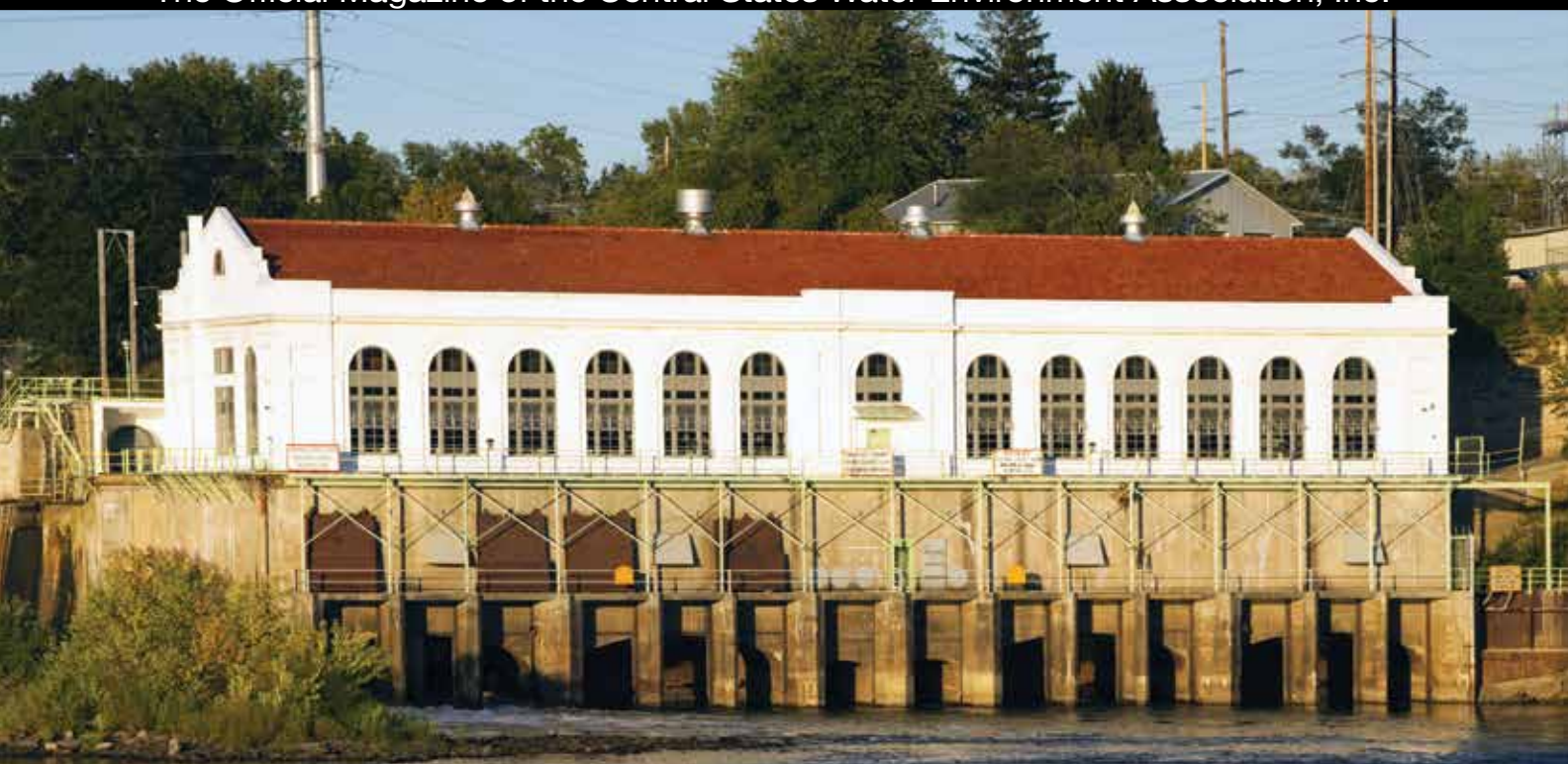
CENTRAL STATES WATER

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



WATER WEEK

PLANT PROFILE:

Northern Moraine
Wastewater Reclamation District

PLUS:

95th Annual Meeting Recap

MSDC Winner
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Water's Worth It
Essay Contest Winners

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Moving Forward with Intention

By Tracy Hodel

Wow, the Annual Meeting a tremendous success! It was so wonderful to see everyone in person again, it felt like a family reunion. Lindsey Busch, LAC Chair, and the rest of the team put so much planning and coordination efforts into the event and it really showed. The Technical Program Committee, under the leadership of Emma Larson and Mandy Sheposh, knocked it out of the park. The Technical Program continues to be one of the reasons why this Annual Meeting is so successful, year after year. Although there were challenges, Mohammed and Amy did a fantastic job with the transition back to an in-person event. There are so many people that put their mark on this event. Congratulations and thank you to all who made it happen! It was truly an example of how great our CSWEA organization is, and the willingness of so many members stepping up and volunteering to help when and where needed.

I could not be prouder or more honored to start my new role as the CSWEA President. I want to thank Jane, Mark, Doug, and the rest of the Executive Committee, all state section committee members, and, of course, Mohammed and Amy for their leadership the last two to three years. There were a lot of challenges and everyone has stepped up, adapted and found a way to make things happen. An incredible example of adaptation and collaboration to achieve great things. That is one reason why I love this association and being part of it – the people.

In the last year, I have been thinking about goals and objectives for the next 12 months for our organization.

> "Ultimately, the biggest responsibility we have, and the goal that many of us have: do today, what we can, to leave this a better place."

There are three things I am hoping we can all focus on.

Number one is mentoring and engaging our emerging leaders (which also happens to be one of WEF's focus areas). There are many people that have mentored and encouraged me, and I cannot say thank you enough to you all. I want to thank Patti Craddock specifically. She was that person at my first Annual Meeting that took the time out of her busy day to say hi, welcomed me, and introduced me to others. At every Annual Meeting that I attended after, she would be there with a big hug. Her energy and passion are contagious and I just love being around people that get that sparkle in their eye when they talk about what they do. Find those people around you and welcome and engage them. The motto for this focus area is "Be Like Patti."

Number two is to think big, have bold ideas, and be brave enough to implement them. We need to take risks, adapt, and evolve. We need to see the future, and go there. We need to think outside of the traditional realm of wastewater and stormwater treatment. We are all charged with many responsibilities in this industry as water and energy professionals. Some of those responsibilities include: protecting our receiving waters, providing cost-effective services to keep user rates low, and reducing our carbon footprint. Ultimately, the biggest responsibility we have, and the goal that many of us have: do today, what we can, to leave this a better place. My colleague shared this question with me not too long ago, which struck her and I alike. The question was "What kind of ancestor do you want to be?" The motto for this focus area is "Big, Bold, and Brave."

Lastly, the third focus area, is take action and don't underestimate the impact of small actions. Big aspirations and goals can be very overwhelming. Sometimes that prevents you from acting upon those goals. Focus on what you can do, and act upon that. One little action can generate the momentum for great things to happen. Then you combine all those "little things" together from you and those around you, then you can watch success unfold before your very eyes. The motto for this focus area is "Big Goals, One Small Step at a Time."

We will be holding the Central States Exchange (CSX) in Wisconsin Dells on July 28-29, 2022 at the Kalahari Resort. We will be taking some time during this event to brainstorm ideas on how to implement these focus areas and develop an action plan for the next year. Hope to see you there! CS

Water Environment Federation
the water quality people

WEF Updates of the Summer

By WEF Delegates, David Arnott and Tracy Ekola

David Arnott

Tracy Ekola

Greetings reetings from Dave and Tracy, your WEF delegates from CSWEA. Here some updates from WEF and the House of Delegates (HOD).

WEFMAX UPDATE

All are invited to attend the in-person WEFMAX meetings. There are four events scheduled for 2022. The Hawaii WEA hosted a WEFMAX on April 20-22, 2022 that focused on Communications. Dave and Tracy were not able to attend this event (as much as we wanted to). WEF Delegate-At-Large, Mandy Sheposh, did attend. Feel free to reach out to Mandy for detailed information.

The South Carolina WEA hosted WEFMAX on May 11-13, 2022. The theme was Emerging Leaders. Dave Arnott attended this event. WEF had identified that the same groups of people tend to be on committees and in leadership positions in WEF, though WEF would like a broader spectrum of member participation. Specific hurdles and potential solutions for WEF participation among emerging leaders were considered in detail at this event.

The North Dakota WEA hosted a WEFMAX on June 1-3, 2022, that focused on Diversity, Equity, and Inclusion (DE&I). The event included an interactive DE&I activity that can be used at a member association (MA) workshop/meeting. The activity was 60-90 minutes and included a prepared power point presentation that can be customized for each MA. Discussions during the DE&I activity included goal setting, issue identification, action plan, and DEI initiative implementation. For more information, please feel free to contact Tracy Ekola at *tekola@brwncald.com*.

In addition, a virtual WEFMAX is also scheduled for July 21, 2022 from 1:00 pm to 2:30 pm CST. This WEFMAX will focus on the WEF Strategic Plan underway currently. More details will follow for this WEFMAX.

CSWEA members are invited to register for these events to network and learn more about other member associations and WEF (Register at *www.wef.org/membership/wef-member-associations/wefmax*. Feel free to reach out to Dave and Tracy for details on the South Carolina and North Dakota WEA WEFMAX events.

WEF STRATEGIC PLANNING CONTINUES

It has been 10 years since the last WEF strategic planning effort. Consequently, WEF started this new initiative in July of 2021. WEF, working with a consulting partner, THRUUE, has conducted a first round of focus groups. WEF members shared about what they value from WEF and industry trends. The Board of Trustees (BoT) has begun diving into WEF's mission and vision, answering the critical question of "why does WEF exist?"

The process will continue through the first half of 2022 with the goal of completing the work before WEFTEC 2022. The next planning sessions with THRUUE will occur after the WEF Board Meeting later this month. Highlights from this effort will be shared at the virtual WEFMAX on July 21, 2022.

MA GRANT PROGRAM RETURNS

The MA Grant Program has returned this year. The first round of applications has been completed and next round applications are due by June 24, 2022.

WEF CODE OF CONDUCT

WEF strongly encourages MAs to create their own Code of Conduct (CoC). If an MA does not have its own CoC, the WEF CoC applies. If an MA does have its own COC, in general, the WEF CoC does not apply. WEF is also working on an event-specific CoC. Stay tuned for more details on this.

HOD WORKGROUPS AND COMMITTEE OFF AND RUNNING

Each of the HOD efforts in our workgroups and committee are underway. Dave is working with the Communications and Emerging Leaders workgroups and Tracy is working with the Federal Advocacy Workgroup.

The Federal Advocacy Workgroup is continuing the work from 2020-2021 to assist with amplifying WEF's advocacy priorities related to the federal government regulations and funding. WEF has advocated for more resources for our communities and utilities. This workgroup is focused on extending advocacy efforts to all member associations (MAs).

If you haven't already, please consider becoming a Water Advocate (www.wef.org/water-advocates). Also check out information on Water Week 2022 here: *www.waterweek.us*.

The Federal Advocacy Workgroup is closely linked to the WEF Government Affairs Committee and has been tracking the Bipartisan Infrastructure Bill, which was signed into law on November 15, 2021. In addition, the focus for continued SRF funding levels for the FY23 Budget is part of our ongoing "ask."

Recent WEF Fly-In information is attached and was presented to various legislators during Water Week in Washington DC. Steve Dye, WEF Legislative Director and can be reached at *sdye@wef.org*. Tracy Ekola participates on both the Federal Advocacy and the Government Affairs Committee and can be contacted at *tekola@brwncald.com*.

The Communications Workgroup aims to help people with a technical background communicate more effectively. Communications is an important discipline within the water sector, just like engineering, project management, and other technical areas.

We have identified a series of leaders in the water industry to talk with the workgroup at our monthly meetings about the importance of and how to conduct clear communication with the various stakeholders in the water sector. The goal is that our workgroup will learn communication best practices from these leaders and share them with WEF and the MAs. Some best practices are as simple as using the right language at a public meeting. For example, using the term "wastewater discharge" instead of "effluent" resonates more with the general public and is more understandable.

The workgroup has broken up into two subgroups. The first subgroup is considering messaging methods. This subgroup will look at various forms of communication such as written, digital, videos and how these forms are used to reach specific audiences. The second subgroup is looking specifically at social media and will research effective forms of digital communication.

The Emerging Leaders Workgroup is another workgroup at WEF. For WEF to continue to grow, we need the engagement and advancement of new leaders from within the organization.

This workgroup has been analyzing various polls and has followed up with 5-10 minute interviews from Emerging Leaders at the Orlando YP Summit held this year. The feedback will help guide our group.

The deliverable to WEF from this group is being developed and will probably consist of a WEF social media tool to for water professionals to identify pathways to WEF involvement. Ideas include potentially a WEF LinkedIn or Instagram tool with short questions and answers. The tool would be made available to MAs as well.

As WEF Delegates, we are here to support you and represent the interests of the CSWEA to the House of Delegates and WEF. If something is on your mind, please feel free to call or e-mail. We are here to serve you/CSWEA and be a liaison to WEF leadership. We look forward to hearing from you! You can reach us at *tekola@brwncald.com* or *darnott@ruekert-mielke.com*. CS

BE A WATER ADVOCATE!

WEF members are the experts when it comes to water issues.
We need to speak up and share our knowledge with those who are making decisions on funding and regulations. Aging infrastructure, new and updated regulations, resiliency issues, coupled with economic pressures are placing unprecedented stress on local governments and agencies that provide essential water services. With reduced revenues, elected officials are being called upon to make tough choices that will impact water quality and the viability of our communities for generations to come.

As water professionals, we can create a better path – a path that leads to public appreciation for the value of water, investment in our essential water infrastructure, and a better quality of life for our states and communities. WEF's Water Advocates Program is a simple and effective way for you to become more involved with engaging elected officials, the public, and other interested stakeholders on important water issues. The Water Advocates Program provides training and engagement to promote grassroots advocacy before elected officials, the public, and other stakeholders with the goal of creating a network of trained water advocates not only in every MA, but also in every state and US Territories.

Visit the Water Advocates website at *www.wef.org/advocacy/water-advocates* or *http://bit.ly/wef-water-advocates* and let your voice be heard. Alternatively, email Amy Kathman at WEF to join the Water Advocates program at *akathman@wef.org*. After you sign up, you will be in the Water Advocates program and receive important announcements about actions you can take to help.

Have questions or need more information? Contact Tracy Ekola, Vice President, Brown and Caldwell (*tekola@brwncald.com*/320-250-6147) or David Arnott, Ruekert Mielke (*darnott@ruekert-mielke.com*/ 363-923-6188).

A State of Transition

By Jake Becken

I want to say thank you to everyone that played a role in supporting CSWEA this past year. It takes dedication to make the organization as strong as it is and I am always amazed by the continued contributions of our members and the consistent quality of the programs supported. I specifically want to thank Mary-Frances Klimek and the outgoing guidance, both on the committee and the leadership level. They make it look easy and the time they dedicate to this organization is critically important to the strength of CSWEA. I was unable to attend the annual meeting in May, as my wife and I had our first child right at that time. Needless to say, the Becken house has been running on a bit less sleep lately. Regardless, I have received positive feedback from the annual meeting and I am very happy it could be held in person.

One of my goals for the year will be to encourage the involvement of young professionals within our organization. Our industry is in a state of transition. Hiring, training, and retainment are different than in the past and the industry needs to adapt to the ever-changing environment. My first request is to work with local colleges and support them in any way possible, such as offer internships, provide tours, and assist in class content. The more awareness and teamwork that can be built the more people we will get interested in the industry. Some utilities have even reached out at the high school level to encourage additional engagement through Youth Apprentice programs.

My second request is to grab the hand of someone in your organization that has just started or is somewhat new to the industry. You likely work with a rock star that just needs a slight push. Bring them to a few events and introduce them to a few different people each time. Encourage them to attend Young Professional events or get involved with a committee. If you are anything like me, it takes a bit of effort to go out of your comfort zone but trust me – the connections are invaluable and it won't kill you. Some of the greatest growth occurs when you are outside that comfort zone. I have made some great friendships over the years that might not have been made without CSWEA and other wastewater organizations. In addition to the friendship, I find myself tapping on these recourses frequently for various wastewater issues, we are all in this together.

Anyway! Take home message; get involved, it's good for your career, the organization you work for, and the industry.

Another area I would like to focus on and have received requests for more discussion relates to staffing. I would love to get some more discussion going on staffing, retention, dealing with knowledge transfer, etc. I have some more homework to do on my end but please reach out to me if you have any ideas. I will be reaching out to the committee level to see how we can incorporate even more of this type of discussion into future offerings. I know many utilities, consultants and vendors would love to hear what has worked (and maybe what hasn't).

Some great opportunities are coming up in the near future; the collection system seminars on June 2 and July 21, CSWEA CSX 2022 on July 28, and I know a few other committees are planning some great opportunities for later this year as well. The YP group will again be having a Brewer outing on August 17! We plan on having the Wisconsin summer section meeting before the Brewer outing (Brewers vs. Dodgers 7:10 pm). In addition, we are working with the Wisconsin State Lab of Hygiene to provide an update on the COVID-19 sampling efforts in the state – likely a virtual option to learn more about the status of the program and the plan moving forward. Please pay close attention to the CSWEA website under the Wisconsin tab and the dropdown events for updates.

Last, it's never too early to start thinking about awards submissions. I challenge people that normally do not consider nominations to look into submitting deserving individuals or organizations. Maybe it's your own organization or those that you have worked with that have accomplished things that deserve recognition.

I am honored to serve as the Wisconsin Section Chair this year and I thank everyone for the opportunity. Please feel free to reach out to me with any updates, ideas, or requests at *jbecken@newwater.us* or 920-438-1004. CS

Roll Out Those Lazy, Hazy, Crazy Days of Summer

By Jacqueline Strait

Roll out those lazy, hazy, crazy days of summer. As I'm writing this, we are already mid-way into June, yet I can recall only a couple of months ago eagerly waiting for the springtime to stop teasing us and for summer weather to be at our doorsteps. Its finally here! As we head into the heart of summer, I am trying to remind myself to pause and slow down. The summer calendar tends to fill up fast, which is great in so many ways, but that leaves less time for the slowdown of summer that we crave all year round. Remembering the fond memories of my childhood summers, when school is out, and each day is anew for the making. Although I have not been in school for quite some time, taking the challenge of making each day anew is my goal for this summer and for my family.

The Minnesota section had a great turnout at the State Business meeting at the Annual Conference in Madison, Wi this past May and is ready to kick-off the 2022 season. At that meeting, the WEF Water Advocacy Program was brought up to the group with a call to action for two campaigns – PFAS and FY23 funding levels. The Water Advocacy group campaign is "Let's speak with a loud, united voice for water." The Water Advocates Program helps you to reach out to and connect with elected officials on important water quality issues. The program helps empower its members to share their knowledge and expertise to inform government decision-makers about the importance of water in their communities. To become a water advocate you can register at *www.wef.org/advocacy/water-advocates*.

Our first event following the Annual conference was held by the MN Industrial Committee. They hosted a pretreatment seminar June 16 at the Cold Spring Brewing Company. The event included a facility tour and afterwards they discussed roles, responsibilities, challenges, and examples of successful pretreatment program. The next event will be MNX scheduled for June 23 in St. Cloud, where we will discuss each committees' goals for the coming section year.

Upcoming events after MNX include the WEF Stormwater Summit that we are fortunate to have hosted here locally in Minneapolis from June 27-29. The MN Stormwater committee will be hosting a social June 27 at Lakes and Legends Brewing to welcome the larger WEF members. CSX will be held July 28-29 in Wisconsin Dells. Our collections committee has already set dates for in-person workshops this year scheduled for September 28 in the Duluth area and January 25, 2023 in Twin Cities metro. The R2E committee is working on a future open house at MN utility and continues to have their monthly meetings with mini presentations. Our Young Professional group is continuously looking at different events they can host both social and informative. Their goal is to host an event every two months so be on the look out for one coming up later this summer!

I'm excited to take on the role as MN Section Chair and look forward to seeing many of you are our upcoming events. As we head into the heart of summer, filled with late summer nights, time outside at the beautiful Minnesota lakes, and hopefully lots of ice cream, I hope you take time to pause and enjoy each day. CS

We're Back and Better Than Ever!

By Jillian Kiss

Welcome to a new year for the Illinois Section! I am honored and excited to serve as the Illinois Section Chair for the 2022-2023 term and to work with all of you to keep our section thriving. I would like to start by recognizing immediate past chair Bob Swirsky for his leadership of the Illinois Section this past year. Thanks to him and his team, we are starting this year in a strong position with engaged and eager leaders in our committees. I plan to continue his work and the work of so many others who have helped make the Illinois Section what it is today. I'd also like to thank Amy and Mohammed Haque's diligent service as the Executive Director of CSWEA. Mohammed and Amy's guidance through the last few years of the pandemic has been remarkable.

The annual meeting is complete and summer is officially underway. We are off to a hot start! I could feel the excitement returning to an in-person annual meeting after two years and the conference pushes us head on into the next year of events. Here's a few highlights of what is going on in the Illinois Section and opportunities for you to get involved and showcase your talents and interests.

In late June, the 2022 IL Collection Systems & Stormwater Conference will take place at the NIU Campus in Naperville, bringing together talent from all over our region. The Collections and Stormwater committees provides this great opportunity for sharing knowledge and ideas amongst CSWEA and other organizations.

Later in the year Laboratory/Pretreatment and Government Affairs committees will hold their annual seminars, typically in March and April.

Stephanie Cioni and the Public Education Committee led a very successful Water's Worth It student essay contest in 2022. Across Illinois, 6th, 7th and 8th grade students were invited to join the Water's Worth It campaign by writing a short essay about the human role in the water cycle. Two prompts were provided to the student: creative writing or research. Finalists from both essay categories were selected from Northern, Central, and Southern Illinois regions and state-wide grand prize winners selected from those finalists. State-wide winning essays are published in this issue of CSWEA magazine. The Committee is planning to expand the essay contest this coming year.

And CSX, our Central States Section Exchange, will be held at the Kalahari in Wisconsin Dells on July 28 and 29. All members are invited to attend. CSX is a fun event designed to bring together members to discuss ways to improve our organization.

There is still more to do to keep the energy and excitement from the annual meeting going throughout the year. The good news for IL Section members is that there is a forum for that – the Section Committees. On top of the committees listed above, the Membership, Operations, Young Professional/Student and Biosolids/Energy/Resource Recovery Committees are also doing great things. Please reach out if you would like to get involved in any of the Section committees or if you have new ideas to share. You can reach out to any of our officers or committee chairs included in the committee roster available in this CS issue or on cswea.org to learn more and get involved. If that's a little daunting, I would be thrilled to introduce you myself to our great members at the next section meeting.

CSWEA is a great networking opportunity to make contacts in our local water industry group, but also lasting friendships. It is within our committees that make the sharing of knowledge both informative and enjoyable. This is essentially CSWEA's mission and the IL Committee members take great pride in that. I'm very proud to be part of the leadership in our Illinois Section and look forward to seeing many of you at our events throughout the year. CS

"I plan to continue his work and the work of so many others who have helped make the Illinois Section what it is today. I'd also like to thank Amy and Mohammed Haque's diligent service as the Executive Director of CSWEA."

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95th Annual Meeting Recap of the Central States Water Environment Association

WISCONSIN | MINNESOTA | ILLINOIS

95TH ANNUAL MEETING RECAP

Stronger Together

MAY 17-19, 2022 | MONONA TERRACE, MADISON, WI

This year's Annual Meeting took place on May 17-19, 2022 in Monona Terrace, where we were once again able to meet in person with our fellow members and friends. Thanks to all those who made this conference successful.

YOUR HARD WORK IS TRULY APPRECIATED.

Passing of the Gavel/Red Suspenders
Jane Carlson, CSWEA President 2021-22 and Tracy Hodel, CSWEA President 2022-23 performed the Passing of the Gavel and Red Suspender CSWEA traditions at the Annual Meeting.

7S Society Inductees

Golden Manhole Society Inductees

NCAA Bracket Champion

CSWEA AWARDS

CSWEA Service Award
Jane Carlson, CSWEA President 2021-22

CSWEA Service Award
Samantha Austin, YP Representative 2020-22

CSWEA Service Award
Christopher Harrington, Minnesota Trustee 2020-22

Operations Award
Dennis Haile, Wheaton, IL

Operations Award
Ben Brooks, Medford, WI

Operations Award
Samidha Junghare, Duluth, MN

Collection System Award
Katie Despinoy, Stanley Consultants

Collection System Award
Chris Helgestad, Village of Spencer

Collection System Award
Isaac Raser, MCES

YP of the Year Award
Ryan Giefer (WI) (accepted posthumously)

YP of the Year Award
Anndee Huff Chester (MI)

YP of the Year Award
Joe Lapastora (Illinois)

Water Stewardship Award
Eider Alvarez-Puras

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Water Technology Innovator Award
Randy Wirtz

Academic Excellence Award
Angeline Decker, UW Platteville

Academic Excellence Award
Ben Edwards, UW Stevens Point

Academic Excellence Award
Carly Amstadt, UW Madison

Academic Excellence Award
Claire Baldus, Marquette

Academic Excellence Award
Joshua Kleinschmidt, MSOE

Academic Excellence Award
Yanan Zhoa, UW Milwaukee

Kelman Scholarship Award
University of Wisconsin – Platteville
Jonessa Haas, Ashlin Caelwarts, Matthew Vincent, Timothy Kunshier, and Travis Noel Samara, Costa Rica Sewer and Treatment Design

MID-WEST STUDENT DESIGN COMPETITION AWARDS

MSOE UNIVERSITY

WEF – Wastewater Category
Milwaukee School of Engineering

ILLINOIS TECH

WEF – Water Environment Category
Illinois Institute of Technology

MARQUETTE UNIVERSITY

Global Water Stewardship Category (Overall)
Marquette University

TEC | Tecnológico de Costa Rica

Global Water Stewardship Category (International)
TEC University, Cartago, Costa Rica

WATER ENVIRONMENT FEDERATION AWARDS

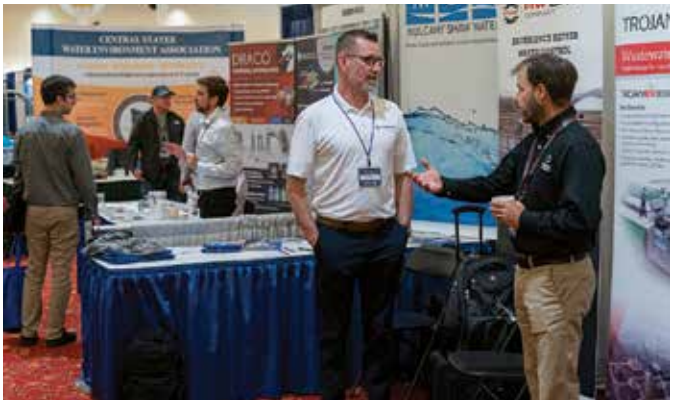
Laboratory Analyst Excellence Award
Brooke Klingbeil, Medford, WI

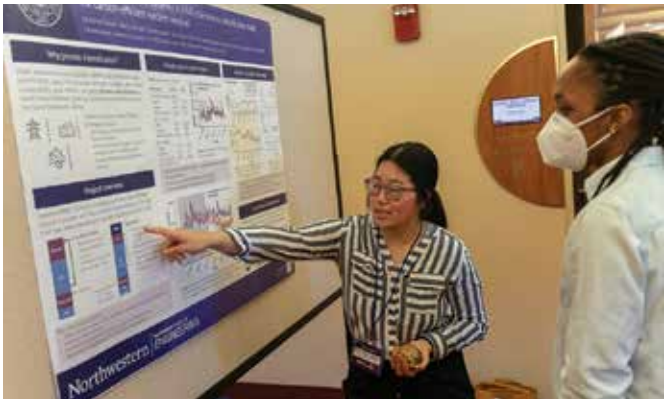
William D. Hatfield Award
Mark Eddington, DeKalb, IL

George W. Burke, Jr. Facility Safety Award
City of Oconomowoc, WI

Arthur Sidney Bedell Award
Jane Carlson, Madison, WI

CONFERENCE HIGHLIGHTS





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The 2022 CSWEA EDUCATION Seminar

By Autumn Fisher

This year marked the 27th Annual Education Seminar, Activated Sludge and Beyond: Harnessing New Technology to Solve Old Problems. The committee would like to thank each and every attendee for their participation in our return to hosting the event in person at Monona Terrace. The program brought to the table a group of excellent speakers with a wealth of perspective and experience. The primary focus was acceleration and evolving science behind data collection, management, and utilization in Wastewater Facilities. This year's seminar also included collaboration with the CSWEA Innovation & Technology (I&T) Committee to highlight more innovation in our field and provide additional networking opportunities. Following the speaker reception on Monday, the I&T Committee hosted dinner at Cooper's Tavern, open to all attendees. This event included CLEARAS Solutions, Inc. who presented on innovations in wastewater treatment using algae-based treatment.

The first speaker of the day, **Dr. Adrienne Menniti**, spoke about "Data Needs to Operate the WRRF of the Future." Her organization, Clean Water Services (CWS), owns and operates multiple water resource recovery facilities (WRRFs) in Washington County, OR that are required to meet low level effluent phosphorus permit requirements. Years of optimization have focused on limiting energy and chemical use to achieve performance limits. The team at CWS has evaluated a range of instrumentation and control strategies at their facilities. Menniti noted that their efforts are broad, but most are focused on biological phosphorus removal. The overview of the work at CWS covered instrumentation and control strategies, data collection, and rate testing completed to date.

Liam Cavanaugh, Chief Operating Officer of Denver Metro Water Recovery followed next and highlighted over a decade of transformational change at their Water Reclamation Facilities (WRFs) located in Denver, CO. Metro Water Recovery has implemented three technologies that were "one of the first" installations in North America (MagPrex, post aerobic digestion, InDENSE) while also optimizing two separate WRFs to achieve enhanced nutrient removal limits. A key to implementing innovative strategies and operational approaches has been managing information generated from data collection, modeling, and pilot testing to inform decisions related to design and optimization efforts.

Will Martin then presented on "Advanced Operational Control Strategies and Tools" highlighting how the water industry is beginning to recognize and apply machine learning (ML) as a tool to optimize system operations in a way that was not possible even a few years ago. He advocated that one of the most compelling benefits of building ML models (with continuous retraining) is that it allows the user to always have an up-to-date model of their system. These ML models can account for some real-life variations that may not be captured in mechanistic models.

Dr. Matt Seib of Madison Metropolitan Sewerage District followed next and discussed how the Madison, WI district has practically applied sensor data for understanding all aspects of operations such as permit compliance, process stability, and troubleshooting. The audience was shown several real-world examples of how taking a systems-level approach to understanding process data can provide greater operational insights.

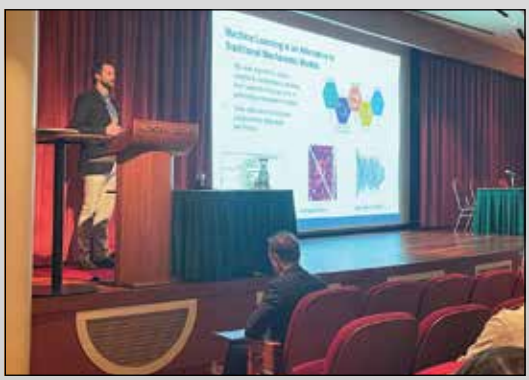
Lunch was followed by welcoming **Dr. Adrienne Menniti** back to the stage to talk about how CWS is collecting data and implementing control strategies as a key aspect of operational optimization. In parallel, CWS has invested in the development and use of innovative modeling efforts to inform biological phosphorus removal (BPR) operations. Modeling has been completed on two fronts: mechanistic process models and the application of Artificial Intelligence and Machine Learning (AI/ML) in an effort to develop a model that forecasts BPR operational stability.

James Kerrigan of Fox River Water Reclamation District emphasized how his district utilized data collection and analysis to inform decision making for the completion of a $60 million biological P removal upgrade at its 7.75 MGD and 25 MGD treatment plants. Kerrigan also focused on how data in the process model can identify treatment issues and result in decisions for incremental changes to improve treatment made by the design and operations team.

The event concluded with three speakers presenting on how they are incorporating real-world AI/ML into their day-to-day facility operations. **Cody Schoepke** and his team at the Fond du Lac Regional Wastewater Treatment and Resource Recovery Facility have made numerous in-house process modifications to enhance bio-P to meet their upcoming effluent phosphorus limit of 0.19 mg/L. They are leveraging a range of advanced monitoring and control concepts to better understand EBPR stability and develop operational strategies for optimal EBPR performance by leveraging data analytics and modeling tools. **Fenghua Yang** of the Metropolitan Water Reclamation District of Greater Chicago followed by talking about how the District is applying advanced data analytics and data driven models through AI/ML to make more informed decisions within the wastewater treatment process. Lastly, **Corey Bjornberg** of the Rochester Water Reclamation Plant talked about how their staff has learned to efficiently leverage the appropriate data to provide insight into plant performance that drives desired outcomes and cost savings.

Throughout the day, attendees were provided with authentic data-driven solutions to tackle key operational issues. The industry is just beginning to scratch the surface on the window of opportunity represented by AI/ML. The encouragement and energy in the room was tangible as people were brought back together, in person discussing our passion and sharing our stories.

Copies of presentations are available on the CSWEA website, and the Education Seminar Committee has already begun planning next year's seminar. We look forward to seeing you April 10-11, 2023. CS



2022 WATER WEEK

KEY MESSAGES OF WATER WEEK

By Tracy Ekola and Sam Lobby

In coordination with Water Week, the National Water Policy Fly-In was held on April 27, 2022, in Washington, DC. Each year, the National Water Policy Fly-In provides attendees the opportunity to hear directly from key EPA officials and Members of Congress on the important regulatory and legislative water policies they are working on now and in the years ahead.

Attendees have the opportunity to discuss the essential role water utilities provide their communities and the important role the water sector has with federal policymakers in Washington DC.

The event brought together water sector organizations from around the nation to Washington, DC, to advocate for national policies, share perspectives, collaborate on solutions, and meet with Members of Congress In advance of the National Water Policy Fly-In, there was a webcast to help attendees prepare for Hill meetings. The webcast participants reviewed the latest from Capitol Hill, the water sector's key issues and talking points, and tools and tips for engaging during Water Week and beyond.

Sam Lobby and Tracy Ekola from the MN Section made visits to members of congress to discuss these priorities including visits with US Senator Amy Klobuchar staff, US Congressman Pete Stauber, US Congressman Tom Emmer staff, and US Congresswomen Michelle Fischbach. Additional invitations were also extended to other congress members and senators.

Key messages to congress included:

- Support for CERCLA PFAS exemption for public and private drinking water, wastewater, and stormwater entities and request for support for adequate resources to advance research, risk assessment, and standards development to advance, not circumvent the regulatory process.
- Build America, Buy America requirements require additional review to recognize the near-term challenges of meeting these requirements.
- Request to sustain FY23 clean water funding levels for SRF programs in addition to the recent Bipartisan Infrastructure Act (BIA) funding (i.e., do not decrease our annual allotment because of the BIA funding).
- EPA affordability standards need future review and revisions.
- Wipes continue to be discussed and receive attention at the federal policy level to require better labeling.
- See *https://bit.ly/3O4Ze1t* for more information.

The event concluded with various panel discussions from DC Water, multiple US EPA speakers, US Department of Energy, US Bureau of Reclamation, US Senator Tom Carper (DE), US Senator Shelley Moore Capito (WV), and US Congresswoman Eleanor Holmes Norton (DC).

If you have not already, please consider becoming a Water advocate (*www.wef.org/water-advocates*) and contact to your congress member or senator – it takes less than five minutes! Ask your Senators to support a legislative fix to the PFAS Action Act and notify Members of Congress to urge them to provide robust funding for water infrastructure funding programs in the fiscal year 2023 budget. Navigate to the WEF water advocates website and click on the "Fix the PFAS Action Act" and/or "Write to your Members." We promise, it is easy and necessary to support the great work you all do! Feel free to contact Sam Lobby (*sam.lobby@wlssd.com*) or Tracy Ekola (*tekola@brwncald.com*) if you would like additional information. Tracy Ekola also participates on the WEF Federal Advocacy Workgroup and the Government Affairs Committee.

Participation to promote our mission through these initiatives is crucial in delivering our message to our governing bodies and the public.

FEDERAL REGULATORY ISSUES

By Brandon Koltz

I attended the Water Week meetings April 26-27, 2022 in Washington DC. I attended one individual meeting with Deborah Nagle, Director USEPA Office of Science & Technology/Office of Water and the updates from other USEPA Office of Water Directors. There was significant discussion regarding PFAS/PFOS and other areas:

- Analytical methods have been developed and verified for 40 PFAS compounds, and 2nd lab verification is in progress. Methods will apply to matrices for biosolids, wastewater and effluent, fish tissue and drinking water. These methods are being presented to APHA for adoption. It is expected that these methods will be incorporated into 40 CFR 136.
- There is a screening test that has been for organic fluorine. The test is expected to be used to test food – some food containers have a lining that contains PFAS.
- PFAS effluent guidelines are being developed for 40 CFR I Subchapter N Parts 413 and 433 (Electroplating and Metal Finishing). PFAS effluent guideline will likely be developed for landfills (leachate) and textiles subcategories. Effluent guidelines are not being developed commercial airports, the pulp and paper industry, and for mineral fertilizers.
- Health guidelines for PFAS compounds will be lowered from the current health guidelines with concurrence from the Science Advisory Board.
- Regulatory authority for PFAS correction is still being debated. WEF continues to inform Congress that POTWs should not be considered principal responsible parties if regulatory is assigned to CERCLA.
- Coliphage recreational criteria development is not advancing currently.
- Pretreatment categorical limits are being developed for the meat and poultry industry.
- Emphasis of assistance to small communities – especially lagoon operation and optimization. There should be funding available.
- The 2012 Recreational criteria are undergoing a five-year review.
- The EPA five-year regulatory plan is being finalized.
- A database is being assembled from the states documenting environmental justice issues.

This and other significant issues were further addressed by the EPA panel. In addition to Deborah Nagle, speakers included Raditha Fox, Assistant Administrator Office of Water; Andrew Sawyers, Director Office of Wastewater Management/Office of Water; Jennifer McLain, Director Office of Groundwater and Drinking Water/ Office of Water; and Brian Fazer/Director Oceans, Wetlands and Communities Division/Office of Wetlands Oceans and Watersheds/Office of Water.
Items not mentioned above include the following:

- Under the Bipartisan Infrastructure Bill, 49% of funding is to be directed to underserved communities. Comments seemed to include lower income urban areas and rural areas.
- The Clean Water Needs Survey is being, again with emphasis on needs for small communities.
- Funding is provided for decentralized systems.
- Climate-related issues are funded.
- Emerging contaminants received funding.
- Stormwater mitigation should be viewed as an opportunity; incorporate into integrated planning.
- EPA issued an update on nutrient management; it continues to emphasize nutrient criteria.
- Lead service line replacement/ management are a significant emphasis for drinking water.
- A risk analysis of the tradeoff between microbial kill versus disinfection byproducts is being conducted.
- Lead and copper rule improvements are expected 2024.
- There is a Biosolids Risk Assessment drafted and sent to the Science Advisory Board for review.
- Selenium water quality criteria are out for comment. Aluminum water quality criteria comments have been received.
- 113,000 comments were received regarding the revised WOTUS definition. The need for a durable rule was emphasized, particularly for wetlands, ephemeral streams, and ditches.
- The Hypoxia Task Force received funding for nutrient management planning and state program support.

In addition to the EPA panel, congressional committee staff and three congressional members spoke. There is concern that PFOS may limit water recycling opportunities. It was noted that additional funding for water and wastewater would be realized in the Build Back Better Bill, yet to be passed.

Separate from Water Week, WEF submitted comments critical of the proposed 2022 Financial Capability Assessment guidance. I participated in drafting that response.

Some areas of authorization and funding in the Bipartisan Infrastructure Bill were for five years; other areas are authorized but are subject to annual appropriations, so it will be necessary to inform Congress of the those continuing needs. Water Week resources can be accessed at *www.waterweek.us/ #about-water-week.* CS

Brandon Koltz
Brandon Koltz Water & Environmental Consulting LLC
Adjunct Professor Carthage College
Lecturer Milwaukee School of Engineering

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Water Funding Updates

By Brandon Koltz and Chris Tippery

With the passage of the *Infrastructure Investment and Jobs Act*, additional funding has become available for water, wastewater, and stormwater utilities. The Environmental Protection Agency (EPA) and the individual states are working through the processes to obtain these funds and utilize them for the completion of projects. The following is a high-level synopsis of the funding available through the *Infrastructure Investment and Jobs Act:*

The Clean Water State Revolving Fund (CWSRF) & Drinking Water State Revolving Fund (DWSRF): Each reauthorized at $14.65 billion over five years, PLUS another $11.7 billion guaranteed funding. To be eligible for funding, the applicant must complete:

- A formal Request for Proposal (RFP) for Engineering Services, if so desired or required for reimbursable payment.
- The owner or community may select the engineering firm, with whom they have been routinely working, in Wisconsin. Municipalities need to follow municipal and state procurement/bidding laws. Generally speaking, engineering services do not need to be competitively bid as there is an exemption for contracts for service which includes professional engineering services. However, if a project is designated as federal equivalency and receives federal funding, competitive bidding requirements may still apply.
- For Minnesota communities, a portion of projects funded by the Clean Water Revolving State Fund must follow a Qualifications Based Selection (QBS) process for consulting engineering services. Applicants to the PPL are encouraged to follow a QBS process for engineering services.
- For Illinois communities, IEPA will continue to fund projects regardless of how a consulting firm is selected; however, the cost of engineering services may not be eligible for IEPA SRF funding unless a qualification-based selection process was utilized.
- For construction, a formal advertisement and bidding process, including Buy American requirements, not only for Iron and Steel which have been typically required of CWSRF and DWSRF projects, but also now required for equipment and other items.

The States may only use 30% (and no less than 10%) of the $14.65 billion for Additional Subsidization of CWSRF and DWSRF loans. In addition, 49% of the $11.7 billion may be used by the States for Additional Subsidization, of which half is required to be dispersed in the form of grants or 100% principal loan forgiveness. These State Revolving Fund increases are in addition to funds allocated through annual federal spending bills.

To address emerging contaminants, such as PFAS, additional grant funding of $1 billion was granted for the CWSRF.

The *Water Infrastructure Finance and Innovation Act* (WIFIA) also received funding of an additional $250 million over five years. The WIFIA program is a federal loan and guarantee program administered by EPA. WIFIA's goal is to accelerate investment in the nation's water infrastructure by providing long-term, low-cost supplemental credit assistance for regionally and nationally significant projects. An additional benefit of the *Infrastructure Investment and Jobs Act* is that only a single credit rating agency letter is now required, where two were previously required. In addition, compliance with the Davis-Bacon Wage Rates is required for all WIFIA loans.

For Sewer Overflow & Stormwater Reuse Municipal Grants, $1.4 billion was allocated.

The Low-Income Water Ratepayer Assistance grant pilot program will issue 40 grants to utilities per year. The top program priorities are to ensure access to household drinking water by avoiding service disconnections and to ensure affordability. These issues don't necessarily apply to water and wastewater infrastructure needs, but are important.

$125 million was established for Infrastructure Resiliency & Sustainability Grants for communities to address

climate change concerns, sustainability and reliability. $200 million was allocated for septic system disconnections and connections to publicly owned treatment works (POTW)'s. The Small Publicly Owned Treatment Works Efficiency Grant Program has an amount to be determined in the Act.

The Stormwater Infrastructure Technology was established to create three to five Stormwater Centers of Excellence, funded at $5 million per year with $10 million per year for stormwater planning and implementation grants.

The Wastewater Energy Efficiency Grant Pilot Program was funded at $100 million and the Alternative Source Water Pilot Program, potentially used to transition from groundwater to surface water sources, or vice versa, was funded at $125 million.

Eligible Projects for funding include "Construction" of Publicly Owned Treatment Works, which can include planning, design and construction related services. Ancillary items eligible for funding include measures to increase security, reduce energy consumption, reduce demand through water conservation, efficiency, and water reuse for wastewater and stormwater. Decentralized systems to treat municipal wastewater are encouraged to connect to a municipal POTW. This funding is also eligible for projects to prevent or reduce pollution from non-point sources, protect watersheds from pollution in sewer overflows and stormwater and protect national estuaries from nutrients.

Finally, the Act provides non-profit assistance by helping small and medium sized systems with planning, developing, and obtaining financing for projects as well as replacing/repairing household decentralized systems (septic systems) or connecting households to centralized systems.

US EPA Funding

WEF recently summarized funding included in the recently passed OMNIBUS bill for FY 2022, US EPA Funding. Overall, the US Environmental Protection Agency (EPA) will receive $9.559 billion. Below are the key details of what's in the Omnibus for water infrastructure funding and policies.

- **The Clean Water State Revolving Fund will receive $1.6 billion. (This is in addition to the $1.9 billion for FY22 from the Bipartisan Infrastructure Law, totaling $3.5 billion for Clean Water SRF in FY22!)**
- **The Drinking Water SRF will receive $1.1 billion. (This is in addition to the $1.9 billion for FY22 from the Bipartisan Infrastructure Law, totaling $3 billion for Drinking Water SRF in FY22!)**
- **The EPA Sewer Overflow & Stormwater Reuse Municipal Grant program (OSG) will receive $43 million.**
- **The WIFIA program will receive $63.5 million.**
- **Water Workforce Grants will receive $4 million.**
- **Technical Assistance for Treatment Works will receive $20 million.**
- **Small & Disadvantaged Communities Grants will receive $27 million.**
- **Non-Profit Grants for Technical Assistance for drinking water, wastewater and septic projects will receive $25.7 million.**
- **Water Quality Protect grants will receive $216 million. (Bill language directs most of the funding to drinking water and wastewater collections and conveyance systems improvements.)**

Cybersecurity for Water

The Omnibus also includes the language recently passed by the Senate to direct the Department of Homeland Security to develop regulations for critical infrastructure cyberattack reporting and preparedness. A designated critical infrastructure entity will need to report to the Cybersecurity & Infrastructure Security Agency (CISA) within 72 hours a substantial cyberattack, and within 24 hours report if they make a ransomware payment. Water and wastewater utilities will likely be designated as critical infrastructure entities.

The Omnibus did not include funding for any of the recently created water infrastructure grant programs in the Bipartisan Infrastructure Law (the enacted name of the *Investment and Jobs Act)*. This legislation was passed by Congress too late into the FY22 appropriations bills drafting process to be included in the final Omnibus. *(www.wef.org/news-hub/wef-news/u.s.-congress-reaches-agreement-on-fy22-budget)*

What does this mean for our three Central States?

Funding will be managed through the existing SRF program. So, funding will be available for more projects on the priority list each year. Those seeking loans should adhere to the deadlines for consideration of loan eligibility. Portions of the loans may be eligible for principal forgiveness. Remember that if federal capitalization funds are designated for the loan, a QBS selection process is required for engineering services. Principle forgiveness is partially available the Clean Water SRF, Drinking Water SRF, and Lead Service Line replacement. Loan forgiveness will be especially directed to projects addressing environmental justice and low-income communities. Low-income communities may be defined within a City or metropolitan area. Each state will be able to address emerging contaminants for clean water and drinking water with 100% forgivable loans. William Dunn with the Minnesota Pollution Control Agency indicated that this will supplement an already robust emerging contaminants program. In Wisconsin, at the Section Government Affairs Seminar, Jason Knutson/ Wisconsin DNR indicated that the state will need to establish a new program for emerging contaminants to utilize the new funding.

The Bipartisan Infrastructure Bill provides once in a generation funding including principal forgiveness to advance needed projects. This will advance our goals of clean water, watershed health and safe drinking water. Be ready to take advantage of these funds. CS

PLANT PROFILE:

Northern Moraine Wastewater Reclamation District

By Luke Markko, Superintendent of Northern Moraine WRD

Established in 1969 under the 1917 *Illinois Sanitary District Act*, this regional Sanitary District can be found in Island Lake, IL, nestled between the southwestern Lake and southeastern McHenry counties. The Northern Moraine Wastewater Reclamation District (NMWRD) provides wastewater collection and treatment services to the communities of Island Lake, Lakemoor, and Port Barrington, along with septage receiving from regional service providers. With a facility planning area comprised of 16,700 acres, NMWRD covers a vast territory. In that territory, 3,700 widely spaced acres are currently within the District's corporate boundaries. The original infrastructure of the District was constructed in 1978 and was established as the Island Lake Sanitary District. The District operated as the Island Lake Sanitary District for 25 years until it was decided that the District should have a name that better reflected the regional services it provided, without being different from any single community that it serves. And so, in 2003 the Island Lake Sanitary District became the Northern Moraine Wastewater Reclamation District (NMWRD).

The NMWRD collection system initially consisted of two lift stations positioned in Island Lake, but has seen an increase of over tenfold, leading to 13 lift stations in Island Lake, eight lift stations in Lakemoor, and two lift stations in Port Barrington. This is a total of 23 lift stations. The two lift stations in Port Barrington receive both conventional gravity flows in addition to those originating from a low-pressure sewer system found in portions of the Port Barrington community located along the waters of the Fox River. Here, failing septic systems prone to inundation by floodwaters were replaced by individual grinder pumps installed at over 200 residences to feed into NMWRD's collection system. Each pump is owned and maintained by the District, presenting a significant operations and maintenance burden for staff and requiring a significant stock of spare pumps be maintained. Most of the collection system is about 40 years old or less, so it is comprised of relatively modern materials such as plastic truss pipe, PVC, and HDPE. The Village of Holiday Hills, an unsewered community situated on the banks of the Fox River and Griswold Lake will be connected to the NMWRD collection system later this year. This will bring the total number of lift stations to 24. The age and construction materials in the collection system aid in preventing significant infiltration and inflow, while a lack of significant industrial users limits operation and maintenance troubles to those of domestic grease and more recently flushable wipes. The District has recently finished with the upfitting of a custom televising vehicle to allow staff to televise the collection system following cleaning and to adhere to it's CMOM program without the need for outside

Northern Moraine Wastewater Reclamation District (NMWRD)

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contractors. The custom approach with a local upfitter allowed development of a vehicle catered to the District's specific needs such as small narrow streets along with significant cost savings compared to the purchase of prebuilt vehicle. Operations staff have all become certified through the National Association of Sewer Service Companies (NASSCO) in their pipeline, lateral, and manhole certification programs (PACP, LACP, and MACP respectively). These programs train staff in what to look for as they televise approximately 80 miles of pipe and inspect over 1,500 manholes, while creating a standard method of inspection that maintains objectivity.

The NMWRD wastewater treatment facility resides in the southern portion of its service area in an unincorporated area North of the Village of Port Barrington and South of the Village of Island Lake. The current facility site uses eight acres of a 31-acre parcel abutting protected wetlands to the North and West. There are some residences to the South separated by a quarter-mile buffer consisting of grasslands and farmland. This affords the District plenty of room for future growth along with the communities it serves. A solar array is currently under consideration to make use of the large parcel and to offset energy consumption.

The original 1978 construction started with a comminutor and was followed by raw pumping feeding to two 78-foot diameter Topco contact stabilization plants, which have a combined capacity of 1.2 MGD. Downstream of these there was seasonal gaseous chlorination for disinfection, which led effluent to exit the facility in a 4,500-foot, 30-inch outfall pipe, discharging into the Fox River through a submerged structure in the center of the riverbed. This effluent pipeline is still in use today. During that time, the District used 14 drying beds to dewater aerobically digested sludge. In 1991, dechlorination equipment, consisting of gaseous feed of sulfur dioxide, had been installed because of IEPA requirements. A 31-in Rotamat fine screen replaced the comminutor in 1992.

At 20-years-in-age, the facility was nearing capacity in 1998, and was unable to meet new ammonia nitrogen limits set by IEPA. A plant expansion that overhauled nearly the entire facility (completed in 1999) increased capacity, improve treatment for BOD, suspended solids, and meet ammonia nitrogen limits. This meabt plant capacity increased to 2.0 MGD DAF and 5.0 MGD DMF. At the headworks an additional 40-inch Rotamat was installed to provide redundancy and the four raw pumps found replacements with higher capacity, two of which received VFDs to improve efficiency. These fed into the new 1.2 MG oxidation ditch, which consisted of two rings with Orbal Disc Aerators. Downstream two 85-foot diameter clarifiers were constructed with a 4 MGD RAS pump station. Construction continued with a two-channel chlorine contact basin and adjoining chemical feed building that would house the chlorine and sulfur dioxide gas feeds in addition to non-potable water distribution. A portion of the two package plants were repurposed and used as aerobic digesters. Preexisting coarse and fine bubble diffusers were left in place to supply air from three centrifugal blowers. A dewatering building was constructed and housed a 1.5-meter Komline-Sanderson belt filter press to supplement the drying beds. At the time Class B dewatered sludge was conveyed into a dump truck bay within the dewatering building and trucked out to a drying bed dedicated to stockpile use. Following this expansion discharge concentration of ammonia nitrogen went from 20 mg/L to an average of 0.075 mg/L. The design lends itself to easy expansion to 3.0 MGD, with the potential addition of a third ring that can include BNR functions. However, with current average flows around 50% of the 2.0 MGD DAF and projections for population growth not meeting that need until the late 2030s, that expansion is still a number of years in the future.

Disinfection Chemical Storage and Feed

In the years between the 1998 expansion and now, the District has seen a number of projects to replace aging equipment, improve safety, optimize facility operations, and meet new NPDES permit limits.

In 2011, the District purchased the small horse farm adjoining the East boundary of the plant site and converted the house to an administration building and boardroom. The administrative office was relocated from the control building at the plant site and features a drive-up window for the convenience of many customers who make payments in person. Later in 2018, a horse barn adjacent to the administrative office was upgraded with a concrete slab to better house equipment. It also served as an impromptu open air meeting space for a period during the COVID-19 pandemic, even hosting the CSWEA Operations Challenge team as competition arena in 2020.

In the same year, the gaseous chlorine and sulfur dioxide systems were replaced with liquid sodium hypochlorite and sodium bisulfite feeds to improve workplace safety. This was a project District staff designed and constructed themselves at the time. It consisted of three 300-gallon bulk storage tanks for sodium hypochlorite and two 300-gallon bulk storage tanks for sodium bisulfite. Four 55-gallon drums were utilized as day tanks where peristaltic pumps drew

the chemicals from. These required manual refilling daily. An overhaul of this system was completed in 2019 to make improvements that provided separate secondary containment spaces for the bulk storage tanks, new bulk storage tanks with outdoor fill ports, and ventilation lines coming from the storage tanks to the rooftop to eliminate corrosive fumes. District staff custom-built chemical feed skids that draw directly from the bulk storage tanks with new Blue-White M2 peristaltic pumps. This improved efficiency by eliminating the day tanks and the need to refill them daily. Later in 2021, a new non-potable pump skid with VFD-controlled pump motors was installed to replace the aging system from 1999.

Several solids handling improvements have been made over the years. In 2012, improvements were made to the digesters, dewatering, and sludge storage. The full capacity of the old package plants was utilized for aerobic digestion by removing the remaining equipment. Sanitaire medium bubble diffusers were installed across the floor of each of the two digesters and aluminum covers were installed over each. This provides nearly one million gallons of capacity between the two digesters and allows for significant solids reductions. At the same time a Centrisys decanter centrifuge was installed to take dewatering operations away from the belt filter press which was utilized as a backup unit. In 2013 high efficiency centrifugal blower with a 200 HP VFD-controlled motor was installed to provide 100% of the aeration requirements of the digesters while consuming 33% less power than three preexisting blowers still utilized as backups. Five of the existing drying beds were converted into two covered storage bays for stockpiled sludge with approximately nine months of storage capacity.

Later, in 2019, the belt filter press was removed, and work began to reconfigure the sludge conveyance system to eliminate the need to manually relocate dewatered sludge from the dewatering building to the sludge storage bays. An opening was made in an exterior wall of the dewatering building and the existing shaft-less screw conveyor that had originally moved dewatered sludge into a central bay of the building was repositioned to convey out through the opening. The existing conveyor was not long enough to reach an existing drying bed located about 30-feet away. At the time, an additional shaft-less screw conveyor would have cost approximately $2,000 per linear foot. With equipment costs and installation estimated at nearly a quarter million dollars, District staff began experimenting with different types of conveyors to see if there was a more cost-effective option. Initial trials of an agricultural belt conveyor were unsuccessful due to sludge falling under the belt and causing slippage on the drive pulley. Success was found with a grain auger that was rented from a local farm supply yard and piloted for a period. A 61-foot grain auger was

District Staff (L-R): Madalina Roscan, Assistant Clerk; Joe Lapastora, Staff Engineer; Chris Molidor, Operator; Emily Lecuyer, Lab Technician; Elisa Fisher, District Clerk-In-Training; Debi Martin, District Clerk; Luke Markko, Superintendent; Mohammed Haque, District Manager. Photo taken by Jonessa Haas, NMWRD Summer Intern.

Sludge Conveyor and Stockpile

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purchased for $10,000. It was installed and fitted with a VFD-driven electric motor to allow speed control, heat trace with insulation to protect against freezing, safety pull cables, and an auger motion sensor to signal back to the centrifuge PLC. This auger has been in service for approximately 18 months and is performing well. A second unit was purchased as a backup. While unconventional, it has proven to be an economic alternative to a shaft-less screw conveyor. Two additional drying beds were converted to a covered sludge storage bay where the conveyor deposits the dewatered sludge. This increased our sludge stockpile capacity to at least one year.

Additional improvements at the headworks have also occurred. In 2013, the 31-inch Rotamat fine screen was replaced with a 36-inch Lakeside Raptor Drum Screen that became the District's primary screen. With the District's headworks and adjacent Control Building located within the 100-year flood plain flood-proofing improvements were made in 2018. This included raising the walls of the raw wet well, modifying the Control Building exterior entryways to accept installation of stoplogs to prevent entry of flood waters along with replacement of one of the raw pumps located in a basement dry well with a fully immersible pump, with plans to replace the remaining three with similar immersible pumps to provide continued operation should flooding occur. In 2019, a Channel Monster channel grinder was installed upstream of the Raptor drum screen to reduce rag accumulation on the lower bearing of the screener and to

Rebuilt North Clarifier

Operator Chris Molidor Measuring Sludge Blanket

Lab Technician Emily Lecuyer Preparing Testing

Operator Tim Hendrickson Cleaning Televising Camera

protect against debris as the District began accepting septage from local haulers.

Improvements at the oxidation ditch began in 2015 with the installation of dissolved oxygen probes and VFDs for the aerator motors to provide DO-controlled pacing of the motors and improve energy efficiency. When a Phosphorous limit coming into effect for the first time in 2019, a chemical feed system was installed to provide CPR. After experimenting with various chemicals and feed points, the second ring of the oxidation ditch was selected as a feed point for an aluminum chloride solution provided by Chemtrade known as Hyper+Ion 1997. Two 1,000 gallon bulk storage tanks were installed in the recessed pit, where the old belt filter press had once sat. This provided an adequate secondary spill containment space. Exterior fill ports and venting were installed as well. Chemical feed is accomplished with a pump skid, equipped with two Blue-White M2 peristaltic pumps.

In 2020, one of the two clarifiers' concrete floors had to be replaced following heaving due to hydraulic forces pushing the floor up during routine maintenance. This required removal of the cover, and removal of most of the existing floor along with the access bridge and the clarifier mechanism. Replacement floor pressure relief valves were installed to supplement the existing relief valves in the walls. A new stainless steel clarifier mechanism was installed along with a new access bridge.

The District's staff currently consists of two full-time Operators, Chris Molidor and Tim Hendrickson, along with part-time Laboratory Technician Emily Lecuyer. This talented and dedicated staff are led by Superintendent Luke Markko. The District is working to expand operational staffing at this time. The Operators are cross trained to operate and maintain all aspects of the collection system and wastewater treatment facility with the ability to assist with laboratory work as needed. The part-time Lab Technician has cross training to perform routine maintenance and perform daily inspections of the facility as well. District Clerk Debi Martin, District Clerk-In-Training Elisa Fisher, and Assistant District Clerk Madalina Roscan handle the administrative work that includes monthly building of over 5,000 District customers. Staff Engineer Joe Lapastora and District Manager Mohammed Haque work to plot a course into the future for the District as they seek and manage grant funding, oversee construction projects, mentor interns, and navigate the legal aspects of running a sanitary district. The Northern Moraine Wastewater Reclamation District is poised to continually improve upon itself as it employs new technologies and explores new ideas to provide a sustainable service to the residents within its service area and to protect downstream users in the Fox River Valley. CS

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GLOBAL WATER STEWARDSHIP

GWS Update

THE 3RD ANNUAL MIDWEST STUDENT DESIGN COMPETITION

By Joe Lapastora and Liz Heise

The 3rd Annual Midwest Student Design Competition (MSDC) was held on April 11, 2022, at the Monona Terrace in Madison, WI. This year the MSDC hosted 13 design teams from eight universities spanning the US, Costa Rica, and Mexico. The event was a huge success, especially considering that this was our first in-person competition since 2019. Presentations ran from 9:00 am through 3:00 pm in two separate rooms and were followed by a career fair and winner announcement ceremony.

Room one included all teams who were competing in either of the Water Environment Federation (WEF) categories, (i.e. Wastewater Category and Water Environment Category). Room 2 included all teams who were competing in the Global Water Stewardship (GWS) Category. Of note, the GWS category hosted three international teams, with one international team competing out of Mexico, while the other two international teams competed out of Costa Rica. Unfortunately, because of the later involvement in competing in the MSDC, the Universidad de Monterey team out of Mexico was unable to compete in person.

CATEGORY WINNERS

WEF Wastewater Category: Milwaukee School of Engineering
Team Members: Grace Cushing, Brandon Garrido, Josh Kleinschmidt, Jack Ferrante, Bennet Harris, and Alexis Countryman.

WEF Water Environment Category: Illinois institute of Technology
Team Members: Emma Dutkiewicz, Anna Slominski, Cornelio Estrella, Kane Liu, and Nevin Abdelghani.

Global Water Stewardship Overall: Marquette University
Team Members: Faviola Perez Mercado, Shayden Harvey, Alondra Gonzalez, and Alondra Rodriguez.

Global Water Stewardship International: Instituto Tecnologico de Costa Rica
Team Members: Sol Carpio. Valeria Castillo, Maricel Chaves, Fabiola Perez, Adriana Rojas, Denisse Saborio, and Melany Trujilo.

The teams that will be representing CSWEA at WEFTEC come from Milwaukee School of Engineering (Wastewater Category) and Illinois Institute of Technology (Wastewater Category). After the commencement of the MSDC, the CSWEA Student Design Committee was informed that one international team from both Mexico and Costa Rica would be invited to compete at WEFTEC under the GWS Problem Statement with CSWEA serving as unofficial team sponsors.

Since CSWEA did not budget for any international participation at WEFTEC beyond what was budgeted for the two CSWEA teams who won the WEF categories, our committee will look to assist each team with seeking team sponsors to assist with or cover finances associated with travel and lodging to compete at WEFTEC.

If interested in international team sponsorship and to support student advancement within our industry, please reach out to CSWEA Student Design Competition Chair, Joe Lapastora, at *lapastora@nmwrd.org*.

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With the invitation of both Instituto Tecnologico de Costa Rica team (Costa Rica) and the Universidad de Monterrey team (Mexico), this marks the second consecutive year where a GWS Problem Statement was featured in the Wastewater Category, and the first year ever that two teams will be competing at WEFTEC under the GWS Problem Statement.

And with the competition now in the rearview, I would like to mention a few people and organizations that made the event a huge success! First, thanks to the CSWEA Student Design Committee and GWS Community Design Committee folks for all of the time and effort throughout the last couple of months! Specific individuals who deserve all the praise in the world include Stephanie Cioni (Downers Grove Sanitary District), Christine Boland-Prom (Black & Veatch), and Jonessa Haas (Northern Moraine WRD). Similarly, I would also like to thank all of our judges who helped judge the competition. Judges included Matt Streicher (Glenbard Wastewater Authority/GWS), Amanda Streicher (Baxter & Woodman/GWS), Jane Carlson (Faculty, University of Wisconsin), Mike Pepin (GWS), Mark Gockowski (Baxter & Woodman), Don Heikkila (Ruekert & Mielke), and Luke Markko (Northern Moraine WRD). Next, I would like to thank our MSDC sponsors including, McMahon Engineers and Associates, Baxter and Woodman, Ruekert and Mielke, Trotter and Associates, Mulcahy Shaw Water, Brown and Caldwell, Carollo, Black and Veatch, Dahme Mechanical, and Energenics. Without these wonderful sponsors, CSWEA would not have been able to provide the necessary funding support required to attend the in-person competition. Lastly, I would like to thank all of our students who competed in this year's competition. I was blown away by all of the talent on display and I mean this wholeheartedly, all employers should be linking up to hire these amazing students!

GWS Category Judges

WEF Category Judges

MSDC Group Photo

Thanks to all those who played a part in this year's success, I look forward to continuing our success at next year's 4th Annual MSDC!

DELEGATION TRIP: TECOLOGICO DE COSTA RICA AND UNIVERSIDAD DE COSTA RICA

By Mohammed Haque

Starting on Sunday, April 10, 2022, coinciding with the CSWEA Midwest Student Design Competition/Education Seminar, Global Water Stewardship had the pleasure of hosting 12 Costa Rican students from Universidad de Costa Rica and Tecnologico de Costa Rica for a weeklong delegation trip with a few visits throughout the Midwest.

For this group of 12 Costa Rican students, the trip started out with attending the Student Design Competition in Madison, WI, where the delegation spent three days. The students spent the entirety of Monday at the Monona Terrace Event Center for the Student Design Competition. When the competition ended, the students had the opportunity to attend the career fair that immediately followed the event and later attended the Education Seminar reception which was followed by the Innovation and Technology (IT) Dinner at Coopers Tavern. On Tuesday, the delegation attended the Education Seminar where they had the opportunity to learn from industry professional about emerging topics in the wastewater industry. That evening, the delegation was able to squeeze in some fun as the group traveled to the UW Madison campus where they toured the University and sat down for some Wisconsin cuisine in the form of grabbing some brats at State Street Brats (huge hit for our Costa Rican friends)! After an extended stay in Madison, WI, the delegation woke up bright and early on Wednesday morning, checked out of their hotels, and packed up their bags for the next

2022 Costa Rican Delegation Group

destination. Before heading South to the Chicagoland area, the delegation squeezed in a facility tour of the Madison Metropolitan Sewerage District (Madison MSD), where they received an insightful tour from Madison MSD Operations Manager, Alan Grooms.

The delegation's next stop was a one night stay in Elgin, IL, where the student's had the opportunity to reset and get some much-needed rest after a busy first three days of their trip. On Thursday morning, the delegation traveled to Dekalb, IL to visit the Kishwaukee Water Reclamation District (KWRD) for a facility tour led by District Engineer/Assistant District Manager, Mike Holland. After the KWRD tour wrapped up, the delegation travelled to Island Lake, IL, where they were scheduled for a facility tour of the Northern Moraine Wastewater Reclamation District (NMWRD) led by Superintendent, Luke Markko, and myself. The delegation braved the cold weather and similar to the Madison MSD tour, both Thursday tours proved to be exciting and useful for the delegation participants! That evening, after all tours were wrapped up, the students travelled to the heart of Chicago, IL, where they would spend the remainder of their trip.

Madison MSD Plant Tour Group Photo

On Friday morning, the students travelled to Wheaton, IL to visit the Wheaton Sanitary District (WSD) for a facility tour led by District Operations Supervisor, Dennis Haile. After a quick early morning tour, the delegation then traveled to the neighboring city of Glen Ellyn, IL to visit the Glenbard Wastewater Authority (GWA) for a facility tour led by District Operator, Chris Dillman. All in all, the delegation had the great opportunity to tour five different wastewater treatment facilities across Madison and the Chicagoland area in just three short days. GWS is extremely thankful to all facilities who were able to offer tours to our friends from Costa Rica. Similarly, the students were equally thankful and that was on display when the TEC team dedicated specific social media posts for each WWTF that they toured while in the US, upon their return to Costa Rica.

On Friday, the students spent nearly an entire day soaking in the beauty that is Chicago, IL. Although I was not with the delegation during their exploration day, I heard a lot of great stories at the evening dinner that was held on Friday evening and it sounded like the students had the time of their lives in Chicago. On Friday evening, GWS held a small get together for the students to meet with other GWS volunteers for a sendoff dinner at Green Street Meats. Due to prior commitments, only a few GWS members were able to meet in Chicago

Madison MSD Plant Tour

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that evening, however, that did not stop the small group from having a proper sendoff. GWS Professional Development Chair, Eider Alverez-Puras was able to join the event and the students really enjoyed chatting with an impressive wastewater engineer like Eider (especially the all-female team from TEC, they were star-struck by Eider's presence). After dinner, the students returned to their hotels form their final night in Chicago before they were up early to travel to O'Hare to catch their returning flights.

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, this year's delegation trip would not have been possible. The delegation trip was a major success for both the visitors from Costa Rica as well as the individuals and facilities that were part of the collective effort. Pura Vida! CS

KWRD Plant Tour Group Photo

KWRD Plant Tour Group Photo

Final Group Photo after GWS Dinner at Green Street Meats

MIDWEST STUDENT DESIGN ~ WINNER ~

WEF Wastewater Category: MILWAUKEE SCHOOL OF ENGINEERING (MSOE)

THIS PAST APRIL, more than 100 students competed in CSWEA's student design competition. The competition itself was broken down into three categories: Water Environment Federation (WEF) Wastewater, WEF Environmental, and Global Water Stewardship. A team of students from Milwaukee School of Engineering University competed in the WEF wastewater competition. The members of the team included Alexis Countryman, Grace Cushing, Jack Ferrante, Brandon Garrido, Bennett Harris, and Josh Kleinschmidt. All members are senior civil engineering students. The team's faculty advisor for the project is William Krill.

PROJECT BEGINNINGS

The Village of Raymond's engineer, RA Smith, Inc. (RAS), got in touch with the team to suggest they take a look at the wastewater treatment alternatives available and create a preliminary design to prepare the best solution for the Village of Raymond (the Village). The Village is in Racine County just off Interstate 94, approximately 20 miles south of the City of Milwaukee, and approximately 11 miles west of the Lake Michigan shoreline.

Figure 1: Map of project area in relation to Southeastern Wisconsin

Figure 2: Village of Raymond, Prioritized Area, and Segment 1

The MSOE Team (L-R): Grace Cushing, Joshua Kleinschmidt, Bennett Harris, Brandon Garrido, Jack Ferrante, and Alexis Countryman

PLANNING FOR FUTURE SERVICE

Recent planning by Milwaukee Metropolitan Sewerage District (MMSD) includes the projected flows associated with the Village. The project area is shown in blue; the Village boundaries are shown in yellow; and Segment 1 is shown outlined in red in Figure 1 and 2. The project area was determined by the Village and RAS to be a main priority for the community due to its higher concentrations of potential industrial and commercial users. Segment 1 is a section of the plan area approximately one square mile located in the northeast corner of the Village. This segment was chosen by the team as a representative area for use in the alternative analysis. Segment 1 is also the closest segment to the proposed MMSD interceptor, which is shown with a star in Figure 2.

The Village's current wastewater treatment systems are individual septic and holding tanks for the residences and businesses within the Village limits. In conversation with the

Village engineer, it became clear that the Village of Raymond has considered plans to upgrade their sewer system for the past three decades. One of the Village's hopes is that this improvement to a sewer system will encourage development in the area. The Village of Raymond is one of the only municipalities in Southeastern Wisconsin without a sanitary sewer system in place, which the Village Board believes puts the Village at a competitive disadvantage.

The project alternatives were assessed using a criteria and relative weight system. Discussions with RAS determined the important criteria when assessing the alternative solutions. Cost is the overarching consideration from the Village, and the cost of each alternative is addressed in the alternative analysis sections. Cost was excluded from the list of weighted criteria to better assess other important factors of the project. The four criterion that were chosen were expansion potential, operation and maintenance simplicity, construction simplicity, and level of environmental protection.

CONSIDERED ALTERNATIVES

Alternative A was the continued use of on-site septic tanks, mound systems, and holding tanks. This alternative included maintenance to existing septic systems and holding tanks, as well as construction of these systems for future developments in the area. These systems are privately managed by property owners and any costs associated with these systems fall to individual residents.

Alternative B employed a gravity-flow sewer system to convey wastewater from each property to a central connection point. This alternative relied on the MMSD to provide an interceptor sewer to send the wastewater to the MMSD system from the design area. Since the system will rely on gravity to carry wastewater, sewer depths will get increasingly deeper to ensure the flow of wastewater. To reach these depths, micro-tunneling is necessary.

Alternative C was a similar collection system to Alternative B but relies both on gravity and pumping for the wastewater to reach the MMSD interceptor sewer. The system layout was similar to Alternative B in that all of the wastewater is being moved to the MMSD interceptor. However, lift stations will be used to pump wastewater as needed. This alternative does not require extreme system depths, but adds the complications of lift stations, including their operation and maintenance. MMSD will treat the wastewater from their treatment plant, however, Raymond must maintain the lift stations.

FEASIBILITY DETERMINATION

The primary consideration of feasibility was whether there is possibility of expansion and development that will result from a sanitary sewer system. The team worked to understand the feasibility by collecting relevant data of the area and the population.

LAND USE SUMMATION		
Land Use Type	**Area (ac)**	**Percent Total**
Rural Residential	147	7.8%
Low Density Residential	78	4.1%
Medium Density Residential	351	18.5%
Commercial	61	3.2%
Industrial	139	7.4%
Ag Land	6	0.3%
Open Land	948	50.1%
Other Open Land	19	1.0%
Surface Water	16	0.9%
Transportation	126	6.7%
TOTAL	**1892**	**100.0%**

Table 1: Area Breakdown by Category

Current and projected land use data was collected to make multiple flow rate estimates. The collected data helped drive the development of preliminary layouts of Alternatives B and C. Additionally, the data helped determine the cost for each alternative. The team used this information to determine the feasibility of developing a sanitary sewer system in Segment 1 in comparison to continuing the use of on-site septic and holding tanks.

The team used GIS data provided by RAS for the Village of Raymond projected 2060 land uses. A little over half the land use in this section of Raymond is open land, with residential areas located along the eastern half of the segment. 30.4% of the area contains combined residential types and there are multiple industrial and commercial properties located along the western half of the section, which make up 7.4% and 3.2% of the area, respectively. Table 1 provides an acreage breakdown of land uses in the project section. This land use contributed to the flow calculations for future flows to the sanitary sewer system.

The population estimate produced by the MSOE team was done to project the 2060 populations to assist in flow calculations for Segment 1. The estimate was produced using residential land use and GIS information from RAS within Section 1.

	Rural	Low-density	Medium-density	Total
2060	80	105	947	1132

Table 2: Segment 1 Population Estimate for Residential Areas

Three types of residential land uses were projected for the 2060 Segment 1 area, those being rural residential, low-density residential, and medium-density residential. Average acre per lot size assumptions were provided by RAS and were used alongside each of the total areas of each residential type. This process provided the number of houses in Segment 1, which was multiplied by 2.7 people per household, a plan area assumption for the Village as a whole, to find the population of 1,132 people. Table 2 shows this estimate.

GIS data obtained from RAS was used to find the increase in land use by type and acreage from 2010 to 2060 within the industrial and commercial land in the area. Table 3 shows this information. The percent growth in the table represents development the Village is projected to have in these categories. The future land use was used to produce the 3.3.10 flow calculations for Segment 1.

	2010 Land Use Area (ac)	2060 Land Use Area (ac)	Percent Increase
Industrial	101	139	38.2%
Commercial	45	61	35.1%

Table 3: Segment 1 Growth by Development Type

Existing topography presented a unique problem for the Village. The eastern portion of the Village has a higher elevation than the western portion. Within Segment 1, the elevation increases going from west to east with the highest point being in the center of the area, which then slopes downward moving west. Figure 3 depicts a topographical map created by USGS which was used to determine the elevation changes used in the preliminary layout design of gravity sewers and lift stations. Elevation points of rivers and streams intersecting roads were used to determine lift stations and micro-tunneling locations.

Figure 3: USGS Topographical Map

Two flow estimates were created for Segment 1; an initial flow estimate and a design flow estimate. The initial estimate is based off the 2060 land use data for Segment 1. A summary of the initial flow estimate can be found below in Table 4. This estimate allows a general idea of the total flows within Segment 1.

The design flow estimate was also based on the 2060 land use of Segment 1 but was done on a generalized parcel-by-parcel basis. First, Segment 1 was broken into sections of parcels that are on the same road. Next, a representative land use (i.e., Rural, Low Density, Medium Density, etc.) was designated to each parcel based on the land use distribution within the parcel. This is the biggest differing factor between the initial and design estimates. The flows were then summed along the parcels based on their representative land use types. This allows for the sewer to be sized accurately along it's whole length.

Land Use	2060 Population	Flow Per Capita (gpd/ac)	Flow (MGD)
Residential	1132	54	0.06
	2060 Land Use Area (ac)	Flow Per Acre (gpd/ac)	
Industrial	139	1500	0.21
Commercial	61	1500	0.09
		Total Flows (MGD)	0.36

Table 4: Initial Flow Estimate of Segment 1, 2060 Land use

The two factors that have the largest impact on the design are the population estimates and the topography of the area. The population estimate is what will decide the feasibility of the sanitary sewer itself. Topography allowed the team to determine where gravity flow was possible and where it was not.

To analyze the alternative systems, the total flow at downstream intersections of 27th Street and 6½ Mile Road, 7 Mile Road, and West County Line Road were determined as well as the total flows from south to north along 43rd Street within Segment 1.

Once the flow rates were determined, the general layout of the sewer system was completed. Google Earth and USGS contour maps were utilized to look at elevations along the roads within the segment. The locations for lift stations were based on elevation profiles and projected flow rates. The elevation profiles also helped to show where micro-tunneling was necessary.

ALTERNATIVE ANALYSIS

Table 5 breaks down the weighting of each criterion. It should be noted that the associated weights are rated from 1 to 5, with 5 being the best rating. The total for each alternative reflects the weighted total of the criteria.

Alternative A scored an overall score of 2.8, making it the second-place alternative. It scored the lowest score possible for the expansion potential category. This alternative cannot sustain increasing development and population density in the Village of Raymond. Septic tanks require underground disposal for the

ALTERNATIVE DECISION MATRIX				
Criteria	Weights	Alternative A	Alternative B	Alternative C
Expansion Potential	35%	1	3	5
O&M Simplicity	30%	3	4	3
Construction Simplicity	25%	5	2	3
Level of Environmental Protection	10%	3	4	3
Totals	**!00%**	**2.8**	**3.2**	**3.7**

Table 5: Preliminary Criteria and Client Weights

wastewater they store. As the region becomes more densely developed the area requirement for disposal of this wastewater will be a limiting factor. The plan area is also comprised of primarily hydric soils, which indicates where septic tanks are viable. Holding tanks are another option but are unsuitable for high flows. This alternative also scored a three for its operations and maintenance category. Septic tanks and holding tanks do require regular maintenance, but the Village of Raymond would not be responsible for this maintenance. The construction complexity category had the highest score possible; a five. This is because septic and holding tanks are easy to install, and most homeowners have already installed them. The construction of these tanks does not impact anything outside of the parcel itself, making the installations quick and straightforward. This alternative scored the lowest score for environmental impacts out of the alternatives. Many of the septic and holding tanks in the plan area are nearing the end of their designed lifetime and may not be properly operated and maintained. Some of these tanks can potentially release untreated wastewater to the environment giving this alternative a low score.

Alternative B scored an overall score of 2.6, making it the third-place alternative. This alternative scored a three for its expansion potential. The largest issue with expanding a primarily gravity system is the depths of the sanitary sewer. In some sections the sewers will need to be buried 40-60 feet to meet slope requirements. When the sewer is expanded, excavation will be required to tie-in to the existing system, and any connections in deep areas will require special excavation, resulting in a costly and arduous upgrade. This alternative scored a two in the operations and maintenance category. Any future maintenance access will be complicated because of the depth of the pipe in certain areas. This alternative scored a two for construction complexity. The depth of the sewers would require micro-tunneling for their construction. This would require a specialized contractor and would be a limiting factor on the speed of construction. This alternative scored a four in the environmental impacts section. The deep tunneling means that there would be reduced surface excavations and less chance of discharges to the environment impacting surface waters.

Alternative C scored the highest of all the alternatives with an overall score of 4.1. This alternative scored a five in the expansion potential category. Alternative C offers the best options for expansion in the future because it will be easy to make future extensions with the planned sewer. The use of lift stations can compensate for the topography of the area. Access to the sewers for tie-ins will be easy. This alternative scored a four in the operations and maintenance category. Although lift stations will require routine maintenance, this maintenance is straightforward and common. Even in emergency situations the lift stations will be easy to access. This alternative scored a three for construction complexity. The sewers will only require simple trenching and excavation to install. The lift stations are more complex but are commonly used, contractors will be experienced in their installation from performing similar projects. This alternative scored a four in the environmental impacts section. The sewer will allow for the centralization and treatment of the wastewater and will take the maintenance and operation responsibilities off the residents of Raymond.

Alternative	NPV of Alternative in 20 Years at 3.375%
Alternative A	$15.3 M
Alternative B	$35.5 M
Alternative C	$16.4 M

Table 6: Alternative Cost Comparison

There was a wide range of cost between alternatives. Since cost was not included in the decision matrix, Table 6 illustrates the differences between alternatives.

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Given the significant differences in the expansion potential and maintenance, the recommended alternative is Alternative C.

In concluding that Alternative C is the best design option for the Village, the team moved forward with doing a more complete design of the sewer system and lift stations. The scope of the team's design included designing the sanitary sewer main that would run along 27th street. This system would be the main branch of the Village's sanitary sewer system and is designed from the MMSD interceptor point at the north end of the Village down to the South end of the Village boundaries at 2 Mile Road.

SEWER DESIGN

To determine any existing conditions that may interfere with the designed sewer, underground utilities and the right of way bounds were located.

Existing utilities were determined by completing a Digger's Hotline ticket. The ticket provided information on the existing underground and aboveground utilities along 27th street, including gas, electrical, and communications lines. Right of way (ROW) boundaries were set with resources from the RAS client. The ROWs were determined for the west side of 27th Street.

GIS was used to determine the existing elevations in the site area. Point elevation data from Racine county's GIS website was used to assign elevations associated with the project area and determine an existing surface.

The Wisconsin State Legislature allows for any sewer elevation if it meets the requirement of NR 110.13.2.b. "Depth. Sewers shall be designed deep enough to prevent freezing and, where economically feasible, to provide gravity basement drainage for sanitary wastes." RAS suggested a depth of 8 to 25 feet. The maximum frost depth in this portion of Wisconsin is 5 feet, so the 8-foot minimum is deep enough to prevent freezing. The 25-foot maximum was due to safety and economic concerns. Trenches deeper than 25 feet often require additional trench protection which slows the project and adds additional costs. By keeping the sewer above 25 feet we are able to eliminate many safety hazards and extra costs.

The layout for the sewer follows the main roadways and slopes with the topography of the land. Where a sewer section cannot transport wastewater by gravity, lift stations were designed to pump the wastewater to the next highest elevation. Wastewater will then flow downwards by gravity again until it reaches the next lowest point.

The sewer was sized to maintain a minimum scouring velocity of 2 feet per second, based on recommendations from the Wastewater Committee of the Great Lakes – Upper Mississippi River (also known as the 10 State Standards). The sewer was sized using two different forms of the Manning's equation: both the velocity version and the volumetric flowrate version of the equation.

Using the design profiles, it was possible to design a sanitary line slope. Then the cumulative flowrate was found along the length of the sewer. A velocity that exceeded the minimum scouring velocity and the design slope were used to calculate the necessary hydraulic radius. Then the hydraulic radius and the volumetric flowrate were used to calculate the necessary cross-sectional area. That area was then used to determine the pipe sizes.

Structure design included manholes meant for proper maintenance. Wisconsin State standards state in NR110(3) a that "Manholes shall be installed at the end of each line, at all changes in grade, size or alignment, and at all pipe intersections." This was considered when designing the system layout. Additionally, NR110(3)b.1 requires that manholes be located at a minimum of every 400 feet. For sections of the sewer that did not change in size or direction, it was made sure that these regulations were met.

For the design of the sewer, three different manhole structures are used. Standard manholes were used for sections with gravity sewers, a force main to gravity manhole was used in places where the force main and gravity sewer met, and a manhole that would read flow measurements was used at the most northern part of the system. The standard manhole is constructed with a precast concrete base and Grade "A" concrete at the base of the structure. The pipe is split as to not interfere with flexibility of the joint. For the sizing of the sewers which are 8 inches to 24 inches, a 4-foot diameter of the manhole barrel is suitable. Force main manholes differed in diameter from typical gravity line manholes.

Lastly, a "measurement" manhole was designed for the structure right before sewage flows to the MMSD interceptor. This manhole is similar in dimension to the force main discharge manhole. To get an accurate flow measurement, a Palmer-Bowlus flume is designed to be placed in between the two lines coming into the structure. This flume allows for exact dimensions of the flow area and volume to be known to calculate the flow rate. Dimensions for the flume were based on master dimensions; the only dimension needed was the diameter of the incoming pipe.

LIFT STATION DESIGN

The sewer required a total of six lift stations to maximize gravity flow throughout while only using pumps when necessary to maintain open trenching. The stations are designed to be a combined wet well and valve vault station. Each lift station was customized with a submerged pumping system that meets the required flow rates and head. The capacity of each station was determined based on the maximum fill time between the pumps running, which was determined to be 30 minutes based on NR110.14(3)(b)7. The max design flow rate entering the pump

was assumed to be constantly flowing into the wet well across those 30 minutes. Therefore, a total volume of the wet well was determined based on this volume of sewage. Each lift station, excluding Lift Station 5, has one main pump running at all times, and a backup pump on standby in case of emergency or pump failure. Lift Station 5 required two pumps in series due to elevation head demands.

Maintenance to both wells can be done via access hatches found on the top of each lift stations. The wet well hatch provides ease of access for removing, replacing, or repairing the submersed pumps by way of a chain attached to the top of the pumps. The dry well hatch allows maintenance directly on the valves from a worker who can fully enter the well.

CONSTRUCTION

This project was broken in five separate construction phases to break the project into smaller pieces that can be done as financing becomes available. To estimate the amount of time required to complete each phase of the project the volume of excavation required for each phase was calculated. Using the production rate of a standard excavation crew in similar soil conditions, the excavation work was assumed to take five working days to place sewer lines and backfill behind the excavation crew. Additionally, it was assumed that it would take another week to install the lift station(s) that are present at some points along each phase of the project. Furthermore, it was also assumed construction crews would work 8-hour days and 40-hour weeks. To accelerate the construction schedule extra crews and longer days/weeks could be worked. A detailed breakdown of how the schedule durations were generated is shown in Table 7.

Task Name	Duration	Start	Finish
Phase 1	64 days	Friday 5/6/22	Wednesday 8/3/22
Phase 2	69 days	Thursday 8/4/22	Tuesday 11/8/22
Phase 3	40 days	Wednesday 11/9/22	Tuesday 1/3/23
Phase 4	80 days	Wednesday 1/4/23	Tuesday 4/25/23
Phase 5	99 days	Wednesday 4/26/23	Monday 9/11/23

Table 7: Construction Schedule Breakdown

The total cost to complete all construction phases of this project was estimated by the team to be $20.2 million. This cost includes all engineering and inspection cost that are required to complete the project. Unit costs to install sewer lines include excavation and backfill. All unit costs were adjusted to reflect present day conditions. Detailed cost estimates for each phase of the project are shown in Table 8.

ENGINEERS OPINION OF PROBABLE PROJECT COST	
Item	**Total Cost**
Phase 1	$3,715,000
Phase 2	$3,287,000
Phase 3	$1,483,000
Phase 4	$4,028,000
Phase 5	$3,472,000
Subtotal	**$15,986,000**
10% Construction Contingency	$1,599,000
Construction Project Total	$17,584,000
Engineering Project Total	$1,758,000
Inspection Project Total	$879,000
Project Total	**$20.2 M**

Table 8: Construction Cost Estimates

CONCLUSION

The work completed for CSWEA's student design competition brought significant experience for each member of MSOE's team. The team hopes that the work completed can be useful for the Village of Raymond. They would like to thank the following people for their aid in the project:

- Kristen Belan
- Christine Boland-Prom
- William Gonwa
- Ben High
- William Krill
- Douglas Nelson
- Chris Stamborski

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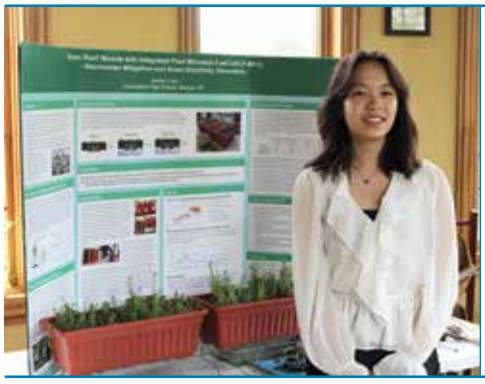
SIWI STOCKHOLM JUNIOR WATER PRIZE

The Stockholm Junior Water Prize (SJWP) is the world's most prestigious youth award for a water-related science project. The prize taps into the unlimited potential of today's high school students as they seek to address current and future water challenges.

WISCONSIN'S 2022 STOCKHOLM JUNIOR WATER PRIZE (SJWP) WINNER

The Wisconsin Public Education & Awareness Committee would like to congratulate the 2022 Stockholm Junior Water Prize winner for Wisconsin, Jocelyn Liao! We'd also like to thank the SJWP judges for this year, for graciously volunteering their time, as well: Mary-Frances Klimek, Rania Bashar, Sharon Thieszen, Catherine Harris, and Tricia Garrison. Jocelyn's paper is entitled: A Green Roof Module with Integrated Plant Microbial Fuel Cell (P-MFC) – Stormwater Mitigation and Green Electricity Generation. Jocelyn represents Homestead High School and her science teacher is Ashley Ackmann.

On June 16-19, 2022, Jocelyn travelled to the Colorado School of Mines in Golden, CO, for the 2022 SJWP national competition. Congratulations, Jocelyn, and thanks for making Wisconsin proud!



Jocelyn Liao

Grade 11
Homestead High School
Mequon, WI

TITLE

A Green Roof Module with Integrated Plant Microbial Fuel Cell (P-MFC) – Stormwater Mitigation and Green Electricity Generation

PAPER SUMMARY

In recent years, climate changes have caused more frequent and intense storms; this has caused more severe flooding and water pollution in urbanized areas of the world. With much research, I was able to discover the idea of augmenting a green roof module into a renewable energy generator by converting it to a plant microbial fuel cell (P-MFC). This solution promotes the adoption of green roofs to reduce stormwater problems. Additionally, I decided to use sedum plants and capillary irrigation so that the system is relatively low maintenance. My project is able to not only produce renewable energy, but also reduce stormwater runoffs, cool down buildings, and take carbon dioxide out of the atmosphere.

With my project, I created three different prototypes of plant MFCs in order to test my hypothesis: Capillary irrigation systems can improve MFC performance by maintaining soil moisture and MFC power production can be further improved if the capillary wicks are brought into contact with the cathode, since this can function as a "salt-bridge" to facilitate proton transport. All three prototypes contain an air cathode attached immediately below a proton exchange membrane (PEM) on the bottom of the soil container. The anode was buried in the soil media near the roots and was placed immediately above the PEM. Treatment A contains a capillary irrigation system with polyester wicks running from the water storage layer to the soil; Treatment B is similar to Treatment A, except the irrigation wick comes in contact with the anode. For the first 18 days, the open circuit voltage (OCV) was measured continuously and the soil moisture was measured every two days. Afterwards, a 1 kilo ohm resistor was added to the system and the data was recorded using an Arduino Uno microcontroller to continuously measure the power density output. In addition, polarization tests were taken at the start and the end of the experiment to measure maximum power density output and internal resistance. My experiments successfully approved my hypothesis since Treatment B resulted in the highest power density output at around 26 mW/m2 of anode area. Along with that, Treatment B also demonstrated the lowest internal resistance.

BIOGRAPHY

Jocelyn Liao is currently a Junior at Homestead High School in Mequon, WI. Since she was in middle school, she had always been interested in environmental science and climate resilient solutions to a sustainable future, and she worked actively to explore new technologies to solve environmental problems. She will publish her research on Green Roof MFCs and conduct follow-up experiments in order to improve the prototype she developed in this study Winning the SJWP was important to Jocelyn because she truly wishes to gain more exposure to Green Roof MFCs in hopes of creating a more sustainable future for the planet. After high school, Jocelyn is planning on attending a prestigious four-year college and majoring in research-related fields of study so that she could further pursue her interests in climate resilient technologies. Outside of her studies, Jocelyn is also a synchronized figure skater who received third place at the US Synchronized Skating National Competition, along with many regional medals. She also likes to paint, bake, and read in her free time. CS

2022 WATER'S WORTH IT ESSAY CONTEST WINNERS

The Central States Water Environment Association recently held its 2022 Water's Worth It Essay Contest in Illinois and Wisconsin. Applicants in grade 6 through 8 submitted either a creative writing essay or research essay on Optimism in the Face of a Global Water Crisis. Thanks to all who participated this year and congratulations on the winners in each state.

WISCONSIN

The Wisconsin Public Education & Awareness Committee would like to congratulate the 2022 Water's Worth It essay contest winners for Wisconsin – Hazel Mittag, and Caden Downing! The committee would like to give a big shout out to Stephanie Cioni in Illinois, for her efforts to create this great essay contest for middle schoolers, and for Stephanie's spirit of collaboration with Wisconsin! #StrongerTogether. Also, a shout out to Hiroko Yoshida and her company Centrisys, for continuing to sponsor this wonderful contest. This year's essay topic was The Human Water Cycle, with both a research prompt, and a creative writing prompt.

Hazel Mittag, Creative Writing Prompt Winner
Essay: From Hawaii to Lake Michigan to Your Faucet

Hazel Mittag is 12 years old and from Glendale, WI. She is homeschooled and her favorite subject is violin. She enjoys sketching, painting, dancing at her church and gymnastics among many other things. Hazel is grateful for water because it's refreshing, cleansing and amazing to swim in.

HAZEL'S ESSAY

Aloha! My name is Talia. I've been around ever since God created Earth. I've been everywhere... Well, except for Lake Michigan.

I love to travel but, every time I do, I can't take my more… stationary friends with me, like Killi, the microplankton, and Willie, the humpback whale. Almost as if on cue, Willie swims up in front of me and uses his tail to propel me up to the surface for today's journey.

I just have time to shout "bye" to all my friends before I evaporate, climbing higher. I swivel around as I become part of a cloud.

"Excuse me?" I ask the nearest water droplet, "What direction is the wind pushing us?"

"Northeast at 100 knots, we're in a cirrus cloud."

"Thank you," I reply. Now it's time to enjoy the ride.

SPLASH!

Before I can adjust to my surroundings, I'm engulfed by a dark pipe. "Great," I grumble, "I was hoping to avoid this, but of COURSE we're dropped near the intake pipe. Hopefully, I'm not used to clean a toilet."

"We're in the Milwaukee waterworks!" someone shouts. A gas is added to our group, ozone.

Well, at least this will get rid of the pest over there. The disease-causing microbes are always annoying, but this one seems to be extra irksome. Mercifully, a molecule of ozone knocks him out and drags him away.

Ugh, great. Alum is being added. They round up all the dead organics and clump them together… right under me. GROSS. Thankfully we'll be getting rid of them soon.

Next, we move to a settling tank where all the dead organics leave – whew, they were really starting to stink up the place.

Here comes my faaaaaaaavorite part, we have to move through TWO FEET of Anthracite coal to get rid of the 'larger' leftover particles. Then we move through a foot of silica sand and become BFFs with chlorine. Lastly, fluoride is added to help humans' teeth.

Now I can just have fun. These pipes are even a better ride than the Northern Equatorial current back home.

"Hey, water," Fluoride says. "You know how humans purposely add us, it's because they value us way more than you…" His next words were drowned out by a two-foot drop. We have finally reached our destination! And it looks like we're in a babysitter's house. Ewww… is that ketchup?

"Oh! We're being used to wash dishes." I exclaim. I look over at Fluoride's shocked face. "So important now?" I shoot at him.

The next part of our journey consists of a maze of sewers.

There's human waste, spit, condiments, toothpaste… YUCK.

Chlorine and Flouride start grumbling about inconsiderate humans and how they should treat valuable chemicals like them. They sound ridiculous, and before we know it, we're at the water reclamation facility about to get cleaned. Hallelujah!

This part of the journey is easy. A screw-shaped pump brings us up from the sewers. Then we cascade down through a screen that removes the larger debris. Clarification then skims oil and grease from the top while solids sink to the bottom. Phew, it is getting stinky. After that, the water runs down small pipes and billions of bacteria are added, oxygen keeps the bacteria alive while they eat the solids, and the dead microbes sink below us and become Milorganite. Finally, we spill over the edge of the tank, clean.

Today's journey was different than my expectations. I'd hoped to see more of Lake Michigan, but it is amazing to see how humans have carefully planned out their water treatment, from adding fluoride to creating a machine that can skim oil from the top of us.

I would change the way we're used for future adventures. We run down people's backs when they take showers, they drink us up, and so on, which is fine, except that as payment, they throw garbage into our oceans and toxic waste pollutes the ground of landfills when we rain and drains down into rivers, lakes, and oceans. That part makes me sad. You only really clean us when YOU need us, not when we and the inhabitants of the oceans need you.

This is Talia and her Michigan adventure, out. CS

WISCONSIN

Caden Downing, Research Prompt Winner
Essay: Madison's Human Water Cycle

Caden Downing will be a seventh grader at Our Lady Queen of Peace School in Madison, WI, beginning in the fall of 2022. Caden has always had an appreciation for water, dating back to third grade when he completed an inventor project on Dr. James Barnard, who discovered the enhanced biological phosphorus removal process. Outside of school, Caden loves skiing, mountain biking, and reading.

CADEN'S ESSAY

The water cycle in the city of Madison is a very complex system in which water from lakes in the ground is pumped into a home, used by people, and then cleaned and returned to a river. In this essay I will explain the steps in this cycle and how they work and how people are interconnected with this cycle.

Water is first pumped out of the ground by wells that are around 1179 feet deep. There are 22 wells for the city of Madison. The city of Madison gets the water from underground lakes called an aquifer. We do not clean this water because the soil cleans the water. It doesn't even let microorganisms through.

This water is then pumped into a water tower. There are 21 water towers and the largest one holds 1.3 million gallons. Water towers are used because they don't need pumps to get water to your house; they use gravity. This makes the whole process much more sustainable. The water forced by gravity is then transported to your house by 870 miles of pipes. These 26 million gallons per day water then gets used for everything in life.

When you flush your toilet or drain your sink this water is sent to a wastewater treatment plant by 790 miles of pipes, 2000 structures and 29 pump stations. These pipes keep our waste water from seeping into our aquifers. At the wastewater treatment plant, the water is treated by a series of treatment processes. For the Nine Springs Wastewater Treatment Plant (the treatment plant for Madison) the following treatment processes are used: screening, grit removal, primary treatment, activated sludge, and ultraviolet disinfection, the solids that are removed from the water are treated with anaerobic digestion anaerobic digestion produces fertilizer and clean energy which is used to power the treatment plant.

After being treated, this clean water is put in a pipeline, which discharges the water in Bad Fish Creek. This benefits the creek because the fish are better off in clean water. Bad fish creek is a tributary to the Mississippi so the water people in New Orleans is the same water we drink in Madison.

All the service workers in Madison are important for any of this to happen. They have the most important jobs in our town and we would all struggle without them. Some work at the wells, pumps and water towers scattered around the city. These workers ensure that everyone gets the water. Others work on the 1660 miles of pipes spread around the city without them we would have major sewer and water problems. Others work at the treatment plants and they help our environment thrive during stay healthy. CS

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ILLINOIS

Rishima Mukherjee, Research Prompt Winner (Northern Illinois)
Essay: Humanity's Most Important Resource

Rishima, 13 years old and is from Aurora, IL, where her favorite subject in school is English Language Arts. In her free time, Rishima enjoys playing badminton, dancing, writing poetry, and reading (her favorite genre is historical fiction or YA fiction). Aware of the crisis and problems of clean drinking water across the world, Rishima is very precautious of the water she drinks. Moreover, her favorite thing about water is its importance in the world: Not only is it essential for the human body, but research and experiments also have shown that water can be used as an energy source. The variety of factors and influences water has in the world amazes Rishima because it can lead to better, sustainable planet.

RISHIMA'S ESSAY

Citizens of Aurora have the privilege of safe drinking water. But the true question is: is it really safe? Aurora is one of the three cities in the US with three proper treatment plants for their water supply, resulting in the award of Partnership for Safe Water's Excellence in Water Treatment. The community's well-being is on the line when it comes to safe drinking water because the quality of the city's water impacts the health of its citizens. Contaminated water exposes people to life-threatening waterborne diseases, classified as dangerous microbes. For citizens to feel protected in the water they are drinking, citizens need to understand the process of how water reaches their homes as well as the city of Aurora to maintain its high standards of water quality.

The city has several sources of its water supply, including the Fox Valley River, deep wells, and shallow wells. From these general origins, water is then mixed to create a blend of 40% well water and 60% surface water that can also pick up natural or radioactive materials in its mixture. It is then filtered and pumped into storage tanks, where it links to underground water mains. While water mains are the hub/trunk of a city's water, water pipes are like the roots, connected directly to wells or boreholes, that provide water to houses. When people open their taps, pressure in the pipes pushes the water out since the city's water tanks are placed at an elevation which creates hydrostatic pressure and gravity for distribution to the pipes.

While the flow and transportation of water from the Fox Valley River to people's homes aren't complicated, the labyrinthine processes in-between are. Water from wells and Fox Valley River are sent to a larger reservoir, where it is then lime-softened, fluoridated, filtered, disinfected, and discharged. A 2020 water report reviews that lead, copper, regulated contaminants (chloramines, haloacetic acids, total trihalomethanes, barium, chromium, and fluoride), coliform bacteria, and turbidity were all negative in Aurora's water. Staying strict to water testing and following EPA standards and regulations, Aurora's water department won a president's award for its water quality. The filter performance of Aurora's water supply is prominent because "Aurora Water Treatment Facility [is] in the top half of the top 1% of surface water treatment plants in the US." (Schumacher 2). Even though many of the city's monitoring in the water reports are unregulated, they still go over them to ensure the protection of the community.

Like the water cycle, water always comes back. Groundwater can be evaporated into the air until it precipitates into oceans and rivers until it infiltrates back into the ground. Similarly, once wastewater goes down people's drains, it goes through the community's sanitary sewage system to come back to the environment. After going through multiple processes, the water is then released into local waterways where it is put into numerous purposes, like drinking water, irrigating crops, or sustaining aquatic life. For proper sterility, the sewage water includes an assuage treatment plan to take out solid objects in the pipes. The second stage of the treatment plan is to use "good" bacteria to eat away smaller, visible fragments that are contaminating the water. Lastly, in the settlement tank, bacteria are separated from the water, leaving it distilled. Managing a dual sewage system, the water always goes through basins or rivers, lakes, etc. However, this process leads to many infrastructure failures.

While many Aurora citizens are taking for granted the opportunity and privilege, they have to drink clean water, many other cities across the country are experiencing terrible water conditions like the Flint water crisis six years ago. For water to be safely distributed into our homes, the city of Aurora and other cities must also go through extensive procedures of filtering, monitoring, and reporting the water quality. Living in a privileged society, children and adults must learn to understand and pay attention to their water supply because one of the driving factors for the sustainability of humanity lies within water; "thousands have lived without love, not one without water." (H. Auden). CS

ILLINOIS

Macy Schroeder, Creative Writing Prompt Winner (Northern Illinois)
Essay: It All Returns to Dirt

Macy is 14, lives in Naperville, IL, and will be a freshman at Metea Valley High School. She is an avid reader and is passionate about learning. Macy is an excellent student and an even better person.

MACY'S ESSAY

I don't even have time to react before a sandpapery tongue is lapping me up from the lake I've been calling home recently. I'm thrown into the place of an animal I've learned is called the stomach. Other water molecules float around. Well at least I'm not alone this time. One other molecule comes over to me, asking how I got here. I don't respond. The molecule continues to talk to me as if I told some harrowing tale about how I arrived in this rodent's stomach. No harrowing tale for me.

I can feel the beast slowing down. Breaking down. I've never been in a creature as it dies. He falters and trips. Eats less and less. I wonder what happens to us when he dies. I'm sure I know, deep down, but after so long in the cycle you forget things. There are some things I remember though. One of which is a waterfall.

I'm pretty sure it rained down to the fall, but things get fuzzy. I just remember the peace of the waterfall. The company. Being surrounded by other water molecules all rushing and sliding around on rocks, down rocks, through rocks. There is something so calming about the craziness that is a waterfall. I was there for a while. After sliding down the fall I stayed in the mini pond below it for some time and I evaporated a few times only to rain down right back in the river that led to my fall. I didn't mind. I liked the falls. I wish I could go back there sometime. But after the falls it was nice too. I finally evaporated away from my waterfall and pond. Traveling in the clouds was always nice too. Cool and relaxing. No one really talked in the clouds. It was a R&R experience. Not that there was much to stress about as a water droplet. Clouds never last long though. Which is always a shame. Some of the water molecules I've met enjoy raining and becoming something new, but I wish I could stay in the clouds. But alas, that's not quite how the water cycle works.

So once my cloud gets heavy enough, I let the rest of the rain pull me down with them. This time I fell into what I think is a rain gauge. It takes a while for the rain to stop and by the time it does, I've been buried in other molecules. The next day, I come to while something cool and metal scopes me out of the rain gauge. A canteen. Someone is carrying the canteen, as expected, and they swirl it around thoughtfully. They take an appreciative sip of my water. Not me through. I stay put. We walked a bit more until we reached the lake I spotted earlier. They sit for a while before surprising me and pouring the rest of the canteen out into the lake. They say something but I can't hear it due to the rushing of the water molecules around me.

This lake was where the rodent drank me.

Decaying is slow. Boring almost. But I can feel the skin of the animal dissipating. And finally, I slip out of the unmoving creature and sink into the soil. Compact and dark. Soil was always nice as well. Lonely. But nice. Once buried deep enough, I reflect. It's been a while since I didn't that. Looking back on my few memories of life. Soil seems as good a place as any to do so. I let myself think back. Over the waterfall. The canteen. The lake. The journeys through places and people that need me. It's odd to think. The person who carried me in the canteen needed me. Even if they never drank me, they still needed me for something. The pouring was symbolic I assume. For what? I don't know, but I hope I helped them. The rodent as well. Despite the eventual death of the creature, I was still needed. It's odd to become aware of such mortality, since the concept does not exist to me.

Though it seems, even without the threat of death, we still all return to dirt. CS

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ILLINOIS

David Wang, Research Prompt Winner (Central Illinois)
Essay: One Step at a Time

David is 13 years old and from Champaign, IL, where his favorite subject in school is Math. In his free time, David enjoys playing piano, computer science, and practicing martial arts. David's favorite ways to enjoy water are drinking a cold glass of iced water and both hot and cold showers.

DAVID'S ESSAY

Water is everywhere. We use it daily in drinking, washing, cooking, and much more. During these modern times, water is something many of us take for granted. A twist of a handle, a click of a button, and water comes gushing out. But why does it come gushing out? How does it work? Where does the water come from, and can we be sure it's clean? This essay will discuss and explore questions like these.

I live in Urbana, IL, and we get our water from the Mahomet Aquifer, which also serves the greater Central Illinois region. After the water is drawn, it is processed by the American Water of Illinois. Using filtration systems, they remove minerals and large particles. Then, chlorine and fluoride are added to kill dangerous microbes. It is then distributed through underground pipes to our local area (Champaign, IL).

Drinking water comes from lakes, rivers, and groundwater. Michigan and the surrounding states get their freshwater from the Great Lakes. Some countries in Europe get theirs from the Mediterranean Sea. Coastal countries/states have begun de-saliating ocean water into freshwater. The rest of the water usually comes from surface water, lakes, rivers, and groundwater (Tan). However, even after treatment, water can still be contaminated during transportation.

Even after vigorous treatment, the water may still be contaminated. This is due to the pipes, which are made up of lead and copper. As the water runs through the pipes, the pipes corrode and parts of the pipe can land as residue inside our drinking water. The Flint, Michigan crisis is a great example of this type of water contamination. Its citizens had to start a movement to bring bottled water in the thousands for all purposes – cooking, cleaning, and drinking. Flint, MI did not have clean water for five years (2014-2019). Thankfully, they now have safe water to drink (NRDCflix).

After water is used and disposed of in homes and businesses, it soon enters a treatment plant. The first stage is to remove floating objects such as sticks or cloth. They do this by allowing the water to flow through a screen. After it is screened, it passes into a grit chamber where small stones, sand, gravel, and other small debris sink to the bottom. After all this treatment, there are still bits and other flotsam in the water. These eventually settle at the bottom, where they become sludge and are used for fertilizers. According to Bruce Rave, spokesman for the Urbana Champaign Sanitary District, After the water is treated in Champaign, the water goes into a drainage ditch in Urbana which empties into the Wabash River. The Wabash River washes into the Ohio river and then the Mississippi river. The Mississippi river then empties into the Gulf of Mexico, a part of the Atlantic Ocean (Rave).

Either from Aquifers, lakes, rivers, or groundwater, the process of drawing, filtering, and transporting water is no small task. Every day a family uses around 100 gallons of water (How Much Water). So many of us take our water for granted and do not realize the long and complicated process of cleaning, filtering, and transporting. Only 3% of earth's water is freshwater and is safe for us to drink. If we continue to waste our water, then there will soon be none left (Earth's Freshwater). But not all hope is lost. If we conserve and use our water wisely, humanity may be saved. Together we can accomplish this – one step at a time. CS

ILLINOIS

Avary Shudrowitz, Creative Writing Prompt Winner (Central Illinois)
Essay: Where, Oh, Where Did Drippy Go?

Avary is 14 years old, from Springfield, IL, where her favorite subject is advanced science. In her free time, Avary enjoys drawing, playing video games with friends, bicycling, spending time with my family, and collecting and restoring dolls with her mom. Avary's favorite way to enjoy clean water is swimming with her friends. Avary loves "that there are so many different ways to enjoy being in nature around a body of water, whether it is fishing, boating, swimming, tubing, or just sitting on shore relaxing."

AVARY'S ESSAY

WOW-WEE… If you only knew the journey I, a single droplet of water, had to endure before arriving here in this tall glass of ice-cold, purified water you are about to savor, you might think twice about letting the faucet run while brushing your teeth! Well, let's start at the beginning, shall we? My name is Drippy. I am a water molecule, that is two hydrogen atoms and one oxygen, and live in Lake Michigan in a liquid state of mind. Just a few short days ago, I was sunbathing on the surface of Lake Michigan with my friends when the strangest thing happened to me. Suddenly, I began floating up, up, up, and away into the atmosphere as a tiny, little vapor droplet, drastically different than the liquid state I was a moment ago. Luckily, there were plenty of small particles offering to give me a lift over to a nearby cloud where everyone who vaporized from the surface were. After playing a round of "20 Questions" with nearby water droplets, everything happening around me became very clear-I had joined the infamous Water Cycle and was scheduled to rain down somewhere near Springfield, IL. I landed in Lake Springfield and was swiftly swept up into the enormous CWLP Water Purification Plant along with a fish, an old shoe, and algae. I was shocked at the intense processes a tiny little molecule like me had to endure in order to be "good enough for human consumption." I was filthy after spending a few days in the atmosphere with all the smog and then in a lake filled with garbage, dead fish, and bacteria. As much as I didn't want to admit it, I needed a bath!

The water molecule behind me must have sensed my fear of the unknown that lay ahead of me. She says, "Oh, honey, don't you fret your pretty little oxygen. Once the carbon activates, it feels like a purification inside and out-absolutely spiritual experience if you ask me."

I am not too sure her words had the desired effect…what does a "spiritual experience" have in common with carbon?

She continues on. "You wouldn't believe the particles that I have shed in the 'Iron Shower,' heck, I imagine some probably are unknown species." She lets out a horrendous cackle echoing off the chamber walls.

I tried to show my appreciation for her kindness, but all I could utter was something about doing our part in fighting tooth decay with fluoride additives.

Once I entered the chemical dosing chamber, any fear I had was replaced with dismay. I was shocked that our natural water supplies are polluted to levels that require each molecule a trip through a "chemical dosing chamber." It seems so unnatural. Each water molecule moved through this process like one would herd cattle through an immunization clinic. I just felt so deflated and unappreciated as I worked my way through the next step, Helical Flow Clarifier.

"Cheer up little one, we are almost out of this place and onto another adventure into the unknown. Springfield has over 768 miles of water main lines that we get to flow through until we find our way to a spigot!"

I looked up to find an old soul molecule smiling at me.

"And then where?" I inquired.

"Well, that's the beauty of the water cycle, youngen, the possibilities: Will you evaporate off the surface you find when you spill out of the faucet? Will you find you way into a human body where you take on a whole new environment with its own water cycle?" That elder water molecule did speak truth, but my disappointment lies with the beautiful perfection of the water cycle to purify, cleanse, and balance itself naturally. I guess I just feel that if waterways and systems were protected and respected on a level humans are lacking to do, then no water molecule would have to endure being subjected to such harsh conditions within the Water Purification Plant. I feel that when harsh chemicals are used to in water treatment plants and wastewater treatment plants, the issues are only being complicated with excess by-products and chemicals being introduced into the water cycle. CS

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ILLINOIS

Gianna Aiello, Creative Writing Prompt Winner (Southern Illinois)
Essay: Water's Worth It

Gianna is 13 years old, from O'Fallon, IL, where favorite subject in school is science. In her free time, Gianna enjoys musical theater, singing, robotics, and playing with her pets. Gianna's favorite way to enjoy clean water is swimming, nice warm baths, and watering her herb garden.

GIANNA'S ESSAY

Swoosh, swoosh. The sound of the faucet rings in my ears as I start to feel weightless and begin to fall. A rush of adrenaline pumps through my veins as I pray that I make it out alive. Right as I hit the ground, I felt like I was being sucked into a vortex. It was the drain! As I clutched on for dear life, I remembered this feeling. I was going through the water cycle again.

I decided to let go, already knowing my fate, and I was spit out into the ocean. The playful sounds of the dolphins and the salty smell of the ocean, being in the water, being part of the water, began to calm me. I took a deep breath of the salty water and sat back and relaxed, but right as I started to get comfortable, my body began to float up into the air as water vapor, and I started the evaporation process of my water cycle. I looked over and saw my friend Clair, and I called over right as we started to condense to form clouds. As we became a cloud, I started to feel claustrophobic again, but then I lost my grip and began to fall thousands of feet below into the river as I felt the jaggy edges of the rocks and the slimy feeling of the salmon's scales.

I took a breath of relief as I floated down the river when I realized we were about to go over a cliff. I had never done this before, so I clutched on to a fellow water droplet as he screamed in an aggravated voice, and I began to comprehend that this might be the end. I let go knowing my fate. As I rolled down the waterfall, I prayed that this wouldn't be the end, and then it ended just as I hit the little pond at the end of the waterfall with a splash, and I found myself in the same spot I was in just a day before. I was sliding down the sewer pipe right back into the facility in which they cleaned us. This was my favorite part. I stepped into the dish as they gave me the shower I had been waiting for since yesterday. I went back through the pipes, weaved through the rust patches, and made it back to the next sink I will go through. I had just been through the water cycle, and what a remarkable experience it was! CS

Keep an eye on *www.cswea.org* for information and encourage your student to enter in 2023!

Montville Facility Embraces Septage

Two things are perhaps certain about septage; it is highly variable – and by its very nature (spewing odorous compounds and elements that can cause disease), it is "objectionable."

Or is it?

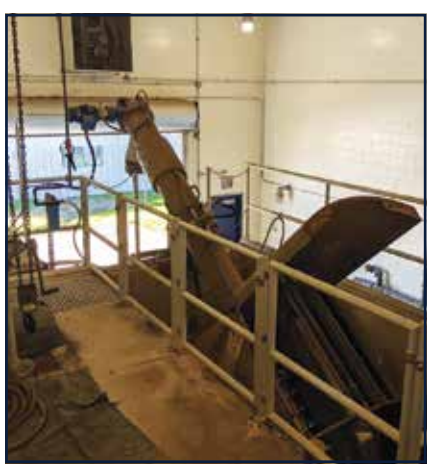
Endless amounts of grease, grit, hair, and debris – not surprisingly very unpleasant in appearance and odor (hydrogen sulfide, mercaptans, and other organic sulfur compounds), viruses, bacteria, and parasites – mean it's not exactly charm-personified. But according to the Environmental Protection Agency (EPA), septic tanks are used for more than 20% of homes in the US. Some 6,500 businesses employ over 30,000 people in an industry worth $5 billion. Is that still "objectionable?"

The word 'debris' sems to have a large degree of interpretation in the septage industry. For many it simply means small, scattered pieces of trash or loose, natural material. For one septage-receiving wastewater treatment facility in Connecticut just recently, 'debris' meant discovering a large fencepost doing its level best to wreck and block the screen and components of its septage acceptance plant.

Raising more than an eyebrow at the uninvited fencepost were the team at Montville's Water Pollution Control Wastewater Treatment Facility (WPCWWTF), whose key responsibility is to protect the ecosystem of the Thames River.

"Can't say that we've seen a fencepost here before," said Scott Farrington, Operator II at Montville WPCWWTF, "but in the large volumes of septage we receive (approximately 150,000 gallons per week), we see plenty of 'interesting' objects – and on top of everything else we take in, our treatment equipment is constantly put to the test."

In addition to all the typical challenges of today's wastewater treatment facility – including the curse of those supposedly 'flushable' wet wipes, which are arguably more 'objectionable' than septage(!), Montville's two-million-gallon



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capacity also includes industrial-strength wastewater from a major packaging factory via a dedicated 2.4-mile pipeline.

According to the Rockland, Massachusetts-based Maher Corporation (established 1970), the leading source of water and wastewater treatment products in New England, very few manufacturers have had long-term success in selling in their equipment to meet those highly variable challenges presented by septage.

'Seriously rugged, for the long-term'

"To be frank, much as we'll always be there for our customers, we don't want to be called back to problems every week (!), so selling, reliable long-lasting equipment for such a tough application as septage is a must," said Fred Croy from Maher Corporation, the company that has provided a wide range of blowers, pumps, pipes, and other equipment for Montville.

He added: "We are very conscious that the septage going into the town's facility has contained no shortage of crushed granite. This shouldn't get sucked up by the hoses when hauliers make their collections, but inevitably, it happens, making it all-the-more reason for us to recommend equipment that is seriously rugged, for the long-term."

Almost 18 years ago, Montville (population 20,000) invested (via Maher Corporation) in a Septage Acceptance Plant (SAP) from Lakeside Equipment Corporation. As the SAP name suggests, it is designed to remove debris and inorganic solids from septage tanks (also for grease traps, sludge, leachate, and industrial waste).

Not surprisingly, septage can have a significant impact on plant operations or performance if receiving facilities are not properly designed and managed. It increases plant operation and maintenance costs, with the handling and disposal cost of residuals (sludge, grit, screenings) often showing the largest increase. No such problems at Montville, however, where generating revenue from highly variable septage is a skilled, delicate, balancing act, that Scott Farrington and the team led by Superintendent Derek Albertson have become masters at. Keeping the Montville process stable continues to set an excellent example, with state permits met very comfortably for parameters such as total suspended solids (TSS) and biological oxygen demand (BOD5), as well as an extremely effective removal of phosphorus. Up to 75% of the treated effluent is recycled for use in a nearby paperboard manufacturer. The remaining clean effluent is discharged to Horton Cove (Thames River).

Processes aside, septage addition to a wastewater treatment plant can also increase administrative tasks associated with record-keeping and billing of haulers and the need to streamline the septage receiving operation, but 10 years ago during a refurbishment Montville (again via Maher Corporation) introduced a Lakeside Raptor Acceptance Control System (RACS), which was integrated with the SAP to allow authorized haulers to unload septage. This security access station, which includes a data management and accounting system, and provides administration capabilities to track and invoice customers.

'The system is incredibly robust'

"We offer very reasonable rates for septage hauliers, so have taken many more on board in recent years, which is fine so long as we continue to manage this proportionally," Montville's Derek Albertson, commented. "We have a constant flow of trucks, but some hauliers think they can bring almost anything in. This is where Lakeside's RACS (control system) is so effective and flexible. There is a learning curve and skill set required as operators, but the system is incredibly robust; it doesn't need very much maintenance at all. The drivers have to sign in with a code, which provides traceability and frees us up. It also gives hauliers the flexibility to call when they need to, without any unnecessary waiting."

The upgrade at Montville a decade ago also included the addition of a Lakeside Raptor Fine Screen in the influent channel. Unlike the existing, conventional bar screen, this new influent screen benefits from a similar type of cylindrical screenings basket as the SAP, with angled installation and screen bars of varied heights to increase removal efficiency and minimize head-loss. The screen's rotating rake teeth fully penetrate the cylindrical screen bars. This prevents plugging and blinding from grease and small debris – thus importantly allowing faster unloading times to generate more revenue. Captured screenings are compacted, dewatered, and washed free of most organic materials to approximately 40% solids. Volume is reduced by 50% and weight by 67%, reducing the cost of disposal.

"The Lakeside Screen (with quarter-inch apertures) has been extremely effective in removing rags and plastics from our process," added Derek Albertson.

'One technology for two applications'

"We never know quite what we're going to get with septage. Over the years, the Lakeside kit has really taken some hits. People have tried their best to kill this equipment, including with that recent fencepost, but despite being our first line of defence at the intake, the Lakeside SAP and its Raptor Screen have been very dependable, with just routine maintenance required," Derek said. "To say that the unit is robust is a big understatement. The equipment also doesn't take up too much space and is very easy to get at and work on. Overall, the SAP and its screen certainly shields our secondary equipment."

He continued: "The consistency in configuration, which effectively has given us one technology for two applications, has also been a big benefit to us. What we have now is so much better for the facility, with an automatic screen compared to the old bar rack that had to be cleaned manually. The Lakeside SAP proved so solid that it gave us every confidence to invest in one of their screens." CS

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