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The Wyoming Connection is the official publication of The Wyoming Association of Rural Water Systems. It is published quarterly for distribution to member systems, water and wastewater Operations Specialists, water related agencies and companies, legislators and government officials.

Graphic Design/Layout - Donna Uribe, WARWS

Articles, letters, and photos are welcome.

Submit to:

Wyoming Association of Rural Water Systems,
PO Box 1750, Glenrock WY 82637
"An equal opportunity provider"
(307) 436-8636 TDD 1-800-877-9965
e-mail: warws@warws.com
Web Site: <http://www.warws.com>

WARWS Staff

Office:

Mark Pepper, Executive Director
(307) 259-6903 markp@warws.com

Cori Wondercheck-Hill, Office Manager
coriw@warws.com

Donna Uribe, Administrative Coordinator
(307) 258-3414 warws@warws.com

Field:

Ross Jorgensen, USDA Registered Circuit Rider, UMC UFC
(307) 251-2803 rossj@warws.com

Johann Nield, Circuit Rider
(307) 751-1138 johannn@warws.com

Kathy Weinsaft, USEPA Training Specialist, UMC
(307) 262-3943 kweinsaft@warws.com

Mark Court, USDA Registered Wastewater Specialist, UMC
(307) 262-3974 mcourt@warws.com

Joe Dankelman, State Small Systems Circuit Rider, UMC
(307) 439-9065 joed@warws.com

Michelle Christopher, Source Water Specialist UMC UFC
259-8239 mchristopher@warws.com

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(307) 264-9762 roverson@grandtarghee.com

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The Association

Wyoming Association of Rural Water Systems is a non-profit association that provides on-site, one-on-one technical assistance and training to small municipalities under 10,000 population and all water and wastewater systems throughout the state. Equal Opportunity Provider.

Cover Photo – Taken in the Snowy Range by Mark Court.



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Cyber, Cyber, Cyber..... So What is all This “Computer” Stuff About?

Since 2018, all we have heard about is cyber security until we are about cybered out. What I hear a lot from our membership is “they are not quite comfortable with all that “computer stuff”. I can’t blame them, I am often in search of a teenager to help me fix my phone, tablet, computer or TV remote.

Well, imagine my surprise that “computer stuff” is much more and really has nothing to do with the “computer” in the way I envision. The following article pretty well sums up some of what I need to get up to speed on. Mission Critical Global Alliance has joined with WARWS to meet the Cyber education needs of our membership. In addition, SannerIT has joined with WARWS to provide free onsite evaluations of your “computer stuff” and offer suggestions to help fill in the gaps and keep all of your systems operating efficiently, effectively and safely.

What You Need to Know to Secure Your Rural Water System

With the daily news filled with stories of companies large and small being hit by ransomware, cybersecurity is now a familiar term to everyone. Understanding cybersecurity is a challenge, not the least because of the diverse interpretations of what is and is not important.

In rural water systems, the challenge is even greater: protecting a water system from unauthorized exploitation or disruption requires a broad set of skills and knowledge.

What most people consider to be cybersecurity is specifically information technology (IT) cybersecurity. This discipline protects computer systems from information disclosure (e.g., employee personally identifiable information), data theft (customer payment card information), and disruption of IT services (loss of billing system).

Rural water system professionals need to understand IT cybersecurity, but more importantly, they need to understand how to apply it to their operational systems. This broader discipline is often called industrial cybersecurity or opera-

tional technology (OT) cybersecurity. The skills and knowledge include:

- Risk management – the risk of unauthorized access or service interruption in a system monitoring and controlling processes such as chemical dosing can have catastrophic consequences, including injury or death, harm to the environment, and damage to expensive machinery.
- Technology – technology in water systems, including programmable logic controllers (PLCs), remote terminal units (RTUs), and supervisory control and data acquisition (SCADA) systems, is very different from conventional computer equipment and needs to be managed differently.
- Operations – managing activities needed in a water system requires a careful and methodical approach to monitoring and maintaining services. Inadequate procedures or poor oversight can result in hazardous conditions to people and the environment.
- Safety, cybersecurity, and physical security – Applying cybersecurity policies to operational systems requires a different mindset. Working on operational water system sites requires a thorough understanding of how to work safely. Good cybersecurity requires good physical security.
- Emergency response – it is not a matter of if a water system is affected by a cybersecurity incident. The only factors that water system professionals can influence is how likely that incident is to occur, and the scale of the impact when it does occur. Having a realistic response plan that is tested regularly is a core element of good water system security.

Having employees and contractors who understand the OT cybersecurity discipline is key to securing your rural water system. Despite what some cybersecurity consultants may say, rural water systems already have most of this expertise. Using external vendors to manage cybersecurity is a sensible approach, but only if everyone involved fully understands and manages the risks to the rural water system. To do this everyone, including operators or vendors, must demonstrate the broad skills and knowledge of OT cybersecurity.



“Spall” 2021 Success!!

Our 30th Annual Spring Training Conference held August 24th-27th, (renamed “Spall” to encompass our normal Spring dates and the upcoming Fall timing) was successful and by all measures, conducted safely during this crazy year. Thank you to all involved.

I am going to hope that attendance was affected by the end of summer activities, school starting and continuing COVID issues that still has some restricted travel and large gatherings. We had over 220 registered along with 45 exhibitors.

The Ramkota did a remarkable job considering the staffing shortages that plague a lot of companies, supply chain issues that affect food choices, as well as cleaning supplies and other aspects. The classes and the outdoor sessions, I believe, made this one of our best conferences since I have been around. Casper also performed pretty well, I hear.



I hope you all feel that you received full value for your registration dollar. The classes were outstanding, currently topical, and useful in this environment. Thank you to Senator Barrasso for his discussion and for all he is doing for Wyoming and for the recognition he gave every veteran in attendance. Knowing him as I do, it was a genuine heartfelt thank you that was well deserved in this day and age.



Senator Lummis for her words of support and thanks to all of you for your work during the pandemic. WYDEQ, CISA, USEPA, CISA, Wyoming Homeland Security, Mission Critical Global Alliance, SannerIT, Wyoming Machinery, City of Casper, Romac Industries, our new Duckweed Skimmer, Aktivov Asset Management, Mueller, Subsurface culvert rehab, Todd Jarvis and witching, the incomparable Bill Mixer and locates, the Vaughn Company and their pump class, the Lead and Copper review with 120Water and to all who participated in the Well Permitting roundtable, and all of our valued exhibitor/presenters. Reading all of this, now that's value for your training dollar!!

We also had a great Best Tasting Drinking Water in Wyoming contest. The Town of Saratoga made it's 10th visit to the finals, while Grand Targhee Resort made it's 7th trip to the finals and The Town of Ten Sleep made it's 3rd. Congratulations to the Town of Ten Sleep for their 3rd win in as many trips to the finals. I am hopeful that we will be able to travel to Washington, DC in February 2022 to watch Ten Sleep compete in the Great American Taste Test. As we were not able to travel last year, we will be hosting both Ten Sleep and Rawlins at the 2022 event.

Again, Thank you to all. Hope you enjoyed your week and even learned something. See you at one of the “mini conferences”, virtual trainings or next year for our 31st Spring (hopefully) Training Conference scheduled for our traditional Spring dates, April 19th-22th, 2022. Mr. P

Pharmaceuticals – A Tale of Blinky, the Three-Eyed fish

In modern society, it is easier to find someone who takes a daily medication than one who does not. With use of prescriptions, over-the-counter medications, and supplements on the rise, it's not surprising that pharmaceuticals are on the EPA's list of Contaminants of Emerging Concern (CEC). Pharmaceuticals have been found in both surface water and ground water supplies. These include antibiotics, heart medications, hormones and over-the-counter medications and supplements. While they generally occur in levels far below the minimum therapeutic dose for humans, these contaminants still pose a potential threat to the environment.

So, how do we know that these contaminants are actually in the drinking water supply? In the 1996 amendments to the Safe Drinking Water Act (SDWA), provisions were made to allow the detection and regulation of previously unknown contaminants. Unregulated contaminants are detected utilizing the Unregulated Contaminant Monitoring Rule. The EPA must publish a list of currently unregulated contaminants that may occur in drinking water called the Contaminant Candidate List (CCL) every five years.

Then EPA must require monitoring of at least 30 unregulated contaminants every five years (this is the UCMR program). This information is collected in the National Contaminant Occurrence Database along with regulated contaminants. From this information, the EPA can decide whether at least five contaminants from the CCL warrant regulation every five years. These regulations are based on (1) the contaminant that may have an adverse effects on the health of persons; (2) the contaminant is known to occur or there is substantial likelihood that the contaminant will occur in public water systems with a frequency and at levels of public health concern; and (3) in the sole judgment of the Administrator, regulation of such contaminant presents a meaningful opportunity for health risk reduction for persons served by public water systems. If regulation is warranted, the EPA must follow the SDWA rules and publish new National Primary Drinking Water Rules. To learn more, go to <https://www.epa.gov/ccl>.

Which pharmaceuticals have been found in drinking water? During UCMR 1 (2001-2003), 1,2-diphenylhydrazine was monitored for. This chemical is used in the production of benzidine and anti-inflammatory drugs. Nitrobenzene was also monitored for, which is used in the production of aniline, which is used to make dyes, herbicides, and drugs. UCMR2 monitored for three parent acetanilides and six acetani-

WARWSDOKU

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The objective is to fill in the empty squares so each row, each column, and each 3x3 block contains the numbers 1-9 with no repeats.

lide degredates between 2008 and 2010. Acetanilides once served as pharmaceuticals for pain and fever reducers back in the late 1800's. UCMR3 required seven hormones to be monitored for through a screening survey during a 12-month period between 2013 and 2015. Some of these hormones are used in pharmaceuticals or supplements including estradiol, equilin, testosterone and androstene. UCMR4 monitoring between 2018 and 2020 did not include any pharmaceuticals. UCMR5 will monitor for 29 PFAS and lithium in water supplies between 2023 and 2025. Lithium is a heavy metal element that has been used in anti-depressant medications. To view a full list of all unregulated contaminants, go to <https://www.epa.gov/dwucmr>.

Now that we know how pharmaceuticals are regulated once they are found in the drinking water, but how do they get there? Most medicinal compounds enter the drinking water through the wastewater stream. They pass through the effluent into surface water, or leach into the groundwater. These compounds enter the wastewater stream through several methods including excretion, flushing and industrial waste.

When we consume pharmaceuticals, some of the compound is metabolized, while some is excreted. The amount of compound excreted depends on the pharmaceutical. Ten percent of the parent compound of Ibuprofen is excreted while the parent compound of Atenolol, a high blood pressure medica-

tion is excreted at a rate of 90%. Flushing is unfortunately a common method of disposing of pharmaceuticals. I actually remember being told by a pharmacist not too many years ago to flush any unused pills so that they wouldn't get mis-used. Pharmaceutical manufacturers often have industrial discharges that are either treated internally and discharged or sent to a POTW (Publicly Owned Treatment Works). Other ways pharmaceuticals enter the environment include non-point sources like agriculture. Pharmaceuticals are used widely throughout livestock production, and while cows haven't been caught directly flushing Ivermectin, veterinary medicines enter the environment through excretion or decomposing carcasses and feedlot lagoons.

Regardless of how the pharmaceuticals enter the environment, the larger question is "are they impacting the environment?" Unfortunately, the answer is "we're not sure." The risks to human health are currently undetermined. No studies have been conducted about the effects of low concentrations of pharmaceuticals over a long period of time. While the risks to human health are probably low, there is some evidence that pharmaceuticals do pose a risk to the environment, particularly aquatic life. The levels detected in surface waters are often considered well below the minimum therapeutic dose (MTD), however, that is sized for humans.

Aquatic species are often much smaller, and rather than taking one pill daily, they are immersed in the water constantly, changing the exposure rate to the contaminant. A research project in England showed that a species of roach (fish) began exhibiting intersex characteristics, potentially disrupting the animal's ability to reproduce. Antibacterial residuals could increase antibiotic resistance in bacteria, creating a potential chain of effects. Laboratory studies have shown anti-depressants to increase aggressive behavior in crawfish and affect learning in cuttlefish. Ibuprofen delayed the hatching of fish eggs in a laboratory experiment. In nature, it is difficult to separate out individual cause and effect, due to multiple variables, and the possibility of the effects going unnoticed until a larger species is affected.

The good news is that there are treatment methods capable of removing many pharmaceuticals. Advanced water treatment techniques such as ozonation, activated carbon, advanced oxidation and nanofiltration and reverse osmosis are capable of removing up to 99% of pharmaceuticals. Wastewater processes such as activated sludge or biofiltration have removal efficiencies of 20-90%, depending on the particular compound and process. The bad news is that these processes add complexity and cost to already stressed water and wastewater treatment systems.

Keeping pharmaceuticals out of the wastewater stream is a more cost-effective solution than adding processes to both the water and wastewater treatment trains. While pharmaceuticals improve the quantity and quality of life for many, there are ways to reduce the amounts released into the environment. The EPA manual "Managing Pharmaceutical Waste: A 10-Step Blueprint for Health Care Facilities in the United States" gives guidance to health care facilities when developing a pharmaceutical hazardous waste management

plan. Physicians could also begin patients on lower doses of medications and ramp up the dosage as necessary as opposed to simply prescribing the maximum dose. It's also important to educate consumers that flushing medications is not an acceptable method of disposal. Working with law enforcement, health care providers and pharmacies to host drug take back days is a great way to provide public outreach. The next National Prescription Drug Take Back Day is October 23.

So – we know that pharmaceuticals are prevalent in our society, and not going away any time soon. In fact, the rate at which the human race is consuming supplements, remedies and medications is increasing. This increase in consumption will lead to an increase in the levels of pharmaceuticals found in wastewater, and eventually drinking water. Currently, there isn't clear evidence as to the effects of these pharmaceuticals in water. However, do we have to wait for an ecological catastrophe to make a change?



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Cultivating Leadership in Generation “X and Y”

I was online during a vimeo meeting last month and this subject just stuck in my mind. I think we all need to reflect on the generations of water/wastewater operators and leaders that will be taking over our industry. The people we hire or put into the leadership roles of tomorrows water/wastewater systems are going to come from the generations “Y” and “X”.

THOUGHTS FOR THINKING

“Water/Wastewater Operator’s in the field today”

Average Age = 45.2 years (good)

Average Age with more than 5 years of experience = 61.7 years (bad)

The following is a list of things to think about while we train and work with new employees.

This is the first time in History that (5) generations are in the workplace at the same time, (5) different personalities that must come together and stop the stereotyping of each other, understanding each other is the key to share knowledge and experiences. If we do not, our industry will fall behind.

Generations: Traditionalist (1925-1945),
Boomers (1946-1965), Gen “X” (1966-1976)
Gen “Y” (1977-1995), Gen “Z” (1996- 2014)

“What Traditionalist think of Boomers”

- * Wasteful
 - * ” Waste Not/Want Not” does not apply
- * Radicals
 - * Rock ‘n Roll, Hippies, Civil Disobedience
- * Original “Me” Generation
 - * Greedy, Materialistic

“What Boomers think of Themselves”

- * Wasteful??
 - * Successful, Efficient
- * Radicals??
 - * Opportunistic, Work over Family
- * Original “Me” Generation??
 - * Ambitious, Achievers

“What Boomers think of Gen X”

- * Slackers
 - * Spoiled
 - * Unfocused
- * Rebellious
 - * Rule Rejectors
 - * Not as Successful
- * “Latchkey” Kids
 - * Emotionally insecure, Momma’s kids

“What Gen X Think of Themselves”

- * Slackers??
 - * Informal, Multi-taskers
- * Rebellious??
 - * Problem Solvers, “Work Smarter, not Harder”
 - * Tolerant for Alternative
- * “Latchkey” Kids??
 - * Value Family Time, Open Communicators
 - * Balance Family with Work

“Boomers thoughts of Gen Y (Millennials)”

- * Lazy
 - * Would rather plug into technology
 - * Want trophy for showing up
- * Sheltered
 - * Sensitive, “fragile snowflake”
- * “Me” Generation
 - * Self-obsessed, Critical of others

“Millennials Thoughts of Themselves”

- * Lazy??
 - * Creative, Self-Confident
- * Sheltered??
 - * Protective, Caring, Socially/Environmentally Responsible
- * “Me” Generation??
 - * Independent, Achievement Oriented

Note: As you read the above Generational review of each other, it is ironic how we are defined by our previous generation as we define the incoming generation in the same way. Let us change it and embrace our new generation of employees and their new tools. The new tools they command make work smarter not harder, to do the workload in less time, while giving more time to family.

How do we accomplish this?

(1) Turning over the Reigns

Challenges as we Change for Gen X

- Set a time Frame – get focused
- Realize replacing with a Boomer doesn’t fix the problem
- Become a Student of Technology
- Teach (not enforce) the past

Challenges as we Change for Gen Y

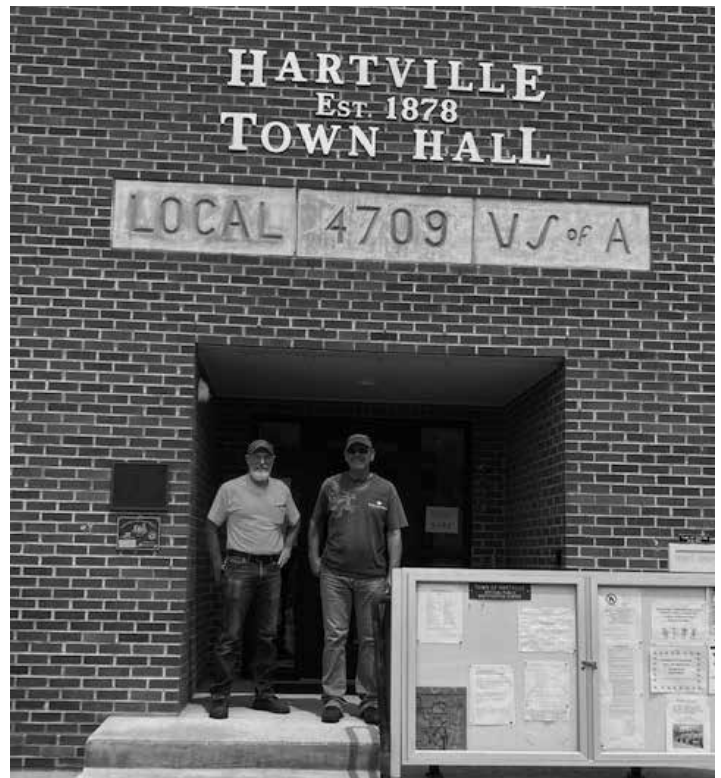
- * The Next “Me” Generation – Ouch!
- * Get things done Quicker
- * Take advantage of Technology
- * Aging Infrastructure? - Ask for Ideas

(2) Riding off into the Sunset

- Millennials need to be the backbone of our industry
- Empathy means something
- Include them in infrastructure upgrades
- Have Xers help with hiring and training the Ys
- 5 generations working in our field. Never Happened Before, May Never Happen Again!

To summarize, we as the leaders of our industry need to look at ourselves and realize that the days of keeping our knowledge to ourselves for job security or afraid of change are over. Our new generation of employees are very smart and ready to take over, with our help, just as we were.

I want to thank Don Van Veldhuizen, AKA: “The Out-house”, for providing me with this information to share. If you want to view Mr. Veldhuizen presentation, “Bringing in the next Generation A Guide for Boomers” email him at don@vanveldhuizen.us



FORD FLEET PROGRAM



The National Rural Water Association and the Ford Motor Company have created a partnership to offer special fleet discounts to State Rural Water Associations and their utility system members. This partnership combines the buying power of 31,000 individual utilities to provide reduced fleet pricing on utility vehicles. The Ford Fleet Team is #1 in commercial fleet customer satisfaction according to surveys. The Rural Water Ford Fleet Program is a valuable member benefit for water and wastewater utilities. State Rural Water Associations determine eligibility for their members, and provide a fleet code that allows access to substantial vehicle discounts to fill the need for reliable work vehicles. Fleet vehicles must be registered in the name of a member water or wastewater system.

Member utilities should contact their State Rural Water Association to access the Rural Water Ford Fleet Program. Vehicles may be purchased at your local dealer or through the national fleet auto group, get all the details you need online at: www.nrwafleet.com. Incentive discount pricing is available on fuel efficient cars, vans, SUVs and trucks. Systems can save up to \$5800 off factory invoice per vehicle. Happy shopping!



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Explorer XLT 4WD or RWD	\$1,500
F-Series Super Duty F250-F550	\$5,800
F150 4X2 Reg Cab	\$4,100
F150 (Excludes Raptor)	\$5,100
Transit Connect	\$2,400
Transit 2WD	\$4,200
Transit AWD	\$3,500
Ranger 4X2 Crew Cab	\$1,000
Ranger 4X2 SuperCab	\$300
Ranger 4X4 Crew Cab	\$1,700
Ranger 4X4 SuperCab	\$1,400

More to it Than That!

Great job everyone on getting your AWIA compliant Risk Assessment certified by the deadline. Wyoming only had two community systems that did not meet the requirement. Keep it up and let's get those Emergency Response Plans certified and or updated by the end of the year, depending on what your population served is. If you have a population above 3,300, you must have an AWIA compliant plan and certify it by December 31st. If you have a population below that, you still need to update your plan, at the very least. As most of you know, I have been encouraging all systems to have an AWIA compliant plan, no matter what population your system serves.

Here is some news for you though. We aren't done with AWIA when the year ends. The AWIA amendments to the Safe Drinking Water act are the most substantial since at least the 1996 amendments, and in my mind are the most far reaching since its actual passage in the 1970's. There are over 30 mandated programs and they impact operators, systems and decision-makers alike.

Thankfully, all these changes do not go into effect at the same time, but I thought this was a good time for us all to get our heads up and look at some of the things that could be changing. Nationally, AWIA authorized the Drinking Water State Revolving Fund to allow extended infrastructure loan terms, requires the provision of additional subsidy to state-defined disadvantaged communities, and expands source water protection-related eligibilities under the Local Assistance set-aside. Stay tuned for how these provisions are being implemented in Wyoming.

AWIA has also amended the Emergency Planning and Community Right-to-Know Act. It requires state and tribal Emergency Response Commissions to notify the applicable state agency of any reportable releases, and provide community water systems with hazardous chemical inventory data. You will be notified if something bad is coming towards your source water. These revisions require that community water systems receive prompt notification of any reportable release of extremely hazardous substance, as defined under EPCRA or CERCLA that potentially affects their source water and that they have access to hazardous chemical inventory data. This provision is in effect now. Did you notice that I wrote community water system? That was purposeful. Transient systems were excluded from having to be notified.

There are some new grants. AWIA provides funding to assist public water systems in small and disadvantaged communities with reducing lead in drinking water systems, provides

financial assistance to homeowners for lead line replacement and testing drinking water in schools and childcare facilities for lead. You can find out more about these funds at <https://epa.gov/dwcapacity/water-infrastructure-improvements-national-act-wiin-act-grant-programs>.

Asset Management has also been addressed by AWIA. States must amend their state capacity development strategies to include a description of how the state will encourage the development of Asset Management Plans that include best practices, training, technical assistance and other activities to help with implementation of those plans.

Wyoming DEQ has recently gone through a rule making that brings Wyoming into compliance with these requirements. Unless you want funding from the state, this might not be a requirement for your system. If you do want funding, Asset Management Plans will be part of the financial package. Even if state funding is not on the horizon for your system, I encourage you to take asset management planning seriously. It can save you and your system big bucks by being proactive and can also help your system to get its fair share of the budget pie.

AWIA brought changes to UCMR. Subject to the availability of appropriations and sufficient laboratory capacity, the Safe Drinking Water Act now requires UCMR monitoring for PWSs serving between 3,300 and 10,000 people. UCMR monitoring is also required by all large PWSs (serving >10,000 people) and a representative sample of PWSs serving fewer than 3,300 people. Under the AWIA provisions, EPA continues to be responsible for all analytical costs associated with monitoring at systems serving 10,000 or fewer people.

Overwhelmed? There is so much to The American Water Infrastructure Act that we just need to take small chunks of it at a time. Our first chunk was the Risk and Resilience Assessment. The next chunk will be the Emergency Response Plan. We will move on from there. Consider it an AWIA journey. Rural Water is right there on the trip with you. We will arrive and if you have questions or need help reach out to us. We are always there to act as guides.

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Finding Water the ol' Timey Way: The Geography, History and Science of Water Witching

by Todd Jarvis, Oregon State University

Water witching, or dowsing, is part of the folklore associated with groundwater. Anyone who works with groundwater or relies on well water has relatives that are dowsers, knows someone in their community who has “witched” wells, has heard stories or has directly observed the marvels of the water finder. Documentation of the dowsing predates the first geologic maps by 400 years. The number of dowsers in the United States approaches tens of thousands compared to the few thousand practicing hydrologists. Water witching and dowsing become media darlings during droughts. Professional boards attempting to limit the practice have run afoul of the dowsers First Amendment rights. Professional associations promoting the practice of dowsing are well organized and have a long history debating the location and movement of groundwater with state and federal water agencies.

Dowsing becomes a media darling during droughts. For example, on July 17, 2021, The New York Times profiled a California witch in the article “Two Rods and a ‘Sixth Sense’: In Drought, Water Witches are Swamped”. The August 3, 2007 edition of the Wall Street Journal ran the piece entitled “In Race to Find Water, It’s Science vs. ‘Witchers’”, where a California “dowser” charges \$200 an hour, plus \$10 for each gallon per minute produced in a well he has located, sometimes making \$7,500 in a day’s work! This same water witch was profiled by both newspapers. How many water professionals can boast these credentials?

The October 2017 issue of the Wyoming Water Well Contractor’s Newsletter published by State Board of Examining Water Well Drilling Contractors and Pump Installation Contractors ran an article on Water Dowsing. It provides a good summary of “how the rods works”, but little else on the practice in Wyoming.

While some folklorists point to drawings in caves dating thousands of years old or subtle references in religious texts as indications of the long-term practice of dowsing in the world, water historians usually point to drawings of miners using forked sticks to hunt for minerals in Germany. Some historians point to dowsers in France as the first to use divining rods to search for water approximately 600 years ago. They also suggest dowsing was used to also search for murderers and Protestants, perhaps the first documented use of multitasking. For comparison, the first geologic maps were developed in the 1800s.

In one of the most complete studies of the psychology and anthropology of water witching - Water Witching, U.S.A. - was published in the late 1950s. Cognitive psychologist and retired University of Oregon professor, Ray Hyman, and anthropologist Evan Vogt show that nearly every tool

imaginable has been used to “divine” water, from pitchforks, car keys hung as a pendulum from bibles, and pliers from a toolbox, to the classic “forked” stick.

The tension between geologists and water finders dates back at least 100 years with the US Geological Survey publishing Water Supply Paper 416 - The Divining Rod: A History of Water Watching in 1917. The American Society of Dowsers challenged the US Geological Survey general interest publications on water dowsing in the 1970s leading to a detente between the two groups. The National Ground Water Association ran a “dowsing buster” campaign in the 1980s, but also published an article on the history of water witching in 2002. The National Driller’s Journal published an article “Water Dowsing is Bad News for Groundwater” in 1999, but concluded that it was better idea to be cognizant of the practice to communicate with dowsers and water well customers. Some drillers in Wyoming offer their services as “water finders”.

The how and why dowsing works, or does not work, depends on whom you ask. Some dowsers consider it a divine gift, others a learned skill. Dowsers in other countries use some of the same tools as American and European dowsers, but some




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also practice dowsing using traditional ecological knowledge by observing different plants, trees, and insects that are known to be near water with the knowledge and stories passed from generation to generation. Retired Psychology Professor Ray Hyman considers water witching to be a form of quackery in *How People Are Fooled by Ideomotor Action* on the Quackwatch website. Dr. Hyman explains what brain researchers refer to as ideomotor actions “as a movement unhesitatingly and immediately follows upon the idea of it.” Yet other researchers and dowsers attribute the reaction to a sensitivity to electricity or magnetic fields from minerals or water movement.

While Wyoming is famous for its pioneering water laws, diverse water landscapes, and legendary water development programs, Wyoming also has a rich history in dowsing and locating water. Romie Nunn of Bar Nunn was profiled by his family on the web posting *Our Dad, the Water Witch of Wyoming* in 2013. Nunn’s daughter-in-law Hannah describes Nunn’s skills as “He never got a chance to prove this, but Ron’s father felt that every mineral in the ground gives off waves. A dowser is just picking up those waves.”

The late Jackson area water well driller Jack Weber learned to witch wells growing up near Medicine Bow. In a 2009 article in the *Jackson Hole News & Guide*, Jack indicated “Your abilities as a water witcher depend on the amount of static electricity in your body.”

I worked with the late WARWS Circuit Rider, Jim Van Dorn, when he was the wellfield supervisor for the Cheyenne Board of Public Utilities in the 1990s. At the time, BOPU was rehabilitating many of the wells in their four wellfields tapping the Ogallala Aquifer. We quickly learned the Ogallala Aquifer is not a sandbox flooded with water, but rather a complex sequence of sand and gravel, with some of these layers cemented like concrete and the water is stored in the fractures. Jim witched the locations of some fractures and considered his well siting and production to being about “just as good as a PhD.”

Want to learn or do more with dowsing? Join the Mile High Dowsers of Colorado Chapter of American Society of Dowsers or create a new Wyoming Chapter.

Todd Jarvis has over 35 years of experience in the groundwater engineering industry with an equal number of years studying water witching and dowsing. He graduated from the University of Wyoming with degrees in geology and hydrogeology and is licensed as a professional geologist in Wyoming. He lead the workshop on the history, geography and science of water witching at the WARWS fall conference where the participants also tried their hand at witching in the meeting venue parking lot where the participants were confident every sewer line, gas line, or sprinkler irrigation line was located.

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Friendly Reminder, Winter is Coming

As I write this, we are in the last few weeks of summer, but by the time you read this the temperatures will be quite a bit cooler than what we went through this summer, and man, it was a hot dry one. Being a long time Wyomingite, when September hits, my thoughts go right to the upcoming winter. Don't get me wrong, as fall is my favorite time of the year as we get to slow down a little after a summer of long workdays and short nights.

It's time to take a deep breath knowing that the burned-out feeling from the long Spring and Summer season that I had every year, and I always see in the Water and Wastewater Specialist of the communities across Wyoming this time of year will soon be over, but we still have a few things we need to get done before Old Man Winter knocks on the door. Take a few minutes and think about what caused you the biggest headaches over the past few winters and inspect them now. Then look around and imagine what could go wrong at the most inopportune time.

Before the freeze, I like to get the distribution system flushed as water usage is beginning to slow and flushing in late September, early October doesn't put such a strain on the groundwater wells and water plant. This also allows you to find any hydrant that isn't fully closing and seeping, or the hydrant barrel is not draining properly and repairs are needed. Fire hydrants need to be in top shape going into the holiday season when house fires caused by electrical circuits being overloaded, bad or wrong sized extension cords are used. Let's not have the local Fire Department be the ones to find frozen or inoperable hydrants.

For water systems that have storage tanks that float on the distribution system and don't have mixers in tanks, now is a really good time to purposely overflow the storage tank to get the old, warm water out of the tank before the water turns over in the tank and monthly Bac-T samples fail. If for some reason you can't overflow, lower the water level in the tank, increase your chlorine level and refill the tank. Remember that old water is our enemy.

Chlorine injection pumps and check valves need to be serviced. The slight little drip of a leak will only get bigger and you know as well as I do that it will break at the worst possible time like the coldest day of the year, Thanksgiving, Christmas morning. Lets not forget to replace the old poly lines from all the chemical feed pumps and to the turbidity meters. A rule of thumb that I was taught was when time changed, but since that's been shortened, the first part of fall before you take off hunting and then the first part of spring

before the madness of getting everything up and running again(September & March).

Speaking of chlorine, do you have the DEQ required 30 day supply of chlorine on hand? We all know that our suppliers for the most part have done such a great job that we really don't worry about this one, but it is still the rule. Last winter was very mild but we do live in Wyoming, need I say more? Wells, chlorine and outbuildings need to be inspected for air gaps around doors and windows and sealed where needed, not only to prevent exposed lines from freezing, but to reduce the amount of energy we use. Insulation and caulk are a lot cheaper than gas, propane, or electricity.

The heating system needs to be inspected and serviced. How old is the heat tape you have on some pipes and the insulation around them? Do they still work? Take the advice from someone that learned this one the hard way and make sure they still work. Spending Thanksgiving Day thawing and replacing busted pipe does not make Mama very happy let alone missing out on watching the game with family and friends.

Take inventory of repair parts particularly the things you can't afford to wait for. Driving 100+ miles in a snowstorm is not my idea of a good day at work, even worse not being able to scrounge up parts on a Saturday night and having customers out of water until parts can be secured on Monday. I know some systems have multiple types and sizes of pipe, most water operators know where the oldest, weakest pipes that are in desperate need of replacement are and what size of repair fittings are needed.

Over the past year a whole lot of training has been done on risk assessment and vulnerability so I know it had to invoke at least some thought on the small systems that didn't have to do the assessment, but I will put my two cents in on what I've seen in the field (you know I have to do this for those that control the budgets). It is a must to have a backup chemical injection pump(s), chemical tubing, booster pumps for gas chlorine on the shelf. The health of our communities does not have to be put at risk because simple, inexpensive precautions are not taken.

There are other Preventative Maintenance items that come to mind, on your list or in your O&M Manual? Don't have an O&M Manual? Plan on getting it done this winter and remember that if you need a template to help you get started, WARWS has one at no charge to our members. Just call or drop me an e-mail. - Ross

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South Pass

Heading over South Pass in the winter can be challenging, to say the least. Snowstorms and that brutal wind makes the drive a white knuckled pain, at times. Even on a windy day, traveling can be just miserable to say the least. However, when Spring comes around, the beautiful sights are abundant. If you keep your eyes peeled there are many critters on the move. Ya, the deer and antelope are always a sporting event when they stand glassy eyed in the middle of the road. Elk and Moose can be seen on the very top of the mountain, and while being a rare sight, they are always worth a quick stop. If you find yourself traveling over South Pass, between May 15 and September 30th, stop in, and see some of Wyoming's History.

Along the Highway heading west towards Farson, you will see some signs on the left pointing the way to South Pass City / Atlantic City. These are great places to stop in and stretch your legs. South Pass City started off as a gold town way back in 1867, when gold was discovered in the area. As with many gold towns, the town grew to over 250 buildings and boasted a population ranging over a thousand. These people must have been some of the hardest people around, to survive up there in the winter. I just think back to what hardships they endured daily, and most of my bad days are not so bad at all. As with many ghost towns in the country, South Pass City population dropped to only a few hundred by 1872. As the gold became harder to extract in the hard rock mining, it became a true ghost town by 1949. A few people stayed on and tried to make a go of it, creating a tourist attraction. However, the upkeep of the buildings just became too much. Then in 1966, the State of Wyoming bought up the property and created a State Park. This was a 75th Birthday present for the citizens of Wyoming. Now, there are 23 structures still standing, and over 30,000 artifacts that can be admired.

This State Park is truly a great little piece of history worth seeing. Just down the road about four miles East, lays another Town called Atlantic City. Although this town was founded in 1893, it still survives today.

Atlantic city was also a gold town, and some prospecting can be seen between the towns to this day. As you come down the hill, a small town appears in the valley. The Town has a walking tour that has little informational signs around the older buildings. This 20-minute waking tour really brings the town to life. When I swing by, more times than not several groups of people can be seen admiring all the history. Here again this town must have also been just miserable in the winters. Something to think about when driving by when it's 20 below, and strong wind warnings of 50+ are in place. After taking in the sights that this little piece of history has to offer, you can grab a bite to eat at either of the town's restaurants. The Minors Grubstake, or the Atlantic City Mercantile offer some tasty home cooked food. I'm partial to the burgers, and amazing onion rings at the Merc myself. Both places have been around since the birth of the town, and either one is a great place to sit back and enjoy a meal. In the times we are going through now, some building is taking place which just may be a good thing keeping this little town going for a long time to come.



If you find yourself in the area, these little pieces of history are sure worth your time to check out. Just down the road, the Oregon Trail is just one more attraction this beautiful part of the state has to offer. There are also many miles of back country roads in the area to be explored. So bring along a sided by side, four wheeler, off road motorcycle, or even a mountain bike and spend the day. The area also has many camping opportunities just waiting to be used. Enjoy Wyoming !



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Rate Setting Values

Carl Brown, President
GettingGreatRates.com

Utilities – water, sewer, electric and others – do things for us. In return, we pay fees or rates to support those utilities. Consequently, utilities should deliver “values” to us.

But utilities are not just machines. Most importantly, there are the people who operate and maintain the machines, those who plan for, and manage the machines, and those who set rates to pay for the machines. And that is just the values starting place.

You, as a utility rate setter, or rates calculator, or services provider deliver values. Strive to make them excellent values. Also know there are other values that may not be your “job” to deliver. Somebody else must deliver those. Delivering value is a team sport. Consider these values.

Values? Think Boy Scout and Girl Scout creeds. Those are the kinds of values utilities should strive for.

1. Adequate rates: This one is the first among equals. A utility must pay its bills, meaning, be self-supporting and sustainable. In truth, most utilities are not fully self-supporting in the United States. Most have been built with at least partial grant or subsidized loan funding from federal and state sources. And some utilities do not have to be sustainable in the forever sense. Some truly are only needed temporarily. But job one of a rate setter should be to fully fund the utility with available sources, so customers can count on it being there serving them and supporting the investments they have made in their homes and businesses.

a. Asset management: Rates can be calculated and set to achieve lots of outcomes. But if your utility’s assets are not being managed well, rate setting can devolve into “rearranging chairs on a ship that is going down.” Asset management and great rate setting go hand in hand. More on that in the future.

2. Fair rates: Fair rates are not needed all the time, everywhere and in every situation. Rate setters should set fair rates because it is the right thing to do. Even if they do not want to treat people fairly, fair rates buy the utility public support. Utilities, and governance generally, need public support to achieve sustainability.

a. Cost-to-serve rates: Fair rates do not necessarily need

to be in a cost-to-serve structure. But if a community is to agree upon what “fair” is, knowing what the cost-to-serve structure would be is a good starting place. If cost-to-serve rates do not place an onerous hardship on difficult-to-pay customers, cost-to-serve rates are the gold standard of fair rates.

b. However, sometimes cost-to-serve rates result in quite high bills for difficult-to-pay customers. At some level of payment difficulty, the community may want to give difficult-to-pay customers a pricing break, so they can get the water they need to stay alive and the wastewater services they need to stay healthy. Consider that your contribution to “promoting the general welfare.”

3. System serviceability has two aspects:

a. A utility should provide service commensurate with the level of funding it receives. If customers are willing to pay relatively high rates, they should get a high level of service, and vice-versa.

b. The other aspect is the ease of operation and maintenance of the system. Hopefully, the technology chosen was quite appropriate for your situation and it was designed and built well. Regardless, operations staff should be able to fine tune it to be quite serviceable. I, for one, have seen great operators do amazing things with their systems – they make them hum.

4. System effectiveness: Utility service should happen consistently at a given level with very few service “outages.” Most of those outages should be on a planned basis to maintain and improve the system, not to fix things that break. Remember asset management?

5. System efficiency: Service should happen with little wasted effort, work, expense, overhead, etc. Effectiveness and efficiency tend to fight one another. Effectiveness should be the primary goal. You must have that. Efficiency should be added to the mix as much as possible. Again, if you are doing excellent asset management, the whole system will be quite efficient.

Above, I ticked off some things that the Association is all about. Call on them not just when things are going bad, but also when you want to make them to go great. And I strive to do my part on the rate setting side.

What values are you providing your customers? Make them excellent! That probably will not make you rich. But it will make your life rich with satisfaction.

Carl Brown is President of GettingGreatRates.com, which specializes in water, sewer, and other utility rate analysis. The firm serves as the RATES Program rate analyst for the Colorado, Kansas, New Mexico, North Dakota, Virginia, and Wyoming rural water associations. Contact: (573) 619-3411; Carl1@gettinggreatrates.com

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Operators Corner

Wastewater Questions by Mark Court:

- What are important elements in the development of an effective maintenance program?
 - Emergency Repair
 - Frequency and schedule of maintenance activities
 - Poor recordkeeping
 - Sanitary sewer overflows
- The average domestic sewage contains about:
 - 0.2 pound per person per day BOD
 - 0.3 pound per person per day BOD
 - 0.4 pound per person per day BOD
 - 0.5 pound per person per day BOD
- What is infiltration?
 - The direct discharge of water into the collection system
 - The percolation of septic tank effluent into a collection
 - The release of boiler feed water directly into a collection system
 - The seepage of groundwater into the collection system
- Algae consumes oxygen during the daytime and produces oxygen during the nighttime.
 - True
 - False
- What must occur if an alarm condition develops in a confined space?
 - Area should be evacuated, ventilated and restarted
 - Atmospheric testing equipment should be recalibrated
 - Confined space entry permit should be reviewed
 - Operators should receive additional training

Water Questions by Michelle Christopher:

- What should be done if a filter will be out of service for a prolonged period of time?
 - Fill filter with a 50 mg/L chlorine solution.
 - Drain filter to prevent algae growth.
 - Cover filter with a 6" layer of diatomaceous earth
 - Nothing, the microbiological activity in the filter will act as a virucide.
- Two pipes of dissimilar metals were connected, and have now deteriorated, causing a leak. Which of these processes has occurred?
 - Tuberculation
 - Electrolysis
 - Galvanic corrosion
 - Depolarization



- What is the purpose of a wear ring on a pump?
 - To protect the volute case and impeller.
 - Slow leakage between the pump and the shaft.
 - Act as a spacer between the lantern ring and the pump packing rings.
 - Reduce clogging in a semi-closed impeller.
- Which of these pieces of lab equipment provides the most accurate measurement?
 - Erlenmeyer flask
 - Beaker
 - Graduated cylinder
 - Pipette
- A 20 ac-ft reservoir is to be dosed with copper sulfate to control algae. The recommended dose is .33 mg/L. How many pounds of copper sulfate are needed? Copper sulfate is sold in 5 lb containers. How many containers do you need to purchase?
 - 55 lbs, 11 containers
 - 2.40 lbs, 1 container
 - 17.93 lbs, 4 containers
 - 411.73 lbs, 83 containers

Answers

Wastewater

- B 2. A 3. D 4. B 5. A

Water

1. B 2. C 3. A 4. D 5. B
1. Convert ac-ft to MG = 6.52 MG
2. Use mass flux equation lbs=flow(MG) x dose(mg/L) x 8.34
6.52 MG x .33 mg/L x 8.34 = 17.93 lbs
3. Divide 17.93 by 5 lbs/containers = 3.59 containers, round up to 4 containers

Our Western Heritage

by Kathy Weinsaft

Not Done Yet!

I told you when I started our Eastern journey of Wyoming that there was a ton to see and experience and we still aren't done. In the last of our adventure I left us peacefully sleeping under the stars at Cook lake a couple of miles west of Sundance. I hope you are well rested because today we are going to lace up our boots and hike some of the best trails in Wyoming.

The Sundance Trail is the most challenging of the hikes we are going to take. It is 11.2 miles loop with a significant elevation gain of 2,132 feet. It is moderately used. Though not an easy hike it is a favorite of locals and visitors alike thanks to the various environments you will encounter on the way. Some spots are open meadows, some are narrow trails and there are plenty of rocky sections to enjoy too. October is the very best month to do this hike in my opinion though it is full of wildflowers during the spring. Be sure to bring plenty of water and snacks for the trail. If this sounds like more of a challenge than you want there are actually 5 different trails that make up the Sundance Trail system. They range from 2.2 to the 11.2 miles that I described. There are maps available at the trail head so you can take your choice. You can't go wrong with any of them.

If you would prefer an easier but just as beautiful hike then the Carson Draw Trail is for you. It is a five mile loop with just a few hundred feet of elevation gain but the views are still spectacular particularly in the fall. It is also quiet and not overrun. It is off the beaten path and offers solitude to those searching for a more primitive trail experience. Pine, aspen and oak stands surround the trails and provide diverse habitats for the abundant wildlife in the area. This trail is part of a system that has existed since the 1800's. In the late 1800's and early 1900's, miners and homesteaders made their way into the Bearlodge Mountains and settled. This trail is named for one of those families, the Carsons.

If you don't mind a little bit of overgrown the Sheep Nose Mountain trail is a local favorite. It is 4.6 miles out-and-back hike. It has some of the best places to see wildlife and is good for all skill level of hikers. If you want to see birds this is the trail for you. The view from the top of this hike is amazing and it is a really good investment of two or three hours. The last couple of times I have done this hike I have not seen a single other person on the trail. It is the perfect hike if you are looking to get away from everyone. I do recommend wearing long pants and sleeves and bringing some tick spray however.

If you are ready to do another challenging hike you may want to check out Dugout Gulch Botanical Trail. It is close to 10 miles long and offers over 1,000 feet of elevation gain, making it good for a workout but not terribly challenging.

The sights along the way and the beautiful foliage make it worth every single step. It is an out and back hike and the trail head is actually closer to Beulah than it is to Sundance. The trail has lots of shade, flowing water and is a mini ecosystem in itself. It is a bit overgrown and could use a tad of maintenance but it is a very pleasant way to spend the day.

I have saved the best hike for last. The Red Beds Trail circles Devils Tower National Monument and is just under three miles. It is one of my favorite things to do in the fall. In fact fall is not fall without a trip to devils tower otherwise known as Bear Lodge or Mateo Tepee. This is a moderately strenuous path that loops around the Tower. It climbs up and down between the river valley and the visitor center. It offers some pretty darn stunning views of the Tower and surrounding landscape and you can get up-close views of the underlying geologic formations. Some of these formations are the oldest visible rocks in the park. This trail does contain some steep and rocky sections. If you would like a shorter and less-strenuous loop around the Tower there is the Tower Trail. I know some people don't consider that trail a hike but I don't care. I love it. I love seeing the visitors and the awe that is written all over their faces upon looking at the Tower. It is beautiful and majestic, captivating and unique and it is in our own backyard as are all of these wonderful trails.

It is fall. Put on your hiking boots and get out there and enjoy the trails!

It is, after all, part of our Western Heritage



Bill Ungricht

Outside Sales Municipal

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Scrawny Girl's Food for 100 Miles

by Michelle Christopher

August 20th at 5:00 am, I left my house at a steady jog. I finished my run 100 miles later, on a county road in Colorado south of Irish Canyon. It was 8:18 am Saturday, August 21st. I say run, but seriously, there was a fair amount of walking. Like every uphill and most of the flats, uphill and downhill in the dark. Ok, a more accurate description of this project is I traveled 100 miles on foot, in less than 28 hours. In answer to the questions I'm sure you're asking right now: yes, but most folks knew I'm crazy already; I'll stop to get snacks, change my socks and you know... basic bodily functions; I have the most amazing crew of people who committed to meeting me every 10 miles or so to help refill my water bottles, add snacks to my pack, etc; and, the answer to the most important question... WHAT DO I EAT?

The answer is pretty much everything. While many runners focus on goos, gels and other quasi-frankenfoods, I revert to my philosophy on backpacking food: it has to be something I'd eat in real life, and it has to be tested where there's access to indoor plumbing. Enter the brownie.

Brownies are amongst the best of all baked goods. Deep, rich, and chocolaty without the fuss of melting chocolate on hot days. The unfortunate side of my favorite brownies (the recipe in the Baker's Unsweetened Chocolate box) is that they are a bit greasy. Grease and running long distances do not make for a positive digestive experience. To combat the grease, and amp up the nutrition, I swapped the butter for beet puree. Beets contain nitric oxide which is magical for improving oxygen transfer. I also added espresso to deepen the chocolate flavor, and honestly, there's caffeine, which will be important in the wee hours of the morning. You could make these brownies vegan if you swap out the egg for ground flax and chia, which also increases the nutritional content, but if that seems weird, use an egg. I'm also including the original Baker's recipe because it is the quintessential brownie, and it's one of the things I used to bribe my crew into helping me.

Original Baker's One Bowl Brownies

4 squares Bakers Unsweetened Baking Chocolate (4 oz)
 $\frac{3}{4}$ cup (1-1/2 sticks) butter
 2 cup sugar
 3 eggs
 1 tsp vanilla
 1 cup flour

Preheat oven to 350 degrees. Grease or line 9x13" pan with greased foil. Melt chocolate and butter. Some people microwave their chocolate, which I think is weird, so I just do everything on the stove top with a large saucepan. Stir in sugar, eggs and vanilla. Add flour and mix well. Pour into pan.

Bake 30-35 minutes, or until toothpick comes out with fudgy crumbs. Do not overbake, or you'll be crushing them with a mallet to break them into bite sized pieces. Allow brownies to cool completely before cutting. (Haha, the recipe says to do this, but I've never succeeded in doing so.)

100 Mile Beet Brownies

4 squares Bakers Unsweetened Baking Chocolate (4 oz)
 $\frac{3}{4}$ cup pureed cooked beets (see note)
 1 cup sugar
 3 eggs, or 3 Tbsp ground chia or flax seed + 9 TBSP water – I use a mix of flax and chia
 1 Tbsp espresso powder
 1 tsp vanilla
 1 cup flour
 1 c chocolate chips (I really like the miniature ones)

Prepare the beets – you could roast raw beets wrapped in foil at 400 degrees for around 45 minutes, peel, cool and puree, or to save time, drain a can of beets and puree those. You're looking for around $\frac{3}{4}$ cup, so 2 large beets or several small beets should be adequate.

Preheat oven to 350 degrees – unless you just got done roasting beets, then turn the oven down. Grease a 9x13 pan.

Place chocolate and puree in a large saucepan and melt over very low heat. I had to add a bit of water to mine, as my beets were a bit dry. Stir quite often so the chocolate doesn't burn. Once the chocolate is completely melted, stir in sugar, eggs (or flaxseed) – if you're using the flaxseed, add the water in small amounts until you reach a consistency that you like, espresso mix and vanilla. When this is all mixed in, add flour, mix well and add chocolate chips. Pour into prepared pan.

Bake at 350 degrees for about 30 minutes. These brownies won't rise like the Baker's Originals, so you have to keep an eye on them to prevent over baking. Under cooked is highly preferable to over cooked.

Just like the originals, allow to cool completely before cutting. I'm just kidding, scoop these babies out with a spoon and dump on vanilla ice cream. Unless you have 100-mile plans. Then you should probably follow the instructions.



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Our Duckweed Skimmer in Action Introduction

My grandfather always said, “*use the right tool for the job*”. Those words still hold true today and they always will. When it comes to controlling duckweed, what really is the right tool? I that also depends on who you ask. Many people will tell you that herbicides are the best method. In many cases, this may be true but, in the case, where duckweed is severely out of control it is probably your worst option because as the duckweed dies off, it will deplete what little dissolved oxygen is in the pond.

Some systems have tied volleyball nets together and dragged the duckweed to shore where it is raked out. Other systems use boats to push the duckweed to shore where it too is raked out. These methods are extremely time consuming and laborious. In small towns with very limited staff, too many hours must go into duckweed control, so it just becomes easier to let it take over the ponds. I have even seen different configurations of boxes with fine mesh screen that are attached to the forks of the backhoe and the duckweed is skimmed. This is less laborious, but it still pulls the operator away from other tasks.

Once the duckweed is on the banks, it cannot be left there to decompose. Duckweed is full of nutrients that will reenter the lagoons and the growth process will take off all over again. Besides, duckweed may appear ashy on the surface after a period, but beneath the ash are seeds that are very capable of regenerating if they return to the lagoons. I cannot stress enough, clean up the duckweed and dispose of it. Some systems will clean up harvested duckweed by employing the vacuum truck. This is a quick means of cleanup. There are others out there that swear by using sterile carp as a means of controlling duckweed. Again, this can be beneficial if the duckweed population is well under control. If it is out of control, there will not be near enough oxygen for them to survive those harsh conditions.

When I Learned About the Skimmer

Finally, in the spring of 2021, when attending a training in Glendo, Wyoming, Steve Harris introduced me to a piece of equipment used to skim duckweed from wastewater lagoons. This piece of equipment can run while the operator can work on other projects around the lagoons or elsewhere if it is frequently checked on. The best part about it, the idea came from one of our own. Yes, that is right. My colleague and friend Phil Harold from the Rural Water Association of Utah came up with a great idea. Phil and I have had many discussions about duckweed issues and that I have many

systems here in Wyoming that battle with duckweed every year. While Phil was onsite in Corrinne City, Utah, he and Jess Nicholas discussed the benefits of duckweed skimming and how it would be great to have a tool that would make duckweed removal less laborious.

Of Course, Jess owning his own business, Aquatic Plant Life Industries, beside operating the system in Corrine City thought about their discussion. Since he is an extraordinary fabricator, he went to work designing a system that would meet the needs of duckweed removal. The finished product that he built for my program was incredible and the cost for the entire package was incredibly reasonable. Our package included the trailer to haul it from one location to another, a three-inch Honda Trash Pump, the hoses, the water return pipe, the float and the filter box.

The Trip to Corrine, Utah

I remember that day that I picked up the equipment. I felt like a kid that got what he wished for on Christmas Day, I mean really, I was grinning from ear to ear knowing that I purchased a piece of equipment that could have an impact on our systems. I was thinking about all the violations I could help eliminate with the reduction of duckweed. I was thinking about how much better these lagoons could look if they were able to get the duckweed under control. I was thinking how other wastewater techs would wish they had one as well and that Wyoming is leading the way. I just couldn't wait to try this equipment out, I just had to make a few phone calls to arrange some demonstrations.

Demo # 1 City of Torrington

Torrington was not a scheduled demo. In fact, I made a routine stop just to see how things were going when Tom Troxel asked me if I could demo the unit for a few of his guys. Sure thing, it was after lunch on a Friday afternoon and the only thing I had left to do that day was to train a few operators from a small system that night. Torrington does a really good job maintaining their duckweed, but they do get some buildup on the corners where the aeration doesn't reach. It was amazing to watch the duckweed on the pond get drawn towards the float and to watch the filter box fill up with duckweed. In a short time, we removed a large amount of duckweed. As we were cleaning up the equipment, I asked for feedback. I was told that they liked the system, but they stated that an extension was needed so the duckweed wouldn't sluff off on the fender. They also stated that the discharge pipe on the skimmer tank should have been 6-inches versus the 4-inch pipe for a more rapid discharge.

Demo # 2 P-V Estates HOA

P-V Estates is a non-discharging lagoon system. There are many factors that allow the duckweed to thrive. These factors include trees blocking the winds' ability to move the water, no aeration built into the system, an overabundance of nutrient accumulation due to the fact the system doesn't discharge and potentially agricultural runoff from a nearby cornfield. This system fights annually to get duckweed un-

der control, and they spend many hours pushing the duckweed to shore and raking it out of the pond. On the August 7th demo, Melody Sellers and Tanner Waid were excited to see the duckweed skimmer in action. It didn't take long for this piece of equipment to impress them. After three hours of run time, we had quite an accumulation of duckweed sitting on the banks. Tanner Waid liked the skimmer so much that he told me to just leave it with them for a few weeks so that they could get the duckweed under control. They also mentioned that one of the drawbacks to the system was how the duckweed accumulated on the fender making it more difficult for cleanup.

Demo #3 Town of Dayton

Traveling to this demo came with some challenges. I left Cheyenne early in the morning on August 9th, so I had plenty of time to prepare for the demo. Well, somebody didn't want me to get there that day. A few miles south of Kaycee, the weld broke loose on my receiver and the trailer was cruising on its own into the ditch and decided to get hung up in the barb wire fence. As I was watching the trailer go into the ditch, it made me think of those Saturday morning cartoons where the trailer rolled past the vehicle. Anyway, there was no way that I was going to make it on time, so I rescheduled the demo for the next morning. I had to drive all the way up to Buffalo to purchase a 2-inch ball to mount on my bumper and back to Kaycee. Thank you, Rex Maxwell, for towing the trailer to your shop.

The next morning, I was on the road ready to go and was in Dayton with plenty of time to spare. At this demo, I asked our Water Circuit Rider Johann Nield to be present because he was the Public Works Director in Dayton for years before he joined Wyoming Rural Water as well as our Transient Non-Community Circuit Rider Joe Dankelman for this demo because their input would be valuable.

At this demo, the operators from the Town of Dayton and Ranchester were present, as well as Dayton's mayor Norm Anderson. I like seeing decision makers present at training. It shows me that they have an interest in the system. This demo went just like the other demos, and we removed a lot of duckweed in a very short time. The feedback at Dayton and was just like the feedback in Torrington and P-V Estates where they thought it would be necessary to have a removable extension over the fender so the duckweed sluffs away from the fender. Johann and Joe had a lot of good ideas as to how they would build a unit completely from ground up.

Demo #4 Town of Clearmont

After Dayton I headed to Clearmont to demo the skimmer again. Like Dayton and P-V Estates, Clearmont battles with keeping Duckweed under control. This time, I met with John Kiser and Joe and Johann followed along for this demo. Once we got the skimmer going, you could see the wheels turning in John's head. John was thinking about a way that he could have a unit like Rural Water's duckweed skimmer. John came up with the idea to design a system and the town purchase the materials. He brought his idea to the school so

the high school shop class has a project to work on. Great idea since they have a whole school year to complete the project before Clearmont's lagoons are overrun with duckweed again.

Annual Conference

At the Annual Conference, I had the opportunity to give a presentation on duckweed, as well as show videos of our demonstrations and Johann was a big part of the class. Thank you, Johann, for all your help. I could not have made it the success that it was without your assistance. Even though we didn't have duckweed nearby, we took the opportunity to set up the equipment outside and allow the attendees to see all the components and simplicity of the skimmer unit.

Future Demos

As we are nearing the end of duckweed season, there still is the opportunity to have a demo at or near your system. We will also be doing demos next year because of the shortness of our season. We are hashing out future plans for leasing the skimmer, and we have the information available if you are interested in purchasing your own unit while helping a fellow operator succeed in his business as these skimmers are extremely affordable.



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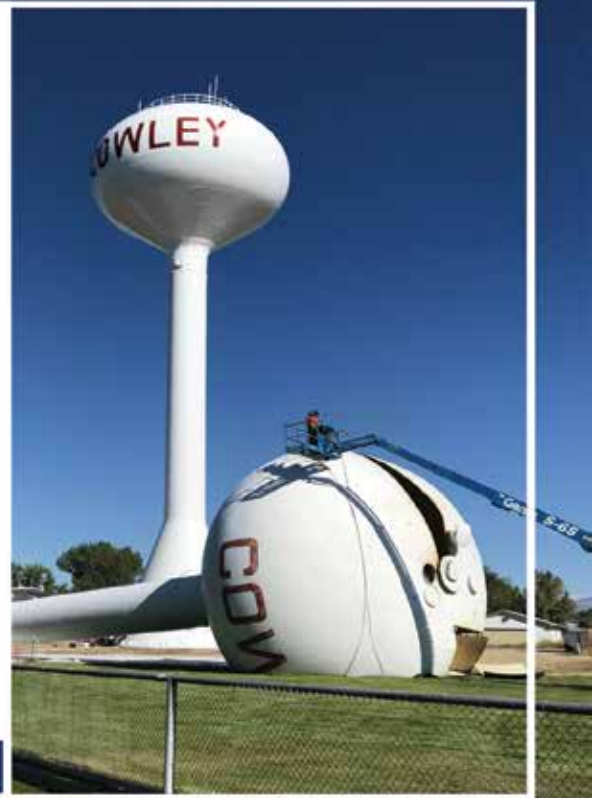
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