

CENTRAL STATES WATER

The Official Magazine of the Central States Water Environment Association, Inc.

92nd ANNUAL MEETING *RECAP*

PLUS:

24th Education Seminar
Water Week Fly-In Report
Monteverde, Costa Rica – MSOE Student Design
The St. Cloud, MN NR2 Project



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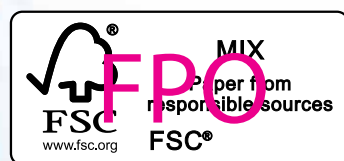
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Thank You and Hello

By Doug Henrichsen

Thank you CSWEA! I am honored and excited to serve as your President for the 2019-20 term. I am also grateful to all the leaders who have served before me to make our association what it is today.

Please join me in thanking **David Arnott** for his wonderful leadership this past year in driving our organization to new levels. The conference this year in Madison (lead by David Arnott and **Lindsey Busch** – Local Arrangements Committee Chair) was wonderful. I believe we set new records for both attendance and exhibitor booths. Well done Dave and Lindsey! The technical program, lead by Technical Committee Chair **Matt Seib**, was also outstanding. The sessions that I attended were fantastic and very high quality. Our WEF Visitor, **Rajendra P. Bhattarai**, 2018-19 Trustee, was an exceptional person to meet and get to know. If you talked with him as I did, you were left with an understanding of what a quality guy he is. I also would like to thank all of the sponsors and exhibitors that contributed to the success of this event. Without you, it would be very difficult to provide such a quality event year after year.

It's time to start planning our activities for the coming year. There are already several activities/functions planned. Please take a look at the list below of great educational and social events already in the works:

- **2019 WEFTEC Reception (CSWEA/IWEA)**, Hilton Chicago, Chicago, IL (September 22, 2019)
- **MN Section (with MWOA) Collections Workshop**, WLSSD, Duluth, MN (September 25, 2019)
- **MN Section Conference on the Environment**, Minneapolis Convention Center, Minneapolis, MN (November 7, 2019)
- **WI Section Operations Seminar, Phosphorus/Nutrients**, UW Oshkosh Alumni Center, Oshkosh, WI (November 14, 2019)
- **WEF 2020 Residuals/Biosolids Conference and Stormwater & Green Infrastructure Symposium**, Minneapolis Convention Center, Minneapolis, MN (March 31-April 3, 2020)
- **Midwest Student Design Competition**, Monona Terrace, Madison, WI (April 6, 2020)
- **25th Annual Education Seminar**, Monona Terrace, Madison, WI (April 7, 2020)
- **93rd Annual Meeting**, RiverCenter Convention Center, St. Paul, MN (May 18-20, 2020)

Information for these upcoming events can be found on our website, www.cswea.org. These events are valued by CSWEA members, as well as by many other distinguished professionals, wastewater pioneers, operators, manufacturers, professors, and students throughout the region.

I hope all of you are enjoying spring in the Central States region! Throughout our three states, the trees and plants are starting to blossom, and thoughts of hiking, biking, canoeing, kayaking, fishing, or whatever, are on the minds of many. For me, I am in the midst of planning my trip to the BWCA, and by the time you read this, I will be in a position to compare mosquito bites and tell you which ones to watch out for.

The value of our CSWEA membership is broad. When we asked our membership why they were involved with CSWEA, many cited the training and networking opportunities. The training opportunities with CSWEA are amazing. For example, the Illinois Section recently began a 14-course, **Operator Training program**, which is focused on providing operators an effective way to achieve their requirements and advancement more easily. My understanding is that these operator training events, two held so far to date, have been sold out. This sends a strong message for the value of these training sessions. In addition to the training opportunities, we also have events like the upcoming **CSX**, which stands for Central States Exchange, in mid-July. This yearly event is an opportunity for many of the leaders from our three sections to get together and discuss and plan our initiatives for the coming year. Because of other commitments during other conferences, it was decided several years ago that we needed to get together without

“The value of our CSWEA membership is broad. When we asked our membership why they were involved with CSWEA, many cited the training and networking opportunities.”

all of the other competing activities, so that we could discuss and plan our future events more effectively. I encourage all of you to attend CSX this year, as it is always a fun event that is held at a key resort in the Wisconsin Dells (fun for the family too).


Members of CSWEA are a community of highly-regarded, water quality professionals who have a unified focus on protecting the environment and public health by advancing the water industry in Minnesota, Wisconsin, and Illinois. We strive to foster an environment of learning, networking, and enjoyment while providing value to our members. This level of professionalism and desire to advance the water industry drives our volunteers to coordinate, host, and participate in many public/private educational opportunities, trainings, and seminars throughout the year. Time is also donated for projects benefiting the community. For example, **Global Water Stewardship (GWS)** is planning a trip to Costa Rica in August to help local leaders in this country develop wastewater initiatives and facilities. I believe there is still time to register to attend this event.

We also monitor the pulse of current and pending legislation and regulations that impact all of us at the local, state, and national levels and provide valuable insight to our local political representatives. Information is provided to help our members stay informed of best

“Each committee has a unique focus or purpose that covers a wide range of important issues we face daily.”

industry practices and we continuously think of the future as we reach out to the next generations of water quality professionals and leaders.

We achieve all this through the action of more than 13 committees at the CSWEA level, and many more at the individual state section levels. Each committee has a unique focus or purpose that covers a wide range of important issues we face daily. Some committees are technically-focused, like the Stormwater and/or Residuals Committees; and some are more audience-focused, such as the General Awards and/or Academic Excellence Committees. We also have committees for member services and external outreach services. All of our committees would appreciate more support from volunteers like you. So please, if you are interested in a particular topic, dive in and get involved.

In closing, if you are like me, be thankful for that last minute when everything seems to get done. 

Doug has been an active member of CSWEA since 1991 when he first moved to the Twin Cities. He has served in the following roles:

- First Vice President (2018-19)
- Second Vice President (2017-18)
- WEF Delegate (2013-17)
- Treasurer (2010-12)
- MN Section Trustee (2008-10)
- MN Section Chair (2006-07)
- S&YP Chair (2003-05)

Doug has also held numerous other positions within CSWEA, including:

- Local Arrangements Chair (2008)
- General Awards Committee

He holds a Bachelor of Science degree in Civil Engineering with an emphasis in Construction Management from the University of Wyoming (1987), and a Master of Science degree in Civil/Environmental Engineering from Iowa State University (1991).

Positioned in Saint Paul, Doug serves municipal wastewater clients in the Midwest as a Managing Engineer for Brown and Caldwell. His 32 years of experience in civil/environmental engineering work includes planning, evaluating, designing and constructing municipal treatment and conveyance facilities. Doug is also a Board Certified Environmental Engineer (BCEE) of the American Academy of Environmental Engineers and Scientists (AAEES) and a certified Project Management Professional (PMP) with the Project Management Institute (PMI). He is a registered Professional Engineer (PE) in Minnesota. Doug was honored to win the Arthur Sidney Bedell Award in 2018.



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Delegation Trip Recap

By Mohammed Haque



Earlier this year, we had the pleasure of hosting 14 Costa Ricans on a weeklong tour of the world of Midwest Wastewater. The group included members from the Towns of Monteverde (Student Design – 2019) and La Fortuna (Student Design – 2020) as well as representatives from the Ministry of Health, the national Water/Wastewater Agency AyA and a professor from University of Costa Rica. The trip started out with attending the Student Design Co – I'd like to thank all the people that helped with the on the ground coordination of activities and tours for our Costa Rican friends. Without their help, it would not have been possible. A big thank you to those below and any others that contributed to making this weeklong trip a success!

- Eider Alvarez-Puras, Baxter & Woodman
- David Arnott, Ruekert & Mielke
- Guissel Davilla, MSOE
- Maureen Durkin, MWRD
- Joan Hawley, Superior Engineering
- Mike Holland, Kishwaukee WRD
- Rich Hussey, LAL, Ltd.
- Emily Jones, Madison MSD
- Joe Lapastora, Northern Moraine WRD
- Troy Larson, Strand Associates
- Marc Majewski, Downers Grove SD
- Luke Markko, Northern Moraine WRD
- Nick Menninga, Downers Grove SD
- Doug Nelson, MSOE
- Paige Peters, Marquette University
- Amanda Streicher, Baxter & Woodman
- Matt Streicher, Glenbard WW
- Mark Van Weelden, Ruekert & Mielke
- Joshua Voigt, Xylem
- Zack Wallin
- Derek Wold, Baxter & Woodman



The participants were able to tour five treatment plants, including Madison MSD,

Paddock Lake, Northern Moraine WRD, Downers Grove SD and the Village of Brooklyn. In addition, the group toured the Water Center, Milwaukee School of Engineering and the Xylem-Flygt Pump facility in Pewaukee. The tour was a major success for both the visitors from Costa Rica as well as the individuals and firms that were part of the effort. It is expected that we can continue these annual tours since they are excellent learning opportunities. [CS](#)

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Highlights from WEFMAX

By Eric Lynne and Derek Wold



Eric Lynne



Derek Wold

The House of Delegates (HOD) members were busy attending WEFMAX and completing committee work before WEFTEC. Eric, Derek and Mohammed represented CSWEA at WEFMAX this year in Nashville and Scottsdale. The WEFMAX takeaways are summarized below, please use these advancements to enhance CSWEA's alignment with the four mission objectives promoted by WEF.

WEFMAX SCOTTSDALE, AZ, MARCH 27-29

Highlights:

Session I – Host Session

- AZ Water – The representatives from AZ talked a lot about their Leadership Series and Annual Conference. The Leadership Series has been well received and focuses on examples of how leaders became successful and professional development. The conference has outgrown its current space and after a long search, they settled on the Phoenix Convention Center. The biggest takeaway is that this is a combined conference with AWWA, which significantly increases their attendance. Most of the attendees that I talked to have a joint annual conference with AWWA.
- WEF Operator Training
 - A new textbook, *Wastewater Treatment Fundamentals – Liquid Train*, is complete. The book is getting really good reviews and also has a trainers kit and slides for operator training available for purchase. We may want

to consider this for CSWEA operator training.

- AZ Water presented on their operator events, which focus on competitions and networking events (typically a bags tournament, car show, etc.) and are often on weekends. AZ has similar struggles as CSWEA with a large area to cover with several population centers.

Session II – Engagement Innovations

- Ohio presented on the videos they created. This is similar to the My Water Legacy video that we prepared at our annual conference last year. A focus of the discussion was on how to use the video and get it out to people.
- Rocky Mountain presented on YP engagement. They basically host their events in Denver and struggle with engaging the members in New Mexico and Wyoming. Webinars is one way to engage. Note that AWWA has made push recently to end joint YP events. Biggest challenges are keeping YPs together (AWWA) and employer support.

Session III – Workforce

- Pacific Northwest presented on their initiatives to engage women in water. They have a long standing networking event at their annual conference and an annual award for the *Top Woman in Water*.
- Central States presented on training and engaging operators and GWS.
- Our takeaways included a need to engage a more diverse workforce when they are younger, a need to

attend STEM programs and talk about getting diverse workforce involved, and a need to expand our outreach to inner city schools.

Session IV – HOD Diversity and Inclusion Workshop

- This was more of generations talk. Learn, Communicate, Act.

Session V – Partnering

- WEF staff presented on their current initiatives and ask for input on how they can support the MAs more.
- The session transitioned to clarify how MAs utilize WEF and what roles should be:

What is WEF's Role?

- To host WEFTEC.
- To bring MAs together.
- To provide support and resources to MAs to succeed, thrive, and continue to grow.
- To provide overarching vision of organization as a whole since MAs will have their own vision – keep moving in same direction; guidance and vision globally.
- To be a national and global voice.
- To be a safety net for MAs that are going through challenges.
- To provide consistency – MAs and people involved are constantly changing so WEF needs to be the consistent voice.
- To contribute content creation and training resources.
- To provide access to national speakers for regional conferences.
- To provide operator certification.
- To be a national voice for congressional rulemaking of our governance.

What is the MA's Role?

- To have MA Conferences.
- To monitor legislation in our states.
- To provide member engagement since we are the closest resource to our members.
- To hold localized operator training seminars.
- To communicate with WEF and making it known what MA's needs are – can be intimidating.
- To be eyes and ears for WEF and help identify issues whether big or small.
- To provide local networking opportunities for our local groups.

How do WEF/MA intersect?

- Exclusively – true partnership, there may not be any exclusive roles – partially responsible for success of WEF and MA.
- Both WEF and MA define customer as our member. Becomes difficult if the voice is different (MA-only membership). WEF needs to look at MAs as customer as well and better define how that partnership works. All MAs are different (sizes, structure, resources).
- To look at each service to see which items are valuable:
 - Self-serve (i.e. Monthly articles).
 - Leadership development resources (i.e. WEFMAX, WEFTEC Leadership Day).
 - Communications (i.e. *WEF Leader*, *YP Connections*, *This Week in Washington*, *HOD Speaker Quarterly Update*).
 - Membership Resources (i.e. Planning guide for membership, new member welcome letter).
 - Marketing Resources.

Session VI – Membership

- AZ Water – *Conference Vendor Pricing*.
- Iowa WEA – *Officer position Descriptions*.
- New Jersey WEA – *Scholarship Guidelines*.

WEFMAX NASHVILLE, TN, MAY 29-31

Highlights:

- Virginia is hiring additional paid staff to manage membership for items that were neglected, such as on

boarding, exit surveys, and populating their database.

- Kentucky-Tennessee hosts a Utility Manager's Forum that is by invite only (no vendors or consultants).
- Kentucky-Tennessee has rebranded their organization (no one could easily explain what a Water Environment was) to focus on Clean Water – the final product of our work. They are working on a handout to help utilities figure out the process of re-naming a facility. A key feature to their next event is to have four craft brews develop several barrels of 'Next Round Brewing' an effluent derived beer.
- Michigan has adapted the *Utility of the Future Award to a Premier Utility Management Performance (PUMP)* award for facilities that lead the sector.
- WEF's new operator manual is available. These manuals will serve as an option to the traditional 'Sacramento' Books. Central States would get a discount on these books if we wanted to purchase a set for the Operator Training seminars. WEF is now developing a trainer's kit to complement the book. WEF is trying to assemble links to the certification advancement pathways for each state.
- Pacific Northwest hosts a Women in Water event. Events are encouraged to be women only to allow those less outgoing a spot to network and/or have a voice. They are currently looking into developing a (7S) shovel as a necklace form to accommodate clothing that does not accommodate a pin/clip. A new T-Shirt for Women in Water is available for purchase and proceeds go toward a scholarship.
- For meetings where we need to vote or provide preferences/feedback, consider use of a live (anonymous) survey on www.polleverywhere.com via text messages from cell phone.
- MA Resources Workgroup is assembling useful info from all MAs. Items that are currently being assembled include:
 - Annual Report template.
 - Organizational Chart for MA and Local Arrangements.
 - Webinar Organization/Management.
 - Risk averse Investment guide to create a scholarship program.



WEF MISSION

- Connect water professionals
- Enrich the expertise of water professionals
- Increase the awareness of the impact and value of water
- Provide a platform for water sector innovation

VOLUNTEER SERVICE RECOGNITION PROGRAM

- For the third year, the Committee Leadership Council is seeking nominations for the Volunteer Service Recognition Program to recognize individuals for outstanding service. Nominations are due June 30.

WEFMAX 2020

Future WEFMAX conferences will be held in Hawaii, South Carolina, New York/New Jersey, and North Dakota. Look for an update to the timing and location of each at WEFTEC this September.

WEF EXECUTIVE DIRECTOR

Just as CSWEA utilizes an executive director to keep us organized, so does WEF. Eileen O'Neil had served in this role for many years. After a proper search, WEF has hired Walter Marlowe to lead the organization. If anyone wants additional information on the new hire, contact Eric or Derek. Walt will start on September 9, 2019. [CS](#)

New Opportunities for Everyone



By Rachel Lee

Here we start a new year of CSWEA and section leadership. My predecessors encouraged, or perhaps warned me, that it would be good to have goals in mind before the year started. Heeding their advice, I have been pondering initiatives. Should I follow WEF's lead and focus on workforce initiatives? Should we incorporate a women's group into the section? Should we focus on resource recovery and utilities of the future? Is it time to review our strategic plan?



Should I push the limits of my writing ability and entertain you with articles that read more like the Holderness Family's musical tributes to life with a young family, but with a special CSWEA Wisconsin Section flair? I can relate to all of their videos. It's May now, and their most recent song focused on the special chaos that May brings. In my house there are a minimum of seven baseball events and two soccer events each week, plus some school projects, concerts, fundraisers, and field trips. It's conference season and the grass is growing fast enough that I could mow three times a week and still be behind. That's my life these days and surely many of you are in the same boat. However, May doesn't allow for hours of creative writing.

There were many ideas to consider, but I can see that one is very much calling out to be addressed. It came from interactions at the annual meeting. There were several people who reached out wanting to get involved in the Wisconsin Section at the annual conference, and in my efforts to have our committee roster updated, several opportunities have appeared. It's wonderful to see people interested in being involved, and having new volunteers will only energize our section more.

Please reach out if you would like to get involved in any of the Section committees or if you have new ideas. You can reach out to any of our officers or committee leaders included in the committee roster to learn more and get more involved. Some ideas to consider include:

- **The Watershed and Stormwater Committee**, which promotes an increased understanding in water quality protection matters and watershed-based solutions. They also encourage the active participation of Section members on watershed stakeholder teams, and host an annual webinar to educate our members. This committee is seeking members and a Vice Chair.
- **The Young Professionals and Students Committee**, which hosts a Brewers Outing each August and several other networking events throughout the year. A representative from the committee is often given the opportunity to attend the WEF YP Summit on behalf of the association. This committee is always open to new members and is a great way for young professionals to get involved and learn more about our section.

The section is looking to initiate a new committee or subcommittee focused on energy management, biogas production and use, resource recovery, and perhaps water reuse. We are going to discuss this at CSX, so please share your ideas and opinions ahead of time.

Many of our committees host seminars throughout the year. This edition of CS Water includes articles highlighting the Government Affairs Seminar and the Biosolids Symposium. Please give those articles a read and consider attending one of our seminars. It's not too late to attend the Northwoods Collection System Seminar on July 25 in Marshfield.

As we endure the end of the school year and transition into summer, there is much to look forward to. Cookouts and time at the pool are always fun. Summer vacations hopefully bring relaxation and new adventures. Wisconsin really is beautiful in the summer, and I encourage all of you to get out and see our local waterways. [CS](#)

"It's wonderful to see people interested in being involved, and having new volunteers will only energize our section more. Please reach out if you would like to get involved in any of the Section committees or if you have new ideas."

THE 37TH ANNUAL SPRING BIOSOLIDS SYMPOSIUM

On March 26, the 37th Annual Spring Biosolids Symposium was held in Stevens Point, WI. Over 200 attendees interacted with speakers who presented on topics related to biosolids and septage management.

Presentations covered septage receiving station design considerations, a survey on why water resource recovery facilities selected to produce either a Class A or Class B biosolid product, and a review of nitrates in WI groundwater. A panel featured three different perspectives on the challenges of applying biosolids using phosphorus based nutrient management. Sue Porter laid out the regulatory framework and status of nutrient management plans throughout WI. Madison Metropolitan Sewerage District Biosolids Coordinate Kim Meyer reviewed phosphorus impacts to how water resource recovery facility apply and dispose biosolids. Agronomist Todd Schaumberg gave a farmer's perspective on nutrient management plans and biosolids. Representatives from the WDNR thoroughly reviewed the ins and outs of licensing renewal, septage storage permitting, PFAS, and gave cautionary enforcement tales. The WDNR statewide biosolids coordinator wrapped up the symposium with an update on the latest changes to regulations and trends to impact stakeholders.



The Spring Biosolids Symposium is organized and implemented by a committee consisting of representatives of the CSWEA Wisconsin Section, the WDNR, WWOA, WLWCA, plus others. Special thanks from the Committee to Jon Butt, Amy Haque, and Mohammed Haque for assisting with registration. An extra special thanks to Bill Marten, who is stepping off the committee. Bill has been instrumental in organizing the symposiums since 2006.

Celebrate St. Patrick's Day in Stevens Point at the 38th Annual Spring Biosolids Symposium on March 17, 2020. If you have a topic or speaker suggestion for next year's symposium, please contact either of your CSWEA-Wisconsin Section SBS Committee representatives at glenn.tranowski@strand.com and diehldl@bv.com. [CS](#)

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CSWEA Active Membership: The Key to Our Success



By Patrick Haney

Three years ago, I relocated to Minnesota from Colorado in a move to return to my passion for water (both professionally and recreationally). Immediately I was welcomed with open arms by the CSWEA community. Since then I've met friends, professional colleagues, and observed the dedication of the MN Section leaders. I continue to be impressed by the quality and time of the volunteerism that the Minnesota Section leadership has provided over the years.



Fast forward to today, and I am honored to be serving as the Minnesota Section Chair. Earlier this month the Minnesota Section Leadership met to transition our roles as chair and vice chair. We discussed and identified potential challenges and opportunities for the coming year. As the meeting went on, we realized how much effort could go into all our potential initiatives. These initiatives included changes to our financial management, adding a utility management workshop similar to the Wisconsin Section, starting a wastewater treatment committee and utility management committee, re-aligning leadership of the Stockholm Junior Water Prize, membership outreach, inclusion, and diversity, networking events, and collaboration with other water and water resource recovery organizations within our state. We all saw the mountain looming before us and came to this conclusion: We are ready to climb, but we need your help.

While the MN Section will prioritize our initiatives for the next year at MNX in June, one thing that we realize is that re-energizing and expanding our membership needs to be a focus over the next year.

To accomplish our goals of the future, we need to promote membership not just in terms of new members, but within our current members as well. Much with the theme of the Central States Annual Conference, we all need to start *Transitioning to a New Generation* of leaders. By all accounts, that doesn't necessarily mean just targeting young professionals, but rather actively seeking renewed membership and invigorated membership activity amongst seasoned professionals. Further, we need to provide meaningful participation, leadership, and educational opportunities for all our engineers, operators, and utility leadership.

To actively seek new CSWEA participants, re-invigorate our current members, and inspire the young members of the future, the Minnesota Section plans on re-emphasizing the importance of our Membership Committee. The membership committee will help organize more networking events, work closely with

our young professionals and public education committees, and bring new energy through a focus on diversity and inclusion.

The Minnesota Section Leadership, in conjunction with the Membership Committee, will be focused on outreach activities to encourage active membership of our consultants, utilities, manufacturers, and equipment representatives. We need to educate our future members and their respective organizations about the value of actively participating in CSWEA.

This outreach isn't intended to replace the leaders of today, but allow for future growth of our organization and expand the positive impact Central States has on our communities.

The Minnesota membership and section leadership has accomplished so much the past year. We've had record attendance at the Conference on the Environment and Innovative Approaches to Wastewater Operations Conference. We continue to have successful collection system workshops, stormwater tours, and conducted the first MN R2E Water and Energy Innovations Seminar. I couldn't be more impressed or prouder of our Section. I'm confident that we can continue these successes in the future; and expand our footprint, service and impacts on the water resource recovery community.

I wanted to end this message with a final and sincere 'thank you' to the Minnesota CSWEA Section Leadership and Members. I'm thankful for the friendship and guidance over the past three years. I'm excited to serve as the Section Chair for the next year, and I look forward to continuing to contribute to our organization in the future. **CS**



At the recent MN R2E Water and Innovations Seminar, attendees had the opportunity to tour the new Lystek and Ostara processes at the St. Cloud Nutrient, Energy, & Water Recovery Facility.

Make YOUR Section Work for YOU – Get Involved!



By James Kerrigan

With summer officially underway and the annual meeting completed, things are heating up for Central States. With record attendance and a busy agenda, this year's conference pushes us full throttle into the summer months. It is an exciting time to be in CSWEA and we have a lot going on, so hold tight, this is going to be fun. Here's a snapshot of what is going on in your section and where you can get involved.



In late June, the Annual Collection Systems Seminar takes place, drawing together some of the best and brightest of our region. This event has been gaining in strength year after year and provides a great opportunity for sharing knowledge and ideas amongst CSWEA and other organizations.

The newly combined Operations and Safety Committee is busily planning its annual seminar for later in the summer. This committee has taken on the additional responsibility of leading the Certified Operator Training Program for the Illinois Section. By all accounts the first session was hugely successful. Watch this space for additional updates.

In similar fashion, the Biosolids and Energy Resource Recovery Committees have combined their resources and reinvigorated their roles. The consolidated committee is currently working on their next seminar for later in the fall, which will be a great addition to the calendar.

As always, the Young Professional (YP) Group has provided their membership with inspiring and educational events that, as would be expected, were suffused with youthful energy. Even seasoned professionals looking for new ideas should consider attending their events, as they have proven to be both fun and productive. Be on the lookout for the next date.

On top of what's already in the works, there is still more to do to keep the momentum and enthusiasm from the annual meeting going throughout the year. The good news is that there are excellent venues in place to do just that – the multiple CSWEA committees. CSWEA is a great way to not only make contacts in your field, but also lifelong friends. It is the committee members that make the sharing of knowledge both informative and enjoyable, which is basically CSWEA's mission.

The question for some is how to get involved, and how to get others that might not know the section to also get involved? How? For me it was a subtle nudge from an enthusiastic engineer who basically answered my question with the following; "You NEED to join CSWEA!" That sounded like a ringing endorsement to me and I am thankful for it. Someone brought

it up at the YP meeting this year that they were 'voluntold' to join a committee and attend a conference. That suggests that we've all got to be better at spreading the word. Sometimes the first step can be quite daunting. In my experience, a little nudge can go a long way.

Here is what I would suggest: come to the section meeting. It's low key, fun, interactive, and you will find that just about everyone who is anyone is there. While you're there, look beyond your age and experience for new faces to associate with. While the

Students and YP's provide guaranteed camaraderie, there is a lot to gain from the more mature and experienced members. Of course, there is no need to wait for a next meeting to get involved. Just pick a committee that sounds interesting to you and reach out to the Chair. If that sounds daunting, contact me personally and I'll help facilitate your involvement. There is never a perfect time to start – so why not now?

"There is never a perfect time to start – so why not now?"

As we continue to grow and strengthen our section, we wouldn't be where we are today without the hard work of our predecessors. I'd like give a big shout out to Chris Marschinke, our immediate Past Chair. Chris has provided much guidance for me as he handed over the reins. His are big shoes to fill. He has also set us out on a strong path moving forward that I – together with your section officers Amanda Streicher and Bob Swirsky – hope to keep travelling in the right direction. Both Amanda and Bob are so well known with their tireless work on various committees with GWS and CSWEA, that any introduction here is probably unnecessary.

With that, I invite you to contact me and let me know what you think is good, what is not so good, and what you'd like to see more of. With Amanda and Bob in the fold we have a good group, but input on how to make the section even better will come from you, the members. It's easy to fall back on a 'that's the way it was always done' mentality. We'd like to move forward with 'this is how it should be done' and get everyone actively involved, not just being a member.

Slan go foill (Bye for now)

James CS

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92ND ANNUAL MEETING

MAY 14-16, 2019 | MONONA TERRACE, MADISON, WISCONSIN

President's Wrap-Up

The 92nd Annual Meeting in Madison was a huge success. Thank you to all who attended and especially to the Local Arrangements Committee (LAC) consisting of Lindsey Busch, Matt Seib, Cary Solberg, Tom Mulcahy, Keith Haas, Mary-Frances Klimek, Mark Van Weelden, Rachel Lee, Marc Zimmerman, Greg Gunderson, Alan Grooms, Jon Lindert, Samantha Austin, Julian Kiss, Linda Reid, and Amy Haque. A special thank goes out to our LAC Chair, Lindsey Busch, who did a masterful job orchestrating all the details that went into the Annual Meeting.

The meeting kicked off on Tuesday with a golf outing at Yahara Hills, a community service project at the Madison Metropolitan Sewerage District (which is at a wetland site of the Yahara WINS program), a tour of the Madison Metropolitan Sewerage District's Nine Springs Treatment Facility, and a stormwater bike tour around Lake Wingra. Meetings for the 7S group, Golden Manhole Society, and Young Professionals took place late in the afternoon.

Tuesday evening was the Meet-and-Greet Social event at the Madison Children's Museum. I enjoyed catching up with many people at this great venue and the rooftop was great!

The main part of the Annual Meeting started on Wednesday with the 5K Run/Walk and Sunrise Yoga as starter activities in the morning. Technical sessions and the exhibition took

place the remainder of the day. The technical presentations covered the areas of digestion and biosolids, low phosphorus limits, stormwater, leadership, young professionals and a variety of other topics. The panel discussion on leadership and Young Professionals was especially interesting to me.

My favorite part took place on Wednesday evening: the Annual CSWEA Awards Event. It was fun and rewarding for me to host the event recognizing and honoring dedicated wastewater professionals who give so much to our industry.

The exhibition and technical sessions continued Thursday, with the Association Luncheon taking place at noon. Operator sessions took place on Thursday morning in the four areas of operation and maintenance of process equipment, valves, pumps, and instrumentation. The attendance was a little on the light side, but the quality of the interactions and discussion between the manufacturers and utility staff was very high.

Thanks to all who attended the Annual Meeting and the LAC. It's been fun, and I look forward to the next Annual Meeting in St. Paul in 2020! [CS](#)



David Arnott



Golf Outing

By Marc Zimmerman

The 92nd CSWEA Annual Meeting Golf Outing had 28 members participating in a four-person team scramble format at the Yahara Hills Golf Course. It was ideal weather to kick off the conference activities as golfers got the opportunity to reconnect with past acquaintances and network with fellow water and wastewater professionals. Cash prizes were awarded to the low scoring team and the second to highest scoring team. Individuals also competed for additional prizes at nine sponsored flag events displaying their golfing 'skills' like:

- Closest to a water hazard
- Closest to the bunker without going in
- Longest putt made
- Longest drive
- Shortest drive

Participants not fortunate to be on a winning team, or if their skill challenge ability was not up to par, they were entered into a second chance drawing for additional cash prizes, gift cards, or tickets to attend the upcoming Madison AMFAM Championship PGA Champions Tournament. A good time was had by all. The Global Water Stewardship was the beneficiary of \$260.00 from participants purchasing mulligans. I would like to acknowledge and thank our generous sponsors that contributed to a successful golf outing. [CS](#)



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- Illinois State Section Trustee '21, Mike Holland
- Wisconsin State Section Trustee '21, Jay Kemp
- Executive Management Team, Mohammed Haque/Amy Haque

City of Madison Stormwater Tour

Stormwater Facilities Protecting the UW-Madison Arboretum and Lake Wingra

By Jon Lindert

The Wisconsin Section Watershed and Stormwater Committee hosted a **bike tour** around Lake Wingra to visit the eight stormwater treatment facilities providing stormwater treatment to protect Lake Wingra and the UW-Madison Arboretum. Lake Wingra is a 339-acre lake in the City of Madison with a 5.68 square-mile highly-urbanized watershed surrounded by the UW-Madison Arboretum, Vilas Park, and Edgewood College lands. The story of rehabilitation, restoration, and stormwater treatment unfolded as 13 sustainable-minded participants engaged in a gentle 9.2-mile bike ride (with some modest hills) looping around the lake.

The tour also included a chance to see the Lake Wingra Dam With Viewing Deck, Wingra Park Coanda Screen Stormwater Treatment Device, Monroe Street Wet Pond Rehabilitation & Alum Pilot Project, Manitou Pond Wet Pond and Natural Channel Restoration, Nakoma Park Stream Restoration, Pond 3 Wet Pond and Upstream Coanda Screen Stormwater Treatment Device, Pond 4 Wet Pond Rehabilitation, and the Wingra Creek Streambank Restoration.



Some attendees rented bikes through Madison B-Cycle, while others brought their own bikes. After the tour, attendees visited the downtown Great Dane to enjoy drinks and further conversations before returning to their lodging accommodations.

Thanks to Madison B-Cycle for coordinating bike rental and Mother Nature for bringing perfect biking conditions. [CS](#)



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Madison Metropolitan Sewerage District Plant Tour

Madison Metropolitan Sewerage District

Madison Metropolitan Sewerage District was pleased to host the plant tour for the Central States Water Environment Association 92nd Annual Meeting. 28 people visited the Nine Springs Wastewater Treatment Facility on the afternoon of Tuesday May 14th. The tour kicked off in the District's Maintenance Facility conference room area with a quick district orientation and then embarked on a tour of the plant and grounds. The Maintenance Facility is a relatively new district structure, serving as a modern base for the maintenance crews and their equipment as well as purchasing and inventory spaces.

After leaving the maintenance facility the tour group enjoyed a nice afternoon on a long walking tour of the plant, stopping first by the struvite recovery facility where the District recovers nearly two tons per day of struvite fertilizer from side streams being returned to the plant, recovering valuable resources and reducing loading on the plant. Next up we visited the Waste Activated Sludge (WAS) thickening facilities, where gravity belt thickeners (GBT) separate solids from water to increase digestion efficiency. We walked past the biogas conditioning system, which removes H₂S and siloxanes from biogas recovered from anaerobic digestion processes and prepares it for use in boilers and engines on site. A brief peek in on the engine-generators was next, a pair of biogas powered engines coupled to 450 kW generators to offset some of the plant electrical demand and recover another resource used extensively on site, that resource being heat.

Following the peek in at the engines, the tour descended to the lower levels of the plant sludge complex and viewed pumps, heat exchangers, and pipes in the basements and tunnels, then continuing on to view the liquid treatment processes. Madison uses a modified University of Capetown (UCT) process without internal recycle to treat their wastewater, removing phosphorus biologically. The group then wound their way to the effluent building where the tour groups saw the ultraviolet disinfection system as well as the effluent pumps that pump all effluent to our two discharge locations on Badfish Creek and Badger Mill Creek. We then passed by the cake biosolids storage and the liquid biosolids storage tanks. The tour ended back at the Maintenance Facility and then attendees departed on their own for their next events. [CS](#)



7S and the Golden Manhole



Transitioning to a New Generation

Service Project



Young and seasoned professionals gathered at the Metropolitan Sewerage District's restored wetlands and lagoons (part of the Capital Springs State Recreation Area) for the second CSWEA Annual Conference Service Project. The lagoons and wetlands provide excess flow storage for treated wastewater during high flow events and provide habitat for a variety of birds and wildlife. With the help of District staff, volunteers identified and removed invasive species as an ongoing effort to enhance a unique and valuable resource. CSWEA volunteers were also joined by WEF Board of Trustees members Joan Hawley and Rajendra Bhattarai. Volunteers finished at the site late Monday afternoon and met the other conference tour groups at The Great Dane Pub & Brewing Co. in Madison for a well-earned beverage. [CS](https://www.cswea.org)



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CSWEA'S 92ND ANNUAL MEETING *RECAP*

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5K Walk/Run

The CSWEA 92nd Annual Meeting offered a beautiful morning for the 5k Run/Walk event on Wednesday, May 15. After a great night of socializing at the Madison Children's Museum, 11 committed conference attendees got up early and ran, walked, and bicycled 5.4 kilometers (3.3 miles) along beautiful Lake Monona. Runners enjoyed scenic views of the lake, Monona Terrace, and glimpses of the Wisconsin State Capitol from the midway point of the course at Olin Park. Doug Lange from Hawkins, Inc. crossed the finish line first with an incredible time under 20 minutes, and Amanda Streicher from Baxter & Woodman was able to estimate her finishing time to within 10 seconds of her actual time. Congratulations to all the participants, and we are looking forward to another great 5k event at next year's conference in Minnesota. [CS](#)



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92nd Annual Meeting Awards and Water Environment Federation Awards

Presented by Raj Bhattarai, Guest of Honor



Laboratory Analyst Excellence Award
Danette Stout, Wheaton Sanitary District



William D. Hatfield Award
Mary-Frances Klimek, Racine Wastewater Utility



George W. Burke, Jr. Facility Safety Award
St. Cloud Public Utilities Department (Accepted by Patrick Shea)



Arthur Sidney Bedell Award
Mike Holland



WEF Service Awards
Mark Eddington, WEF Delegate 2017-2018



CSWEA Service Awards
David Arnett, CSWEA President 2018-19



CSWEA Service Awards
Chris Lefebvre, PWO Representative 2017-19



CSWEA Service Awards
Daniel Zitomer, Wisconsin Section Trustee 2017-19



CSWEA Service Awards
Derek Wold, Illinois Section Trustee 2017-18



CSWEA Service Awards
Rich Hussey, Illinois Section Trustee 2018-19



Operations Award
Ryan Giefer, City of Wisconsin Rapids, WI



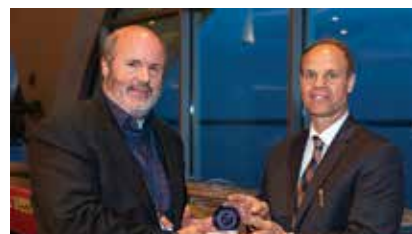
Operations Award
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Operations Award
Steve Olson, Kishwaukee Water Reclamation District, IL



Collection System Award
Mark Kivela, City of Marshfield, WI



Collection System Award
Scott Dentz, Metropolitan Council

92nd Annual Meeting Awards and Water Environment Federation Awards

Presented by Raj Bhattarai, Guest of Honor



Collection System Award
Aaron Berry, Trotter and Associates



Industrial Environmental Achievement Award
Peerless Industrial Group, Winona, Minnesota
(Accepted by George Kosidowski)



Gus H. Radebaugh Award
A Study on the Effects of Side Streams on Phosphorus Removal
by Scott Trotter and Elizabeth Heise, Trotter and Associates



Young Professional of the Year Award
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Young Professional of the Year Award
Hasibul Hasan, Sambatek, MI



Young Professional of the Year Award
Chris Marschinke, Trotter and Associates, IL



Water Stewardship Award
Mike Holland, Kishwaukee Water Reclamation District



Sustainability & Green Infrastructure Award
Joshua Gad and the City of Mankato, MI



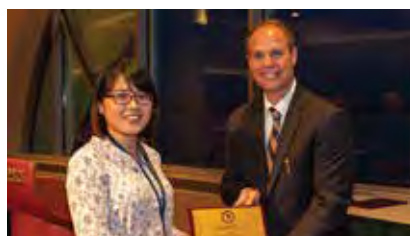
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Academic Excellence Award
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Academic Excellence Award
Daniel Rider, University of Wisconsin – Stevens Point



Water Technology Innovator Award
Daniel Zitomer, Marquette University

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Central States Water, Kelman Scholarship Award
'Palmar Sur, Costa Rica Sewer and Treatment Design' for GWS by Joe Lapastora, Elizabeth Ebert, Jessica Zemen and Erik Papenfus; University of Wisconsin – Platteville. (Accepted by Joe Lapastora and Elizabeth Ebert)



Global Water Stewardship
'Monteverde, Costa Rica Sewer and Treatment Design', by Miranda Durbin, Sydney Shaffer, Alexis Countryman, Jamie Sykora, Christine Boland-Prom, Guissel Davilla, Rachel Montavan; Milwaukee School of Engineering (Accepted by Christina Boland-Prom)



WEF Officer Memento
Raj Bhattarai

Award Winners Not Pictured

WEF Service Awards

Tracy Ekola, WEF Delegate-at-Large 2017-2018

Academic Excellence Award

Alexander Weislak, Milwaukee School of Engineering

Student Design Competition Environmental Design

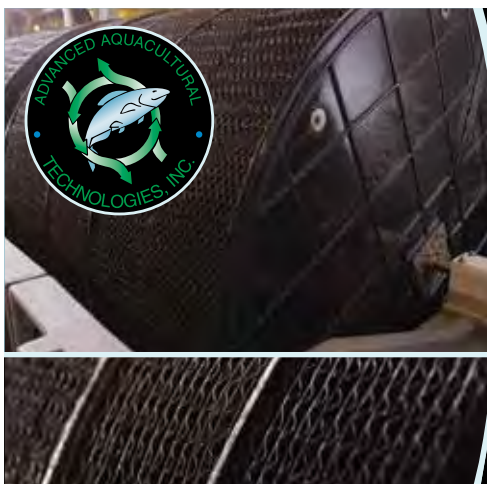
'Solutions for Houston Flooding' by Jinglin Duan, Jonathan Kolweier, Javier Mulero, Justin Shen and Alana Rosenbaum; University of Illinois at Urbana - Champaign

Highlights of the Night



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Conference at a Glance



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The 2019 CSWEA Education Seminar

Thank you to everyone who turned out for a tremendous 2019 Education Seminar on New Innovations in Wastewater Resource Recovery Facility Design and Operations. This year's seminar included new features that provided more opportunities for interaction, and we plan to include as components of future seminars. Specifically, the CSWEA Education Seminar Committee collaborated with the CSWEA Innovation & Technology (I&T) Committee to highlight more breakthroughs in our field and provide additional networking opportunities. Following the speaker reception on Monday, an inaugural I&T-LIFT dinner was hosted at Cooper's Tavern, open to all attendees. This event included speakers who presented as part of the LIFT panel and yielded a dynamic environment for stimulating conversation. Additionally, we had an expanded poster session that occurred during the reception on Monday as well as during breaks and lunch on Tuesday. We had great representation from students, exhibitors, and LIFT presenters. Stay tuned for more changes to come for our 2020 Education Seminar poster session.

Kicking off our education seminar was the eminent **James Barnard**. He provided an articulate history and overview of Enhanced Biological Phosphorus Removal (EBPR) and current processes, understanding, troubleshooting, and retrofitting approaches. He also pointed out that models are primarily based on *Accumulabacter* and are in need of updates to include *Tetrasphaera*. Relative to conventional activated sludge, EBPR is a newer process, and we were honored to have the original pioneer of this process share his story.

Moving from phosphorus to nitrogen, **George Wells** from Northwestern University provided overviews of the array of nitrogen transformation processes including nitrification, denitrification, and partial nitrification/anammox to save energy, recover resources, and decouple carbon and nitrogen removal. For example, partial nitrification/anammox offers the opportunity to decrease oxygen consumption (and associated energy requirements) for N removal by ~60%. He also highlighted complete ammonia oxidizers (comammox) as a new microbial player in the field. Low DO nitrification with comammox could be a low energy N removal option in the future.

Karen Pallansch, the CEO of Alexandria Renew Enterprises, started out by noting that, regardless if your day to day work is considered innovative, what we all do as part of this field is important. If we weren't here, a lot more people would be sick and without water. She then noted that innovation is not just the what or how, but also the *who*. The public helps us innovate if we are listening.

Brian Perkovich, Executive Director at Metropolitan Water Reclamation District of Greater Chicago, provided an overview of their plans to manage stormwater, nutrients, and biosolids, as these are all elements that include recoverable resources.

Fidan Karimova then presented on behalf of the LIFT organization from the Water Research Foundation (WRF). She noted the various manners in which we can get involved with LIFT and the bounty of resources available on their website. Her overview of LIFT preceded the lunch poster session that included LIFT projects, student research, and vendor technologies.

While in some cases innovation can require high up-front costs in research, development, and deployment, low cost technologies also need to be part of the repertoire and require fundamental research to know how effective they are. **Jennifer Becker** from Michigan Tech University presented findings from her WRF study on air drying biosolids for class A biosolids production. She concluded that class A biosolids generated from low-cost low temperature storage is feasible.

Peter Schauer from Clean Water Services explained how they use sensors to monitor, understand, and predict EBPR systems. Mixing was a big theme both in his talk, throughout the day, and in Q&A from the audience. What is optimal? More research and data are needed.

The event concluded with three speakers presenting how they incorporated new technologies at their utilities. **Larry McFall** from Rock River Water Reclamation District explained that entering into a partnership with a for-profit company can fast track a technology at your plant. **Tracy Hodel** from St. Cloud noted that they produce 82% of their energy needs from renewable energy made on-site, and they have a goal to be energy neutral by 2020. She also highlighted that explaining wastewater treatment plants from an energy standpoint can make them more favorable to the public. Finally, **Tom Sigmund** from Green Bay NEW

Water highlighted their recent Resource Recovery and Electrical Energy (R2E2) project. They now produce fertilizer products and energy, and he postulated that someday we will recover plastics, gold, and an array of other materials from our facilities.

In conclusion, we were reminded of the massive importance of all of our jobs in the water and resource recovery sector. Older technologies such as biosolids air drying, to recent discoveries such as EBPR to cutting edge revelations such as comammox are all tools in our toolbelt, and beyond technologies it's all the people that we must invest in and listen to as we strive to continually change our field and make a positive impact. The event concluded with a heart-warming story from Tracy Hodel about her first WEFTEC experience where she knew nobody and was just starting out. A friendly stranger who happened to be named James Barnard invited her to join him and his wife for a dinner. The people component to this industry was evident early on and it was a reminder that the actions we take today as both mentors and mentees can have long lasting ripple effects for years to come.

The seminar will be available as a webinar and can be purchased through the CSWEA website if anyone is interested in hearing any of the presentations. We hope to see you April 6 and 7, 2020! [CS](#)

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Brian Johnson/Executive Director Greater Peoria Sanitary District with Representative LaHood



John Friel and Hans Holmberg with Senator Klobachar

Infrastructure investment is a continuing discussion on Capitol Hill, but Congress often thinks of airports and roads – overlooking water, wastewater and stormwater facilities as a persistent need. Moreover, to advance continuing cost-effective improvement in the water environment, there is a need for additional research, workforce development, and technology innovation to meet our future needs. Water Week engagement with Congressional leaders and staff advances the awareness that investment in the water sector is good for the US.

Water Week messaging is now coordinated among several organizations so that there is a consistent dialogue as attendees make their Capitol Hill visits. In addition to WEF, participating organizations include APWA, AWWA, NACWA, US Water Alliance, WaterReuse, Water Research Foundation, the Rural Community Assistance Program, Council of Infrastructure Financing Authorities, Association of Metropolitan Water Agencies, and the Water and Wastewater Equipment Manufacturers Association.

Key Discussion Points for Congressional Visits include:

- Increasing FY 2020 Clean Water Act SRF appropriations and reauthorizing the program.
- Funding Drinking Water SRF to the fully authorized level.
- Funding the Water Infrastructure and Finance & Innovation Act (WIFIA) at or above \$50 million (leverages \$5 billion in additional funding).
- Providing \$20 million for the National Priorities Water Research Grant Program.
- Increasing the Bureau of Reclamation's Water Reuse and Recycling Grants Program.
- Funding USDA Rural Utility Service's Water/Wastewater loans and grants at \$2 billion/\$500 million respectively.
- Protecting full funding for water quality conservation and source water protection programs in the USDA National Resources Conservation Service.
- Fully funding new grant programs created in America's Water Infrastructure Act of 2018.
- Supporting EPA's Action Plan for PFAS Compounds. (Note: Legislation has been introduced to add PFAS compounds to the Toxic Release Inventory – HR 2577 Rep Gallagher, Wisconsin 8th District is a cosponsor).
- Supporting stormwater program recommendations, including improved stormwater infrastructure data needs collection, stormwater infrastructure funding tools, and verification program funding.



A packet of information is provided to leave with Congressional offices detailing the need for consideration of these items. Detailed information on the contents of can be obtained by contacting one of the authors of this article.

★REGULATORY UPDATE

David Ross, Assistant Administrator Office of Water US EPA, provided an overview of agency initiatives and actions. These include:

- Working to move the 404 program to state agencies.
- Addressing technology gaps, risk, and financing the Water Reuse Action Plan.
- Examining stormwater as water source is being examined.
- Addressing the concern of water sector work force development.
- Addressing the need for Federal coordination of programs, among the Bureau of Reclamation, NOAA, USDA and the Corps of Engineers.
- Resolving the difference of opinions at the Circuit Court level and in the Supreme Court on the topic of groundwater as a source of pollutants to surface. USEPA is in the process of developing a position. US EPA is concentrating on compliance assistance versus enforcement.

Andrew Sawyers, Director of Office Wastewater Management, provided updates regarding financing and other initiatives. WIFIA has generated a number of applicants. SRF has invested \$134 billion over last 30 years with an average interest rate of 1.5%. There is support of nonpoint source reduction working with USDA.

The next needs survey will include stormwater. Integrated planning gives additional flexibility for permittees facing multiple long-term obligations. A draft of the updated policy regarding peak flow/blending 'is expected pretty soon.'

Jennifer McClain, Acting Director of the Office of Ground Water and Drinking Water, related that lead is a high priority. Emerging contaminants include algal toxins (advisory rule for two cyanotoxins being developed) and PFAS & PFOS compounds (rulemaking anticipated). The USDA is collaborating to protect source waters. This protection compliance needs additional tools and technical assistance.

Deborah Nagle, Director of Office of Science and Technology, provided updates with respect to several water quality criteria. She said that field work is progressing for lakes, coastal waters and streams for stressor-response factors, with a draft for lakes expected in 2020; and that researching criteria for Chlorides based on local conditions has progressed with a completed literature search, a partial draft prepared. She also mentioned that:

- The aluminum criteria update will be variable based on carbon and pH, with the publication expected in December. There will be draft guidance for implementation.

- The draft swimming advisory criteria have been published for cyanotoxin and microcystins.
- The Literature review has been completed on Coliphage, which have been studied since 2015 as additional criteria for recreational water quality. Lab methods were reviewed in 2017 and published in 2018. A coliphage study for raw effluent and effluent is underway and risk assessment being performed. There will an extensive peer review in 2020.
- A screening tool for pollutants in Biosolids is under development. OIG has stated that 'EPA not able to assess the risk of biosolids', so they are updating the guidance on risk. The risk assessment is being peer reviewed in 2019. PFOA/ PFAS in biosolids is being investigated.

Sandra Connors, Deputy Director of the Office of Wetlands, Oceans and Watersheds reported that two states have assumed primacy for the 404 program, working with other states and working with the Corps of Engineers for multipurpose mitigation for 404 projects. There is also a new market-based approach to nutrient management. There is also a new support nutrient management effort by the USDA, and an aquatic survey (coastal, wetland, lakes, streams). Nitrogen levels are steady, phosphorus increasing. The Hypoxia Task Force includes 12 states and a 45% reduction goal. As well, the next generation of *How's My Watershed* is under development.

USEPA also facilitated several roundtable discussions on specific topics, including:

- Infrastructure Funding, Water, Finance, WIFIA Affordability, in which a draft on updated affordability guidance, will soon be available.
- The Water Reuse Framework/Water Security Grand Challenge. John Friel and Leisa Thompson, MCES, attended this roundtable; Jeff Lape/USEPA and Andre DeFontaine/US Dept of Energy facilitated the discussion. Jeff led the overall discussion, which included an overview of the EPA national water reuse action plan which is being developed. Please visit and submit comments regarding the draft plan and its development; www.epa.gov/waterreuse/water-reuse-action-plan. Andre summarized the US DOE Water Security Grand Challenge, which was rolled out in the fall of 2018 and is through the Office of Energy Efficiency and Renewable Energy (EERE) – www.energy.gov/eere/water-security-grand-challenge.
- CSOs, Post LTCP Compliance & Peak Flow Management.
- Watershed Approaches, Trading, and Other Efforts to Address Nutrient Pollution. Brandon Koltz attended this roundtable; Chris Hornbeck /NACWA facilitated a discussion with Kevin Norton/USDA, Anna Wildman/USEPA Office of Water and Don Parrish/Farm Bureau. There was considerable support for trading and program coordination between USDA and USEPA. A portion of the \$4.1 billion should be directed to water quality (Farm Bureau). There is a need for better 'edge of field' techniques for nutrient control.

★ CONGRESSIONAL STAFF ROUNDTABLE

The roundtable included **Navis Bermudez**, Professional Staff for the House Water Resources & Environment Subcommittee, Transportation Infrastructure Committee Professional; **Joe Brown**, Legislative Assistant to Senator John Boozman (R, AR); and **John Wye**, Legislative Assistant to Senator Feinstein (D, CA). The three provided a summary of legislative activities.

There was agreement about the need for infrastructure investment and the shortfall that exists. The infrastructure discussions mainly involve roads, rail and runways – agreed with the need to expand to water/wastewater. A segment of the legislature wants to expand public private partnerships (3P), privatization, etc. Discussion also indicated P3 not likely to work in rural areas. Water use reduction, recycle/reuse was a hot topic. Expect to expand programs with additional funding from the southwest/water poor areas to the rest of the country. Education is needed with respect to water supply and climate change and there is support to restoration of earmarks for specific local projects.

★ ILLINOIS CONGRESSIONAL VISITS

Brian Johnson and **Mark Eddington** met with **Congressman Darin LaHood** (18th District, Peoria, Springfield, Jacksonville, Bloomington) and highlighted the NACWA priorities list. Representative LaHood has since helped introduce bipartisan, NACWA-supported legislation, HR 2776, which, among other things, extends the authorization of the *Clean Water Act*, Section 221 Sewer Overflow and Stormwater Control Grants, which provides grants to states and municipal entities for treatment works to intercept, transport, control, treat, or reuse municipal combined sewer overflows; sanitary sewer overflows; and/or stormwater. Additionally, the new legislation would extend the bill's authorization through Fiscal Year (FY) 2029 (versus FY2020 in current law), increase the annual funding authorization to \$500 million per year (versus \$225 million in current law), and amend the program to reduce the required non-federal cost-share based on the burden of sewer service bills on households in the lowest 20 percent of a community's income bracket. In addition, Mark met with **Representative Casten** (IL-06) and the staffs of **Representative Underwood** (IL-14) and **Representative Kinzinger** (IL-16). All visits were to advocate for an increase to the 2020 Clean Water SRF program and the re-appropriation of the 2019. Mark also met with the Department of Agriculture to discuss their Water & Waste Disposal Loan & Grant Program.

★ MINNESOTA CONGRESSIONAL VISITS

John Friel and **Hans Holmberg** met with the offices of **Senators Klobuchar** and **Representative McCollum**, **Peterson**, **Omar**, **Craig**, **Emmer** and **Hagedorn**. **Representative Betty McCollum** is the Chair of the Appropriations

Subcommittee on Interior, Environment, and Related Agencies which appropriates \$35 billion dollars annually and which includes funds for the Environmental Protection Agency (EPA). She has been advocating for the environment directly through this position for many years. Hans and John stressed the importance of continued financial support for water and wastewater infrastructure in all of their meetings. The face-to-face meetings fostered new connections with key staffers of newly elected representatives and Senator Smith and continued to build upon the existing relationships with returning key staffers and legislators. The key staff from the Senators and Representatives were all very receptive and in agreement that water and wastewater infrastructure is a critical need to everyone and deserves support. Some of the other comments received from staffers related to making sure available funding is getting out to communities, concern and support for rural communities, and interest in examples of success stories.

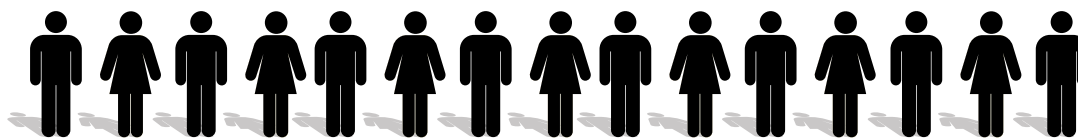
★ WISCONSIN CONGRESSIONAL VISITS

Brandon Koltz met with the offices of **Senators Baldwin** and **Johnson** and **Representatives Moore** (4th District, Milwaukee) and **Steil** (1st District, Racine, Kenosha, Beloit, Janesville). Representative Moore and Senator Baldwin have been strong advocates for water and have received recognition for their efforts in the past. Representative Steil replaced **Paul Ryan**, his staff representative was well informed regarding water issues and recognized the importance to the District. Brandon has found repeat visits with congressional staff has resulted in recognition of the importance of water infrastructure funding and technology advancement to the quality of life in Wisconsin.

Tom Sigmund met with **Mike Gallagher** (8th District, northeast Wisconsin). A delegation from Madison MSD met with **Mark Pocan** (2nd District, Madison) and **Tammy Baldwin**.

★ SUMMARY

The handouts for congressional visits include that \$66 billion of SRF projects has generated \$171 billion in clean and drinking water projects and that each job in water and wastewater construction or rehab jobs creates 3.68 jobs in the national economy. Congressional staff are coming to realize investment in water and wastewater is also beneficial to the economy, as well as providing an environmental benefit. Return visits and communications have led to a better-educated Congress about the value of water. Broad communications from the water sector to congressional representative and staff – in Washington or the local offices – reinforces the needs and importance of safe water and robust water reclamation for our environment, our well-being and for the economy. Each year our representatives are better educated about the importance of water. Thanks for the support of State Sections utilities and other employers for continued support of this effort. [CS](#)



CSWEA Welcomes Our New Members

March 2019

Payal Shah, Xylem Inc.
Tom Greybill, City of Naperville
Scott Schramm, Strategic Municipal Services
Greg Ackerson, Apex
Eileen Kennedy
Karen Nenahlo, Milwaukee MSD
Steve Stiles, City of Racine
Jason Tranchitella
Mark Harold
Mike Marquardt, Village of Buffalo Grove
Trenton Shutter, UW-Platteville
Stacey Koch, Madison MSD
Rob Bredeson, City of Detroit Lakes

April 2019

John Loomis, South Washington Watershed District
Kay Marie Curtin, Metropolitan Council
Jerry Strub, GZA Geoenvironmental
Jeff Norton, Village of Mundelein
Ashley Elmore, In-Pipe Technology Inc.
Charles Taylor, Lake County
April Anderson, Staab Construction
Luzheng (Stanley) Sun

Juhi Tilak, Shive Hattery
Tim Young, City of Waukesha
Patty Kettles, Springsted and Umbaugh
Eric Tourdot, WHKS & Co.
Ryan Otto, City of Bloomington
Ian Mager, Bloomington Normal WRD
Jim Karch, City of Bloomington
Jeffrey Holste, Illinois EPA
Olivia Bojan, UIUC
Reginald Jansen
Anthony Minette III, Village of Frankfort
Luke Sharp, Village of Lombard
Kurt Wolken, Village of Lombard
Paul Siegfried, Baxter & Woodman
Dan Popehn, Victaulic
Mike Harder, Metropolitan Airports Commission
Dianne Matthews, Western Lake Superior SD
Tim Birkel, City of Cudahy
Laurie Dunn, Madison MSD
Kris Huehne, Madison MSD
Elizabeth Sauer, Milwaukee MSD
Robert Evangelisti, UW-Whitewater
Theodore Schultz, Foth
Thu Ho, Augustana College

May 2019

Leo Valdez, MWRD
Joe Payne, RF Payne
Mark Castillo, MWRD
Spencer Cossalter, SEH
Kyle Kriz, Village of Fox Lake
Megan R. Baskerville, Sanitary District of Decatur
Dan Moore, City of Racine
Lewis Blaszczyk
Rebecca Mattson, Barr Engineering
Adam J Shelton, Brown & Caldwell
Michelle Madrid, Donohue & Associates
Tom Larsen, Lakeside Equipment Corp.
Sydney Shaffer, MSOE
Alexis Countryman, MSOE
Jeffrey S. Polenske, City of Milwaukee
Joe Leszczynski, Milwaukee MSD
Kate Yuhas, Symbiont
Christine Boland-Prom, MSOE
XiaoJun Dang, DMP Corporation
Miranda Durbin, MSOE
Abram Peterson, MPCA
Hong Yang, UIUC
Scott Gilbertson, Alexandria Lake Area SD 

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DATE: Sunday, September 22, 2019
TIME: 6:00 pm to 8:00 pm
LOCATION:
Hilton Chicago, 720 S Michigan Ave, Chicago, IL,
Continental Ballroom & Foyer

If paying by check, **please send your donation by September 15, 2019** made payable to:
CSWEA, 1021 Alexandra Blvd, Crystal Lake, IL. 60014

Sincerely,

Mike Holland,
CSWEA WEFTEC Reception Chair
mholland@kishwrd.com

Laurie Frieders,
IWEA WEFTEC Reception Chair
execmgr@iweasite.org

AUGUST



WI Section Summer Board Meeting

August 26
Rasmith | Brookfield, WI

1st Annual Effective Utility Management Workshop

August 28
WSB Conference Space | Minneapolis, MN



Northern Moraine WRD Plant Tour, BBQ & Volleyball

August 30
NMWRD/Three Oaks Recreation Area | Crystal Lake, IL

SEPTEMBER



2019 CSWEA/IWEA WEFTEC Reception

September 22
Hilton Chicago | Chicago, IL



Collections Workshop (W/MWOA)

September 25
Western Lake Superior Sanitary District | Duluth, MN

OCTOBER



Operator Training Course #14293: Purpose and Fundamentals of Wastewater Treatment

October 24
Urbana & Champaign SD | Urbana, IL

NOVEMBER



MN Conference on the Environment

November 7
Minneapolis Convention Center | Minneapolis, MN



WI Operations Seminar - Phosphorous/Nutrients

November 14
UW Oshkosh Alumni Center | Oshkosh, WI



IL 2019 B.E.E.R. Seminar

November 19
Reserve 22 | Glen Ellyn, IL

APRIL 2020



Midwest Student Design Competition

April 6
Monona Terrace | Madison, WI



25th Annual Education Seminar

April 7
Monona Terrace | Madison, WI

MAY 2020



CSWEA 93rd Annual Meeting

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By Michael Arceneaux and Jennifer Lyn Walker

Cybersecurity Fundamentals

Water and wastewater utilities provide critical lifeline services to their communities and their regions. Supporting these vitally important functions requires secure information technology (IT) and operational technology (OT) – yet the sector’s IT and OT networks continue to face an onslaught of threats from cyber criminals, nation states, and others.

To support the sector in its cybersecurity goals, and in response to the continually evolving threats, WaterISAC, the Water Information Sharing and Analysis Center, has just published a newly-updated resource: *15 Cybersecurity Fundamentals for Water and Wastewater Utilities*.

The updated guide contains dozens of best practices, grouped into 15 main categories, that water and wastewater systems can implement to reduce security risks to their IT and OT systems. Each recommendation is accompanied by links to corresponding technical resources. In sum, the guide connects users to the information and tools needed to take a dive deep into this important issue.

Here is a summary of the 15 fundamentals:

Perform asset inventories. You can only protect what you know about. Knowing your environment is a basic requirement of a sound cybersecurity program.

Assess risks. Once assets inventories are completed, OT and IT risk should be assessed, considering the likelihood a threat will occur and the degree of impact the threat will cause to the organization.

Minimize control system exposure. Protect the control system environment from outside, untrusted networks. This involves network segmentation, traffic restrictions, and encrypted communications.

Enforce user access controls. Users on a network should have no more access than they need to do their jobs. Apply role-based access controls and the principle of least privilege, including limited use of administrator rights to prevent users from accessing systems and files they are not authorized to access.

Safeguard from unauthorized physical access. If an adversary can gain physical access to your equipment, they can compromise it. Non-technical, physical security controls can restrict physical access to IT and OT environments.

Install independent cyber and physical safety systems. Cyber-attacks can result in physical effects. To protect critical assets from such ‘blended’ threats, utilities should consider non-digital engineering solutions such as independent cyber and physical safety systems.

Embrace vulnerability management. Largely informed by asset inventory and risk assessments, vulnerability management involves the need to identify and remediate cybersecurity gaps and vulnerabilities before the bad guys exploit them.

Create a cybersecurity culture. Cybersecurity is everyone’s responsibility, from the break room to the boardroom. Effective cybersecurity starts at the top: to affect positive behavioral changes, involve every executive, board member, and employee in cybersecurity awareness and training.

Develop and enforce cybersecurity policies and procedures (governance). Create, disseminate, and operationalize clear and actionable organizational policies and procedures regarding cybersecurity expectations. The fundamentals in this guide can be used to begin developing policies that are most relevant to each organization.

Implement threat detection and monitoring. You will not find it if you are not looking. The importance of configuring detailed logging and reviewing system logs to detect active threats in your environment cannot be overstated.

Plan for incidents, emergencies, and disasters. Plan ahead for maintaining business continuity and resilience. Emergency response plans (ERPs) will be required by *America’s Water Infrastructure Act* (AWIA) beginning in 2020.

Tackle insider threats. The insider threat is a people problem, not a technology problem; however, not all insider threats are malicious. Mitigate this organizational-level threat by understanding behavioral indicators that predicate an insider threat and apply appropriate training and technology controls to deter an incident.

Secure the supply chain. The supply chain/vendor relationship is a common threat vector for cyber-attacks and must be intentionally managed through security and vulnerability testing and risk assessments.

Address all smart devices. When unsecured, internet of things (IoT) and mobile devices are connected to networks, they create holes (often to the Internet) that may not have previously existed. Cisco’s *2018 Annual Cybersecurity Report* states that few organizations view IoT as an imminent threat, yet adversaries are exploiting weaknesses in connected devices to gain access to industrial control systems that support critical infrastructure.


Participate in information sharing and collaboration communities. Share information with others. Utilities can learn from each another by getting involved in WaterISAC, InfraGard, and similar communities. Cyber-mature utilities can significantly help the community and sector by sharing their experiences.

About WaterISAC

WaterISAC is a nonprofit water and wastewater sector organization dedicated to protecting sector utilities from all hazards. WaterISAC disseminates threat advisories, reports, and mitigation resources to help utilities prevent cyber and physical security incidents and to recover from disasters.

WaterISAC draws information from federal and state law enforcement and many private sector sources to produce products that are relevant to the water and wastewater sector.

Membership, including a free 60-day trial, is open to utilities, consulting firms, sector associations and state agencies. More information is available at www.waterisac.org.

Michael Arceneaux is WaterISAC’s managing director and **Jennifer Lyn Walker** is WaterISAC’s cybersecurity risk analyst. 

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NEW PROGRAM

CENTRAL STATES WATER ENVIRONMENT ASSOCIATION

OPERATOR TRAINING PROGRAM



ILLINOIS PROGRAM

PURPOSE

The CSWEA Operator Training Program is intended to recognize a person's commitment to professionalism, continual improvement and ability to finish a long-term task. This will help Operators prepare for Wastewater Certification Exams with IEPA. It is also a separate acknowledgment of the completion of a training program consisting of top-notch materials and instructors. Individuals benefit by having the ability to differentiate themselves from other candidates when seeking promotions and/or new jobs, and to be able to take pride in an important professional accomplishment.

Employers also benefit by being able to identify employees and potential employees who are serious about a career in the wastewater treatment profession, and are willing to invest in themselves and their future.

CSWEA CERTIFIED OPERATOR REQUIREMENTS

To become a CSWEA Certified Operator, you will need to attend a minimum of eight (8) CSWEA Courses from the prescribed list in a period of no more than three (3) years. In addition, you will need to attend one (1) Seminar from the list of seminars (to the right). Once you are a CSWEA Certified Operator, refresher courses are at no cost to you.

The Courses will include a multiple-choice test (approximately 20 questions) that must be passed by the participant with a score of 70% before the course will be counted towards fulfilling the CSWEA Certified Operator requirements.

IEPA WASTEWATER OPERATOR CERTIFICATION EXAMS

The CSWEA Courses are an excellent way to prepare for the IEPA Wastewater Operator Certification Exams. The table to the right outlines the recommended courses for preparation of the Operator Exams.

	IEPA CLASS			
COURSE	3&4	2	1	Collections
Purpose and Fundamentals of WW Treatment	X			
Health and Safety in Water Treatment Plants	X			
Wastewater Math I	X			
Wastewater Math II		X		
Activated Sludge I		X		
Activated Sludge II			X	
Preliminary and Primary Treatment		X		
Secondary Treatment			X	
Disinfection		X		
Solids Handling		X		
Anaerobic Digesters			X	
Collection Systems				X
Maintenance I	X			
Maintenance II		X		

SEMINARS

- CSWEA Annual Conference
- Education Seminar
- IL Section Operations Seminar
- IL Section Collections Seminar
- IL Section Energy Seminar
- IL Section Resource Recovery Seminar

GETTING STARTED

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Individual class registrations will need to be done separately. Once you have registered for the program, you have 3 years to meet the certification requirements.

CENTRAL STATES WATER ENVIRONMENT ASSOCIATION

OPERATOR TRAINING PROGRAM



ILLINOIS PROGRAM

PROGRAM REGISTRATION FORM

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Operator ID	

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(AMOUNT ENCLOSED \$50.00)

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Expiration Date	CCV
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GLOBAL WATER STEWARDSHIP

GWS

Update

By Liz Heise, GWS Chair

Summer is always a very busy time for GWS but this year is the busiest yet! This year's August trip will be the 2nd Annual GWS Education Conference for wastewater professionals in Costa Rica. This conference will take place over two days in San Jose with a focus on both plant operations and maintenance as well as the design of new systems. While working to prepare content for this, we are also developing the design and O&M manual for our 3rd biogarden. This will be constructed at a primary school in La Fortuna. While we are there, we will do a combination of data collection for next year's student design competition and education of students in the school.



This will also be our biggest service trip yet. We expect more than 20 people to participate between the San Jose conference, public education, data collection, and biogarden construction.

Aside from the trip, we have been developing as an organization. Beginning in May, we had a change over in chairs, as well as restructuring as a whole. As we have grown and evolved, we realized that the existing committee structure was not serving us to the best potential. Our priorities have shifted, and with that, our roles within the organization. We have an amazing group of volunteers and I am so excited to take on the role as Chair for this year. Thank you to all of our past chairs for your work and continued involvement.

2019-2020 GWS CHAIRS AND OFFICERS

* Vacant

Chair, Liz Heise
Vice Chair, *
2nd Vice Chair, Eider Alvarez-Puras

COMMUNITY DESIGN

Chair, Zach Wallin
Vice Chair, Joe Lapastora

- Prepare student design problem statement.
- Gather community data.
- Mentor student design teams.
- Judge GWS student design competition.
- Request and finalize design deliverables to ASADA in English and Spanish.
- Coordinate student design presentation for ASADA.
- Follow-up on previous designs for ASADAS.
- Assist ASADAs with the coordination in transitioning the student design to a final professional design.

PUBLIC EDUCATION AND OUTREACH

Chair, Elizabeth Brown
Vice Chair*

- Presentations to elementary and high schools students in Costa Rica (CR).
- Presentations to elementary and high school students in the US.
- Coordinate STEM activities and resources for schools (US and CR).
- Educate communities and leaders about need for sanitation.
- Organize events in the US to bring awareness.

PROFESSIONAL TRAINING AND KNOWLEDGE EXCHANGE

Chair, Eider Alvarez-Puras
Vice Chair, * (Spanish Required)
Past Chair, Manual De Los Santos

- Provide training for water and sanitation professionals on wastewater treatment.
- Coordinate tours and knowledge exchange trips between US and CR.
- Establish scholarship fund and program for in-depth training of wastewater professionals.
- Develop bilingual resources, manuals, and curriculum on wastewater collection systems and treatment.
- Organize technical seminars for water and wastewater professionals.
- Establish a graduate research internship program in CR for US students.

MARKETING AND FUNDRAISING

Chair, Rich Hussey
Vice Chair, Matt Castillo

- Prepare and publish newsletters.
- Prepare and distribute annual report.
- Work with marketing firm to develop material and provide required information
- Maintain website and social media.
- Market events in the US to raise GWS awareness.
- Prepare GWS brochures and other marketing materials.
- Solicit donations and manage relationships with donors.
- Organize annual GWS Donor Banquet and other fundraising events.

PROJECTS FOR CONSTRUCTION

Chair, Micah Pitner
Vice Chair, Maria Claudia Reed

- Coordinate biogarden construction program.
- Build biogardens at participating community schools.
- Follow up on biogarden maintenance.
- Develop designs and recommendations for special projects as needed.
- Provide technical support for community on final design and construction.
- Follow up on the maintenance of constructed projects.

FINANCE

Chair, Matt Streicher
Vice Chair, Tom Foley



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That being said, we have quite a few open chair positions that we are looking to fill! I have included a list of the new chairs and open positions on page 49. If you are interested in getting more involved, stepping up to a leadership role is a great way to do so! The chart shows the new committees and chairs, as well as vacant spots.

In addition to restructuring, we also held our very first GWX. This was a two-day conference where we worked with new and past organization leaders to determine what we can do to make the organization better. We came out of this meeting with a few main goals. These included developing an MOU with communities prior to student design so they understand our role and their responsibilities, developing a project checklist, nominating project managers for past and future projects, and developing a way to quantify our impact.

“We have now added programming and curriculum that includes educating and providing knowledge exchange for children, teachers, engineers, operators, and lab technicians so that they can be prepared for the multitude of wastewater projects and infrastructure that is currently being built in the country.”

We have also shifted to becoming a more education-based organization after realizing that the greatest impact that we can have is to help AyA (the Costa Rican water/wastewater authority) to help themselves and to teach the communities we work with about wastewater treatment. We have now added programming and curriculum that includes educating and providing knowledge exchange for children, teachers, engineers, operators, and lab technicians so that they can be prepared for the multitude of wastewater projects and infrastructure that is currently being built in the country. We are working to bridge the gap and create a sustainable wastewater industry in Costa Rica. It's an exciting time to be a part of the organization. If you're interested in learning more or getting involved, reach out to chair@globalwaterstewardship.org. **CS**

MONTEVERDE, COSTA RICA

Water Renewal Facility



Student Designer Winner

Monteverde, Costa Rica is in need of a long-term solution to a sanitation problem. The region of concern is made up of smaller communities that are heavily dependent on tourism, the majority of businesses and homes are on septic systems and there are about 11 smaller private treatment plants in the region. The proposed solution in this document consists of a centralized treatment system with a respective complete collection system. The goal of this article is to improve public health in the Monteverde region and to provide the region with an appropriate sanitation system.

Monteverde, Costa Rica is a landlocked region 120 km northeast of San Jose near the Gulf of Nicoya, usually heavily flooded with tourists. The Monteverde planning service area includes Cerro Plano, Santa Elena, and Los Llanos. Currently, the population is about 6,500 with an annual tourist population of 250,000 people, with an expected 2% increase in population of and up to 4% growth in tourist population. There are approximately 1,600 existing

buildings within the region. Currently, pollution and improper treatment of septic tank effluent are not uncommon, thus the community has encouraged the introduction of a new system that will properly sustain the population.

CONCERNS

Existing Conditions

With 1,600 existing buildings, Monteverde is on the higher end of Costa Rican development. However, the electric grid only holds 110 volts of power and experiences unexpected power outages. Therefore, any equipment that uses 220 volts or more must use step up transformers. Currently, there are 11 privately owned small treatment plants, seven of which reuse the effluent and four that discharge into surface streams. Many homes and businesses use their own septic tanks that discharge greywater directly over land. These septic tanks often have inadequate leach fields, which lead to the effluent's improper treatment. Also, effluent from sludge cisterns have been trucked and dumped in rural areas instead of being taken to a wastewater treatment facility.

Future Conditions

A centralized wastewater system with a collection system for Monteverde's population and annual tourists is desired. The system needs to accommodate a residential population growth of 10,400 people in 2039 and tourism growth of 450,000 tourists/year in 2039. Since Monteverde relies heavily on tourism, the system needs to accommodate sporadic tourism population while being aesthetically pleasing or hidden within the community. The system was designed with effluent requirements of BOD and TSS of 30 mg/L. Ease of maintenance and self-sufficient options were considered. Appendix A expresses the conducted population and TSS BOD loading projections for the Monteverde planning area for the next 10 and 20 years.

Location

Three sites were evaluated for the proposed centralized water renewal facility. When identifying these sites, flow by gravity was considered, as it would reduce operation costs. Also, a large footprint with a relative proximity to irrigation sites was considered as part of the criteria. Figure 1 shows the location of the sites analyzed.

Options

Site 1

This site is approximately 0.101 square kilometers collectively. It is located southeast of the Monteverde planned service area. The average elevation is approximately 1220 meters. This area would make an appropriate WRF location

because it sits at a low elevation relative to the majority of the expected service area. A collection system that feeds to site by gravity is feasible at this location.

Site 2

This site is approximately 0.178 square kilometers, assuming this land is available. It is located directly west of the central part of Santa Elena. The average elevation of the site is approximately 1350 meters. This site is relatively large in footprint and would be an ideal site for a treatment option that required large surface footprint.

Site 3

Site 3 is approximately 0.040 square kilometers, assuming land is available. It is located on the south east side of the planning area. The average elevation is approximately 1.35 km, the maximum and minimum elevation of the site are 1390 and 1330 meters respectively.

Solution

From the sites analyzed, Site 1 appears to be the best location to implement the Water Renewal Facility. This site is adequate because it is located at lower elevation than the other two sites considered. Its location is adequate to serve the majority of the Monteverde planning area with minimal pumping. It is also in a location that does not have a significant elevation difference, which facilitates construction operations. This site is also relatively close to areas that could benefit and use the discharge effluent for irrigation purposes.

Parameters

The assumed water consumption of 200 liters per person per day was assumed. At a residential population increase of 1% per year, and tourism growth of 2% per year, the design-planned population was 10,400 people by 2039. This yielded a design average flow of 0.70 MGD and a peak hourly flow of 1.72 MGD. These flows contain a 15% safety factor to account for flow fluctuations and I/I using peaking factor from *Ten States Standards 2014*.

Collection and Conveyance

Options

The collection and conveyance system reaches out over the entire Monteverde region potentially bringing wastewater to any of the three proposed sites. The system could either run to each home and business or could connect to the septic tanks that most of the properties already utilize. Both systems would need to use pressurized pipes for pumping when necessary depending on the site chosen.

Solution

The approximate total length of piping for the system when using existing septic tanks is 15 km. If Site 1 is used, the least amount of pressurized pipe would be required out of the three proposed sites. Site 1 requires approximately 4 km of pressurized pipe while Site 3 requires about 13 km. To minimize the cost of the system and to minimize the power needed to run it, Site 1 is recommended for this collection and conveyance system.

WATER RENEWAL FACILITY

Wastewater Treatment Alternatives

Subsurface Constructed Wetland

This treatment technology was considered because of its low maintenance and low costs that are associated with it. A SF wetland is a man-made wetland that uses a media to cover the water as well as plants. These typically include shallow basins or channels with liners that prevent seepage to groundwater. They are very effective in the removal of both BOD and TSS. Implementing a SF constructed wetland would minimize equipment, energy and skilled operator attention. The disadvantages with such a system are their large land requirements, potential for clogging and potential higher costs when systems are designed to handle more than 60,000 gallons per day (USEPA, 2000).



Figure 1



Figure 2: Conveyance Layout

A preliminary design for the planned service area was prepared, which indicated a large amount of land requirement to treat the DAF of 0.70 MGD. Then it was considered splitting the flow into two different locations, but the land requirement was still over what the land availability is. Appendix B is a spreadsheet with the calculations conducted implementing the SF wetland in Monteverde with a primary clarifier preceding the SF wetland system. These values were calculated using the 2014 recommended 10 states standards for wastewater facilities, with a target effluent for TSS and BOD of less than 30 milligrams per liter. With the accepted assumption that a primary clarifier would reduce the BOD and TSS concentration by 35% and 65% respectively, the total land requirement to treat the DAF of 0.70 MGD was calculated to be approximately 20 acres. Following the 2007 Iowa's DNR *Constructed Wetland Technology Design Guidance*, it was best recommended to design the system with four trains, each containing two cells per train for a total of eight treatment cells (Iowa Department of Natural Resources, 2007).

Implementing this treatment technology would provide Monteverde with a modular technology that can be designed and constructed as population and tourism increase. It would also be a great aesthetic asset to the community, as it would be a natural environment, and no sludge handling would be required with such system.

Activated Sludge

This treatment technology was considered as it is one of the most commonly used forms of wastewater treatment. The activated sludge process uses a sedimentation tank, followed by a complete mix reactor aeration tank, which produces microorganisms that feed on organic contaminants within incoming wastewater. Preliminary sedimentation effectively removes settleable solids; primarily the removal of both BOD and TSS. Following the primary clarifier, an aeration basin serves as the secondary treatment of the wastewater. Following the aeration basin, a secondary clarifier operates in the same manner as the primary clarifier; however, the collected settleable solids are sent back into the aeration tank as the return activated sludge, whereas the excess sludge is transported to a separate location (Metcalf & Eddy, 2014).

Following the 2014 recommended ten states standards for wastewater facilities, as well as regulated standards given from *Wastewater Engineering: Treatment and Resource Recovery*, the system was designed to have two primary clarifiers. This system was designed based on the peak hourly flow of 1.72 MGD. Both clarifiers will be circular with a surface area of 200 square meters, and a diameter of 16 m. Each clarifier is recommended to have 3 m of side water depth and 1.5 m of sludge accommodation, resulting in a height of 4.5 m. Accompanied by a hydraulic retention time of two hours and the accepted assumption that a

primary clarifier would reduce the BOD and TSS concentration by 35% and 65% respectively, this clarifier results in a BOD effluent of 182 mg/L and a TSS effluent of 77 mg/L. Following the same standards, an aeration basin will be placed following the primary clarifier. The aeration basin will occupy an approximate surface area of 404 square meters, and a recommended depth of 4.6 m. Area was calculated to assure both clarification and thickening requirements would be met. Based on a volumetric loading rate of 40 lb./1000 ft³ per day, the basin occupies a hydraulic retention time of 6.81 hours. Following the aeration basin, a secondary clarifier will be placed having a surface area of 120 square meters, with a diameter of 13 m. Using a recommended water depth of 5 m, as well as a sludge accommodation depth of 3 m, the total height of the clarifier is approximately 8 m. Based on the peak hourly flow, it was calculated that a recycle flow of 0.22 MGD and a waste flow of 7.9 GPD is needed; this results in a recycle ratio of approximately 0.31. Assuring that the SOR and SLR requirements are met, it is known that effluent of the secondary clarifier is well below the target effluents of 30 mg/L for both BOD and TSS. Appendix C shows more in-depth calculations regarding the system (Metcalf & Eddy, 2014).

This preliminary design for the planned service area indicated the system would take a rather conservative area based on our location selections, but would result in high construction, as well as operation and management costs. It can also be noted that the waste sludge dropping out of the secondary clarifier can be classified as Class B sludge; this sludge can be collected and transported to a landfill or spread out on the surrounding location area to dry and be used as fertilizer. It is important to note that if the waste sludge is laid out to dry, there could be an odor issue.

Anaerobic Filter

This treatment technology is a fixed-bed biological reactor with one or more filtration tanks in series. This technology uses anaerobic conditions, which gives potential for biogas collection if designed as anaerobic digesters. These are typically used for secondary treatment and require preliminary and primary treatment to remove large solids that may clog the filters used. There are several configurations that are available for this technology, but the most widely practiced is the up-flow configuration

as it involves less risk that the fixed biomass will be washed out (Technology, 2014).

The preliminary design for the Monteverde planned service area was created, and it involves the integration of a settling tank or a septic tank that precedes the anaerobic filter. For this project as this is a centralized treatment system, it is recommended for the anaerobic filter part of the system to be subdivided into individual filter units that flow in series. Filter media ranges from natural filter media such as gravel to synthetic media such as plastic pieces. The media serves as surface area for bacterial growth, which increases contact time that assists with the degradation of organic matter. Having the flexibility of what media to use gives the project some flexibility to look for locally available materials that can serve as the filtration media. The system can be built underground or above ground depending on the site, and preferred aesthetics of the treatment site. It is important to mention that each filter unit should be equipped with appropriate access ports for maintenance, and with adequate ventilation that takes care of the gases produced from organic degradation.

At the DAF of 0.70 MGD, the system was designed to have a pre-settling tank with a four-hour hydraulic detention time and with preliminary approximate dimensions of 7.50 m x 15 m x 4 m. The septic tank to be followed by 15 filter tanks, each with the dimensions of 7.5 m x 5 m x 4 m, which totals to a gross volume of 2250 cubed meters, enough to have a hydraulic retention time of approximately 20 hours, which is within the recommended range of 15-36 hours, and within the typical COD loading rates of 1-10 kilogram per meter cubed per day (Spuhler, 2019). Refer to Appendix D for more detailed calculations. Figure 3 shows a typical AFFR flow diagram, this figure shows a total of three anaerobic filter units, and our design includes 15 filter tanks with the respective dimensions mentioned in this report.

Recommended Treatment Solution

From the three treatment technologies that were considered for the implementation of them in Monteverde, the Anaerobic Fixed Film Reactor was chosen as the recommended treatment solution for the planned service area. This treatment technology seems to be the most appropriate for Monteverde when considering capital costs,

Table 1: Recommended Treatment Technology Capital Cost Comparison

Treatment Technology	Total Capital Cost (USD)	Total Capital Cost (CRC)
SCWL	\$6,800,000.00	₡ 3,604,000,000.00
Activated Sludge	\$3,052,000.00	₡ 1,617,560,000.00
Anaerobic Fixed Film	\$2,397,000.00	₡ 1,270,410,000.00

Table 2: Capital Cost Comparison between three considered technologies

Treatment Technology	Total Capital Cost (USD)	Total Capital Cost	O&M Cost per year
SCWL	\$6,800,000.00	₡ 3,604,000	\$371,800.00
Activated Sludge	\$3,052,000.00	₡ 1,617,560	\$1,120,504.09
Anaerobic Fixed Film	\$2,397,000.00	₡ 1,270,410	\$114,109.00

Table 3: Calculated approximate user fees in USD

	2039		2029		2019	
Treatment Technology	User fee per year	User fee per month	User fee per year	User fee per month	User fee per year	User fee per month
SCWL	\$1.55	\$0.13	\$2.94	\$0.24	\$27.96	\$2.33
Activated Sludge	\$2.77	\$0.23	\$3.98	\$0.33	\$16.27	\$1.36
Anaerobic Fixed Film	\$0.51	\$0.04	\$0.99	\$0.08	\$9.79	\$0.82

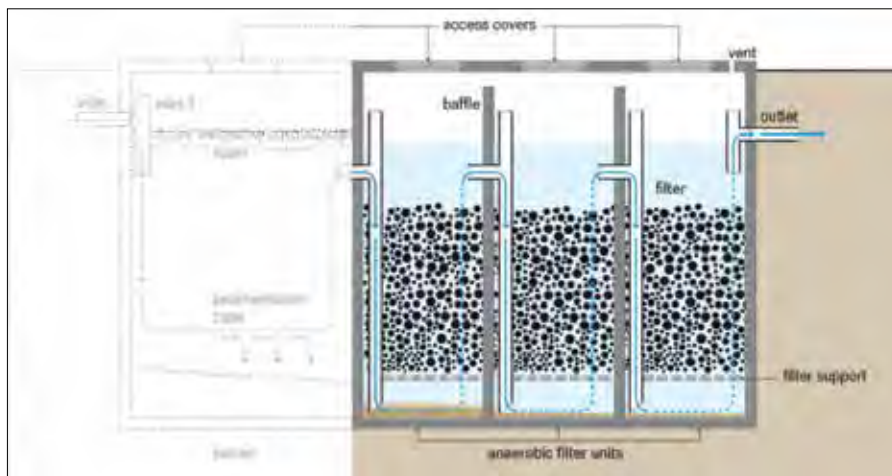


Figure 3: Anaerobic Fixed Film Filter Unit (Spuhler, 2019)

expected operation and maintenance costs, and overall system technology level of difficulty.

The recommended treatment solution proposes a pre-settling tank preceding the Anaerobic Fixed Film Reactor. This pre-settling tank will act essentially as a primary clarifier and reduce the BOD and TSS concentrations by 35% and 65% respectively. This will help reduce the suspended solids in the incoming stream, which is beneficial to the filter tanks, as it reduces the potential for clogging of the filter media. Following the pre-settling tank will be 15 filter tanks, each tank will be filled with either gravel or plastic media, the choice of media will be left for community officials to decide. Having such system divided into separate filters allows for redundancy and efficiency of the system, as the filters can be put added into the system as flows are increased.

Having a constant flow in the system is essential for this type of system, which is why the several filter tanks are added as part of the system design. For a better accurate sizing of the system that will increase the overall efficiency, it is recommended for a bench scale simulation with the accurate concentrations of influent COD, as for this type of system COD concentrations are an important parameter that influences formation and upkeep of biofilm in the filter tanks.

Discharge

Based on the recommended location Site 1, the discharge options are to either discharge to the nearby surface water body to the east of Site 1, which is approximately one kilometer away and approximately 300 kilometers lower in elevation.

Table 4: Approximate methane production from calculated COD concentration

	Value	Units
Methane produced per COD unit	0.4	L CH ₄ /g COD
Methane Production @ DAF=0.70 MGD	385767	L CH ₄ /day
Energy Produced by Methane	11754	MJ/day
	3300	kWh/day

The second discharge option would be to consider using the renewed water for irrigation purposes. The area surrounding Site 1 appears to have several farming areas surrounding it, using effluent water for irrigation would be something to be considered and discussed with the community.

Cost

In the process of providing Monteverde with the proper sanitation solution, cost of the project is a big fact affecting the selected treatment technology. When creating estimates for each particular technology, cost indexes per RS means were used to update cost values gathered from the cost curves provided by the April 1980 EPA report titled *Construction Costs for Municipal Wastewater Treatment Plants: 1973-1978*. Also, certain items were estimated using unit values given by GWS. Appendix E shows a breakdown of the capital and O&M costs per technology treatment. Table 1 expresses a cost comparison between the three considered treatment technologies, each includes a 10% capital contingency (DiGregorio, 1968). Table 2 shows a capital cost and O&M cost comparison per technology. It can be observed that from all three technologies Anaerobic Fixed Film Reactor has the lowest capital and O&M costs. This is another supporting factor to why this technology has been selected as the most appropriate for Monteverde.

O&M Costs

The recommended sanitation design for Monteverde is low in energy consumption, as there are no significant moving parts in the treatment system. The conveyance system is mainly gravity flow to the selected Site 1. Appropriate conveyance flow calculations need to be conducted to exactly determine the sizes of collection system pipes and for appropriate sizing of potential pumping locations.

Operation of the water renewal facility is very simplistic, no moving parts in the system, as this is planned to be gravity fed throughout. Table 2 shows a comparison of O&M costs for the Anaerobic Fixed Film Reactor.

User fees calculated by adding the total capital cost and the expected O&M costs per year and dividing it by the number of years and population expected at the specific year. Table 3 shows the potential expected user fees per technology (USEPA, User Charge Guidance Manual for Publicly-Owned Treatment Works, 1984).

The recommended treatment technology offers the most economic user fee per month of approximately \$0.82 US dollars, or 433 Costa Rican colones in 2019. The O&M cost has only been estimated for the first year, but it can be expected for these costs to increase by about 3-5% depending on economy.

Biogas Utilization Feasibility

The purpose of this section is to address the issue of how to use biogas as well as properly irrigate the water renewed from the Water Renewal Facility.

Today, there are multiple wastewater treatment plants that run on 100% grid electricity, and this is because those that do are producing biogas from anaerobic processes in which they are able to contain and convert it to electricity or power. However, there are some wastewater treatment plants that flare the biogas on site and do not utilize it. It would be ideal if every wastewater treatment plant used their produced biogas to counterbalance their energy consumption. Though, the demands of energy may not match the energy that is being generated from the water renewal process. This is because the amount of biogas produced is based upon the wastewater flow quality and quantity. Furthermore, stored onsite biogas may help to solve this incongruity between energy demand and energy generation because it can be used as an additional form of energy to the grid.

Due to varying costs of electricity, a control system can be used to heighten the amounts of energy used from on-site biogas and the grid to minimize the costs of electricity on an hourly basis that satisfies part of the energy demand with on-site use of biogas produced.

Biogas Production from Wastewater Treatment Alternatives

From the three technologies analyzed mentioned in this report. Two of them have big potential for biogas production, Activated Sludge and Anaerobic Fixed Film Reactor. Table 4 shows the potential of methane production for these two technologies.

There is a potential for activated sludge technology to collect methane to produce energy, following a sludge thickener and an anaerobic digester. However, to reduce both capital costs and well as operational and maintenance costs, the current design does not include those particular treatment processes.


Milwaukee School of Engineering

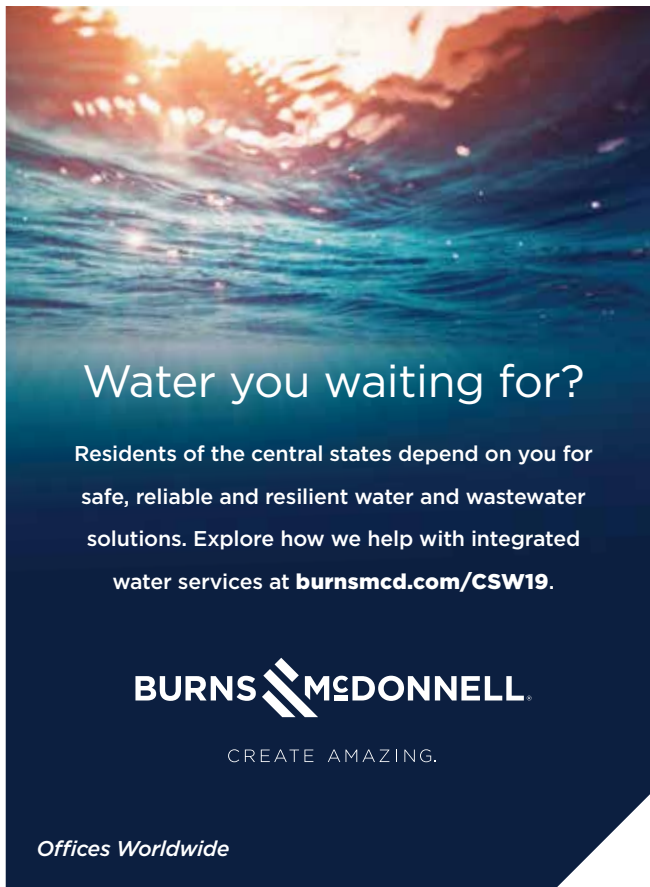
Milwaukee School of Engineering's all female team consisted of dedicated students from all years. Guissel Davilla guided the team with her 3 year involvement with GWS and recently started her career dedicated to waste water after graduating. Jamie Sykora and Christine Boland-Prom have been involved with GWS for 2 years and used their junior year classes to design different treatment options along side classmate Rachel Montavon. Sydney Shaffer and Miranda Durbin were interested in using their sophomore level classes to assist in design, scheduling and documentation. Alexis Countryman was an enthusiastic freshman who's dedication to learning and new found passion for wastewater helped elevated team morale.

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APPENDIXES

Appendixes can be viewed online: <https://tinyurl.com/yxm6jnul> 



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MINNESOTA

Haley Jostes is a recent graduate from Stillwater Area High School. She represented the state of Minnesota at the National Stockholm Junior Water Prize Competitions and was awarded the Bjorn von Euler Innovation in Water Scholarship Award. The Bjorn von Euler Innovation in Water Scholarship Award is sponsored by Xylem Inc., is given to the SJWP state winner who demonstrates a passion for education, spirit of creativity, and innovation.

Haley will be attending Gustavus Adolphus College in the fall of 2019 and plans to double major in biochemistry and chemistry with a minor in environmental studies. She is very active with music and science fairs, and has been playing the trumpet in concert and jazz settings since the 5th grade. In the science world, Haley has been recognized on regional, state, national, and international levels for her work regarding water quality and the environment. Her latest research revolves around the production of nutritious food for developing countries in a compact

aeroponics system with contaminated water. She is a 2019 Regeneron Science Talent Search Scholar, a two-time finalist for the National Junior Science and Humanities Symposium, a three-time attendee of the International Science and Engineering Fair, and a two-time finalist for the International GENIUS Olympiad. Haley has also been a competitive figure skater since the age of six and trains six days a week for three to four hours a day. Haley is a 2019 National German Championships competitor. She is also a two-time US Figure Skating Gold Medalist and a two-time MN State Silver Medalist.

Haley Jostes has been a citizen scientist for the MN Valley Branch Watershed District for four years. She and her neighbor, Bonnie Juran, have monitored the water quality of a neighborhood pond throughout this time. Over the years, they discovered a significant decrease in the water quality of the pond. This was mostly attributed to over-fertilization of nearby farmland and backyards. In order to combat this issue, Haley developed two different science fair projects that explored natural removal methods of the excess nutrients. This branched off into the development of an organic farming method that used an aquatic plant to absorb excess nutrients, then reapplication of the plant as its own fertilizer. This improved the water quality and also provided a financial benefit to the farmer. In hopes of continuing to decontaminate water and produce an output in the process, Haley transitioned

to her current project. This project uses saltwater and contaminated water to grow fresh produce in a cost-effective aeroponics system. This project would not have been possible without Bonnie Juran, who has been a guiding hand throughout Haley's involvement with the environment that surrounds us. She has provided Haley with an appreciation for the monarch butterfly, water quality, and a variety of pollinators. We send a special thank you to Bonnie, for advising Haley and aiding in the development of a life-long passion.

The abstract for Haley's winning project are as follows: *12% of the global population is impacted by undernutrition, the primary risk to health worldwide.* Fresh produce has large nutritional benefits but often is unattainable. The objective was to develop a self-powered system that enables the use of contaminated water to grow produce in an efficient and accessible aeroponics system (the process of growing plants without a growth medium). Plant roots hang in the air and are periodically misted with a nutrient-rich spray, in this case, provided by compost tea. Saltwater or murky water will be distilled using a solar distillation device, optimized by manipulating the angle of depression and water depth. The feasibility of this idea was tested in a full-scale model. The solar distillation box gave a final output of 34.5mL/hr. The compost tea was tested for the main growth nutrients: nitrogen, phosphate, and potassium. Cold brewing for 72 hours provided enough sustenance to support plant development.



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Experienced Professionals - Better Solutions

Our reputation is built on practical experience. Every engineer on our team started in the field, and to ensure that our designs work in the real world, our team always has plenty of

Boots on the Ground

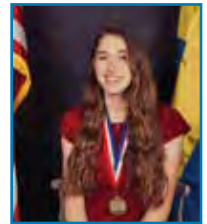


trotter-inc.com

Most components used are accessible to individuals living in Africa. A one-time shipment of basic materials totaling \$19.00 will provide a family with fresh food for years to come.

WISCONSIN

Beatrice Youd, a 16-year-old junior from F. J. Turner High School in Beloit, WI, was selected as the state winner of the SJWP from Wisconsin.



Her teachers – Kelsey Uttke, Brianne Allbee, and Lisabeth Langer – supported her project, *Eutrophication Prevention Analysis of Driveway Materials*. Beatrice witnessed firsthand how nutrient pollution from fertilizers caused eutrophication and damaged the aquatic ecosystem around where she lived. This inspired her project.

The following is her abstract: This study uses simulated rainfall to identify the ammonia (NH₃) filtration abilities of driveways where runoff into the watershed and surrounding marine environment poses growing concern to the health of the coastal ecosystem. Driveway materials tested included: 1) brick with greenery, 2) crushed shell, 3) brick, and 4) gravel. These materials were tested against two controls: 1) soil with grass and 2) concrete. Research on these various materials states that they have filtration characteristics which may make them suitable for green infrastructure projects. This study employs the popular home garden fertilizer Miracle Gro[®], dissolved in well water. Miracle Gro[®] contains ammonia. The results of this experiment help to determine whether the tested driveway materials are effective in filtering significant amounts of ammonia out of water. This experiment contributes to defining the filtration properties of these various materials. Findings may be used to improve the ecology of densely populated coastal environments. They may also contribute to the analysis of future green infrastructure projects in developed areas where large quantities of runoff cause eutrophication.

Other than her passion for environmental science, Beatrice has interests in music, philosophy, and Latin. She plays the piano and french horn, and enjoys singing in a number of ensembles. In college, Beatrice plans to major in a science-related field and to minor in music. [CS](#)

LIFT Spotlight: The St. Cloud, MN NR2 Project

By the St. Cloud NR2 Project Team



The INNOVATION & TECHNOLOGY COMMITTEE will regularly solicit articles for publication in the *Central States Water* magazine regarding new water technologies and innovation in the water field and will help promote CSWEA Leaders Innovation Forum for Technology (LIFT) engagement. This first article focuses on an innovative activated sludge process, a granular sludge process, which allows for multiple process benefits to be realized. This is one of the innovative technologies in LIFT Link. LIFT Link was developed by the Water Research Foundation (WRF), then known as the Water Environment Research Foundation. LIFT Link is part of the WRF/WEF LIFT (www.werf.org/lift) program to accelerate innovation into practice. LIFT Link is an online platform which serves as a conduit of interaction among municipal and industrial water, wastewater, and stormwater agencies, technology providers, consultants, academics, investors, federal agencies, and others for advancing innovation. LIFT Link allows its users to discover new technologies and research needs; connect with others with similar needs, technology interests, and desired expertise; and collaborate on research and technology ideas, proposals, projects, demonstrations, and implementation. If interested in accessing LIFT and gaining a login please reach out to Mohammed Haque at mhaque@cswea.org. Look for more innovative articles in the near future.

Risk, Reward and Resource Recovery in the Mississippi Rivershed

The St. Cloud Nutrient, Energy & Water (NEW) Recovery Facility is a regional facility with a 17.9 mgd design flow that serves a population of over 120,000 people in greater St. Cloud, MN. The facility is owned and operated by the City of St. Cloud and provides conveyance and treatment services for five other communities. In the last decade, the facility has undergone numerous upgrades to accommodate:

- A growing population
- More stringent regulatory objectives
- Cost-effective services through low user rates
- Sustainability goals

Since 2013, a full biological nutrient removal process was constructed, significant energy efficiency and recovery projects have been completed, and in August 2017, St. Cloud broke ground on the Nutrient Recovery and Reuse (NR2) Project which included biofuel storage/recovery, biosolids reuse, and nutrient recovery.

Beneficial Reuse of Biosolids

Biosolids dewatering in combination with Lystek's low temperature thermal-alkaline hydrolysis process (Lystek THP) technology were selected for beneficial reuse of Class A biosolids. The proprietary Lystek process involves a combination of heat, alkali,

and high shear mixing to achieve effective lysis (breakdown) of the biological material in the biosolids. The process hydrolyzes macromolecules to smaller molecules that are amenable for further use as a carbon source and biodegradation in any biological media, such as soil, anaerobic





digesters, or biological nutrient removal (BNR) systems. The resultant high solids, low viscosity, liquified material, branded LysteGro, can be easily managed with St. Cloud's existing liquid land application recycling program and equipment.

Since the system is installed as an onsite, post-anaerobic digestion and post dewatering solution at the facility, it does not interfere with other wastewater treatment processes. Compared to a high temperature and pressure thermal hydrolysis process, Lystek's fully automated physical chemical thermal hydrolysis process has lower capital and operating costs, smaller footprint and does not require any high-pressure vessels, or dedicated operators.

The ability for the City to advance their successful land application program, while reducing and controlling costs, were key features of the project. Existing plant infrastructure, such as liquid storage tanks, buildings, and the truck loading station could be reused as part of this project. The City was also able to improve efficiencies. The concentrated nature of the LysteGro, has reduced biosolids volumes by over 70%, extending the capacity of St. Cloud's existing storage and solving this challenge. Further, the high solid, liquid properties of the product allowed the city to maintain pumping, loading, and unloading efficiencies, while also dramatically decreasing the amount of road time and wear and tear on trucks, overtime, and the number of passes application equipment must undertake, per field.



There are additional agronomic benefits of the Class A biosolids to the farmers receiving the material as well. The Lystek THP adds potassium hydroxide (KOH) as a part of the process, which increased the K content of the biosolids by more than three times. Potassium is a highly valued nutrient in field crop production and in demand from the agricultural community.

St. Cloud completed its first full biosolids-recycling season with the new Lystek system and LysteGro product in spring 2019. The reduction in volume resulted in a significant decrease in miles driven to recycle the product, total acres applied and a reduction in staff hours. The concentrated nutrient-rich product biosolids product in spring 2019 resulted in an average application rate of 4,700 gallons per acre, compared to an average application rate of 9,200 gallons per acre in spring 2018.

Nutrient Release and Recovery

The biosolids dewatering process creates a recycle stream rich in phosphorus. To achieve nutrient recovery targets, St. Cloud elected to harvest phosphorous (P) from both the dewatering centrate and from P released from waste activated sludge (WAS) prior to digestion. The drivers for pre-digestion phosphorus release included increasing the amount of phosphorus recovered, reducing phosphorus in effluent, protecting the digester and dewatering equipment from nuisance struvite formation, as well as redirecting the facility's reclaimed phosphorus from the biosolids to a commercial struvite fertilizer product which could export nutrient load out of the local watershed to where there are phosphorus deficiencies. Ostara's Waste Activated Sludge Stripping To Remove Internal Phosphorus (WASSTRIP) process in combination with Pearl nutrient recovery was selected to accomplish this. This technology produces a revenue generating struvite fertilizer product, branded as Crystal Green.

The Pearl process recovers phosphorus from nutrient-rich streams, through the controlled precipitation of struvite. Struvite is comprised of magnesium, ammonium and phosphate, together with water of hydration within the crystal. Its chemical



Spring 2018 (Class B)				
6.6 million gallons	11,869 miles	736 acres	1,043 regular staff hours	560 overtime staff hours
Spring 2019 (Class A)				
2.3 million gallons	3,684 miles	619 acres	625 regular staff hours	84 overtime staff hours

formula is $\text{NH}_4\text{MgPO}_4 \cdot 6\text{H}_2\text{O}$.

Phosphate and ammonium concentrations in St. Cloud feed streams are present in sufficient quantities for the reaction, and magnesium chloride salt is used to supplement magnesium already present in the feed streams. The Pearl reactor is an expanding up-flow fluidized-bed reactor. Two principles are fundamental in the process – maximizing efficient nutrient removal and consistently recovering high quality, inorganic fertilizer. The Pearl reactor model selected for St. Cloud's NR2 installation was the Pearl 2K, model. The Pearl 2K has the capacity to treat up to 550 lbs of orthophosphate per day in the incoming feed stream.

Growing fertilizer pellets in the reactor are held in suspension using the recycle stream and the inventory of fertilizer in the reactor is measured using instrumentation. When a target fertilizer inventory in the reactor is reached, the reactor will automatically harvest the fertilizer by sending it to the product handling system. The product is dewatered, heat dried, and stored in silos in a simple and fully automated process. Periodically the silo contents are removed from site, using truck unloading, for sale to Ostara's network of fertilizer processors, blenders, and distributors.

The WASSTRIP process releases phosphate from WAS in a mixed tank maintained in an anaerobic condition. Phosphate accumulating organisms (PAOs) present in enhanced biological phosphorus removal (EBPR) sludge readily release stored phosphate (together with magnesium and potassium counter ions) in WASSTRIP's anaerobic conditions. Subsequent sludge thickening diverts released nutrients into thickening liquor, which the Pearl reactor recovers. Since the WASSTRIP liquor is low in ammonia, the stream needs to be combined with dewatering liquors in the Pearl reactor to precipitate struvite.

WASSTRIP controls struvite precipitation throughout the treatment stream by reducing the phosphate and magnesium content of the WAS before anaerobic digestion (where ammonia forms). This improves solids treatment performance, tackles struvite related maintenance, and significantly reduces biosolids production. WASSTRIP also partially reverses the negative impact of EBPR on dewaterability by changing the phosphate and divalent ion (e.g. Ca^{++} , Mg^{++} and Fe^{++}) balance in the digester.

The WASSTRIP process solids retention time (SRT) is influenced by WAS phosphorus content and volatile fatty acid





(VFA) availability. PAOs cannot release phosphate unless VFA is present to be absorbed. In the simplest form, WASSTRIP can operate endogenously with VFA being created as the WAS ferments or, as a process enhancement, VFAs can be added to the WASSTRIP process (e.g. from primary sludge fermentate, acid phase digestate, etc.) to accelerate phosphate release and reduce SRT. The WASSTRIP process at St. Cloud was designed to operate endogenously with approximately 30 to 45 hours of SRT required to ferment sufficient VFA in the summer and winter respectively. The existing chlorine contact tank that was abandoned as part of the 2013 construction project, with an approximate total volume of 100,000 gallons, was repurposed as the WASSTRIP reactor through piping changes and the addition of mixers.

Technology Synergies

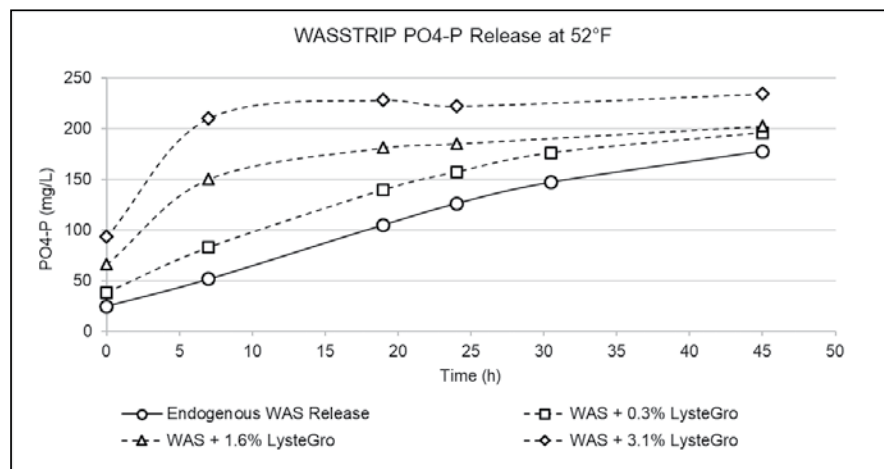
One of the innovative outcomes of this resource recovery project is the potential synergies between both the Ostara and Lystek technologies. Due to the hydrolysis of macromolecules in Lystek-processed biosolids (LysteGro), the biosolids contain higher amounts of soluble phosphate and a high concentration of volatile fatty acids (VFAs). By recycling the Lystek treated product back to the WASSTRIP reactor, the released phosphate could

be captured in the WAS thickening liquor and the valuable VFAs can be utilized in the Ostara WASSTRIP process to provide an external carbon source to accelerate P release from the WAS, as shown in the bench-top study results below.

The addition of LysteGro to the WASSTRIP tank has two benefits. It can be used to accelerate PO₄-P release at cold temperatures, and it can be used to increase the P loading to the Pearl reactor. If the simulations from this test are extrapolated to the full-scale system, adding 3.1% (3,255 gallons/d) of LysteGro to the WASSTRIP tank could increase the PO₄-P load to the Pearl reactor by about 40 lbs PO₄-P/d, translating to 170 lbs/d of additional Crystal Green production.

CONCLUSION

St. Cloud decided to take a risk as part of the NR2 Project by installing two new technologies at the same time thus keeping user rates low, enhancing resource recovery opportunities and meeting sustainability goals. The St. Cloud Lystek installation is the second in the United States and the 7th Ostara Pearl 2K reactor in the nation, 10th world-wide. This is the first site combining thermal hydrolysis and phosphorus recovery in North America. The end result has been a success with so many opportunities to capitalize on the potential synergies available by taking this risk. [CS](#)



Study on the Effects of Side Streams on Phosphorus Removal

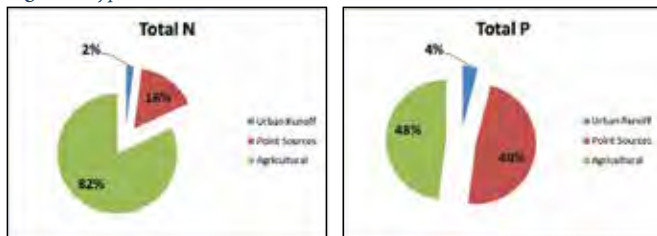
By: Elizabeth Bohne, EIT, Trotter and Associates, Inc. and Scott Trotter, PE, Trotter and Associates, Inc.

A nationwide push to reduce nutrient levels in US waterways has been implemented by the USEPA. This effort has affected NPDES permits for treatment systems through implementation of a total phosphorus effluent limit. In some states, this limit is as low as 0.075 mg/L. These new regulations have necessitated advanced treatment methods at plants that were not originally designed with the intention of removing phosphorus. There are many phosphorus removal methods that can be implemented including chemical removal, biological removal, or a combination of the two. The best method is plant specific, based on parameters including size, existing processes, available land, and public opinion. This study was conducted to determine the impact of the existing infrastructure, specifically the sludge stabilization and dewatering processes, on phosphorus removal at various wastewater treatment facilities throughout Northeastern Illinois. It was concluded that without thorough evaluation of the impact of the side streams, both Chemical Phosphorus Removal and Biological Nutrient Removal (BNR) are likely not going to perform as effectively as possible. The impact of compounding phosphorus due to the side stream was found to be so significant in some situations that BNR proved to be completely ineffective. A detailed analysis of the side stream is recommended for any WWTFs that are implementing phosphorus removal processes. This was also found to be a primary contributing factor in plants underperforming in designed phosphorus removal efficiencies.

Why the Big Push for Phosphorus Removal?

Phosphorus is typically the limiting nutrient in plant growth, hence its prevalence in agricultural runoff from fertilizers. It is also found in food, many industrial cleaners, and human waste. There is both a soluble and particulate component of the total phosphorus. The particulate is largely eliminated in the solids removal processes, however the soluble component remains, and is typically discharged with the effluent if it is not removed. This contributes to algal blooms in receiving waters, which affects local water quality in Illinois, and eventually makes its way to the Gulf of Mexico where there is a large 'dead zone.' This dead zone encompasses over 9,000 square miles and is unable to support various forms of aquatic life due to decomposition of these algal blooms. Oxygen is used during the decomposition process, resulting in very low dissolved oxygen levels (hypoxic conditions).

Figure 1: Typical Nutrient Sources



Nutrient Removal Processes

There are many methods to remove phosphorus in wastewater. All of these methods include transforming soluble phosphorus (ortho-P) to particulate phosphorus. Particulate phosphorus can then be removed in more traditional solids removal processes. To achieve ultra-low effluent limits (<0.1 mg/L), soluble phosphorus can be removed through nanofiltration, however it is typically cost prohibitive in plants with treatment capacities less than 20 MGD and rarely implemented within the Central States region. Typically, a plant will choose between chemical removal, biological removal, or a combination of both. Each of these methods has significant benefits and drawbacks to consider. Chemical removal typically has a lower capital cost, and a larger operations and maintenance cost. At lower effluent limits, this cost increases greatly due to the need for more chemical at low levels from competing reactions (see Figure 3). Biological removal is traditionally the opposite: high capital cost for implementation and lower annual costs. There are also a number of biological phosphorus removal methods, which also remove nitrogen, usually referred to as 'biological nutrient removal.' These processes deserve consideration due to ongoing regulatory discussions regarding future Total Nitrogen (TN) limits.

Figure 2: Nutrient Removal Methods

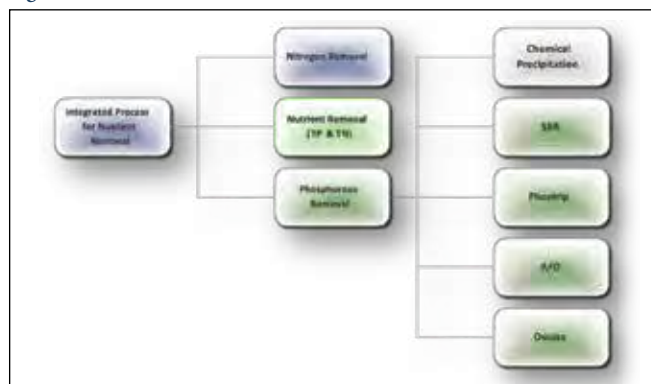
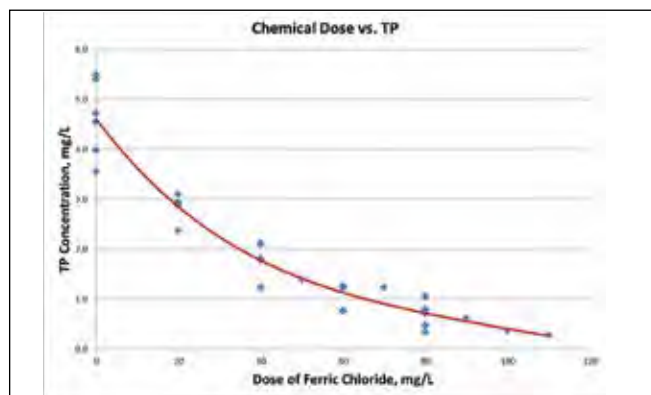


Figure 3: Typical Chemical Dose Based on TP concentration



The study used BioWin™, a tool used for modeling the wastewater treatment process, to evaluate the impact of side streams on nutrient removal, with a specific interest in biological nutrient removal. Models were calibrated using historical process data for ten different plants and then manipulated to determine the effect of a variety of nutrient removal processes. Dynamic modeling was used to allow for pH modeling and compounding impacts over time. Typical models assume a constant pH, which becomes inaccurate in phosphorus precipitation, as well as in volatile fatty acid creation (such as what is found in fermentation). Dynamic modeling drastically changed the results to include impacts of pH and side-streams, improving their accuracy. Results from each model were validated through long hand calculations.

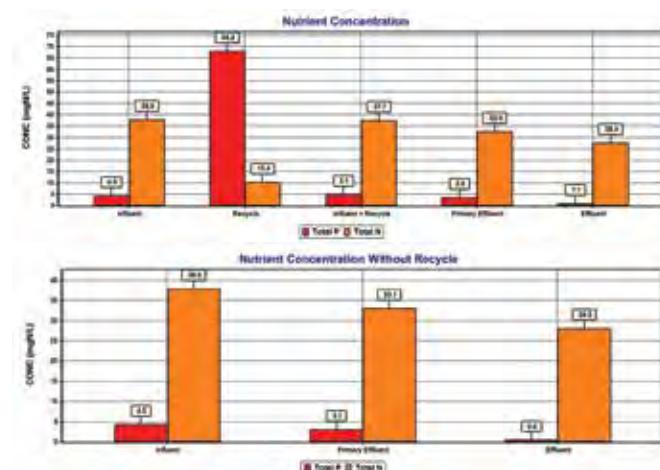
Effects of Sludge Stabilization – Aerobic Digestion

It was determined that the side stream from the sludge dewatering process can greatly reduce the efficiency of the nutrient removal process. This is due to the volatile solids destruction in the digestion process. In biological phosphorus removal (Bio-P), phosphorus is removed as a volatile solid within the sludge. This impact was reduced when chemical phosphorus removal was used wherein phosphorus is removed as a fixed solid.

The existing sludge stabilization process at a plant plays a significant part in the effectiveness of phosphorus removal. In this study, four plants utilizing aerobic digestion and five plants utilizing anaerobic digestion were evaluated, as well as one plant that currently operates aerobic digestion with WAS and anaerobic digestion with primary sludge.

In plants utilizing aerobic digestion, the volatile solids destruction rate is about 40-50%. This means that 40-50% of the phosphorus that is removed in the solids is rereleased in its soluble form and then returned to the head of the plant with the dewatering side stream (filtrate, centrate, etc). Figure 4 demonstrates the impact that the removal of the recycle stream has on phosphorus removal and effluent nutrient concentration when the same amount of chemical is used. This demonstrates an increase in removal by about 0.5 mg/L when the recycle load is removed.

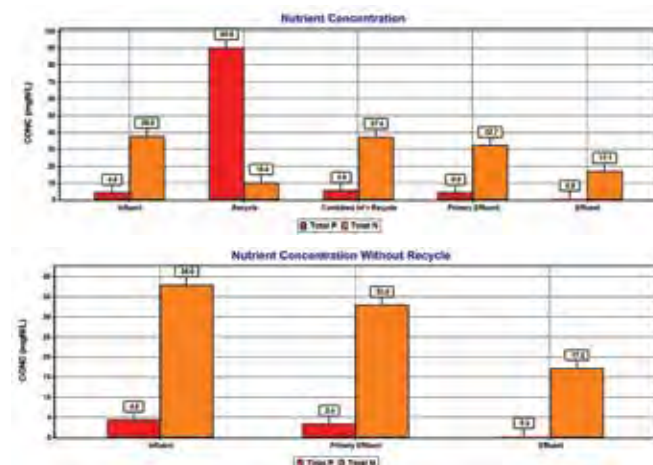
Figure 4: Nutrient Profiles for Chemical P Removal with Aerobic Digestion with and without Recycle Stream



The impact is even more significant with biological phosphorus removal. Figure 5 demonstrates the nutrient profile on the same plant with an A2O process that is optimized for the most efficient nutrient removal. The nutrient load carried by the recycle stream

increases the load on the biological process, thus increasing the carbon that is required for biological nutrient removal. Figure 5 demonstrates the impact removing the recycle stream had on the overall treatment process.

Figure 5: Nutrient Profiles for Biological P Removal with Aerobic Digestion with and without Recycle Stream



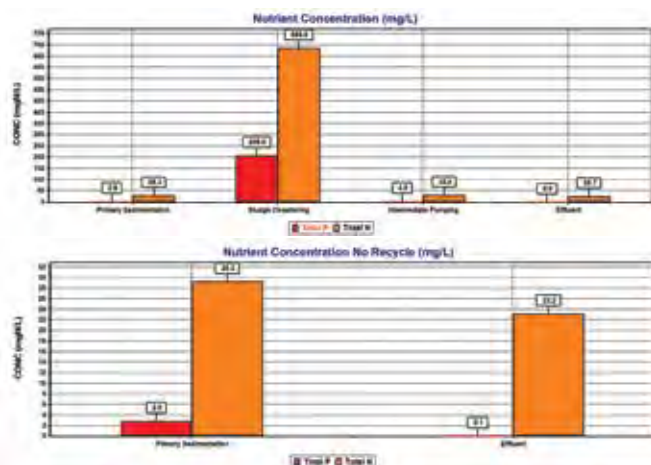
The model demonstrated about 0.5 mg/L more phosphorus removed when the recycle load is removed. This is similar to that which was seen with chemical phosphorus removal. This is likely due to phosphorus that was tied up in the volatile solids that was released during digestion. During this study typical nutrient concentration in the side stream were about 75-150 mg/L soluble phosphorus and 100-300 mg/L nitrate. This increases the rbCOD demand in BNR by 30-50% to treat the phosphorus when 10 mg/L rbCOD is used for phosphorus release in the anaerobic zone. It increases the rbCOD demand by an additional 10% for denitrification of the recycled nitrate. When evaluating side stream treatment methods, it was determined that phosphorus, nitrate, or both could be treated. With no side stream treatment, the rbCOD demand is about 85-115 mg/L. Typical rbCOD available in domestic wastewater influent is around 64-80 mg/L, this demonstrates that a typical plant is carbon limited. If the total recycle nitrate is removed, the rbCOD demand is reduced to about 61-95 mg/L. If the total recycle phosphorus is removed, the rbCOD demand drops to 70-100 mg/L. When both are treated, the rbCOD demand is reduced to about 55-80 mg/L, which is no longer carbon limited. Methods for side stream treatment will be further discussed in the following sections.

Effects of Sludge Stabilization – Anaerobic Digestion

In anaerobic digesters, the typical volatile solids destruction is greater than 60%. This means that at least 60% of phosphorus that was converted to solids is rereleased with a large portion of that being sent back to the head of the plant with the recycle stream. In addition to the release due to volatile solids destruction, there is additional release occurring as phosphorus accumulating organisms (PAOs) release phosphorus when exposed to anaerobic conditions. This process is what facilitates biological phosphorus removal, leading the 'luxury uptake' phase that occurs when these organisms are subsequently exposed to an aerobic zone. When sludge is anaerobically digested, this uptake does not occur. After dewatering, the soluble phosphorus is recycled to the head of the plant. These loads can exceed the total influent phosphorus

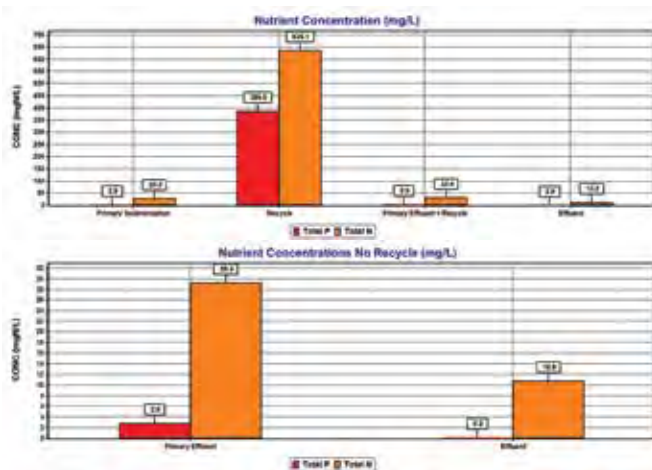
load due to a compounding effect that the recycle creates. As seen in Figure 6, the same approach was taken in evaluating chemical phosphorus removal (chem-P) with anaerobically digested sludge. It was found that with the same amount of chemical, the effluent P drops about 0.8 mg/L when the side stream is removed.

Figure 6: Nutrient Profiles for Chemical P Removal with Anaerobic Digestion with and without Recycle Stream



When evaluating biological nutrient removal, it was determined that even when the process was optimized, little to no phosphorus was removed with the side stream. Figure 7 demonstrates the nutrient profile for a plant with an A2O process before and after the side stream is removed.

Figure 7: Nutrient Profiles for Biological P Removal with Anaerobic Digestion with and without Recycle Stream



The model demonstrated that the additional nutrient load from the recycle on the biological process greatly reduced the effectiveness of nutrient removal to a point where it is basically ineffective. This appeared to be due to the undoing any phosphorus removal completed in the biological process when solids were moved into anaerobic digestion. The model also demonstrated that when the side stream is removed from the process, biological phosphorus removal can be effectively and reliably meet lower effluent nutrient limits.

An additional concern with anaerobic digesters is the large ammonia load that is recycled. Primary sludge can contain high ammonia concentrations that are not nitrified prior to digestion.

This ammonia is soluble, so it is concentrated in the dewatering side stream that goes back to the head of the plant. This leads to higher levels of nitrate in the return activated sludge (RAS) and a larger carbon demand on the biological process. The nitrate goes through an anaerobic cellular respiration process known as denitrification that also requires carbon. This process will occur more readily than phosphorus release by PAOs.

During this study typical nutrient concentration in the side stream ranged from 300-700 mg/L soluble phosphorus and 700-1400 mg/L TKN, mostly in the form of ammonia. This increases the rbCOD demand in BNR by over 100% to treat the phosphorus when 10 mg/L rbCOD is used for phosphorus release in the anaerobic zone. It increases the rbCOD demand by an additional 25% for denitrification of the recycled ammonia after it is converted to nitrate. When evaluating side stream treatment methods, it was determined that either phosphorus, nitrate, or both could be treated. With no side stream treatment, the rbCOD demand is about 103-130 mg/L. Typical rbCOD available in domestic wastewater influent is around 64-80 mg/L. This demonstrates that a typical plant is carbon limited. If the total recycle TKN is removed, the rbCOD demand is reduced to about 96-116 mg/L. If the total recycle phosphorus is removed, the rbCOD demand drops to 69-89 mg/L. When both are treated, the rbCOD demand is reduced to about 56-76 mg/L, which is no longer carbon limited.

It is not feasible to completely remove the side stream, but it is possible to treat this side stream if the impacts are understood. It is likely that many plants that either currently or are planning on implementing a BNR process could increase their efficiency and reduce operating costs with the implementation of some form of side stream treatment. A variety of methods to mitigate this issue were evaluated and will be described in the following sections.

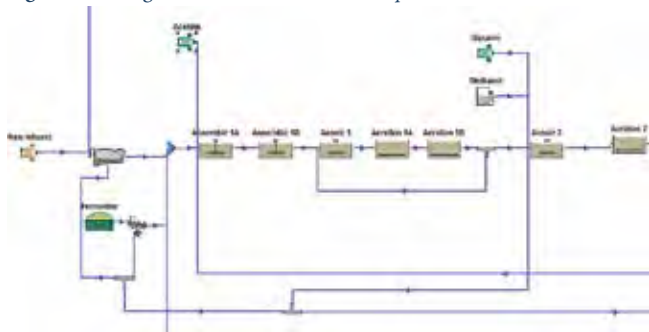
Bio-Augmentation

It is important to note that in biological nutrient removal a carbon source is necessary, typically in the form of rbCOD, in order for the nutrient release and subsequent uptake processes to occur. The influent carbon to the plant must be considered when selecting a nutrient removal process.

One way to increase the carbon in the biological process would be through bio-augmentation. This can be accomplished through the installation of a primary sludge fermenter, activating the primary clarifiers, or through dosing of a carbon-based chemical. Typical chemicals include methanol, acetate, or glycerin. Figure 8 below demonstrates the typical installation locations for each of these chemicals in a traditional Bardenpho process.

In a primary sludge fermenter, volatile solids undergo hydrolysis that creates volatile fatty acids such as acetate and propionate. These are used as a food source by PAOs, allowing for a greater phosphorus release in the anaerobic zone. This can also be done through a carbon-based chemical such as microC™ which is glycerin-based providing a source of rbCOD. This chemical can be fed to the anaerobic zone of the biological process where it will ferment, increasing the VFAs and allowing for improved phosphorus removal. Acetic acid or a similar VFA could also be directly added. This does not directly treat the side stream, but provides a means to manage the additional load.

Figure 8: Bio-augmentation Methods in Bardenpho

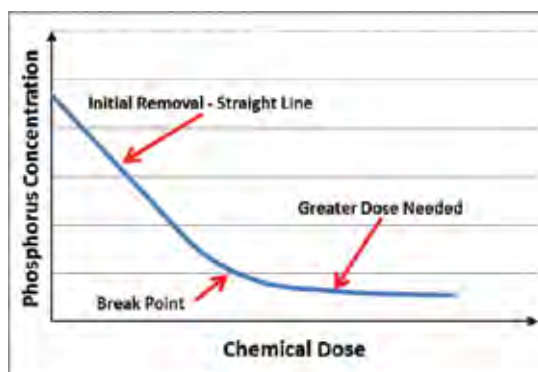


Side Stream Treatment

There are also many ways to directly treat the side stream. This can be performed through chemical or biological treatment. BioWin modeling results demonstrated that significantly less chemical can be used to remove phosphorus from the side stream, rather than the process flow, when used in conjunction with a biological or chemical phosphorus removal process to reach effluent TP levels less than 1.0 mg/L. This is due to the reaction kinetics of the chemical at various concentrations of phosphorus.

At lower phosphorus concentrations, there are many competing reactions that occur when a metal salt is used, leading to decreased removal efficiency and a higher required molar ratio of metal salt to phosphorus. When chemical is used to treat the sludge prior to dewatering, or the side stream after dewatering, the nutrient concentrations are much higher and there are less competing reactions. This allows considerably less chemical to be used to reduce the load from the side stream, increasing the efficiency of the nutrient removal on process flow, and leading to lower effluent phosphorus levels.

Figure 9: Impact of Low Phosphorus Concentration on Chemical Requirement



Struvite Harvesting

Another method to reduce phosphorus in the side stream is through the use of struvite harvesting. This typically requires a great deal of additional equipment including large vessels and careful monitoring. There are many benefits to struvite harvesting as it creates a product that can be reused, and also minimizes the potential for struvite buildup in digesters and sludge piping. It also has its drawbacks; it rarely shows payback for WWTFs with capacities less than 15 MGD due to large capital costs and footprint, and also typically requires a magnesium feed, so it does not entirely eliminate the need for some form of chemical addition.



WWTF's that utilize aerobic digestion also benefit from side stream control, however may be able to meet effluent limits without additional side stream management.

There are a few manufacturers available including Ostara, CNP Airprex, and Multifarm Harvest. These should be considered for facilities utilizing BNR with anaerobic digestion greater than 15 MGD.

Conclusion

The study concluded that the side stream has greater impact on effluent P concentrations in plants operating phosphorus removal processes that utilize anaerobic digesters than those that utilize aerobic digesters. It was found that in order to effectively perform biological phosphorus removal in plants with anaerobic digesters, the side streams typically must be addressed. This can be done through bio-augmentation or side stream treatment. WWTF's that utilize aerobic digestion also benefit from side stream control, however may be able to meet effluent limits without additional side stream management. The recommendations for the ten plants evaluated during this study are included in Table 1. [CS](#)

Table 1: Recommendations for Phosphorus Removal

WWTF	1.0 mg/L	0.5 mg/L	0.1 mg/L
Wheaton Sanitary District (8.9 MGD)	Chem-P (alum)	+ A/O + fermenter	+ A2O + ANITA Mox
Roselle-Devlin (2.0 MGD)	Chem-P (alum)	+ A2O	+ Bardenpho + Bioaugmentation
Roselle – Botterman (1.22 MGD)	Chem-P (alum)	+ Denitrification	AlternatIR + Filtration
Glendale Heights (5.27 MGD)	AO + Chem-P (alum)	+ A2O	+ Bardenpho + bioaugmentation
Algonquin (5 MGD)	Bardenpho – Currently Operating	Bioaugmentation + Chem-P (recycle)	+ Filtration
Batavia (4.2 MGD)	Chem-P (ferric) – In construction	Bardenpho + Bioaugmentation + Aerobic Digestion (WAS) + Chem-P (recycle)	+ Filtration
East Dundee (2.3 MGD)	SNDR-Existing	P-recycle	+ Filtration
Fox Lake (12.0 MGD)	MLE and Chem-P – Currently Operating	Annamox + Chem-P (recycle)	+ A2O
St. Charles Main (9.0 MGD)	A2O + fermentation + Chem-P (recycle)- in construction	+ Filtration	+ Annamox + Filtration
St. Charles West (0.7 MGD)	Bardenpho	+ Chem-P (recycle)	+ Filtration

WASTEWATER TREATMENT FOR LESS?

"I love wastewater because it is a really important factor in protecting our environment. It is our first line of defense – especially in densely populated, urban environments in protecting our water systems. Wastewater is a really interesting, messy chemistry and biology problem. We have taken what nature does on a long time scale and been able to shorten that timescale with different technologies and processes. I find it fascinating."

-Anndee Huff



That is the goal of the research coming out of Paige Novak's research group at the University of Minnesota.

Currently, one of the most energy-intensive and therefore costliest aspects of a typical wastewater treatment plant is the aeration process, not even considering the need to add chemicals and the other operational costs involved. The process of using a blower to force air up a large water column and through diffusers requires a lot of energy, causing wastewater treatment plants in North America to spend 2.8 billion dollars a year on energy. Aeration accounts for approximately 60% of a treatment plant's energy consumption, making aeration the most expensive portion of a treatment plant's energy budget.

Anndee Huff, a graduate student in Novak's group, is researching the use of anaerobic ammonia oxidation, called anammox, for mainstream nitrogen removal. "If we could replace aerobic microorganisms currently used for conventional treatment with anammox, we could save approximately 60-70% on aeration costs," says Huff. "So there is a lot of potential."

If the need for aeration and its required energy could be reduced, that would be substantial cost savings for wastewater plants – and applying that savings to a few large plants would amount to a huge energy savings for the industry. Novak and Huff (along with collaborators in the Chemistry and Chemical Engineering departments) are working on a new type of membrane to select for anammox bacteria for mainstream wastewater treatment. They are developing a membrane that creates ideal conditions for anammox to grow, which would allow them to grow in biofilm formation alongside aerobic ammonia oxidizers (AOBs).

Anammox convert ammonium and nitrite to dinitrogen gas anaerobically while fixing their own carbon (Figure 1),

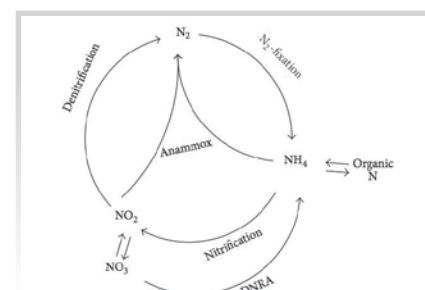


FIGURE 1. Anammox: The Nitrogen Cycle

resulting in savings on aeration costs and carbon addition. It also saves real estate as only one tank is required compared to conventional nutrient removal.

The new membrane technology attracts ammonium and creates a micro-environment that is ideal for anammox organisms to flourish. Polymer based or other types of membranes can be modified to attract ammonium ions. Successful modification of the membrane surface can be verified through characterization techniques such as Fourier transform infrared scanning, x-ray photoelectron spectroscopy, and scanning electron microscopy. The membranes are also porous and can deliver controlled oxygen to the biofilm growing on the surface.

The membranes developed were tested in a reactor over the summer. Anammox organisms were detected when sampled membranes were analyzed several weeks after seeding. So, the first step of growing anammox on the modified membrane was successful.

Currently, Huff is working to demonstrate repeatability, reliability, and experimental control. The next step will be to compare modified membranes and unmodified membranes for their affinity for attracting anammox.

"This project is super interesting and very applicable," says Huff. "When I came back to school, I was concerned that my time in graduate school should feel like I was moving my career forward. I wanted my additional education to be something that could apply directly to the wastewater treatment industry. This project certainly does that. Even if this new membrane technology is not fully developed in my time here, the knowledge I've acquired about anammox treatment will really benefit a career in wastewater."

The Anammox process is slower than its aerobic equivalent, but it displays several advantages. The anaerobic process can be done in one tank (or one-tank-per-flow, depending on the plant's set up). Anammox can fix its own carbon, so this system does not require an additional carbon source; anammox can convert ammonium (in the presence of nitrite) directly to nitrogen gas. Another benefit is that the anammox process does not generate as much sludge as the conventional aerobic process. Treating less sludge would also save money.

"Doing research like this is critical for moving the industry forward and continuing to improve current treatment processes," says Huff. "Not only to achieve higher nitrogen removal limits, but also to move the industry toward economic and environmental sustainability. As the wastewater treatment industry strives toward becoming energy neutral, or even energy producing, it will be essential to reduce high energy inputs like the aeration process."

Nitrogen levels will likely be more closely regulated in the future here in Minnesota leading to potential upgrades for wastewater treatment facility around the state. Huff sees that an anammox option could be beneficial. "Of course, plants of all sizes would benefit from achieving nitrogen removal more economically. Small plants might benefit most. An anammox system could remove nitrogen in one step, greatly reduce the amount of air needed, eliminate carbon addition, and save space. Ultimately, this research helps to keep our rivers healthy and clean for aquatic life, drinking water, and recreation while moving the industry in a greener direction."

FUNDED BY THE MINNESOTA WATER RESEARCH FUND

Anndee Huff was the first recipient of monies from the Minnesota Water Research Fund. The funding she received allowed her to continue her research through the summer when she could really focus without other commitments. "The summer after my first year in graduate school, I spent focused time in the lab. It was great to not divide my research time with classes or working as a teaching assistant. I got comfortable in the lab and felt like my research really made progress then. Over that first summer, I successfully modified the developed membrane surface. The progress I made that summer set me up to continue to make significant progress in the fall, even when classes resumed." *If you would like to contribute to the Minnesota Water Research Fund, contact Shannon Walkerstorfer, at 612-625-6035 or swalkers@umn.edu.*



MORE ABOUT ANNDEE

From early on Anndee Huff knew she wanted to get involved with the environment. She grew up in the Twin Cities and attended the School of Environmental Studies, affectionately known as 'the Zoo School' because it is located on the grounds of the Minnesota Zoo. The alternative high school emphasizes awareness of the environment. She started college at Lewis & Clark in Oregon, focused on Environmental Studies. After transferring to Portland State, she completed her degree in Environmental Engineering.

"After college, I worked as an engineering consultant for Black & Veatch. I got to explore water problems up and down the west coast, and really learned what water/wastewater engineers do. That is what brought me back to graduate school in August 2016.

I was drawn to the University of Minnesota because Paige Novak offered me the opportunity to work on an interesting, relevant, and very applicable project. The project is looking at removal of nitrogen from wastewater. We are targeting a microorganism that can remove nutrients more efficiently than traditional treatment processes can. Essentially, the current nitrogen removal process is a two-step process. Two zones are needed; one needs to be aerated, and one often needs carbon addition to make the nitrogen convert to harmless nitrogen gas that is released into atmosphere. The microorganism that we are working with can do it in one step, reduce (almost eliminate) the amount of air needed, eliminate the carbon, and save space. So that adds up to a great cost savings.

Professor Novak and I, with some colleagues in the Chemical Engineering and Chemistry departments, are developing a new membrane technology that concentrates the ammonium form of nitrogen onto a membrane surface. We can also supply a very controlled amount of oxygen or air through

that material. By doing that we can target the microorganisms needed for this anammox process.”

Huff has set up small batch experiments in the lab on the 7th floor of the Civil Engineering Building. “At this stage I want to replicate this very new technology. In order to prove that it does do what we say, it is important to have replication and statistical validation. Right now, I am testing in little jars, verifying what is going on at this small scale. In the past we have used larger reactors (liter size with flow through, etc). In the future we will go back to larger reactors.

Sometimes wastewater reactors are like black boxes. We put certain things in and we don’t entirely know all the processes that are happening. We are trying to pin down exactly how the organisms are behaving and interacting in our specific system. We have the microorganisms there and know, theoretically, how they should be interacting. The large goal will be to wrap up this current experiment and move to a larger scale to test how it could apply in industry.” [CS](#)

FUNDS FOR MINNESOTA WATER RESEARCH BEGIN TO FLOW

The Minnesota Water Research Fund (MWRF), established in 2015 by Bernie R. Bullert, is providing support for water research done by faculty and students in the University of Minnesota’s Department of Civil, Environmental, and Geo-Engineering. The researchers work in areas related to water resources management and water treatment. The benefits of the Minnesota Water Research Fund are compounded: the funded research projects lead to solutions for water quality problems and future engineers are trained to serve the industries thoughtfully, with a long term view of water management and treatment.

Bernie R. Bullert is a respected regional and national leader in water and wastewater engineering. Early in his career, Bullert saw the benefits that come from scientific study and careful application of the results. This led him to initiate research programs in the water utility departments of both Minneapolis and St. Paul, and he influenced the Metropolitan Council to sponsor research.

Already, over 25 individuals and organizations have joined Bullert in supporting the Minnesota Water Research Fund and awards are being distributed to support research. Recent projects include an innovative approach to nitrogen removal in wastewater treatment plants, study of conditions (‘pre-cursors’) that lead to an unintended byproduct (N-nitrosodimethylamine or NDMA) of water disinfection processes using chloramines, and a new wastewater treatment approach to treat high-strength wastewater that can generate clean water and clean energy.

Bullert envisions that advances from this research will help guide critical water infrastructure decisions and investments across the state of Minnesota, particularly in small communities where funds for water research, training, and education are scarce.

Read more about Bernie Bullert’s background and his vision at www.cege.umn.edu/news-events/in-the-news/fall2016_cegemag_online/berniebullert.html. [CS](#)



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