCRR were delayed.

On December 17, 2021, the EPA committed to proposing the Lead and Copper Rule Improvements by October 2024. The LCRI planned to improve the LCRR by replacing all lead and galvanized requiring replacement service lines, reducing the complexity for public health protection, and increasing transparency and public information. The EPA announced the proposed LCRI on November 30, 2023 and anticipates finalizing it prior to October 16, 2024. While some portions of the LCRR may be delayed due to the proposed LCRI, the EPA maintains the October 16, 2024 compliance data for the initial lead service line inventory (LSLI), which is what everyone has been rushing to complete.

As of now, the LCRI aims to:

- **Achieve 100 percent lead pipe**

replacement within 10 years. This would require the replacement of lead service lines within 10 years in the majority of water systems.

- **Locating legacy lead pipes.** You're currently being required to provide an inventory of your lead services lines by October 16, 2024. You would then be required to update your inventories regularly, establish a publicly available service line replacement plan, and identify the materials of all unknown service line material.
- **Improving tap sampling.** Water systems would be required to collect first and fifth liter samples at sites with lead service lines and use the higher of the two when determining compliance with the rule.
- **Lowering the lead action level.** EPA is wanting to lower the lead action level from 15 µg/L to 10 µg/L. If a system's sampling exceeded the action level, the system would have to inform the public and take action to reduce lead exposure. This would all be simultaneously of you working to replace your lead pipes.
- **Strengthening protections to reduce exposure.** Systems who exceeded the lead action level multiple times would be required to provide additional outreach to customers and make filters certified to reduce lead available to all of them.

Yes, the rules regarding lead and copper are constantly evolving. We'll do all we can to keep you informed of all the changes as they come to us. Don't hesitate to reach out if you have any questions or concerns. ■

WVRWA's e-Newsletter, *News Droplets* provides information on new programs and benefits, training classes, conference, legislative news, and much more. If you are currently not receiving *News Droplets*, but would like to, please send your name and email address to connect@wvrwa.org to be added to the mailing list.

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SUDOKU PUZZLE

	4				6		5	
1		6	7		9			
	9	8	3	1			2	
9			4					
8			1	2				7
	6	1	9			3		
7								
						8	3	
		9				6		2

The aim of the canonical puzzle is to enter a numerical digit from 1 through 9 in each cell starting with various digits given in some cells (the "givens"). Each row, column, and region must contain only one instance of each numerical. Completing the puzzle requires patience and logical ability.

Answers can be found on page 38.

By Jim Johnson, Wastewater Technician

Cyber Security Recommendations

In the water and wastewater industry, cyber security is becoming a topic of major concern. Cyber attacks against public water systems have been increasing in recent years. Implementing basic cyber security practices can help a public utility to prevent, respond and recover from a cyber-attack. If your system is concerned about cyber-security, the USEPA website has several templates you can pick from to give your system a cyber-security assessment.

Many of our SCADA systems and control systems are on the internet these days. This makes them vulnerable to cyber-attacks. Systems should have virus and malware protection on all computers that run this equipment. I would limit the use of these computers to operating that equipment; use a different computer to do your everyday office work and searching for replacement parts and such. Conduct regular cyber-security assessments and keep your virus protection and malware protection continuously updated. We have our computers to automatically check for updates and run the updates every day. These are usually done in the early morning hours so it does not disrupt us when we need to be working on our computers. Conduct regular cyber-security assessments to make sure you have the proper protection. Change the passwords on everything frequently. Require strong, unique passwords with some letters, some numbers and a symbol or two. The two worst passwords in the world and the two most frequent are password or 1234. Do not use one of these passwords.

Create an inventory of your computer or OT assets. In larger systems, it will be easy to miss something. If you have an inventory of what you need to protect, it will make it easier to make sure everything is protected. Focas on systems where the equipment is operated by the computer system and then expand to other cyber protection. If possible, have your equipment set up so it will operate manually if you have to take it off of the OT system for a time. Most systems should have a set up so they can recover to a known point and a safe point where everything was working well and the system had control. Test backup procedures from time to time and have a few staff know how to implement the backup procedures. Have all information backed up in about three different places so you do not lose it. Do not have all the backups on the same system.

When systems have a computer or OT system that operates critical components at the water or sewer system, do not search a lot of websites on these computers or systems. Instead, use another computer when searching websites. Have these computers that control critical system components pretty well dedicated to that component. That gives less chance of clicking on something that would give a hacker access to a critical component. Also, employees and officials change the passwords on these systems. A disgruntled employee could be a problem that would have easy access to our systems. Just be careful and change the passwords often. Also, do not reuse passwords. A lot of places have three or so passwords that they alternate. This is a bad practice. There are a lot of words out there, so have different, strong passwords each time. There is no way we are going to be able to remember all of our passwords as we update them so often. Have the passwords in a secure location. Taped to the edge of your computer, which is the most common place, is not a secure location. Have them someplace where trusted staff knows about and where no one else would think to look.

As we perform our jobs at a water or wastewater system, be aware of the cyber-security threat. We need to protect our systems from the chance that a hacker could take control of them and make changes. So, protect your systems cyber-security wise. It's something all public utilities need to do. ■

Answers to Soduko Puzzle

3	4	7	2	8	6	1	5	9
1	2	6	7	5	9	4	8	3
5	9	8	3	1	4	7	2	6
9	7	5	4	6	3	2	1	8
8	3	4	1	2	5	9	6	7
2	6	1	9	7	8	3	4	5
7	8	3	6	4	2	5	9	1
6	1	2	5	9	7	8	3	4
4	5	9	8	3	1	6	7	2

By Michael Hersman, Water Circuit Rider

Gaining Public Support for Increasing Water Rates

No utility likes to increase water rates, but implementing adequate water rates is a necessity if the utility wants to stay viable. It can be a difficult task for managers and decision makers and telling your customers why the increase is needed is not easy, but conveying your message to the consumer through education can ease the burden of the increase.

The single most important factor when increasing water rates is public education. Public education is a process of informing decision-makers and consumers that clean water has a price, letting them know what their money is buying and explaining the consequences of poor water management. Public education requires a commitment to openness and overcoming the tendency to shy away from the public eye. You must inform customers about your operation to eliminate doubts and concerns. Water rate increases can be of little opposition if adequate public support is gained. It will require work, organization and attention.

The first step is to do your homework. The work of implementing a rate increase should start at least one year before the target date. Critically examine your system with your board or council members. Factually and honestly appraise what you've been doing and what you need to do in the future. Is management top-heavy? Can the operation be run more efficiently? Can operating and repair costs be reduced? Is all water being accurately metered and billed? Do you aggressively collect past due accounts? Does your use of in-house or contract labor maximize the customer's dollar?

When you can't delay increases any longer, highlight the problems that have been corrected: you have eliminated inefficient methods, you have trimmed the labor force, and you have initiated water conservation practices. Then, point out the problems that need attention: equipment has reached its useful life and maintenance costs are increasing, portion of the distribution system needs upgraded, cost of service continues to rise. Take photos of your facilities, equipment, structures, and people. These visual aids will come in handy for your next step: Communicating with the public. Knowledge means power, strength, and comfort. If people understand a service's value and importance of that service in their lives, they will support it and they will pay for it.

So what is the message? Talk about the leaky water mains and dilapidated system conditions. Be prepared to answer the key question, "why is the increase necessary?" Rely on your research and make use of what you learned during the homework phase. Employ some salesmanship by highlighting the problems that have been corrected. Delineate the problems that need attention and what the costs will be to correct the problems. Talk about the equipment needs and the importance of retaining certified Water System Operations Specialists and Distribution System Operations Specialist. Talk about the buried infrastructure and when they were constructed and how old leaky water mains compromise customer service and public health. Highlight corrective measures and the costs associated with those measures such as, an engineering study of the water treatment plant, a plan to repair or replace water and sewer mains, an ordinance to eliminate sources of inflow from private property. Link community growth, economic development, recreation and increased property value to water and wastewater treatment services.

The key is to communicate an honest, concise, consistent and positive believable message in as many ways and as many times as possible. To convince people, you must first capture their attention, relate the message to them, and then demonstrate the value of the message. How do you get the message across? You do it with a commitment of time, people and money. ■

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By Beth Fletcher, Wastewater Technician

A Brief History of Wastewater Treatment

Wastewater treatment is often an overlooked necessity of our everyday lives but without proper sewer systems, wastewater treatment plants, and overall regulation, our cities would be ripe with disease and there would be human waste everywhere. Believe it or not, much of the modern wastewater management technology we consider standard in any 21st century homes, things like toilets and sewer pipes are actually relatively new in the grand scheme of history, but that's not to say that sewer systems haven't been around for ages.

Writings from ancient Greece around 1500 B.C. indicate Early water treatment was primarily focused on the aesthetic properties of water, taste and odor. The first simple wastewater treatment processes were boiling and filtering water through charcoal were used along with exposing the water to sunlight and straining.

During the same time the ancient Egyptians were the first people to separate clean water from its contaminants by adding coagulants such as alum. Alum is positively charged therefore attracts the negatively charged particles in the water and over time those particles form bigger flocs that settle down. Proof of this early technology was found on the Tomb of Ramses 2th and alum is still a commonly used coagulant in modern wastewater treatment today.

Egyptian Coagulation using alum:

The person on the right is adding alum to a water tank whereas the person on the left is blowing into a tube to ensure good mixing and leading cleaned water into a boiler.

In 600 B.C the ancient Romans built the first sewer system called the Cloaca Maxima in order to remove waste from the growing cities. It began as an open-air canal, but developed into a much larger sewer over the course of time, consisting of open and closed ditches and pipes to carry away excrement and trash by using rainwater runoff. Eventually contaminated waters flowed into large concrete tanks where solids would settle out before the water was allowed

to flow back into the nearby rivers. Indoor plumbing, and public latrines were also built over these sewers. This was revolutionary for the time although fairly basic by today's standards.

After the collapse of the western roman empire many aqueducts were destroyed, and the future of water seamed bleak. It took many more years, as well as pandemics such as the black death in the late 1400s before major steps would be taken to prove the importance for clean water.

In 1627 Sir Francis Bacon made the first discoveries of desalination which set the scene for future experiments and in 1676 Van Leeuwenhoek was the first scientist to record microorganisms in water treatment. Wastewater treatment became more and more vital as the Industrial Revolution led to rapid growth of cities and pollution causing the need for expansion in waterworks and pumping systems.

The first true wastewater treatment plant was designed in the early 18th century by Robert Thom of Scotland. The plant used slow sand filters for water purification then distributed it through an early sewer system to everyone within the city limits of Paisley. Water entered the plant through a bed of earth and stone and into a sedimen-

tation basin where coagulants and flocculants were used to accelerate particle settling. Finer particles were filtered out in a gravel filter and slowly drained through the sand filters before being stored in a clear well basin. Soon after Thoms first construction of a wastewater treatment plant the idea spread over the whole UK and later to Europe. The first of these systems were built in the United States in Chicago IL and Brooklyn NY in the late 1850s.

It wasn't until 1854 that chlorine disinfection treatment was added to WWTPs as a solution against the increasing number of cholera infections spread through sewer pipes.

The 20th century presented new challenges for wastewater treatment due to industrialization, population growth and agricultural developments. The existing filter and sedimentation technologies were not able to handle the increasing BOD and ammonia levels. In 1913 biological wastewater treatment– the activated sludge process –was invented by Edward Ardern, chemist at the Manchester-Davyhulme wastewater treatment plant, and his co-worker William Lockett. In the following years several tests of the new technology were performed until the first activated sludge plant was built in Stockport, UK in 1920. The basic principle behind all activated sludge processes still used today is to cultivate microorganisms that consume organic waste and oxidize ammonium to Nitrate and Nitrite.

The years following are characterized by the development of improved biological treatment processes such as SBRs, CBRs, oxidation ditches and fixed bed fill media technologies like trickling filters. After 1970 new technologies emerged for the removal of phosphorus, pesticides and other harmful chemicals. Processes such as reverse osmosis and UV filtration were developed.

The history of wastewater treatment is a long and fascinating one and continues being driven by global population growth and the development of bigger cities just as it was from the beginning. Today some of the biggest challenges for industrialized countries are increasing hormone levels found in wastewater and the need for energy reductions and smaller footprints. Since the earliest days of civilization, when wastewater was simply allowed to flow into the environment, to today's sophisticated treatment plants that use a combination of processes, the field has undergone many changes and innovations all while using the same fundamentals developed so long ago. These advances have helped to protect human health and the environment and the demand for continuous improvements in wastewater treatment will never cease. ■

By Daniel Vestal, ARC Specialist

Operators Remembered

Shaun Patrick Meadows
Passed away at home on Sunday, May 19, 2024 at the age of 46 following a sudden illness.

Shaun was born on December 21, 1977 in Hinton, West Virginia. He was the son of Phillip Meadows and stepson of Debbie Meadows of Hilldale, WV and Cheryl Lynn Blake of Tallassee, Alabama.

A 1996 graduate of Summers County High School and lifelong resident of Summers County, he enjoyed fishing, cooking, golfing, and was an avid gardener, especially when it came to growing tomatoes.

Shaun was employed by Big Bend Public Service District for the last 16 years. He started working in the field and as an Operator in Training for the water treatment plant. He then passed the Class I Water Certification exam and became a Certified Class I Water Operator. A couple years later, he passed the Class II Water Certification exam and became a Certified Class II Water Operator and, for the past few years, was the system's Chief Water Operator producing some of the finest drinking water.

Besides his parents, those left to cherish his memory include his loving wife, Crystal Leigh Ford Meadows of Hinton, WV; grandfather, Sonny Meadows of Beckley, WV; mother-in-law, Jennifer Rookstool of Hinton, WV; sister, Megan Meadows of Hilldale, WV; nephew, and Jasper Kidd of Hilldale, WV.

Gary Stephen (Steve) Cooper
Entered into rest at Charleston General Hospital on November 5, 2023 after a brief illness.

Steve was the third son of Philip and Barbara Burns Cooper. He married the love of his life, Millie (Cole) Cooper on March 18, 1977 and have two children; son, Gary Stephen II (Nikki) and daughter, Amber Nicole.

He is survived by his loving wife of 46.5 years, son, daughter, and three grandsons, Steve III, James, and Jack, and granddaughter, Trinity. Brothers, Mike (KeKe) Cooper and Randy (Debbie) Cooper; sister, Karen Cooper, and several nephews and nieces.

Steve loved his family and was always ready to help them in any way. He loved hunting with his son and Millie, loved gardening, lawn care, and home repairs.

Preceded in death by his parents, brother Keith Cooper, and infant grandson, Skyler.

Steve started his wastewater career at Craigsville Public Service District Wastewater Treatment Plant as an Operator in Training. It didn't take him long to pass the Class I Wastewater exam and, a couple of years later, passed the Class II Wastewater exam to become a Certified Class II Wastewater Operator; working for Craigsville from 1984 to March 1992 (8 years).

He left Craigsville to go to work for Flatwoods-Canoe Run Public Service District as their Chief Operator of the Wastewater Treatment Plant on April 4, 1992. While there, Steve passed the Class III Wastewater exam to become a Certified Class III Wastewater Operator. If I may quote, one gentleman told me that "Steve was the epitome of a Wastewater Professional! He got the job done! Right, the first time!" He was employed at Flatwoods-Canoe Run PSD until he retired in January 2017 (almost 25 years).

Here we have two public utility workers and operators supplying our great state of West Virginia with a quality product that we cannot survive without and many people don't even think twice about. We are a very blessed country to be able to supply our friends, family, and the public with a high-quality resource and service. These gentlemen are no longer with us, but they are greatly and dearly MISSED and I consider it a privilege to have known them! Love and prayers go out to all your families!

THANK YOU to all our Great Water and Wastewater Operators out there!

Thank You Letters

Clover Public Service District
3365 Clay Road, Spencer, WV 25276 (304) 927-3323

July 12, 2024

RE: Michael Hersman

Dear Mr. Todd Grinstead, WVRWA

On behalf of the Board and staff of the Clover Public Service District, I would like to recognize and express out appreciation to Michael Herman, for his recent assistance to the Clover PSD as we recently experienced a very serious and potentially disruption of services to the customers we serve.

In mid June, our long-time, and only knowledgeable water system maintenance employee, Stephen Cale Jr., died suddenly, leaving us with no water system operator. Mike Hersman showed up immediately and went right to work checking tank levels, performing water sampling, assessing pump performance, checking all remote sites and so many other checks and duties which we had not even thought of.

At a specially called Board meeting, Mike was on hand to assist us with recommendations for what to look for in a new employee. He spent many of his own personal hours drafting and constructing templates for job descriptions, employee handbooks, training requirements and a host of other things we would never have thought of. Mike agreed to sit in with the Board for interviews, and upon the hiring of our new employee, he volunteered to go out on the job with the new hire to show him the route and acquaint him with his duties and requirements. Mike taught him proper methods of water sampling and testing, and accompanied him to drop off samples at the laboratory. Mike is also assisting our new employee with signing up for mandatory trainings for his certifications.

These and so many other acts of assistance which were vital to the continued operation of the Clover PSD were freely given by Mike, and made all the difference to us, AND he did all this in addition to his many other state-wide obligations.

Mike Hersman represents the best example of service and dedication. WV Rural Water Association is so fortunate to have such a dedicated representative as him.

I hope you can find a way to let Mike know just how much we appreciate his many efforts on our behalf.

Sincerely yours,

Clover Public Service District Board and Staff

HONORARY MEMBERS

We would like to give a special thanks to all of our current and former Board Members and Staff who have helped shape WVRWA.

April Atkinson
Lew Baker
Joe Blair
Rocky Bragg
Ron Brill
Debbie Britt
Gary Buckbee
Dwight Calhoun
Dan Campbell
June Ann Carr
Tim Carroll
Linda Davis-Adkins
Ricky Dennison
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Mike Hersman
Doug Hervey
C. David Holt
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Mary Hutson
Deborah D. Jividen
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George Kallai
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Danny Lewis
Randall Lewis
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Jeff Martin
Bertis McCarty
J. Robert McCarty
Amanda McGinnis
Jack McIntosh
Mike McNulty
David Miller
Will Miller
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Herb Montgomery
Grover Moore, Jr.
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Wayne Oates
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Tina Parsons
Tom Pitman
Gregory Preece
Larry Rader
Jearl Ramsey
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Rick Roberts
Porter Robertson
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Douglas Schafer
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David Swain
Amy Swann
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Ray Tilley
Daniel Vestal
David Wagner
Darrell Wellman
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Bill Yunker

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Arthurdale Water
Athens
Beckley Sanitary Board
Belington
Belmont
Benwood
Berkeley County PSSD
Berkeley County PSWD
Berkeley Springs Water
Bethany Sanitation Board
Beverly
Big Bend PSD
Bingamon PSD
Bradley PSD
Branchland-Midkiff PSD
Bridgeport
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Buckhannon
Burnsville
Cairo
Caledonia Heights
Cameron
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Central Barbour PSD
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Central Hampshire PSD
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Chestnut Ridge PSD
Clarksburg Water Board
Clay County PSD
Clay Municipal Water Works
Claywood Park PSD
Clinton Water Assoc.
Clover PSD
Coalton
Colfax PSD
Cool Ridge Flat Top PSD
Coolfont Mountainside Assoc.
Cottageville PSD
Cowen PSD
Craigsville PSD
Danese PSD
Davis
Davy Municipal Water Works
Denver Water Assoc.
Doddridge County PSD
Downs PSD
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East View PSD
Eastern Wyoming PSD
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Elk Valley PSD
Elkins
Elkins Road PSD
Ellenboro
Enlarged Hepzibah PSD
Fairview
Farmington
Fenwick Mountain PSD
Flatwoods-Canoe Run PSD
Follansbee
Fountain PSD
Frankfort PSD
Franklin
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Gauley River PSD
Gilbert Water
Gilmer County PSD
Glasgow
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Grandview Doolin PSD
Grant County PSD
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Hancock Co. PSD
Hardy County PSD
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Hughes River Water Board
Hundred-Littleton PSD
Huntington Water Quality Board
Huttonsville
Huttonsville PSD
Ice's Run PSD
Jane Lew PSD
Kanawha Falls PSD
Kanawha PSD
Kenova Municipal
Keyser
Kingwood
Lavalette PSD
Leadsville PSD
Lewisburg
Lincoln PSD
Little Creek PSD
Logan
Logan County PSD
Lubeck PSD
Lumberport
Mannington
Mannington PSD
Marlinton
Marshall County PSD #2
Marshall County PSD #3
Marshall County PSD #4
Marshall County Sewage
Mason
Mason County PSD
Masontown
Matewan
Meadow Bridge
Middlebourne
Midland PSD
Mill Creek
Milton
Mineral Wells PSD
Monongah
Monumental PSD
Moorefield
Moorefield Regional Wastewater
Moreland MHP
Morgantown Utility Board
Moundsville Sanitary/Water
Mount Hope
Mount Hope Water Association
Mountain Top PSD
Mt. View Water Assoc.
Mt. Zion PSD
Nettie - Leivasy PSD
New Creek Water Assoc.
New Haven
New Martinsville
Newburg
Northern Jackson County PSD
Norton-Harding-Jimtown PSD
Nutter Fort
Oak Hill Sanitary Board
Oakland PSD
Paden City
Parkersburg Utility Board
Parsons
Paw Paw Municipal
Paw Paw Rt. 19 PSD
Pea Ridge PSD
Pendleton Co. PSD
Pennsboro
Philippi
Piedmont
Pine Grove
Pleasant Valley PSD
Pocahontas County PSD
Preston County PSD #1
Preston County PSD #4
Preston County Sewer PSD
Putnam PSD
Rainelle
Raleigh County PSD
Ravencliff-McGraws-Saulsville PSD
Ravenswood
Red Sulphur PSD
Reedsville
Richwood
Ripley
Rivesville
Romney
Ronceverte
Rowlesburg
Rupert
Salem
Salt Rock Sewer PSD
Shady Spring PSD
Shepherdstown
Shinnston
Short Line PSD
Southern Jackson PSD
Southwestern Water PSD
Spencer
St. Albans MUC
St. Marys
Stonewood
Sugar Creek PSD
Summersville
Summit Park PSD
Sun Valley PSD
Taylor County PSD
Tennerton PSD
Tri County Water Assoc.
Triadelphia
Tunnelton Municipal
Tyler Co. PSD
Union
Union PSD
Union Williams PSD
Valley Falls PSD
Village of Beech Bottom
Village of Bethlehem
Vienna
Wardensville
Washington Pike PSD
Wayne
Webster Springs PSD
Weirton Area Water Board
Welch
West Hamlin
West Milford
West Union
Weston Sanitary Board
Wetzel County PSD #1
Wheeling
White Oak PSD
White Sulphur Springs
Wilderness PSD
Williamstown
Winfield Sanitary Board

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Alum Creek, WV 25003
Phone: (304) 756-3600
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***Lowe & Associates, PLLC**
1156 South Main Street
Milton, WV 25541
Phone: (304) 743-5573
See Our Ad Page 35

***Rural Water Financing Agency**
1151 Old Porter Pike
Bowling Green, KY 42103
Phone: (270) 843-2291

Attorneys

***Bowles Rice, LLP**
600 Quarrier Street
Charleston, WV 25301
Phone: (304) 347-1100
See Our Ad Page 6

*****Jackson Kelly PLLC**
500 Lee Street, E., Suite 1600
Charleston, WV 25301
Phone: (304) 340-1000
See Our Ad Page 4

***Kay Casto & Chaney, PLLC**
707 Virginia Street, E
Charleston, WV 25301
Phone: (304) 345-8900
See Our Ad Page 10

*****Steptoe & Johnson, PLLC**
P.O. Box 1588
Charleston, WV 25301
Phone: (304) 353-8000
See Our Ad Page 41

Insurance

*****Bill Bailey Insurance Agency, Inc.**
701 Highland Avenue
Williamstown, WV 26187
Phone: (304) 375-4900
See Our Ad Page 19

*****Bray & Oakley Insurance Agency, Inc.**
P.O. Box 386
Logan, WV 25601
Phone: (304) 784-4700
See Our Ad Page 44

****Hayes Insurance Agency**
202 Union Square
Marietta, OH 45750
Phone: (740) 373-2347
See Our Ad Page 16

Consultants

***Burgess & Niple, Inc.**
4424 Emerson Avenue
Parkersburg, WV 26104
Phone: (304) 485-8541
See Our Ad Page 45

***Cerrone & Associates, Inc.**
97 14th Street
Wheeling, WV 26003
Phone: (304) 232-5550
See Our Ad Page 10

***Chapman Technical Group**
200 Sixth Avenue
St. Albans, WV 25177
Phone: (304) 727-5501
See Our Ad Page 38

***Crews & Associates, Inc.**
69 Clay Street, Suite 202
Morgantown, WV 26501
Phone: (304) 292-6600
See Our Ad Page 40

*****E.L. Robinson Engr. Co.**
5088 Washington Street, West
Charleston, WV 25313
Phone: (304) 776-7473
See Our Ad Page 24

****Gwin, Dobson & Foreman, Inc.**
3121 Fairway Drive, Suite B
Altoona, PA 16602-4475
Phone: (814) 943-5214
See Our Ad Page 32

*****Hornor Brothers Engineers**
P.O. Box 386
Clarksburg, WV 26302
Phone: (304) 624-6445
See Our Ad Page 46

***New River Engineers, Inc.**
501 Eagle Mountain Road
Charleston, WV 25311
Phone: (304) 342-7168
See Our Ad Page 35

***Potesta & Associates, Inc.**
7012 MacCorkle Avenue, SE
Charleston, WV 25304
Phone: (304) 342-1400
See Our Ad Page 36

***RK&K**
159 Plaza Drive
Keyser, WV 26726
Phone: (304) 788-3370

***Rockacy & Associates, Inc.**
2528 Thrush Road
Charlottesville, VA 22901
Phone: (800) 836-1011
See Our Ad Page 10

***Stantec Consulting Services, Inc.**
320 Southview Drive, Suite 102
Bridgeport, WV 26330
Phone: (304) 816-5199
See Our Ad Page 6

***Stiffler, McGraw and Assoc., Inc.**
1731 N. Juniata Street
Hollidaysburg, PA 16648
Phone: (814) 696-6280
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****The EADS Group, Inc.**
250 Scott Avenue
Morgantown, WV 26508
Phone: (304) 212-5927
See Our Ad Page 38

*****The Thrasher Group, Inc.**
600 White Oaks Blvd.
Bridgeport, WV 26330
Phone: (304) 624-4108
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Contractors

***Breckenridge Corporation**
P.O. Box 247 Brickyard Road
Buckhannon, WV 26201
Phone: (304) 472-3350
See Our Ad Page 38

Laboratories

***Mineral Labs, Inc.**
P. O. Box 549
Salyersville, KY 41465
Phone: (606) 349-6145

***Pace Analytical**
225 Industrial Park Road
Beaver, WV 25813
Phone: (800) 999-0105
See Our Ad Page 32

***Preiser Scientific**
94 Oliver Street
St. Albans, WV 25177
Phone: (800) 624-8285
See Our Ad Page 36

Services and Products

****A to Z Plumbing, LLC**
1013 Crestmont Road
Hurricane, WV 25526
Phone: (304) 415-2015

***Advance Instruments**
10200 Brecksville Road
Brecksville, OH 44141
Phone: (440) 596-1432
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***Advanced Rehabilitation Technology**
525 Winzeler Drive, Unit 1
Bryan, OH 43506
Phone: (419) 636-2684
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****American Cast Iron Pipe/ American Flow Control**
2257 Clairmont Drive
Suite 220-222
Pittsburgh, PA 15241
Phone: (412) 721-9509
See Our Ad Page 3

***AMS**
1127 Judson Road, Unit 233B
Longview, TX 75601
Phone: (844) 475-8343

***Appalachian Software, Inc.**
44 Amber Way
Scott Depot, WV 25560
Phone: (304) 757-1260
See Our Ad Page 40

***Benchmark Construction Co., Inc.**
P. O. Box 1018
Hurricane, WV 25526
Phone: (304) 881-1735
See Our Ad Page 40

***BissNuss, Inc.**
7 Court Street, Suite 260
Canfield, OH 44406
Phone: (330) 533-5531
See Our Ad Page 40

***Buchanan Pump Service & Supply Co., Inc.**
P.O. Box 827
Pound, VA 24279
Phone: (276) 796-5473
See Our Ad Page 10

***C2G Engineering, Inc.**
641 Industrial Park Road
Beaver, WV 25813
Phone: (681) 368-3400

****CITCO Water**
4034 Altizer Avenue
Huntington, WV 25705
Phone: (800) 999-3484
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***Clow Valve Co.**
5908 Sodom Hutchings Road
Farmdale, OH 44417
Phone: (330) 360-4550
See Our Ad Page 36

***Consolidated Pipe & Supply Co., Inc.**
907 Honeybranch Industrial Park
Debord, KY 41214
Phone: (606) 298-0333
See Our Ad Page 38

***Core & Main**
2825 Fairlawn Ave.
Dunbar, WV 25064
Phone: (304) 768-0086
See Our Ad Page 16

***CUES, Inc.**
3600 Rio Vista Avenue
Orlando, FL 32805
Phone: (407) 849-0190

***Daman Superior**
754 Kittanning Hollow Road
East Brady, PA 16028
Phone: (724) 664-6089
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***DN Tanks, Inc.**
39 East Main Street
Mechanicsburg, PA 17050
Phone: (717) 356-0491
See Our Ad Page 36

***Dorsett Controls**
486 N. Patterson Ave., Suite 301
Winston-Salem, NC 27101
Phone: (855) 387-2232
See Our Ad Page 22

***DRV, Inc.**
6 Commerce Drive
Pittsburgh, PA 15239
Phone: (412) 247-4816
See Our Ad Page 40

***Eastcom Associates**
185 Industrial Parkway, Suite G
Branchburg, NJ 08876
Phone: (908) 722-7774

***Edmunds GovTech**
301 Tilton Road
Northfield, NJ 08225
Phone: (609) 645-7333

***Extreme Endeavors**
1063 Hickory Corner Rd.
Philippi, WV 26416
Phone: (304) 457-2500
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***Ferguson Waterworks**
698 Middletown Rd.
White Hall, WV 26554
Phone: (681) 404-2857
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***Forberg Smith**
800 Old Pond Road, Suite 705
Bridgeville, PA 15017
Phone: (412) 420-7262

***Ford Meter Box**
775 Manchester Avenue
Wabash, IN 43056
Phone: (260) 563-3171
See Our Ad Page 40

***Fortiline Waterworks**
7025 Northwinds Drive NW
Concord, NC 28027
Phone: (704) 788-9800

*****FPG**
605 Sheridan Rd., Suite 100
Noblesville, IN 46060
Phone: (317) 565-5012
See Our Ad Page 26

***Gilson Engineering Sales, Inc.**
535 Rochester Road
Pittsburgh, PA 15237
Phone: (304) 342-0012

***Golden Equipment Co., Inc.**
P.O. Box 873
Mars, PA 16046
Phone: (800) 242-1494

***Hawkins, Inc.**
1161 Commercial Ave., S.E.
New Philadelphia, OH 44663
Phone: (573) 881-0756
See Our Ad Page 32

***Infratech Solutions, LLC**
6004 Wellesley Drive
Wilmington, NC 28409
Phone: (910) 617-0291
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***InstruLogic**
212 Fort Collier Road
Winchester, VA 22603
Phone: (540) 338-2222

*****JABO Supply Corporation, Inc.**
5164 Braley Street
Huntington, WV 25705
Phone: (304) 736-8333
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***JHA Companies**
466 S. Main Street
Montrose, PA 18801
Phone: (844) 542-4757
See Our Ad Page 40

***Kennedy Valve**
1021 E. Water Street
Elmira, NY 14901
Phone: (804) 807-0484

***Learco Equipment Company**
13032 Frankstown Road
Pittsburgh, PA 15235
Phone: (412) 221-4888
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Bel Air, MD 21015
Phone: (800) 771-7252
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*****Master Meter, Inc.**
101 Regency Parkway
Mansfield, TX 76063
Phone: (937) 902-4663
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***McWane Ductile**
2266 South 6th Street
Coshocton, OH 43812
Phone: (330) 260-9292
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***Mid Atlantic Storage Systems, Inc.**
1551 Robinson Road, SE
Washington Court House, OH 43160
Phone: (740) 335-2019
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***Miller Environmental, Inc.**
320 S. 17th Street
Reading, PA 19602
Phone: (610) 376-9162

****Mountaineer Generator Service**
400 Airport Road, Suite 7
Elkins, WV 26241
Phone: (304) 636-0011

***Munibilling**
3300 Battleground Avenue, Suite 402
Greensboro, NC 27410
Phone: (800) 259-7020

***Nexbillpay, LLC**
2416 Green Springs Highway
Birmingham, AL 35209
Phone: (800) 639-2435

***Pennoni**
117 E. Piccadilly St.
Winchester, VA 22601
Phone: (540) 771-2091
See Our Ad Page 10

***Pittsburg Tank & Tower Co.**
P.O. Box 913
Henderson, KY 42419
Phone: (270) 826-9000
See Our Ad Page 36

*****Precision Pump & Valve Service, Inc.**
P.O. Box 7027
Charleston, WV 25356
Phone: (304) 776-1710
See Our Ad Page 43

***ProSource Water Products, Ltd.**
14680 Pleasant Valley Road
Chillicothe, OH 45601
Phone: (888) 772-5478
See Our Ad Page 6

****PumpMan West Virginia**
P.O. Box 199
Allison Park, PA 15101
Phone: (412) 487-7140
See Our Ad Page 45

***Quality Water Services, LLC**
160 John Street
Weston, WV 26452
Phone: (304) 269-0072
See Our Ad Page 10

***Service Pump & Supply Co.**
P.O. Box 2097
Huntington, WV 25721
Phone: (304) 429-6731
See Our Ad Page 6

***Shafer, Troxell & Howe, Inc.**
97D Monocacy Blvd.
Frederick, MD 21701
Phone: (301) 682-3390
See Our Ad Page 5

****Smith-Midland Corporation**
P.O. Box 300
Midland, VA 22728
Phone: (540) 439-3266
See Our Ad Page 29

***Southern Corrosion, Inc.**
738 Thelma Road
Roanoke Rapids, NC 27870
Phone: (434) 262-1613
See Our Ad Page 45

***State Equipment Inc.**
P.O. Box 3939
Charleston, WV 25339
Phone: (304) 776-4405
See Our Ad Page 6

***Tepco-Trombold Equipment Co., Inc.**
P.O. Box 897
Mars, PA 16046
Phone: (724) 625-4260
See Our Ad Page 6

***The Sherwin Williams Company Protective & Marine Division**
139 Dover Drive
Moon Township, PA 15108
Phone: (717) 753-0653

***Thompson & Litton**
1105 Mercer Street
Princeton, WV 24740
Phone: (304) 425-9555
See Our Ad Page 35

***Tri State Industrial Coating Contractors Alliance**
1591 Washington Street, East
Charleston, WV 25311
Phone: (304) 546-2896
See Our Ad Page 40

****U.S. Pipe & Foundry Co., Inc.**
2247 Maiden Lane
Roanoke, VA 24015
Phone: (540) 353-7425

*****USABlueBook**
3781 Burwood Drive
Waukegan, IL 60085
Phone: (800) 548-1234
See Our Ad Back Cover

***Utility Solutions, Inc.**
327 Curtis St.
Delaware, OH 43015
Phone: (740) 369-4300
See Our Ad Page 16

****Utility Technologies, LLC**
1054 Monroe Rd., Suite 105
Lebanon, OH 45036
Phone: (513) 488-1940
See Our Ad Page 8

***Valtronics, Inc.**
P.O. Box 490
Ravenswood, WV 26164
Phone: (304) 273-5356
See Our Ad Page 32

***Warren Pump & Supply**
1551 Jackson Avenue
Huntington, WV 25704
Phone: (304) 429-6723
See Our Ad Page 10

***Water Development Authority**
1009 Bullitt Street
Charleston, WV 25301
Phone: (304) 414-6500
See Our Ad Page 36

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