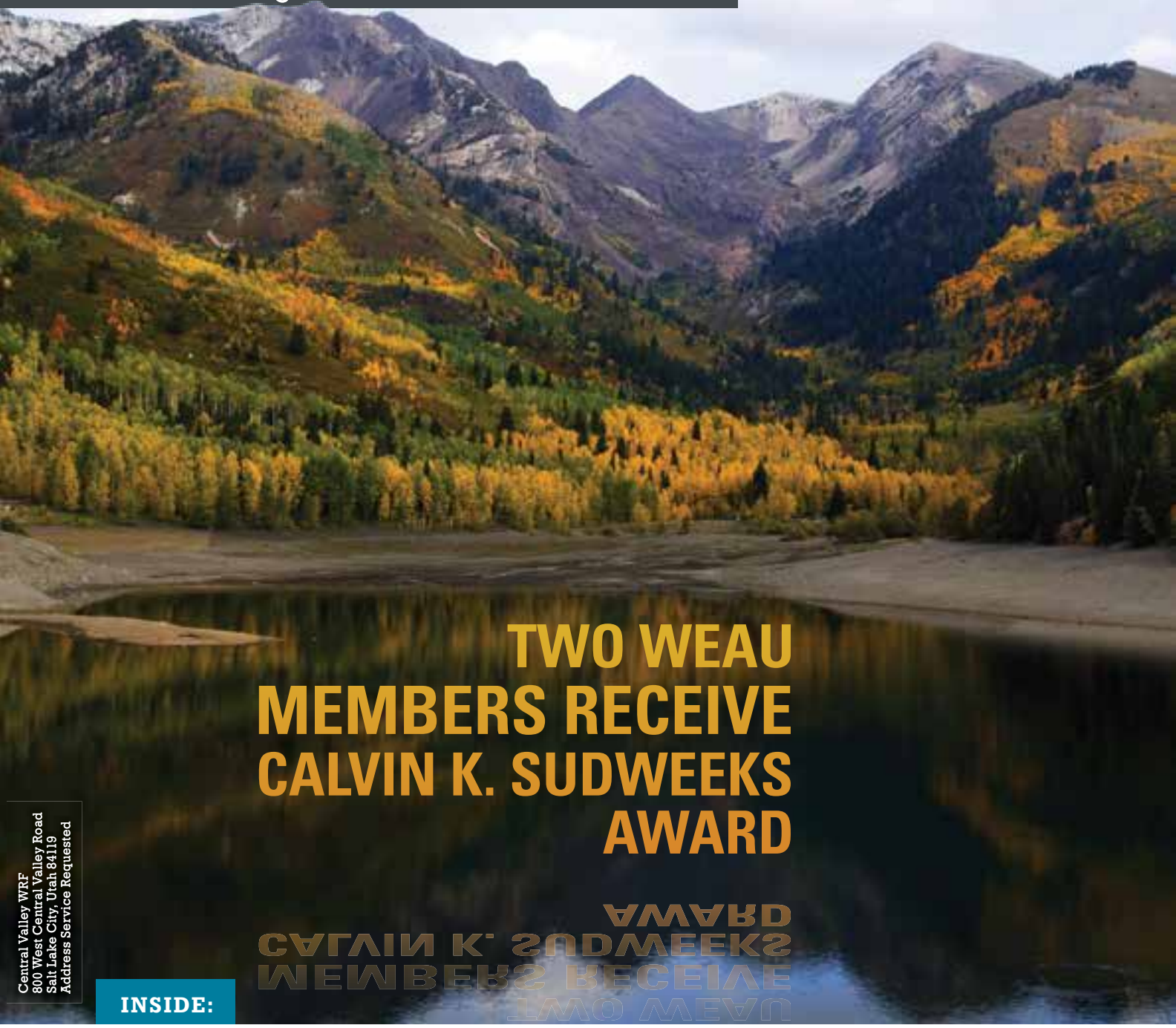
FALL
2020

The Official Publication of the Water Environment Association of Utah

DIGESTED news

Celebrating 50 Years of Clean Water



TWO WEAU MEMBERS RECEIVE CALVIN K. SUDWEEKS AWARD

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INSIDE:

Discover the Cost-Effective Difference ACO Stormbrixx Makes For You.

Schoonover Case Study

The Schoonover Plumbing ACO Stormbrixx project was brought to Mountain Supply out of a need to find a cost-effective way to eliminate an on-site drainage pond, while staying in compliance with the current State of Utah Stormwater Requirements. In order to eliminate the pond, it was determined that an underground stormwater detention system would be necessary. Working with Mustang Design and ACO an appropriately sized below ground retention system was designed for the site that included two access and maintenance points. Once approved, the system was installed with on-site assistance from Mountainland Supply.

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Learning to Live in Fluidity


Chris Reilley

I started the last President's message with "WOW!!" but I'm not sure how to start this one, especially after these last few months. Maybe 'double WOW!!!' or a long 'Wooooooow!' or just 'HANG ON', which is probably a common feeling that we have as we adapt to this ride that we call life.

I remember, as a kid, loving to go out and play in the rain. I was amazed at how the water transformed everything; how everything seemed to be washed and renewed. It surprised me how it just flowed and adapted as it fell to the ground. I remember having popsicle stick races with my friends and creating little dams with leaves and twigs. The water would always build up at the dams and then eventually find a way through, creating its own new path.

We often hear the term 'be fluid'. We're asked to 'be adaptable to change' and 'rise to the occasion'. I'm thinking I need to learn a little from H_2O. No matter what we find blocking our path or slowing us down, may we rise to the occasion and forge our own new future.

We have had to cancel another one of our conferences – our Midyear Conference. We miss another opportunity to gather, share our experience, connect with others in the industry, and build each other up. So, like flowing water, we are going to have to find new ways to share our experiences, connect with each other, and build up one another. Start with your co-workers and reach out further from there. Help forge new ways to make these connections.

Our Operator Certification Exams recently took place throughout the state. Based on what has been reported to me, they were a success due to the help from many people within the industry. I hope for the best for all those who took their test and have been thinking about how the new social distancing requirements necessitate a different way of studying all the ideas, science, engineering, principles, and treatment methods. Maybe this will be a time for folks to dig deeper into learning these concepts and helping each other on a more personal level. If you are a more seasoned professional, help someone new or someone growing in the field. I know that education is now different for many of us. Our children in K to 12, our college students, and maybe even ourselves, are experiencing changes in education. As we are still trying to find ways to help earn CEUs, please look

to the WEAU website as the GoToWebinar® links start to arrive. There are also courses from different trade schools, colleges, and universities that can help us obtain the required CEUs and ongoing educational opportunities. Also, I know that WEF is having different webinars for CEU credit. WEF is likewise preparing to hold a virtual Operations Challenge, which will be new and exciting. Give it a whirl if you're able to participate.

There are many new norms being formed in our society; and we all vary in our different personal needs and desires. We are performing our jobs with new restrictions and changes. It can be hard to plan and organize things when we don't know if, for example, '2 weeks shipping' really means '4- 6 weeks shipping' (that is, if it's even available and if they are actually working wherever you ordered the parts from!). These new norms can cause us new stress. I have recently read several articles on the importance of helping our children, from elementary up to college, adapt to the changes they are facing and all the new anxieties they must face. Their previous 'normal' has been pulled out from under them. They need us to be patient, understanding, as well as be the bedrock that stabilizes them as they try to navigate through these uncertain times. We too, as adults, may be experiencing some level of uncertainty and may not always feel stable in our current circumstances or as a community within WEAU. I hope we all can find ways to help and serve each other, wherever we are working. Reach out to someone in the field that maybe you're aware of. Find a way to help someone!

As of right now, we are still planning on holding our Annual Conference in St. George in the spring of 2021. Yet, we know that we will have to be fluid and flexible as we adapt to changing situations. In one way or another, our member association will continue to help its members grow and develop.

We will hang in there and get through this together. I have watched people adapt and make things work. We must pull together and find new ways to get things accomplished. WE CAN and WE WILL for the sake of those we serve. You are great people. I look forward to hearing from you and, yes, gathering again one day soon.dn

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Lorem Ipsum…

Bryan Mansell

You've seen it before: the words 'Lorem Ipsum dolor sit amet….' filling up a page or text box. Perhaps you've also wondered what it means. According to Wikipedia, it's nonsensical, improper Latin that roughly follows the first century text by Cicero, *De Finibus Bonorum et Malorum*, but with words randomly altered, added, and removed to form dummy text. It's intended to help the reader focus on the style and format rather than the content; and although it has been used by type setters for centuries, its popularity has really climbed in the last half-century due to the graphic and word processing templates of the internet age. Side note: In 2014, this filler text was accidentally published in a Singapore newspaper.

And if you haven't fallen asleep by now, you're too easily entertained.

The phrase 'Lorem Ipsum' came up in immature conversation the other day with a good, goofy friend of mine. We began thinking of more meaningful and worthwhile uses for 'Lorem Ipsum.' Here are a few of our ideas you're welcome to borrow:

- Editorial filler, if you happen to edit and prepare editors messages for a periodical.
- Elegant name for your next daughter.
- Name for your next pet or chia pet.
- Hair product brand – 'beautiful, colorful…Lorem Ipsum'.
- An ineffective pick-up line.
- Listed qualification on your resume.
- Empty appendix of a technical document.
- Off-menu request at a Chinese restaurant.
- Campaign slogan.
- Name for a sappy Hallmark movie.
- Distracting bumper sticker.
- Confusing COVID-19 face mask style.
- Useful phrase for pretending Italian fluency.
- Name for a prestigious literary award.

I hope at least one of these ideas gives you an avenue for incorporating some meaningless Latin into your life. DN

Breathing Easy at Work

Take a deep breath and see if you can hold it until you complete the quiz.

1. **The best way to eliminate workplace breathing hazards is by?**
   A. Engineering controls.
   B. Hazard assessments.
   C. Issuing respirators.
   D. Fit testing.

2. **Workers will need to wear a respirator when?**
   A. The air is to hot.
   B. Working in a confined space.
   C. Dumping the debris tank.
   D. Hazardous contaminates can't be vented outside.

3. **One of the ways workers can be exposed to hazardous substances is?**
   A. Driving.
   B. Inhalation.
   C. Wearing a respirator.
   D. Using the restroom after _____.

4. **You must be trained in the use and limitations of respirators, medically evaluated and?**
   A. Pass the exam.
   B. Have enough CEUs.
   C. Fit tested.
   D. Clean-shaven.

5. **Workers that wear eyeglasses or contacts are not permitted to use respirators.**
   A. True B. False

6. **Atmospheres are hazardous if contaminates are above the _____, Permissible Exposure Limit (PEL), Short Term Exposure Limit (STEL) or Time weighted Average (TWA).**
   A. PPE C. TRC
   B. IDLH D. MRT

7. **The most common cause of an air leak while wearing a respirator is?**
   A. Cracks in the seal.
   B. Weight loss.
   C. Swelling in the face.
   D. Facial hair.

8. **What are signs your respirator might not be operating correctly?**
   A. Coughing.
   B. Shortness of breath.
   C. Chemical smell.
   D. All the above.

9. **Wastewater workers are highly exposed to COVID-19 in sewage.**
   A. True. B. False

10. **Were you able to hold your breath long enough to complete the quiz?**
    A. Yes, my nickname is Iron Lungs.
    B. I forgot that part.
    C. No way, gave up after #1.
    D. Who comes up with these questions?

ANSWERS:

1-A, 2-D, 3-B, 4-C, 5-A/T, 6-B, 7-D, 8-D, 9-B/F, 10-All

Submitted by the
WEAU Collection Committee.

WEAU Collections College Tentative Fall 2020 Class Schedule

When
Weekly beginning August 12, 2020 through November 4, 2020.
Class is held from 12:30 pm to 3:30 pm.

Tickets
FREE
RSVP to Lonn Rasmussen

Directions
Cottonwood Improvement District
8620 South Highland Drive
Sandy, UT 84093

Read the Sacramento, Ken Kerri manuals titled *Operation and Maintenance of Wastewater Collection Systems*, 7th or 8th Edition, Volume 1 & 7th Edition Volume 2. The manuals can be purchased at *www.owp.csus.edu/courses/wastewater.php*. Do the chapter tests as you read, for example by August 20 class; you should have read chapters 1 & 2 and have finished the test.

Along with the chapter test you will get two sets of math sheets each week, the B (beginning) math series is for people just starting out. The A (advanced) math is for people who have taken and passed a test before and need training for a higher test.

Tentative Class Schedule

Date	Chapter	Tests
August 12		Math Review Packet
August 20 (Thursday)	1 & 2	Ch. 1 & 2 B Math 1, A Math 2
August 26	3 & 11	Ch. 3 & 11 B Math 2, A Math 4
September 2	4	Ch.4 & B Math 4, A Math 5
September 9	5 & 6	Ch. 5 & 6, B Math 5, A Math 6
September 16	8	Ch. 8, B Math 6, A Math 7
September 23	9	Ch. 9, B Math 7, A Math 8 **Turn in test application to DEQ**
September 30		**Fall Break No Class**
October 7		**WEFTEC Break, No Class**
October 14	10	Ch. 10, B Math 8, Mini Review
October 22 (Thursday)	12	Ch. 12, Adv. Practice problems
October 28	13 & 14	Ch.13 & 14, 100 question test
November 4		Last minute review
November 5 (Thursday)		Test, Good Luck

There is no cost for the class, but a contribution of a ream of paper per student is appreciated. It will be given back as handouts.

Taking this class does not guarantee you will pass. The more you study outside of class, the better the chances are of passing.

Call Lonn Rasmussen at 801-943-7671 with questions and to sign up. DN

A Bear of a Quiz

Test Your Knowledge on: Nitrogen Removal

1. **Ammonium is ____.**
   A. NH_3
   B. NH_3^+
   C. NH_4
   D. NH_4^+

2. **The percentage of Nitrogen in Ammonia is ____.**
   A. 66.6%
   B. 77.6%
   C. 82.2%
   D. 100%

3. **Ammonium is Ammonia that has been _____.**
   A. Hydrolyzed
   B. Ionized
   C. Solubilized
   D. Un-ionized

4. **Ammonia Oxidizing Bacteria (AOB) consume _____ mg/L Alkalinity.**
   A. 0.00
   B. 2.86
   C. 3.85
   D. 7.14

5. **Nitrite Oxidizing Bacteria (NOB) consume _____ mg/L Alkalinity.**
   A. 0.00
   B. 2.86
   C. 3.85
   D. 7.14

6. **Typical percent of TKN that is non-biodegradable.**
   A. 0.0 – 5.0%
   B. 5.0 – 10.0 %
   C. 10.0 – 15.0%
   D. 15.0 – 20.0%

7. **One mg/L of Nitrate is equivalent to ____ of oxygen.**
   A. 1.98 mg/L
   B. 2.86 mg/L
   C. 3.00 mg/L
   D. 3.21mg/L

8. **The ORP range (silver-silver chloride) for Denitrification is _____.**
   A. +150 to +250 mV
   B. +50 to- +150 mV
   C. +50 to -50 mV
   D. -50 to -150 mV

9. **The most effective carbon source for Denitrification is _____.**
   A. Cellular carbon
   B. COD
   C. CBOD
   D. Methanol

10. **A simple pre-denitrification process is known as _____.**
    A. AS
    B. MLE
    C. SBR
    D. SCR

ANSWERS:
1-D, 2-C, 3-B, 4-D, 5-A, 6-C, 7-B, 8-C, 9-D, 10-B

WEAU Mid-Year Conference Cancellation

COVID-19 has continued to put a strain on our lives in our communities, state, nation, and the world. We recognize the benefits of gathering together as associates in the water industry, as well as the need to help our members obtain CEUs for certifications and licenses. However, after much discussion as a board, we regret that we will have to cancel our 2020 mid-year conference due to a wide variety of circumstances, restrictions, and unknowns. Many such restrictions and unknowns function at both a local and state level, and we are doing our part to be fluid in these changes that are ever-present in our lives.

With the cancellation of our Mid-Year Conference, we want to thank you for your understanding and patience as we adapt to these circumstances. As we each do our part to slow the spread of Coronavirus, we appreciate the sacrifices you all make in your different roles in the communities you serve. Despite the unknowns of the future, we know that with our joint efforts we will overcome these challenging times.

Based on discussions with our WEAU leadership and observing what WEF and other member associations are doing, we will be working with our committees to push forward with online training over the coming months. We have chosen to use GoToWebinars as our online webinar service to help us in our efforts to provide classes and trainings for certification and licensing CEUs. We anticipate these webinars will start in August or September and will initially include presentations from speakers who were slated to present at the 2020 Annual Conference. If you are willing to present in some of the webinar trainings, please contact our technical service director, Marianka Sochanska at *msochanska@brwncald.com*.

View the complete announcement here: *https://weau.org/announcements.php?id=80*

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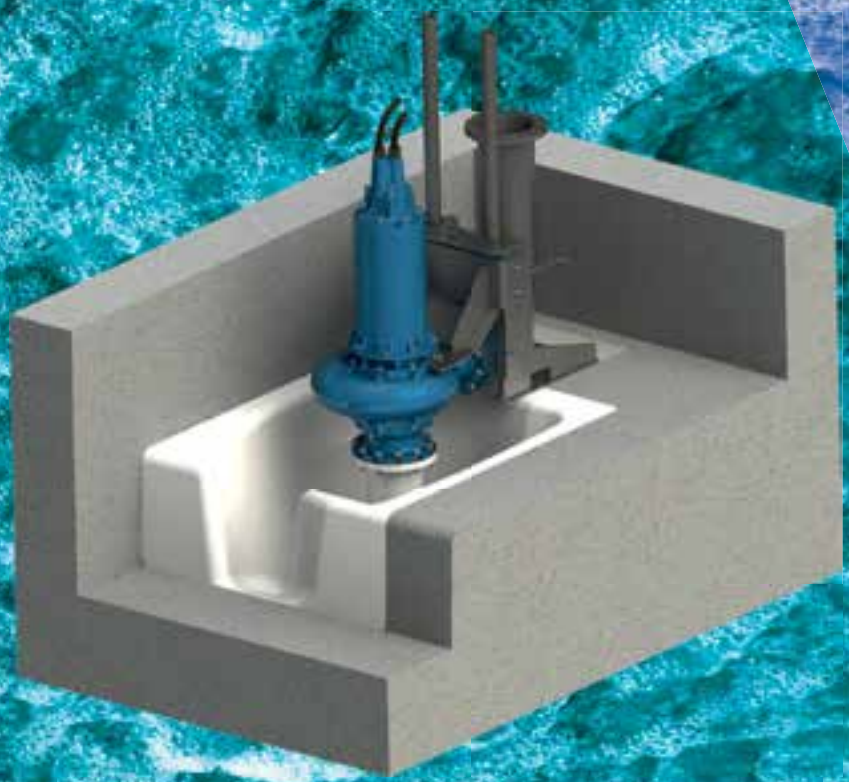

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AWIA COMPLIANCE

Risk and Resilience: What You Need to Know and Where to Find Resources

Passed in 2018, *America's Water Infrastructure Act* (AWIA) requires community water systems to file a 'risk and resilience' assessment with the EPA. Within six months of the assessment, water systems must develop an emergency response plan. Links to the process, certification requirements, and resources can be found at *www.epa.gov/waterresilience/americas-water-infrastructure-act-risk-assessments-and-emergency-response-plans.*

Who Must File a Risk and Resilience Assessment?

Any community water system that serves more than 3,300 persons is required to file an assessment and emergency response plan. While a community water system is defined as any drinking water utility that consistently serves at least 25 people or has 15 service connections year-round, only those serving 3,300 people are impacted by this requirement.

When Do I Need to File?

The due dates for both the assessments and the plan are dependent upon the size of your service population.

Service Population	Risk and Resilience Assessment	Emergency Response Plan
≥ 100,000 people	March 31, 2020	September 30, 2020
Serving ≥ 50,000 and ≤ 99,999	December 31, 2020	June 30, 2021
Serving ≥ 3,301 and ≤ 49,999	June 30, 2021	December 30, 2021

Continuing Requirements

Every five years, your utility must review your risk and resilience assessment and adjust if needed. You then must recertify your assessment with the EPA. Within six months of recertification of your risk and resilience assessment, you must review your emergency response plan and revise if necessary.

Is There a Form or a Standard I Must Follow?

The short answer is no. Your utility's assessment and plan must meet all the criteria in AWIA Section 2013(a) and (b), but the AWIA does not require that you use any particular standard, tool or method for conducting your assessment or developing your plan. Please be aware that your risk assessment and emergency response plan need to include assessments accidental emergencies (chemical leaks, equipment malfunctions), natural disasters, and changing conditions (flooding or drought from climate change, for example), as well as malevolent acts of sabotage, both on your physical assets and your cyber-control systems.

The lack of a hard and fast standard recognizes the need for these assessments and plans to be flexible and tailored to each utility's needs. However, there are some guidance documents that can act as a road map to the development of these documents. The AWWA has developed *J100-10 Risk and Resilience Management of Water and Wastewater Systems* to guide utilities in their assessments, available for purchase here: *www.awwa.org/store/product-details/productid/21625.*

Establishing Priorities, Determining Strategies, and Finding Funding Sources

The EPA's *Resilient Strategies Guide* will help you identify possible priorities to evaluate and strategies to fortify your assets based on your utility type (it includes wastewater/stormwater as options, in addition to drinking water), your utility size, and state. The Launch Guide button is at *www.epa.gov/crwu/resilient-strategies-guide-water-utilities#*, which will take you to the guide launch page at *www.epa.gov/crwu/resilient-strategies-guide-water-utilities#/utility-information?utilityname=&region=101&utilitytype=4&utilitysize=1315.*

Malevolent Acts: A New Concern

The risk for terrorism and potential sabotage must be taken seriously. The EPA has designed a guide to assist in this aspect of risk assessment and plan development, entitled *Baseline Information on Malevolent Acts for Community Water Systems.* This guide provides step-by-step assessments for different utility types and threats. The link to the EPA's site is *www.epa.gov/waterriskassessment/baseline-information-malevolent-acts-community-water-systems,* which includes the link to the document PDF at *www.epa.gov/sites/production/files/2019-07/documents/baseline_information_malevolent_acts_508_072519.pdf.*

Risk Assessment for Extreme Weather

If extreme weather is a major risk for your utility, there is an assessment tool that will help you project current and long-term conditions. CREAT has interactive maps to help evaluate your area and integrates with the resilient strategies guide at *www.epa.gov/crwu/creat-risk-assessment-application-water-utilities.* This resource also helps identify strategies and, in some cases, funding sources for implementation.

Don't Forget Chemical Safety

One of the asset categories identified is 'the use, storage or handling of chemicals.' The example cites chlorine as a chemical of concern for uncontrolled release. Maintaining a chlorine residual is key to the safety of your water, and maintaining safe chlorine handling practices is also critical to the safety of your employees and surrounding populations.

Your Communities Depend on You

You know your water is literally the life-giver to your community. The economic and physical health of your communities are only as stable as the water source you provide. Thorough risk assessment and emergency planning is critical to maintaining your utility and the welfare of your community.

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Two WEAU Members Receive Calvin K. Sudweeks Award

Each year, the Utah Water Quality Board considers recommendations for presentation of the Sudweeks Award. The individuals are recognized for contributions to Water Quality using the following criteria: The recipient has shown leadership and achievement in the field of water pollution control and/or water quality improvement in the State of Utah. These achievements have been through their employment, through work with volunteer organizations, or as a private citizen. The achievements may have been exhibited at the local, state, or national level. The recipient has shown qualities of professionalism, personal integrity, and dedication to the goals and principles of improved water quality in the State of Utah. The following outstanding members of the wastewater community were nominated for their work.

Sharon Burton

It is with great pleasure that I nominate Sharon Burton for consideration for the 2020 Calvin K. Sudweeks Award. In addition to performing her job here at Central Valley Water Reclamation Facility (CVWRF) at an exemplary level, Sharon demonstrates an extraordinary commitment to the field of water pollution control in the State of Utah.

At CVWRF, Sharon has been an Operations Supervisor since 2008 and has served as the Training Supervisor with the responsibility for training all our plant operators over the past 12 years. She was recently promoted to the newly created position of Operations Manager for the Biological Nutrient Removal (BNR) Process that is currently under construction. In this new role, she is responsible for developing a highly trained Process Operations Group within our Operation Department specifically dedicated to starting-up and controlling the operation of the new mainstream BNR process and the side-stream treatment processes for phosphorus and nitrogen removal.

In addition to developing CVWRF's operational program and staff, Sharon has trained many wastewater operators at other facilities across the state. She has been highly involved in leadership of the Water Environment Association of Utah (WEAU). I believe her work experience and significant volunteer activities (much of which has been after work hours on her own personal time) show her enthusiasm, passion and dedication to the goals and principles of improving water quality in the State of Utah as outlined in the criteria for the Sudweeks Award.

Some of Sharon's contributions include the following:

- CVWRF Training Supervisor, 2008 to 2019. In this role Sharon created the training course outline and materials, then conducted in-house training and statewide WEAU certification preparation classes open to all operators in the state. These courses were 8 to 12 weeks in length; and she taught twice per year. Topics included basic and advanced wastewater treatment, as well as mathematics.

  CVWRF management has received many compliments from our staff and people around the state who loved Sharon's training. A comment from one of our staff (which is typical of many others) reads: "She always gives so much to others in helping them grow, develop, or just succeed in whatever capacity they are in. I know many people and I personally am a recipient of her strong leadership and character as she sacrifices for others (myself included) in catching the vision of improving the environment by cleaning the water. Yes, even one operator at a time." These are the types of comments that we receive about Sharon. She is enthusiastic and passionate about what she does, not only on a personal level, but also by instilling those same qualities in those around her.
- Sharon has held the following leadership positions within WEAU:
  - 2000-2001 – PWO Representative
  - 2003-2005 – Board Director
  - 2005-2006 – Vice President
  - 2006-2007 – President Elect
  - 2007-2008 – President
  - 2008-2009 – Past President
- Sharon has received the following awards from WEAU:
  - 1999 – Outstanding Treatment Plant Operator (over 5 mgd)
  - 2002 – Select Society of Sanitary Sludge Shovelers (5S)
  - 2009 – Arthur Sydney Bedel Award
  - 2011 – Outstanding Supervisor
  - 2013 – William D. Hatfield Award
- Sharon has been a member of CVWRF's Operations Challenge Team (2002 and 2003) and has served for many years as a competition judge. She has competed and judged both at the local WEAU annual conference and at the national WEFTEC competition. Her significant involvement with the operations challenge event has helped raise the prominence of the event both locally and nationally which has directly led to the involvement and training of many new operators.

Through the professional and volunteer activities outlined above, Sharon has made a significant difference in the training and level of professionalism throughout the wastewater operator community in Utah. This directly translates to substantial improvements in how wastewater treatment facilities are operated which has improved water quality for all of Utah. For these reasons I believe Sharon is highly deserving of the Calvin K. Sudweeks Award.

Sincerely,
Phillip Heck, Ph.D., P.E.
General Manager

> Lonn is Operations Supervisor and has been employed at the district since 1983. He works tirelessly to improve the knowledge and working environment of wastewater collection operators.

Lonn Rasmussen

Please accept a nomination of Lonn Rasmussen from Cottonwood Improvement District for the Calvin K. Sudweeks water quality award.

Lonn is Operations Supervisor and has been employed at the district since 1983. He works tirelessly to improve the knowledge and working environment of wastewater collection operators. He semi-annually conducted 'Collections Colleges' that are 13 weeks of collection subject matter reviews with sample questions, math worksheets, and guided self-study, to help operators work through reference materials in preparation for wastewater certification exams or continuing education credit. He also volunteered with the Association of Boards of Certification's (ABC) exam development and review committees to regularly reassess and improve the certification exams for collection operators throughout the US, Canada, and other parts of the world who use the standardized exams through ABC. He is also the first person in Utah to qualify for and receive ABC's Professional Operator credential by demonstrating through education, experience, and examination that he meets that standard of excellence. As well, Lonn volunteered on the Utah Wastewater Operator Certification Council from 2000 to 2005, and continues to occasionally help with proctoring certification exams when called upon.

Sincerely,
Judy Etherington
Wastewater Certification Program Coordinator

The Changing World of Pretreatment

By Rick Allen, CEO and Founder of BioLynceus

Why your municipality should complete a pretreatment survey?

During my research for my new class *The Changing World of Pretreatment*, I ran across new and inventive ways to use THC and CBD products. In Denver, Ganja Yoga encourages the two relaxation methods in one class. While teaching at the Tri-State Water conference in Las Vegas in August, I was fortunate enough to visit with another instructor who said one of her adult children was recommending that she attend a Ganja Yoga class in the Bay Area.

The Ultimate Relaxation? A Potential Problem for Water Processing?

With the growing market for THC and CBD products, perhaps Ganja Yoga should be on your pretreatment survey list to visit. Why should you complete a pretreatment survey? The reasons are many. How is the material prepared? Is it prepared onsite through edible products? If so, what are they doing with the waste? What products are being used to disinfect food preparation surfaces?

In Colorado, it is now legal to add CBD or THC to your burrito from a mobile food truck. Mobile food trucks are a big enough issue just from the fats, oils, and grease (FOG), but now we have other potential issues. In California, there do not appear to be any regulations around what they call 'cottage industries'. These are people who prepare food in their house for distribution. Due to the opportunities to enhance food with THC or CBD, maybe this rule should be revisited.

In Washington state, I stopped at a roadside drive-through coffee shop. I asked to have my mocha latte made with coconut milk. They did not have coconut milk, but they did have soy, almond, and CBD oil as an alternate milk.

It is unclear how these products will ultimately affect your wastewater streams.

Learning from the Past

On the other side of the issue are manufacturers such as beer, seltzer water, and food manufacturers (for both humans and animals), just to name a few, that are creating edible products. Hopefully, these companies are already being checked because of your grease or pretreatment ordinances. By the way, grease (FOG) and pretreatment ordinances are no longer optional.

Every business new and old in your community should be on your list of annual pretreatment surveys. You just never know what is coming next. Maybe a beauty shop that offers THC brownies with every haircut, which would definitely be a way to relax a client while doing their hair. There's no telling which new trend could jumpstart a whole industry.

CBD and THC Products in Wastewater

What are the issues with CBD and THC products in the wastewater industry? On the growing side of the business, are they hydroponic, green house, or agricultural (farming)? Many of the issues with growing are related to fertilizers, pesticides, and herbicides. Most states (except for California) do not have any regulations concerning the use of these chemicals, because the federal government considers it illegal to grow cannabis and hemp.

Therefore, a lot of growing products do not have recommendations for use on their labels for either cannabis or hemp, meaning they can end up in your wastewater or groundwater if not regulated. According to recent conversations in parts of California, they have at least prohibited the use of floor drains in green house operations. This is an effort to stop contaminates from being flushed into the sewer system.

Other contaminates that could show up in your system from either growing or producing consumable products from these two plants are hydrocarbons, ethanol, propane, butane, phenols, acetone, discarded or failed edible products, oils, wax, and ancillary manufacturing waste.

Planning for the Future

There are many other issues on the horizon in the world of wastewater, some of which include breweries, distilleries, truck and car washes. It's an ever-growing list. The ultimate question is "What's next?"

Your city pretreatment ordinances need to be reviewed to ensure they cover the option for special assessments or surcharges for all these entities based on loading of contaminates. If needed, your ordinances should be revised. Excessive loading from any commercial or industrial user will cost you money, so it is always easier to have it covered before you need it. DN

The staff of BioLynceus

Teamwork

Enables Homeowner's Association to **Protect Delicate Waterway**

By Chris French

Managing two adjacent wastewater treatment plants both nearing the end of their days can be a tall order at the best of times. Yet, when they discharge into one of the most diverse and sensitive waterways in the world, home to more species of fish than many rivers in North America, some might be deterred by the sizeable challenge.

The need to meet increasingly tight restrictions, particularly on phosphorus levels, is daunting enough. Add to that, a site so awkward that it looked like helicopters might be needed to deliver new equipment and the task seems downright impossible. Undeterred, the Lockerbie Homeowner's Association in Mountain Brook, Birmingham, Alabama (AL), decided to invest in and take responsibility for a brand-new treatment plant.

The Association consulted Living Water Services (Living Water). One option put forward by the state-wide wastewater company was to create a new lift station where effluent could be pumped to the Jefferson County Sewer. Thanks to the connections it has made through owning, managing, or serving 58 wastewater facilities through AL, Living Water was able to consult key contacts, such as Krebs Engineering (Krebs), for the best solution.

"The old plants just weren't designed for today's needs," said Tyler McKeller, Co-owner of Living Water. "Discharge levels were being met, but only by adding large volumes of chemicals, which all came with significant cost and labor. The first plant, which is around 30 years old, couldn't cope much longer, and the adjacent plant, some 22 years old, was basic at best. With discharge into a tributary of such a delicate waterway as the Cahaba River, the pressure was on to find a dependable, long-term, cost-effective solution."

There was no government funding or grants. The Lockerbie Homeowner's Association expected its new wastewater treatment plant to meet all requirements

"People paying for such an important service out of their own pockets understandably want it to be right," Gary Huffman, President of Krebs, explained. "They don't want to have to constantly worry about the day-to-day operation or not meeting their permit. They want complete peace of mind."

He added: "We were all concerned about the existing systems, how we could bring about a smooth-running, long-lasting treatment plant, and how we could get round the severe constraints of such a small and awkward location. The old systems did not have the capability to remove phosphorus without additives, so Tyler and Krebs realized the more the treatment plant could achieve biologically, the less chemically dependent it would be. We both knew restrictions on discharge would become increasingly tighter in the future."

Eshelman's Ed Moore came in to assess the requirements and the logistics of a new package plant for Lockerbie. "Ed is a good listener and knowledgeable," said McKeller. "He knows how to meet needs and pull things together." Uniting the expertise of Krebs Engineering (founded in 1926), The Eshelman Company (founded in 1927), and Lakeside (founded in 1928), meant there was no shortage of company experience to find the best possible solution.

"Considering the age of the plants," said Moore, "Living Water Services was doing a tremendous job in meeting permit requirements, especially in AL's hot summers. We knew well to safeguard the environment and bring about the upgrade at the complicated location, we'd all have to work closely together. As Gary Huffman rightly said, expectation from the Homeowner's Association was high. Naturally, they had their concerns and wanted to ensure the investment in the new plant would provide the right protection for the Cahaba River,

an important asset to the states of Birmingham and AL. So, at an early stage we spoke to Lakeside to see what they could offer and how the new equipment could be installed."

A compact design that would work for the treatment plant's small footprint was essential, so Lakeside, through Jim Aitkenhead, Regional Sales Manager, proposed a continuous-feed sequencing batch reactor (CSBR). Designed as a cost-effective solution for biological treatment processes, the fully automated CSBR treats raw wastewater flow in a single basin, using timed based phases to fill, mix, aerate, settle, and decant waste sludge. Compared to a conventional Sequencing Batch Reactor, the CSBR system allows raw wastewater to continuously flow into the reactor basin during the treatment cycles, including during the settling and decanting phase. A baffle wall prevents short-circuiting as the flow travels from the reactor's pre-react zone. It also equally distributes the flow into the main react zone, where aeration, settling, and decanting occur. The process produces clear effluent without foam or floating scum.

"I knew of Lakeside's solid reputation from other treatment plants, but to be honest, I wasn't sure how the system could handle the phosphorous biologically, especially without us having to continue to use lots of chemicals." McKeller added, " On top of the man-hours to go to site, the cost from April through to October had risen to around $1500 per month."

With Living Water, Krebs, and Eshelman all based within 10 to 15 minutes of the Lockerbie plant, logistics would be much simpler than for many upgrades. Nevertheless, the close-knit team had to keep one plant online during the upgrade and work out how best to get the new CSBR to the site.

"First, the older of the plants was shut down," said Huffman."Working with Livingston-based Goldman Contracting, we extended the existing slab so we could repurpose an existing tank to store sludge. We didn't have any other choice."

Bringing in a crane truck would have been easy but there was no access to the eight-lane highway less than 100 yards to the east of the treatment plant, leaving a small, winding gravel road.

"The best way to describe the location of the plant is it is 50-feet down a hole!" Moore explained, "Setting down an air conditioner is one thing, but a 20,000 lb. steel fabrication is something else. For the first time in my career I even inquired about using a helicopter, but the quote I received would have taken us over budget."

Thad Goldman (Goldman Contracting) and Lakeside worked together to have the CSBR designed and manufactured in two parts. It was delivered by an 18-wheeler, which reversed down a small winding gravel road, performing a 180-degree switchback, swinging the equipment out over the existing embankment and lowering it precisely in to place – twice.

"The local company CraneWorks of Birmingham did a fantastic job," added McKeller, "I'm still amazed at how they got the plant in!"

To assemble the CSBR, a navy-certified welder arrived from Austal, a Mobile, AL-based shipbuilding company. "We're a close community of companies," Huffman stated. "We needed to show the Lockerbie Homeowners Association their investment in equipment designed for 25-plus years of reliable, low-maintenance operation was money well spent."

The new plant has now been operating since January 2020. Early discrepancies with the site's power supply were resolved quickly. McKeller commented: "As with all new equipment it can take a little while to get used to. We needed to find the best way of understanding the control system, but since, from an operator's point of view, we haven't had a single issue"

The plant now produces immaculate water. "We're now getting Total Suspended Solids between just 1 or 2. As for our 0.3 mg per litre limit on phosphorus, we're typically getting 0.1." Mckeller adds, "You just wouldn't expect to see those results out of a non-filtered plant. This is phenomenal compared to before."

With the Cahaba River regarded as a natural preserve, the new largely unmanned Lockerbie plant is under the jurisdiction of the Alabama Department of Environmental Management and has already been visited by the Environmental Protection Agency.

"They were impressed with the outstanding water quality," McKeller said. "The discharge point here is not forgiving so we have to be right on top of the operation. But now we have the new treatment system and our great monitoring system, we have every confidence in it."

Permit requirements are now comfortably met and the customer is saving around $7,000 pa in chemical savings. The unofficial partnership of like-minded AL companies is confident about the future wellbeing of the Lockerbie wastewater facility.

"The Lakeside team takes huge pride in the longevity and quality of their equipment," said Ed Moore from Eshelman. "We know in the future, regardless of the age of a system, they keep exceptional records and documentation, and we can get parts. I know for sure they will always help us find a way to keep everything shipshape."

McKeller concluded: "When Jim Aitkenhead at Lakeside said their CSBR could make such an impact on the phosphorous biologically, I thought I'd need to see it to believe it. Well, he was right." DN

DARE TO COMPARE:

Municipalities choose aftermarket parts suppliers over OEM

By Wendy Jamison, Vice President of Sales & Marketing at ABBA Parts

The chain of events is easy to predict. In municipalities – from diverse economic powerhouses to quaint rural villages – centrifugal pumps provide a wide range of services. They are always behind the scenes, but in the forefront of city planner and manager budgets. With pumps in service constantly, their life cycle counts down to the inevitable need to repair components or replace the pump entirely.

But when the inevitable strikes, it doesn't happen in a vacuum. With recent declines in revenue, Municipalities all over North America are being challenged to do more with smaller budgets. Balancing the competing realities of engineering and economics is no easy task, and it's made more difficult by the often-limited resources and choices managers have to work with. However, more and more, municipalities are turning to a new solution that provides quality components within their maintenance budgets. The solution is not necessarily new either, but a new mind-set is helping budget-conscious pump users make better use of their resources.

The Origins of the Budget Crunch

For years Original Equipment Manufacturers (OEMs) have charged top dollar for replacement parts, because end-users perceive a lack of options when selecting new parts. In addition to charging a premium, OEMs' long lead times have stretched municipalities to the breaking point. Many municipalities have been told to open up their bid specs to accept bids from "the OEM or Equal." With the search expanding, between the OEM and an aftermarket parts solution specialist, who gives you the most bang for your buck? Unfortunately, many end-users still feel compelled to pay a premium through OEMs because of "penny-wise but pound foolish" experiences with pirated parts. Establishing reliability and trust with an aftermarket parts supplier is key to navigating this new marketplace.

Aftermarket Parts Solution Specialists

These companies are few and far between. Aftermarket parts solution specialists (APSS), are knowledgeable about centrifugal pumps, their design, their manufacturer, their application in the field, and their repair and maintenance. In addition, these companies are able to offer superior reverse engineering capabilities and design modifications/upgrades, which improve the functionality and/or performance of an OEM pump. APSS manufacture parts that meet and often exceed the OEM standards for quality and reliability. Working with an APSS will save you time and money as they usually price far lower than the original manufacturer, while delivering sooner. Several conditions can make working with an APSS the right option for your facility. If your facility maintenance managers have more than one brand of pump to look after, then it might save time and money to work with one APSS instead of multiple OEMs (who could require a premium expense in your budget) versus an APSS (who offers one-stop shopping and bulk savings). If you've ever wondered about casting alternative materials to make parts last longer, then an APSS would be the place to start.

When choosing an alternative material, one must consider both chemical compatibility and wear resistance. An APSS can help navigate the options and can offer cast parts in a variety of materials like: cast iron, bronze, stainless steel, and in a variety of grades to best suit your application. Typically these companies work with local foundries and can cast parts in a variety of materials quickly and easily, resulting in parts that are delivered faster and less expensive than the OEM.

How to Get Ahead with Aftermarket Parts

A good APSS will have the ability to manufacture individual replacement parts, assemblies, and drop-in replacement pumps to fit or retrofit a multitude of common water or sewage pump brands. The aftermarket parts solution specialists' credibility is inextricably linked with the quality of the product they produce. Look for an APSS who will guarantee their products will meet or exceed the OEM standards for fit, form, and function.

Finding the Right Partner For You

Partnering with an APSS with proven experience and a solid understanding of centrifugal pump design is critical. A qualified aftermarket parts solutions specialist may be what you need for a range of issues, from having problems with noise, vibration, poor performance, corrosion, erosion, cavitation, or extended downtime. Look for an APSS that can:

- Offer modernization of old or obsolete models with current design parts and assemblies.
- Offer alternate impeller design or redesign options to solve specific application and performance problems.
- Provide design upgrades and modifications to improve reliability.
- Extend the operating life of your pump installations.

For more information regarding ABBA Parts, visit *www.abbaparts.com*. DN

KKR and XPV Grow Water Quality Platform by Acquiring EDI

Acquisition Completes First Add-on to Strategic Platform that includes Nexom and EOSi

A global strategic platform established by KKR and XPV Water Partners to provide end-to-end nutrient management solutions has announced the acquisition of Environmental Dynamics International, Inc. (EDI), a leading global manufacturer of diffused aeration systems.

The addition accelerates the growth of the water quality platform's nutrient management offerings through Nexom, Inc. (Nexom) and Environmental Operating Solutions, Inc. (EOSi). EDI will integrate into Nexom, combining EDI's expertise in serving medium to large-scale treatment facilities – both in North America and internationally – with Nexom's expertise in serving small to medium-sized treatment facilities. Martin Hildebrand, CEO of Nexom, will lead the combined entities.

Founded in 1975 with its headquarters in Columbia, MO, EDI specializes in the research, development and application of advanced technology aeration, and biological treatment solutions for municipal and industrial wastewater. EDI's systems have been installed in over 7,000 facilities across 100 countries, benefiting more than an estimated 300 million people around the world.

"We are committed to scaling solutions to promote water quality and we look forward to collaborating with EDI's management team and dedicated employees to deliver our resources, ideas and capital to unlock additional growth. Our ambition is for this acquisition to be the first of many as we expand our platform by teaming up with leading entrepreneurs, technologies, and businesses across the sector," said Robert Antablin of KKR Global Impact and David Henderson of XPV Water Partners.

"Adding EDI to our platform is an incredible strategic fit. I look forward to working closely with the employees of EDI to grow the combined business," said Martin Hildebrand, CEO of Nexom.

Chuck Tharp, Founder of EDI, who will transition to an advisor role as part of the transaction, said: "In addition to being a great cultural fit for EDI, KKR and XPV's water quality platform brings significant resources, expertise and passion to fuel our collective growth."

For KKR, the investment is part of the Firm's global impact strategy, which focuses on identifying and investing behind companies whose core business models provide commercial solutions that contribute measurable progress toward one or more of the United Nations Sustainable Development Goals. By reducing pollution and improving water quality, KKR's platform is delivering measurable progress toward achieving the United Nations SDG #6 of ensuring the availability and sustainable management of clean water.

ABOUT KKR

KKR is a leading global investment firm that manages multiple alternative asset classes, including private equity, energy, infrastructure, real estate and credit, with strategic partners that manage hedge funds. KKR aims to generate attractive investment returns for its fund investors by following a patient and disciplined investment approach, employing world-class people, and driving growth and value creation with KKR portfolio companies. Visit *www.kkr.com* to learn more.

ABOUT XPV WATER PARTNERS

XPV Water Partners is comprised of experienced water entrepreneurs, operators, and investment professionals dedicated to making a difference in the water industry. XPV invests in and actively supports water-focused companies to enable them to grow and deliver value for all stakeholders. XPV manages over $400 million USD in investment capital from institutional investors in North America, Europe, and Asia. For more information, visit *www.xpvwaterpartners.com.*

ABOUT NEXOM

Based in Winnipeg, CAN, Nexom provides proven technologies that enable new and existing wastewater treatment plants to meet their nutrient reduction targets. Nexom has developed or acquired seven biological or filtration based technologies, all of which are used for wastewater nutrient removal. Nexom benefits from a strong portfolio of products with technical differentiation in certain use cases and a portfolio of references.

ABOUT EDI

Based in Columbia, MO, EDI specializes in the research, development and application of advanced technology aeration and biological treatment solutions for municipal and industrial wastewater. Founded in 1975, EDI is one of the leading manufacturers of diffuser aeration systems in the US and globally with over 7,000 installations across 100 countries.

ABOUT EOSI

Based in Bourne, MA, EOSi provides non-hazardous and environmentally sustainable glycerin-based chemicals (MicroC) and technical services for biological nutrient removal applications in wastewater systems. EOSi offers strong product quality, technical support and service levels to plant operators at large, urban wastewater utilities, and industrial clients. DN

Latest Learnings from the Water Action Platform

Assessing risk and determining responses to COVID-19 were major themes of the most recent Water Action Platform webinar, which took place on July 9. Here are six key learnings from the interactive event, which was hosted by Isle chairman Piers Clark.

1 Expect seasonal resurgence of COVID-19.

Recent research shows that we can expect resurgence of COVID-19 due to seasonal fluctuations. In an interview on the Water Action Platform webinar, hydrologist Fernando Miralles-Wilhelm, Chair and Professor at University of Maryland said research into the environmental conditions needed for virus outbreaks to "explode" showed the sweetspot for temperature was between 5-11 ºC and for relative humidity, between 40-70%. He also explained that this information is not yet included in predictive models.

Miralles-Wilhelm said, "We do expect resurgence of the virus. It's a seasonal virus like influenza. As we have very good ways to predict weather and climate we can expect to see a resurgence in November/early December in the northern hemisphere.

"If we are prepared and take the social distancing measures needed, we can minimise the impact. We have plenty of warning, there is no excuse for not being ready."

2 Wastewater detection can give early warning about COVID-19.

The potential for wastewater to act as an early-warning system for outbreaks of COVID-19 in communities is being demonstrated by Canadian technology company LuminUltra. Repeatedly testing everyone in a given population for COVID-19 may not be feasible, but identifying and quantifying the presence of SARS-CoV-2 in their collective wastewater can serve as an early warning system, alerting health authorities.

Patrick Whalen, chief executive, LuminUltra said, "The science is still evolving but what we know is that people not only infect others directly, but also through air and surfaces. There is potential for waste-water to act as early warning system, to determine the presence of asymptomatic carriers without having to run tests directly on people."

Responding to a government callout for technologies for diagnostic testing, LuminUltra contacted Public Health Canada and offered to help shore-up the supply chain for reagents.

The company has now produced 5 million quantitative polymerase chain reaction (qPCR) tests for Canada and is helping other countries.

3 Sewage-based epidemiology costs quantified.

Participants in the Water Action Platform have been keen to better understand the cost of implementing a sewage-based epidemiological system. A new research paper from collaboration between engineering consultancy Arup, KWR Research Institute in the Netherlands, and Exeter University in the UK outlines the tasks and costs associated with designing an early-warning system as cites two main expense elements.

The first is the initiation phase during which systems are set up, for which the costs are estimated at £200,000. Deployment costs then have to be factored in and for populations of 3-5 million that could run up to £1 million, depending on localised variables.

Spanish technology company GoAigua has developed a similar pricing model, which shows that costs vary depending on size and complexity of the utility and the number of samples, the cost of which ranges from US$30-50 dollars per unit.

4 Far-UVC light inactivates coronaviruses safely.

Recent research carried out in the US has shown that far-UVC light – wavelengths in the 207-222nm range – efficiently inactivates airborne human coronaviruses. It is well known that conventional germicidal UVC lamps, emitting 254nm wavelengths, can be used to disinfect unoccupied spaces such as empty hospital wards and train carriages, but direct exposure poses a health hazard to humans and cannot be used in occupied spaces.

The new study from Columbia University Irving Medical Center found that more than 99.9% of seasonal coronaviruses present in airborne droplets were killed when exposed to a particular wavelength of ultraviolet light that is safe to use around humans. Far-UVC light cannot penetrate the tear film on the surface of the eye or the outermost layer of skin so it cannot damage living cells in the human body.

"At these low dose rates," Clark said, "far-UVC exposure might well provide a method for reducing the virus in public locations. On its own this doesn't solve the pandemic, but it's definitely part of the solution."

> **An ongoing review of the available academic literature by analysts from Isle continues to conclude that the risk of contracting COVID-19 through exposure to sewage is very low.**

5 Very low risk of virus spreading through sewage.

An ongoing review of the available academic literature by analysts from Isle continues to conclude that the risk of contracting COVID-19 through exposure to sewage is very low. A recent paper on transmission in recreational waters in the journal Science of the Total Environment says that while wastewater is a potential dissemination route for SARS-CoV-2 to recreational waters, there is limited data on the presence and viability of the virus in water bodies.

Clark said, "More research is needed, but we hold to our previously stated conclusions that the risk of the virus spreading through sewage is very low."

6 Workplace diversity accelerated at innovation sprint.

A collaborative sprint on Improving Workplace Diversity in the Water Industry will take place as part of the Northumbrian Water Innovation Festival. The event, which facilitates sprints and challenges to help solve real-world water issues, was delivered digitally and internationally for the first time from September 14 to 17.

Isle is leading the diversity sprint, which will take place 24-hours-a-day, over all four days of the festival.

"We're going to look at how we can improve workplace diversity in the water sector and I'm delighted that a much wider group can get involved than ever before," Clark stated, "from anywhere around the world. We aim to highlight key issues, gather data and share best practice on a topic which very relevant, especially in light of the Black Lives Matter movement."

Participants will need to take part in two 45-minute Zoom calls timed to suit different time zones. The event will start in the Asia Pacific region, then pass to Europe, then the Americas and then back to Asia Pacific. To get involved, email *megan.ford@isleutilities.com*.

The Water Action Platform webinar is open to utilities, organisations and companies across the water sector and can be viewed at *www.wateractionplatform.com*. Register at *www.wateractionplatform.com/contact*. DN

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Understanding Polymer for Thickening and Dewatering Processes

By Heidi Bauer, CWP, P.E. and Yong Kim, Ph.D.
Reviewed by Ed Fritz, P.E. BCEE, James Hanson, P.E, David Oerke, P.E., BCEE

The first thing an operator needs to know about polymer is it becomes a **dangerous slipping hazard** when introduced to water. Extreme caution should be exercised whenever working or cleaning around polymer.

Polymer in solution is viscous (**Figure 1**), which means it is resistant to flowing. Because polymer solutions may be clear (no color), slippery areas are difficult to detect. Using absorbent material (such as cat litter) is the best way to clean polymer spills. Always consult the Safety Data Sheets (SDS) and the manufacturer's instructions on how to safely handle each type of polymer.

Polymer is used as a flocculant for solids separation processes. The aggregation of particles into larger and more removable forms by applying coagulants or flocculants is necessary for efficient separation by clarification, decanting, sedimentation, filtration, thickening, and dewatering processes.

The terms coagulant and flocculant are often used interchangeably but they are not the same (**Figure 2**). Coagulants neutralize the surface charge of particles, which allows them to create small clusters of particles, called flocs. Flocculants make large flocs by bridging the small particles or flocs together.

Polymers are effective as flocculants because they consist of long chains of molecules called monomers, which create bridges between solids particles (**Figure 3**). Polymers can have different charges, charge densities, and molecular weights. They also have a positive charge (a cationic) and a high molecular weight typically used for thickening and dewatering solids separation processes.

Figure 1. Polymer Solution is Very Viscous.1 Reprinted with permission from GEA Mechanical Equipment US, Inc.

Applying polymer prior to a thickening or dewatering process is also called conditioning. Conditioning with polymer is often a requirement for the thickening or dewatering equipment to successfully operate.

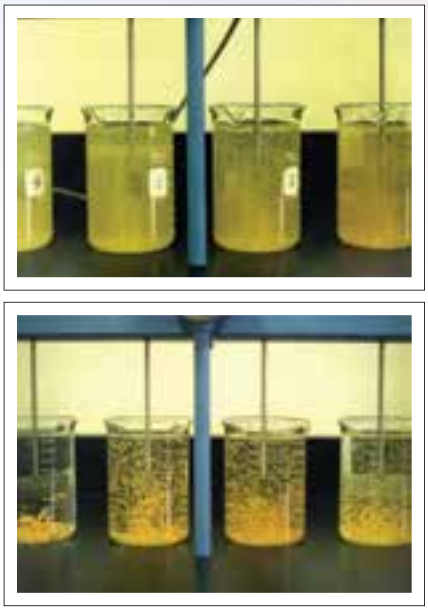

Figure 2. Coagulants (top) produce small flocs, and flocculants (bottom) bridge the small flocs together. Reprinted with permission from UGSI Chemical Feed Inc.

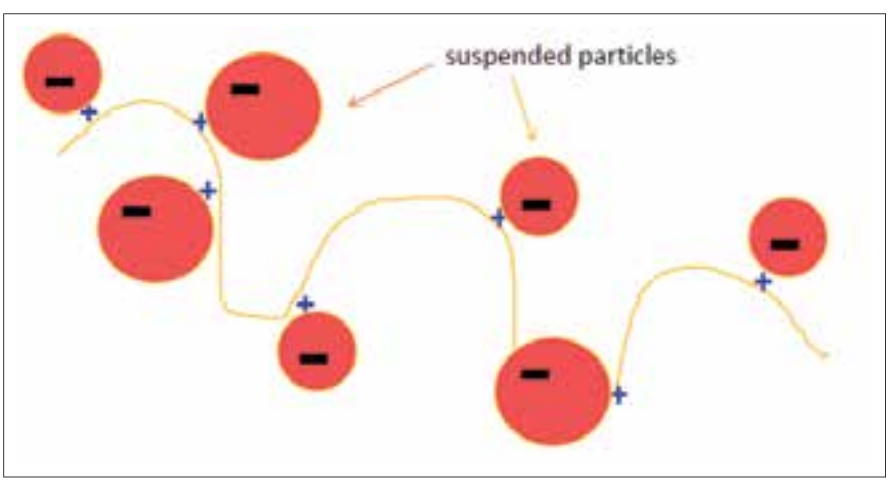

Figure 3. A Depiction of a floc formed by a cationic polymer chain bridging the solids particles. Reprinted with permission from UGSI Chemical Feed Inc.

Figure 4. Dry Powder. Reprinted with permission from GEA Mechanical Equipment US, Inc.

Figure 5. Emulsion Polymer.Reprinted with permission from GEA Mechanical Equipment US, Inc.

Figure 6. Mannich Polymer. Reprinted with permission from GEA Mechanical Equipment US, Inc.

POLYMER TYPE

Polymer is supplied in three different forms:

- Dry (Powder) Polymer (**Figure 4**)
  - Typically contains up to 90% active polymer. The remaining amount consists of residual water, buffers to control the solution pH, anti-caking additives to increase the shelf-life, anti-dusting agents, and small amounts of surfactants to facilitate the activation process.
  - Requires more time for complete dissolution and activation than emulsion polymers.
  - Can be delivered in 23 kg (50 lb) bags or 'Super Sacks' as large as 907 kg (2000 lb).
- Emulsion Polymer (**Figure 5**)
  - Consists of micron-sized polymer gels emulsified in 30% hydrocarbon oil.
  - Depending on the amount of water in the polymer gels, the active polymer ranges from 20% to 55%, with the most commonly used being 40%.
  - Can be delivered in 19 L (5 gal) pails, 208 L (55 gal) drums, 1022 L (270 gal) totes, or 11 400 to 18 900 L (3000 to 5000 gal) tanker loads.
- Mannich Polymer (**Figure 6**)
  - Typically custom blended for the specific application.
  - Has a low active polymer content of 4% to 6%. Is delivered in 11 400 to 18 900 L (3000 to 5000 gal) tanker loads, and the transportation costs are high unless the Mannich polymer production facility is located close to the water resource recovery facility (WRRF).

POLYMER ACTIVITY AND DOSAGES

The polymer delivered to a WRRF is called neat and may include water, oil, surfactants, and other ingredients in addition to active polymer. The active content is the portion reacts with the solids. The percentage of active content is what's being referred to when expressing a concentration of polymer. For example, a 1% polymer solution has 1 gram of active polymer per 100 grams of polymer solution.

Dry Polymer has the highest activity levels in its neat form, so it requires the smallest storage containers. This saves money in the cost to ship and needs the least space to store but requires more equipment and time to prepare (or activate). The active content should be considered when assessing appropriate polymer dosages for solids processing systems.

The best way to think of polymer dose for thickening and dewatering processes is in active pounds of polymer per dry ton of solids (active lb/dry ton). In international standard (SI) units, active kilograms of polymer per dry tonne of solids (active kg/dry tonne). See equations below for examples.

- If the desired polymer dose is 10 active lb/dry ton, the flow rate to a rotary drum thickener (Solids Flow Rate) is 350 gpm, the rotary drum thickener feed solids concentration (Solids Concentration) is 0.75%, and
- If the active content of neat polymer (Active Neat Polymer Concentration) is 40%, then, using the equation provided, the Polymer Solution Flow Rate is calculated to be 0.03 gpm, or 1.8 gph.
- Or, if the desired polymer solution (Active Polymer Solution Concentration) is 0.2%, then, using the equation provided, the Polymer Solution Flow Rate is calculated to be 6.6 gpm.

HANDLING AND STORAGE

Dry polymer is *hygroscopic* (moisture-attracting) and should be stored in a cool and dry area (neither above 40 °C [104 °F] nor humid). It has a shelf life of over three

A proper polymer dose for solids separation processes must relate the mass of the active polymer to the mass of the solids to which polymer is applied. The calculation of polymer dose is as follows:

$$\frac{Active\ lb\ polymer}{dry\ ton\ solids} = \frac{2000\left(\frac{lb}{ton}\right) * Polymer\ Flow\ Rate\ (gpm) * Active\ Polymer\ Concentration\ \left(\frac{\%}{100}\right)}{Solids\ Flow\ Rate\ (gpm) * Solids\ Concentration\ \left(\frac{\%}{100}\right)}$$

In international standard (SI) units:

$$\frac{Active\ kg\ polymer}{dry\ tonne\ solids} = \frac{1000\left(\frac{kg}{tonne}\right) * Polymer\ Flow\ Rate\ (L/m) * Active\ Polymer\ Concentration\ \left(\frac{\%}{100}\right)}{Solids\ Flow\ Rate\ (L/m) * Solids\ Concentration\ \left(\frac{\%}{100}\right)}$$

years if unopened and properly stored. Once a bag is opened, dry polymer can quickly clump and become unusable.

Emulsion polymer tends to *stratify* (separate oil from water in the polymer gels) during storage, so a drum/tote mixer or recirculation pump should be used before the neat polymer is fed to the activation equipment. Emulsion polymer should be stored at the temperature range of 5 °C to 30 °C (41 °F to 86 °F) and dry conditions, preferably inside a building. If properly stored, emulsion polymer has a shelf life of six months. Should freezing occur, the product should be allowed to thaw thoroughly in a warm area and mixed well before use.

Mannich polymer must be used within four weeks and should be kept away from both freezing and overly warm environments.

POLYMER MAKE-DOWN & ACTIVATION

Emulsion and dry polymer in their neat forms must be activated in a dilute solution before being applied to a solids stream for conditioning. Dilution water is mixed with neat polymer to produce this dilute solution in a 'make-down' process (or a makeup process).

Make-down refers to the initial application of dilution water to neat polymer. Dry polymers are typically diluted to 0.2% to 1% active solutions for activation, whereas the purpose of a surfactant provided in neat oil-based emulsion polymer is to facilitate activation of the polymer in an aqueous solution and is often recommended at 0.5%. Mannich polymers are delivered as activated compounds, so the only goal for its make-down process is to produce a dilute solution for injection.

Aging After Make-down

Often, additional time is desired or necessary after the make-down process to complete the activation process. Aging (or maturing) starts from the moment polymer solution is discharged out of the polymer make-down system. Sometimes, the detention time of the make-down solution in the polymer feed piping is sufficient to complete full activation prior to injection. Other systems require a separate aging tank (for example, with a 30-minute detention time) to achieve full activation. Aging tanks are typically required for dry polymer systems.

Post-dilution After Activation

The optimal polymer concentration for activation is often not dilute enough to be the optimal concentration at the injection point, so it is helpful to have an additional post-dilution stage after the make-down and/or aging stages. Optimal concentrations for polymer injection solution can range from 0.1% to 0.25%, regardless of type.

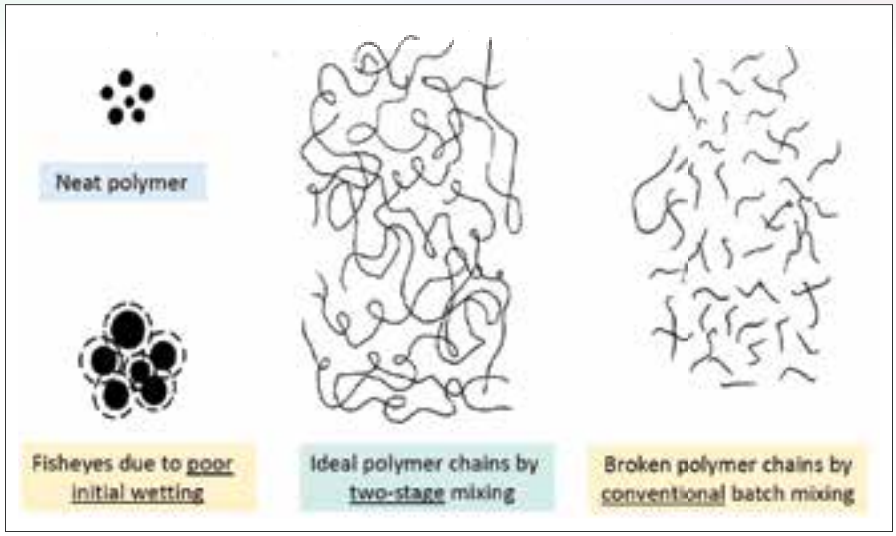

Figure 7. A Depiction of Ideal Polymer Chain Activation Versus Common Pitfalls.
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Care must be taken to avoid breaking polymer chains through excessive mixing once activated. Damaged polymer chains will result in an increased polymer dose.

Two-stage Mixing for Make-down

While polymers with higher molecular weights are more efficient in flocculation, they also present greater technical challenges in solution preparation than lower molecular weight polymers. The concept of two-stage mixing is well established in the polymer make-down process for dry and emulsion polymer (**Figure 7**).

- First Stage, or initial mixing: High energy mixing at the initial stage. Proper wetting (for dry polymer) and high energy mixing during this stage will prevent 'fisheye' formation, including the prevention of fisheyes that occur on a microscopic level.
- Second Stage: Low energy mixing to minimize damaging the polymer molecules as they 'uncoil' out of polymer gels/particles. Much longer residence time is required for the second stage than the first stage. Second stage mixing can occur in the same mixing chamber as the first stage.
- Care must be taken to avoid breaking polymer chains through excessive mixing once activated. Damaged polymer chains will result in an increased polymer dose.

Emulsion Make-down Equipment

Although there are numerous emulsion polymer make-down systems available in the market (**Figure 8**), they can be classified into two types which differ in how mixing energy is delivered for effective polymer activation, mechanical and non-mechanical.

An advantage of mechanical systems includes the ability to provide high mixing energy (ideal for first-stage mixing), regardless of the fluctuation of WRRF water pressure. However, they may require more maintenance than non-mechanical systems.

Non-mechanical (or hydraulic) systems are easy to operate with fewer moving parts than mechanical systems. However, they require a dilution water booster pump to maintain the consistent incoming water pressure (minimum of 414 kPa [60 psi]), which is the source of the applied mixing energy.

Some make-down systems are designed to include both mechanical and non-mechanical mixing.

Dry Polymer Make-Down Equipment
These (**Figure 9**) typically include a wetting system (including dry polymer feeders and a rapid fill water dispenser), an aging tank, and a day tank for feeding the activated solution. A full batch system minimizes the number of tanks. For example, a mixer could be programmed to provide both the initial high energy and the second-stage low energy mixing, and then the activated solution could be fed from this same tank. Other systems maintain separate tanks to optimize for each function.

INJECTION OF POLYMER SOLUTION

Because polymer solutions are so viscous, they are difficult to inject and disperse rapidly into the solids flow stream, especially if the concentration of the solids receiving the polymer solution is thick.

Different thickening and dewatering equipment units and applications require different polymer/sludge mixing mechanisms. Some equipment is designed with zones to accept the polymer solution and mix it with the sludge flow stream. Other equipment and applications perform better when the polymer solution is injected in the upstream piping of the thickening or dewatering unit.

There are many commercially available mixers with either static or mechanical mixing, so careful evaluation is required. Factors to consider are type of dewatering equipment, solids concentration, solids to polymer contact time, and polymer solution viscosity. For example, if solids contains higher than 4% solids, the static polymer-solids mixer may not be able to disperse polymer solution rapidly and uniformly into the solids. This can cause overdosing or under-dosing of polymer, leading to inefficient dewatering and wasted cost.

DILUTION WATER

The quality of dilution water has a tremendous effect on the efficiency of a polymer solution. Hardness, which represents a major portion of the ionic strength of dilution water, plays an important role in polymer activation. If hardness exceeds a certain level (such as 400 mg/L), it is strongly recommended to add a softening device to minimize the negative effect of hardness.

It is essential to reduce the chlorine level of dilution water to below 4 mg/L to avoid damaging the structure of polymer molecules. When reclaimed water is used for the creation of polymer solution, it must be evaluated. Chlorine, suspended solids, turbidity, and dissolved ions in reclaimed water react with polymer molecules and reduce the polymer's effectiveness.

There is an optimal temperature range for dilution water. A water heater is recommended for dilution water below 4 °C (39 °F). Dilution water over 38 °C (100 °F) may damage polymer chains.

Figure 8. One Example of a Mechanical (on the left) and a Hydraulic (on the right) Emulsion Polymer Make-Down Systems Available on the Market.

Figure 9. One Example of a Variety of Dry Polymer Make-Down Systems Available on the Market which Includes an Initial Wetting Device, Mix Tank and Post-Dilution.

	Dry Polymer	Emulsion Polymer	Mannich Polymer
Neat (as delivered)	90%	22 to 55% (commonly 40%)	4 to 6%
Activation Solution	0.2 to 1% (achieved by make-down process)	0.5% (achieved by make-down process)	Same as the neat solution because it is delivered as already activated compounds.
Injection (Feed) Solution	Recommended: 0.1 to 0.25%, achieved by post-dilution. However, can be the same as the activation concentration if post-dilution is not feasible.		Recommended: 0.1 to 0.25%, achieved by the make-down process. However, can often be 0.2 to 0.5% if the optimal concentration is not feasible.

Table 1. Common Ranges for Polymer Concentrations

SUMMARY

Polymers are excellent flocculants critical for use as a solids conditioner prior to thickening and dewatering equipment. A summary of common ranges for active polymer content (otherwise known as polymer concentration) is provided in **Table 1**. Optimal make-down and feed solution concentrations vary by the polymer product, type of injection system, and the concentration and other conditions of solids in the solids flow stream. Conducting polymer optimization trials is recommended to determine the best concentrations for an individual system.

The type of polymer (dry, emulsion, or Mannich) will dictate the necessary systems and equipment for storage, handling, polymer solution make-down, and polymer solution injection. Due to the high viscosity, pumps that feed neat, activated, or post-diluted polymer solutions are typically high viscosity diaphragm pump, gear pump, peristaltic, or progressive cavity pump.

Operators can save money on polymer by:

- Helping to select a cost-effective polymer product.
- Calculating and monitoring the polymer dose in terms of active lb/dry ton.
- Appropriately handling and storing polymer in accordance with the polymer type.
- Ensuring proper mixing energy and residence times for make-down and aging.
- Experimenting with polymer activation and injection concentrations to find the
- Optimal concentrations that minimize polymer dose.
- Measuring and monitoring hardness and other water quality parameters in the dilution water. DN

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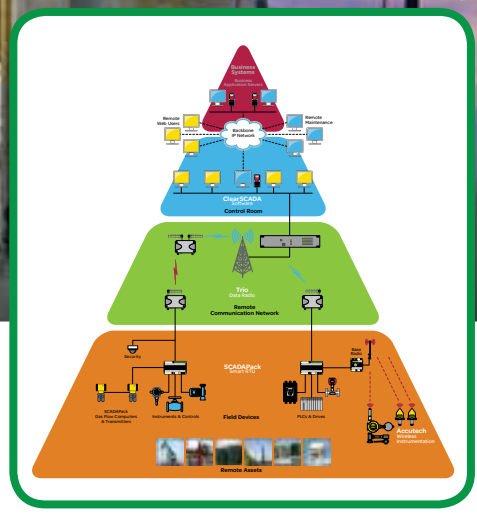

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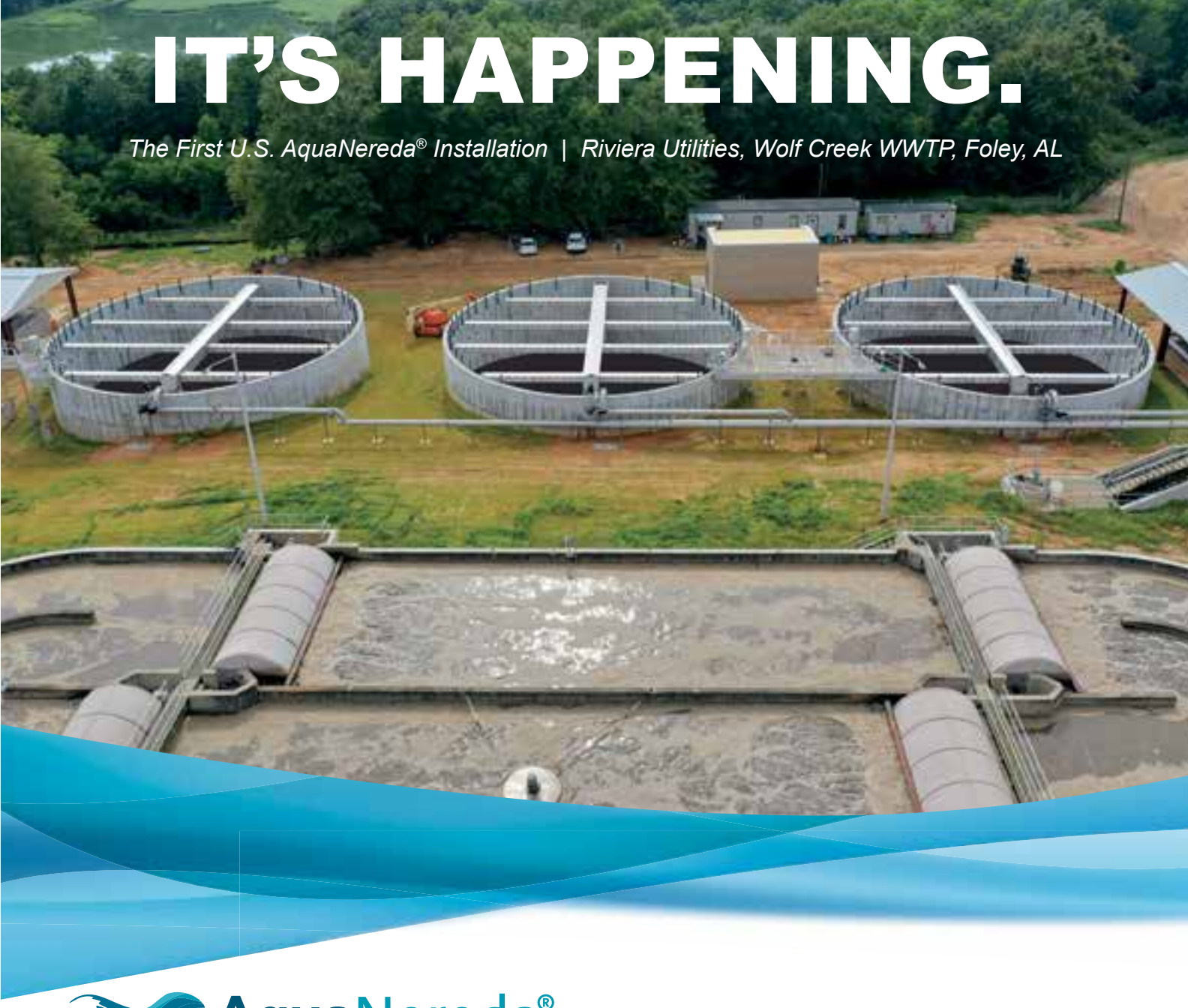

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