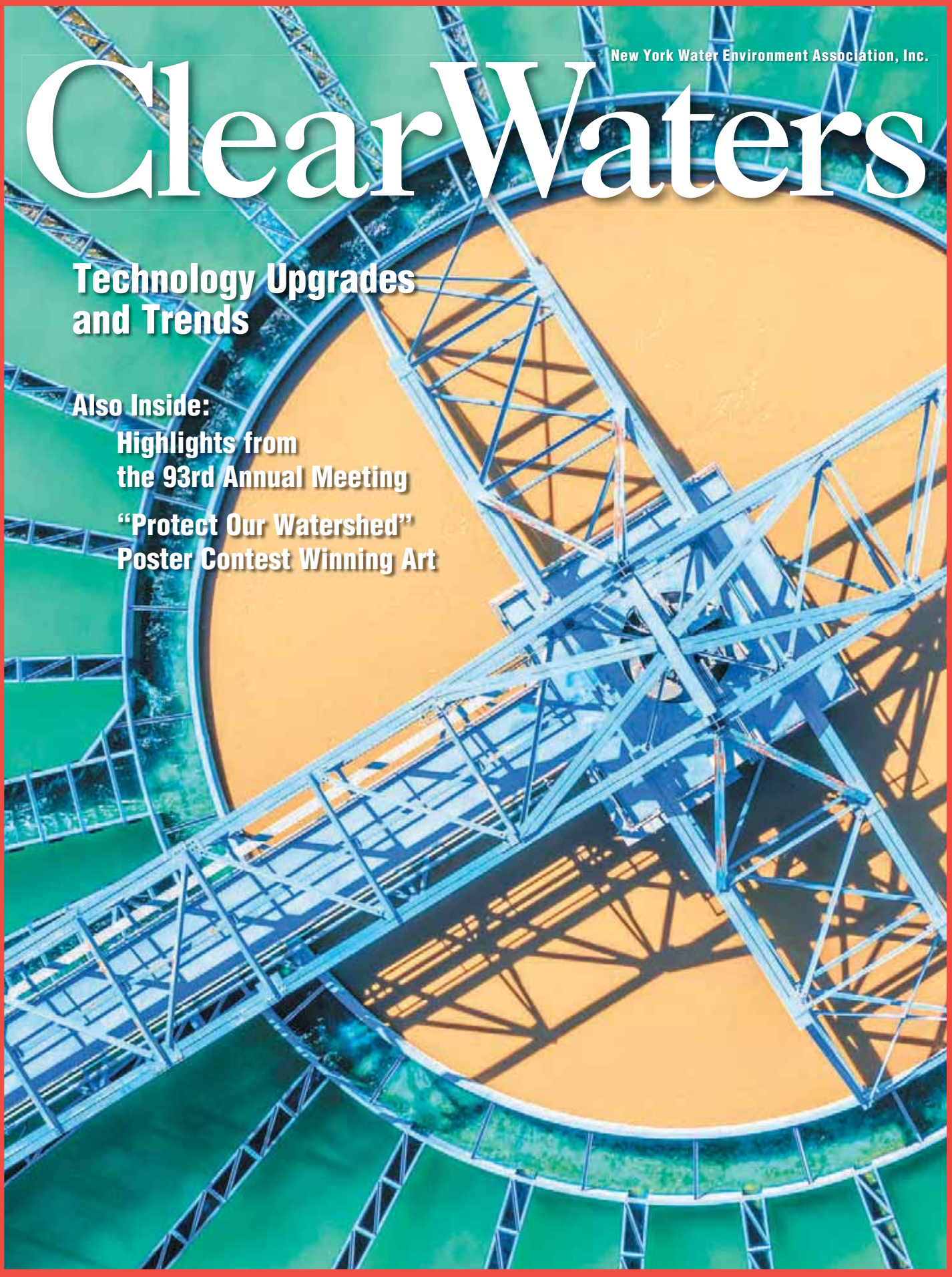
Spring 2021, Vol. 51, No. 1

New York Water Environment Association, Inc.

ClearWaters



Technology Upgrades and Trends

Also Inside:

- Highlights from the 93rd Annual Meeting
- "Protect Our Watershed" Poster Contest Winning Art

Spring 2021, Vol. 51, No. 1

Clear Waters

New York Water Environment Association, Inc.

Cover: Wastewater treatment technology is constantly evolving to be more energy efficient and cost effective. From recirculation solid contact clarifier sedimentation tanks to co-digestion of high-strength organic waste, from biogas production that saves on fuel costs to biosolids management, technology improvements benefit the water resource recovery facilities and the communities that they serve. *Photo courtesy of istockphoto.com, Avigator Photographer*

Clear Waters (USPS 004-595) (ISSN 01642030) is published quarterly with a directory every four years in the fall by the New York Water Environment Association, Inc., 525 Plum Street, Suite 102, Syracuse, NY 13204. Subscription is through membership; public subscription is $25.00/year. PERIODICALS postage paid at Syracuse, NY. POSTMASTER: Send address changes to the New York Water Environment Association, Inc., 525 Plum Street, Suite 102, Syracuse, NY 13204. Ph: 315-422-7811, Fax: 315-422-3851.

President's Message | Spring 2021

It is an honor and pleasure to be putting together my first president's message for *Clear Waters*. It's hard to believe that only a decade ago I was attending a Central Chapter event and water ambassador Tom Whetham asked me if I had any thoughts of serving as NYWEA president. I said of course, "maybe in 20 or 30 years." He quickly responded, "I think a little sooner than that." Turns out he was absolutely right!

I would be remiss if I did not celebrate and reflect on those that came before me, particularly Gail Wolfe (president 1994-1995) and Janice Jijina (president 2006-2007). Their involvement and dedication paved the way for my presidency and for that I am truly grateful. As several of us hopped on early for the Women's Networking Panel Discussion at the 93rd Annual Meeting, we asked Janice about her hopes and dreams for NYWEA. She said "My dream has already come true! All of you taking office! It took 15 years to get another female on the executive board and now we have three!" I also realized Janice's year as president coincided with the first year that I attended the annual meeting – no wonder I could so clearly see myself up on that podium!

Before I share with you the theme for my year as NYWEA president, I must commend all of you for pivoting on a dime to the new normal we are all still trying to navigate while keeping our sanity through this pandemic. Our NYWEA events are looking a little different these days, but we see light at the end of the tunnel and our NYWEA family is, and will continue to be, only a Zoom call away!

Reflect. Protect. Connect.

As we head into this year as an organization, I implore all of us to be more like water. What do I mean by that, you ask? Just think about it.

Water has the ability to **Reflect**.

Water has the ability to **Protect**.

Water has the ability to **Connect**.

- **Water in a lake on a calm day reflects the entire world around it through its surface.**

We can and should do the same thing – reflect on where we have been and where we are going. As we complete all the things that we must do, day-to-day and week-to-week, I ask you to do one more thing: don't forget your passion, how you got here and what keeps you in the water sector. We all have that story of what inspired us to devote our lives to public health and the environment. I dare you all to revive your passion and share it with your friends, your family, your acquaintances and your community. Make sure they love and appreciate water as much as you do! I also urge you to identify and thank your mentors (Bob Kukenberger, Mark Gorthey, Tim Taber and so many others, thank you!), and appreciate the good experiences and the challenges that made you who you are today.

- **Water can provide a safe habitat for the organisms living beneath its surface, but also has the power to change everything it touches, whether it be a rock on a riverbed or a flood-ravaged community after an intense storm.**

As an organization, we have the power to create change! We have the power to protect those around us and influence the water sector:

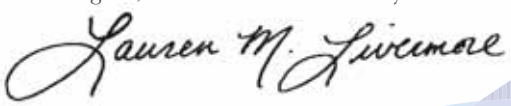
- To design and construct projects that protect public health and the environment.
- To uphold high standards in water quality today, and research and adapt to the water quality standards of tomorrow.
- To operate and maintain complex, essential water resource recovery facilities 24/7, 365 days a year.
- To encourage and mentor the next generation of environmental professionals and have them be a more accurate representation of the diverse populations we serve.

A diverse workforce of water professionals, visible and active within our communities, will only make the water sector stronger and better able to tackle the unique and ever-changing challenges we face.

- **Water is cohesive, it attracts other water molecules to realize its true power.**

A writer back in the 1920s, Ryunosuke Satoro, stated, "Individually, we are one drop. Together, we are an ocean." Similarly, as members of NYWEA, we are stronger together. I implore you: go to that virtual happy hour, attend that virtual conference, connect with NYWEA by getting involved on a committee or connecting with your local chapter. Make and keep those connections strong so we can form one cohesive unit, one bond, one water. Remember who we are striving to protect public health and the environment for - not just for us – not just for our kids, our grandchildren or nieces or nephews – but for seven generations into the future.

So again, be more like water this year: Reflect. Protect. Connect.



Lauren M. Livermore, P.E., BCEE
NYWEA President

For those of you who have seen the award-winning documentary film, "Brave Blue World," you know its powerful story. This insightful documentary film explores the technologies and innovations that have the potential to change the way we think about water at the local, national and global level. If you haven't seen the film, I encourage you to do so! It is a tremendous shot in the arm for the misunderstood and literally buried underground water infrastructure that we have been trying to bring to the public's attention. The film daylights the application of science for practical applications of water technology to help give everyone access to clean water and sanitation. See *page 34* for Paul O'Callaghan's article on his experience in creating this compelling film.

We hope you enjoy the other technologies featured in this issue of *Clear Waters*. In many cases (but not all), technology can help us improve efficiency and work smarter! Innovation and creativity are at the heart of the stories included in this issue.

COVID's Impact on NYWEA: Creation of a Future Conferences Planning Task Force

Since NYWEA's Annual Meetings at the Marriott Marquis in New York City were so successful, in 2016 a contract was executed to reserve the site for the annual meetings in 2021 through 2025. Unfortunately, due to the coronavirus pandemic, our 2021 annual meeting was canceled. To eliminate a significant cancellation fee, the contract with the Marriott Marquis was extended by two years, to 2027. The decision was also made to extend the contract for one more year, for a total of three years' extension, so that NYWEA's 100th Anniversary Annual Meeting can be held at the Marriott Marquis in 2028. Favorable terms were negotiated with the hotel for this extension.

During the board discussions, concerns were raised about the viability of future in person conferences that have a dual role of providing quality education to our members while delivering financial support to the organization. As a result, the board of directors created a Future Conferences Planning Task Force to look at our current contract with the Marriott and address the viability of other conferences whose finances could be adversely affected by the pandemic and its aftermath.

The goal of the Future Conferences Planning Task Force is to submit findings and recommendations concerning the viability of in person conferences *after* the 2028 annual meeting, including alternate formats that will be further developed going forward. The Task Force will be led by Lisa Derrigan, vice president-elect and Alex Bullers, the 2020 YP representative to the board.

It is likely there will always be a "virtual" component to NYWEA meetings, as the silver lining to this technology is that it brings educational sessions to those members who can't fit travel into their schedules.

Safety Column – Thank You, Eileen Reynolds!

Our heartfelt appreciation to Eileen Reynolds for writing insightful, useful and witty columns in *Clear Waters* for more than a decade. Eileen, your words have made us laugh, and made a difference. Most importantly, you have made us think about safety in a new light. May your light continue to shine on!

Patricia Cerro-Reehil, pcr@nywea.org

VIRTUAL SPRING TECHNICAL CONFERENCE & EXHIBITION

"Bringing Back Onondaga Lake"

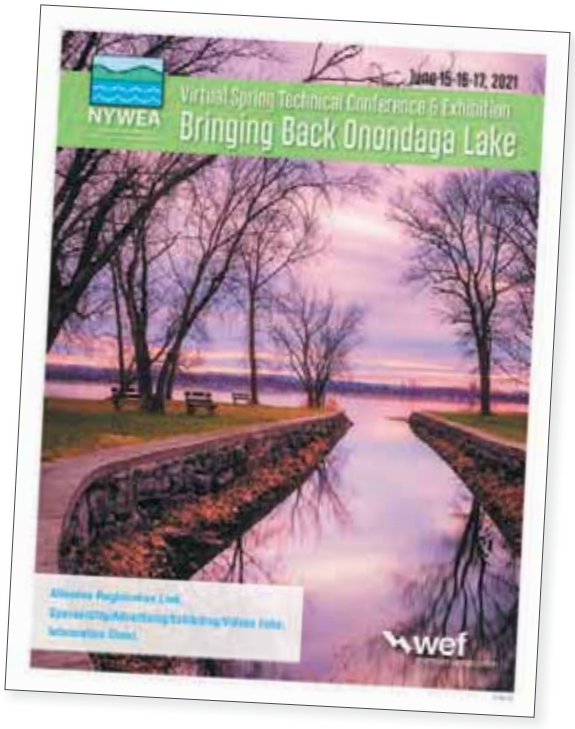
June 15-16-17 (Tuesday-Thursday)

Don't miss this opportunity to sharpen your skills and keep current on technological trends!

Ten sessions include:

- Session 1: Bringing Back Onondaga Lake – Part 1
- Session 2: Collection Systems and Distribution
- Session 3: Bringing Back Onondaga Lake – Part 2
- Session 4: Optimizing Water Resource Recovery Facilities through Innovation
- Session 5: Residuals & Biosolids
- Session 6: CSO/SSO/Wet Weather Issues
- Session 7: Resiliency
- Session 8: Energy Conservation and Generation
- Session 9: Water Reclamation
- Session 10: Manufacturer's Forum

Several panel discussions will also be featured including DE&I, Collection Systems, and Humanitarian Assistance. Visit **nywea.org** for more program specifics plus sponsor, exhibit, advertising and video information.



Highlights from NYWEA's Virtual 93rd Annual Meeting

Just under 900 people participated in NYWEA's Virtual 93rd Annual Meeting, "Bringing Water to Life", held during the two-week time-frame of February 9-11 and February 16-18, 2021. This unique conference was NYWEA's third foray into a virtual meeting format, brought about due to the continuing situation caused by the COVID-19 pandemic.

Featured here are the speakers and moderators who stepped forward to share their knowledge and help make the meeting a success. The program involved 112 speakers and 50 moderators in 24 technical sessions. Two Mobile Exhibitor sessions were also featured. Unique to this meeting was the interactive Remo platform, which allowed Exhibitors to connect in real-time with members. During the breaks Exhibitor videos were presented.

The Opening Session covered "COVID Tracing via Water Resource Recovery Facilities" with a panel discussion on the topic. Dr. Andrew Sanderson, Chief Medical Officer, WEF, queued up the conversation.

Many thanks to the speakers, moderators, advertisers, sponsors and exhibitors who helped support this meeting!

NYWEA 93rd Annual Meeting Opening Session. Top to bottom, left to right: Row 1: Dr. Andrew Sanderson (WEF); William Nylic, III, NYWEA President. Row 2: Dr. Dave Larsen, Syracuse University; Daniel Gerrity, Southern Nevada Water Authority; Darcy Sachs, Arcadis. Row 3: Anna Mehrotra, CDM Smith; Dimitrios Katehis, NYC Department of Environmental Protection.

Thank You to Our Sponsors and Exhibitors!

Our Sponsors

GEYSER LEVEL
AECOM
Arcadis
Barton & Loguidice
Brown and Caldwell
Cameron Engineering
Carollo Engineers
CDM Smith
Clear Flo Technologies, Inc.
D&B Engineers and Architects
EDR
GannettFleming
GP Jager Inc.
H2M architects + engineers
Hazen
HDR
HOBAS Pipe USA
Jacobs
Koester
MetroFab
Rapid Pump & Meter Service Co., Inc.
Stantec
Woodard & Curran

WATERFALL LEVEL
Denali Water Solutions

RIVER LEVEL
GA Fleet Associates
GHD
Invent
M&J Engineering P.C.
STV
Tetra Tech

LAKE LEVEL
Green Mountain Pipeline Services
MRB Group
Ramboll
Siewert Equipment
W.A.S.T.E. inc.

Our Exhibitors

ADS LLC
BDP Industries
Boerger, LLC
Carollo Engineers
Clear Flo Technologies, Inc./ Clean & Green Recycling Corp.
CUES, Inc.
DLVEWS, Inc.
D.W. Martine & Associates, LLC
Erdman Anthony
Flow Assessment Services
GA Fleet Associates
Green Mountain Pipeline Services
Hayward Gordon ULC
Newterra
Pumping Services, Inc. (PSI)
Purestream ES, LLC
Rapid Pump & Meter Service Co., Inc.
Reiner Pump Systems, Inc.
REXA, Inc.
RVA
Schnabel Engineering
SNF
Surpass Chemical
WesTech Engineering, Inc.
World Water Works

thank you

David Field
DPW Director, Easton, MA
Session 1

Tyler Elkins
Xylem Inc.
Session 1

Christopher Curran
AECOM
Session 2

Dorin Bogdan
AECOM
Session 2

Janine Burke-Wells
NEBRA
Session 2

Lily Lee
NYC DEP
Session 3

Zach Henderson
Woodard & Curran
Session 3

Adam Woodburn
Onondaga County WEP
Session 4

Taylor Brown
Buffalo Sewer Authority
Session 7

Richard Loeffler IV
Xylem Inc.
Session 7

Bill Barber
Cambi Inc.
Session 9

Irina Dopson
NYC DEP
Session 10

Eleanor Allen
Water For People
Session 12

Peter Van Arsdale
Rotary
Session 12

Eric Lehan
Engineers Without Borders
Session 12

Joel Kaatz
Arcadis
Session 13

William Pfrang
AECOM
Session 14

David Railsback
Schnabel Engineering
Session 16

Nikki Ong
Manhattan College
Session 18

Steven Hearl
H2M architects & engineers
Session 21

continued on page 8

Yong Kim
UGSI Solutions, Inc.
Session 21

Natalie Sierra
Brown and Caldwell
Session 21

Paula Dorn
Aqua-Aerobic Systems
Session 23

Jennifer McDonnell
NYC DEP
Session 23

Sarah Lobe
Nixon Peabody
Session 24

thank you

KUDOS

to some of the 93rd Annual Meeting Awardees!

(Visit nywea.org for more Awardees.)

State Senator
Andrea Stewart-Cousins
Nelson A. Rockefeller Award
(Elected Official)

Mayor Brian J. Schenk
Village of Naples, NY
Frank E. Van Lare Award
(Elected Official)

George Desmarais
2021 Hall of Fame
Inductee

Roy Zimmerman
2021 Hall of Fame
Inductee

Richard R. Roll
Milton T. Hill Award,
Wastewater Facility Operations

Mary Herington
Young Professionals
Service Award

Nellie Brown
Ernest R. Carroll
Safety Award

Oluwole A. (O.J.) McFoy
Emmeline Moore Award
(Enviromental Science
and Management)

Jeanette Brown
WEF Arthur Sidney Bedell
Award (Extraordinary
Personal Service)

Water Views | Spring 2021

Technology for Water Quality

Technological innovation has always been central to the protection of our waters. In fact, the Clean Water Act includes a legal requirement to install the systems necessary to attain technology-based effluent limitations on pollution. NYSDEC works with partners to improve treatment technologies that address the ever-evolving water quality issues we face.

To address harmful algal blooms (HABs), NYSDEC is working with partners on new or updated technologies to keep the public informed, to identify the root causes and to abate HABs:

- The New York Harmful Algal Bloom System (NYHABS *https://www.dec.ny.gov/chemical/83310.html*) is a web-based interactive map of HABs occurrences throughout the state, updated daily from May through October. NYHABS provides timely information for the public, local governments, health departments and recreationists. HABs reports are summarized annually and are available on Open Data NY *(https://www.data.ny.gov/)*.
- NYSDEC, in partnership with the United States Geological Survey, is pilot-testing advanced monitoring systems to improve our understanding of the causes of HABs. This past year, smart buoys were deployed on Skaneateles, Seneca, and Owasco lakes that send data directly to NYSDEC scientists for evaluation. All data is made public on the web.
- NYSDEC is field-evaluating HABs mitigation technologies, such as nutrient inactivants, ultrasonic devices and algae harvesters, to assess effectiveness in controlling bloom formation or persistence. With our partners, we are also deploying technologies that may be effective HABs rapid responses. In 2020, pilot projects to attack HABs were conducted on Chautauqua Lake and Lake Neatahwanta. More study is needed, but some of these technologies look promising.

Another area for technological innovation is on Long Island, where nitrogen entering groundwater from poorly performing septic systems has a significant impact on surface water quality. Under the Long Island Nitrogen Action Plan, these two initiatives are underway:

- SUNY Stony Brook is piloting vastly improved nitrogen-removing septic systems and developing three variations of nitrogen-removing biofilters (NRBs) that are adaptable to site constraints, depth to groundwater, and degree of desired nitrogen removal. To date, 16 NRBs have been installed in Suffolk County.
- Suffolk County's Septic Improvement Program provides grants and loans to homeowners to replace septic systems or cesspools with tested and approved Innovative/Alternative On-site Wastewater Treatment Systems, developed by the private sector, to significantly reduce nitrogen discharges.

NYSDEC recognizes that accessible information is central to effective water quality management. In 2019, NYSDEC launched the DECinfo Locator *(https://www.dec.ny.gov/pubs/109457.html)*, an interactive map that allows public access to NYSDEC documents and data about the environmental quality of sites throughout New York. More than 65 data layers are available including: wastewater facilities, annual water withdrawal reports, waterbody inventory fact sheets, and boat launches.

NYSDEC applauds the innovators!

– James Tierney, Deputy Commissioner for Water Resources
NYS Department of Environmental Conservation

Focus on Safety | Spring 2021

Swan Song

After many years writing this column, I have decided to put up the pen. It is a bittersweet moment. However, I have one last opportunity to reach out to you.

I did not start my adult working life as a safety professional. I lost my job as a food cannery field rep due to downsizing. With a degree in agriculture and a teaching credential in my pocket, I looked for a new job. I wound up at an environmental firm that offered training in environmentally related topics. A student from the local utility was looking for someone to help start a safety program, offered me the job and I jumped. Did I want to be a safety professional before this job? No, I needed a job, and I could do the work. My new employer had enough faith in me to send me to safety training, help me become certified, then let me run to get the experience I needed. It worked out pretty well. Life is a series of choices; sometimes you land far away from your intended career target.

Many of you are not safety professionals. But some of you could be and don't yet know it. You have an interest in safety, either for the engineering aspects, the people aspects, or, frankly, because you need a job and have the aptitude for it. No harm in that, says the cannery field rep who became the "safety lady!"

If you have this interest, I encourage you to pursue this career, whether you are in the rank-and-file or part of management. Step up. Make your interest known to the people in your organization. Does your company have a safety committee? Volunteer for it. There is no safety committee? Help create it. If your company has a safety department, start the conversation about your future. Can you take classes online to get a good safety foundation? Buckle up and start studying. Do you complain about lack of safety in your workplace? Stop whining and do something constructive about it. Are you a go-to person who will do the right thing even when it isn't popular? Do you pick up stray pieces of wood, so no one trips? Do you remind people (constantly) to wear their safety glasses? Can you make tough decisions? Then do I have a career for you!

Even in a good career, sometimes you need something more. I took a leap when I button-holed Patricia Cerro-Reehil on a train during a field trip. Either through astonishment or foresight, she thought my wacky idea about bringing safety into a technical journal had some merit. She suggested a regular column and the rest, as they say, was history. I appreciate that faith every time I struggle to pound out a column.

Take the leap. And take care.

– Eileen M. Reynolds, Certified Safety Professional
Owner, Coracle Safety Management

Aerial photograph of Woodland Reservoir and surrounding area. *Syracuse Water Department*

Ultrasonic Units and Diffused Aeration Replace Decades of Applying Copper Sulfate in an Open Drinking Water Reservoir

by Rich Abbott *(Published previously in the Winter 2020 issue of* Lakeline *[NALMS])*

A combined ultrasonic algal control and diffused aeration systems added to Woodland Reservoir has eliminated the need to add algaecide (copper sulfate) for algal control and has paid for itself in two years while improving the quality of the water for a capital investment of $26,056.

Records dating back to 1975 documented that copper sulfate pentahydrate (CuSO4·5H2O) was applied for 44 consecutive years to Woodland Reservoir to control algal growth. As diffused aeration systems and advanced ultrasonic units were positioned in the reservoir, daily algal cell counts decreased to levels where treatment was not necessary in 2019 and 2020. Cell counts of consistently dominant cyanobacteria (blue-green algae) – *Chroococcus* Type I, *Cyanobium* and *Polycystis* – decreased by 96%, 94% and 77%, respectively, from 2014 to 2020. For residents dependent on the reservoir as their primary drinking water source, the $26,056 capital investment in diffused aeration systems and advanced ultrasonic units has resulted in a major improvement to water quality during the summer and fall months. At an average annual material cost for copper sulfate of $16,110 (2004-2015) the payback period for the City of Syracuse was less than two years.

Background

Woodland Reservoir is a 126-million-gallon (460,000-cubic-meter) constructed reservoir that serves as a drinking water supply for the City of Syracuse, New York, population 142,327 *(US Census 2019)*. The reservoir's water surface area is approximately 14 acres with a maximum depth of 35 feet. The reservoir bottom is lined with concrete and the side walls are faced with rubble masonry laid in cement. Completed in 1894, it is at the receiving end of 19 miles (30 kilometers) of conduits conveying water from Skaneateles Lake, which is an unfiltered water supply located in New York's Finger Lakes Region.

To control algal populations, two approaches have been used:

- Reservoir manipulation.
- Application of algaecide.

Reservoir manipulation is conducted during the summer and early fall months; these manipulations include increasing flow to maximize turnover rate and drawing down the reservoir to expose periphytic growth on the reservoir walls. Adjustments within the water distribution system allow for reductions in flow to covered water storage tanks and the diversion of a higher volume of Syracuse's daily water demand into the reservoir. Maximum daily discharges recorded at the reservoir for July through September typically average 24 to 27 million gallons per day (MGD) allowing for a residence time of approximately five to six days. Average discharges for spring and winter months range between 13 and 16 MGD.

Algaecide has been applied regularly to the reservoir from May through October to suppress algal growth. As water temperatures increase, algal cell counts, periphytic growth on reservoir walls, turbidity, water color and clarity are all carefully monitored. Conditions that warrant algaecide treatment include exceedance of established algal threshold levels or indications of deteriorating water quality based on visual inspection of the reservoir.

The method of algaecide application is dependent on whether the growth is planktonic or periphytic. For attached growth on reservoir walls, the treatment method consists of city employees dispensing medium crystal copper sulfate from 50-pound burlap bags into the reservoir, either by dragging the bags around the perimeter of the reservoir or towing the bags along the entire reservoir surface by boat.

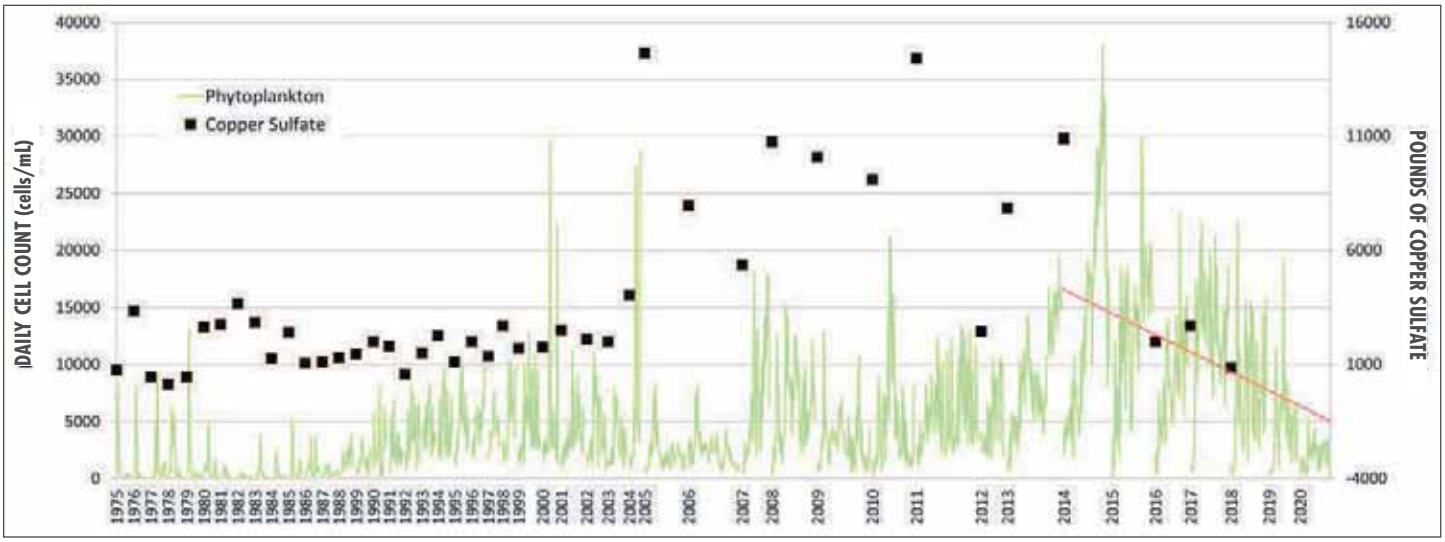


Figure 1. Daily algal cell count totals and annual pounds of copper sulfate, 1975 through 2020. *Rich Abbott*

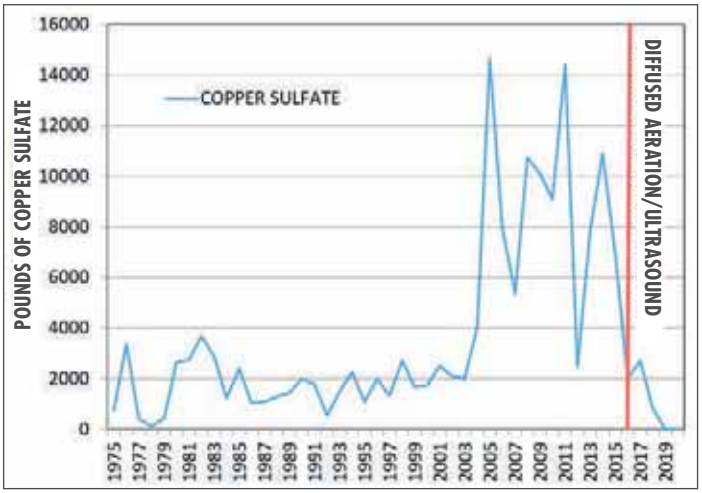


Figure 2. Copper sulfate annual applications. *Rich Abbott*

Copper Sulfate Treatments over Time

From 1975 through 2018, at least one copper sulfate treatment was recorded each year. A total of 266 treatments were recorded during this 43-year period, averaging six per year. The annual volume of copper sulfate applied ranged from 125 pounds (1978) to 14,650 pounds (2005). ***Figure 1*** illustrates cell counts and corresponding annual copper sulfate treatments dating back to 1975. From 2004 through 2015, the reservoir was treated with copper sulfate on 112 occasions, averaging 8,708 pounds per year. Annual copper sulfate treatments exceeded 4,000 pounds throughout this time frame except for 2012, when the reservoir was drained for the season July 19, 2012, as part of an infrastructure project.

Figure 2 illustrates the dramatic increase in total pounds of copper sulfate applied annually beginning in 2004 because of elevated cell counts of cyanobacteria and their apparent resistance to established treatment amounts. Average annual copper sulfate treatments increased from 1,755 pounds (1975 through 2003) to 8,708 pounds (2004 through 2015). ***Figure 2*** also illustrates the significant decrease in total pounds of copper sulfate applied annually following the initiation of diffused aeration and advanced ultrasonic units in 2016.

Treatment effectiveness has varied considerably depending on environmental conditions, algal species targeted, cell counts and how uniformly the product was dispersed. Of the 78 treatments recorded from 2007 through 2018, 22% resulted in an actual increase in targeted species cell counts (two to four days following pre-treatment counts). Of the 17 targeted treatments for *Chroococcus* Type I during this time frame, post-treatment cell counts exceeded pre-treatment counts 35% of the time within two to four days of treatment.

Unmanageable Algal Cell Counts

In August 2004, *Chroococcus* Type II (Cyanobacteria, family; Chroococcaceae) cell counts increased from 3,000 cells per milliliter of water (cells/mL) to more than 28,000 cells/mL within a six-day period despite several copper sulfate treatments. The reservoir was taken offline and follow-up treatments of copper sulfate and a liquid, chelated copper formulation were not effective in improving water quality. The reservoir was ultimately drawn down and not put back into service until colder water temperatures resulted in a significantly reduced cell count.

Elevated *Chroococcus* Type II cell counts continued to be problematic in 2005 and 2006 accounting for 43% and 26% of the annual cell counts, respectively. Copper sulfate was applied to the reservoir on 15 occasions in 2005 totaling 14,650 pounds, which is the highest annual amount on record. In early August 2006, 1,500 gallons of an acidified, copper-based algaecide was applied to the reservoir over a two-day period as an alternative to copper sulfate. As *Chroococcus* Type II cell counts increased rapidly in late August, exceeding 3,200 cells/mL, the reservoir was treated with three copper sulfate applications totaling 5,200 pounds within a seven-day period.

A New Approach – Ultrasonics

A new strategy employing ultrasonic algal control devices was employed in 2007 in an effort to suppress *Chroococcus* Type II growth. The devices work by emitting soundwaves from a transducer head positioned just under the water surface, converting electrical energy into sound (mechanical) energy with the sound projected into the water body. Soundwaves at the same frequency of algal cell structures reach Critical Structural Resonance (CSR) causing internal wall damage or ruptured gas vesicles depending on the type of algae.

The internal wall damage compromises cell pressure and inter-

continued on page 12

continued from page 11

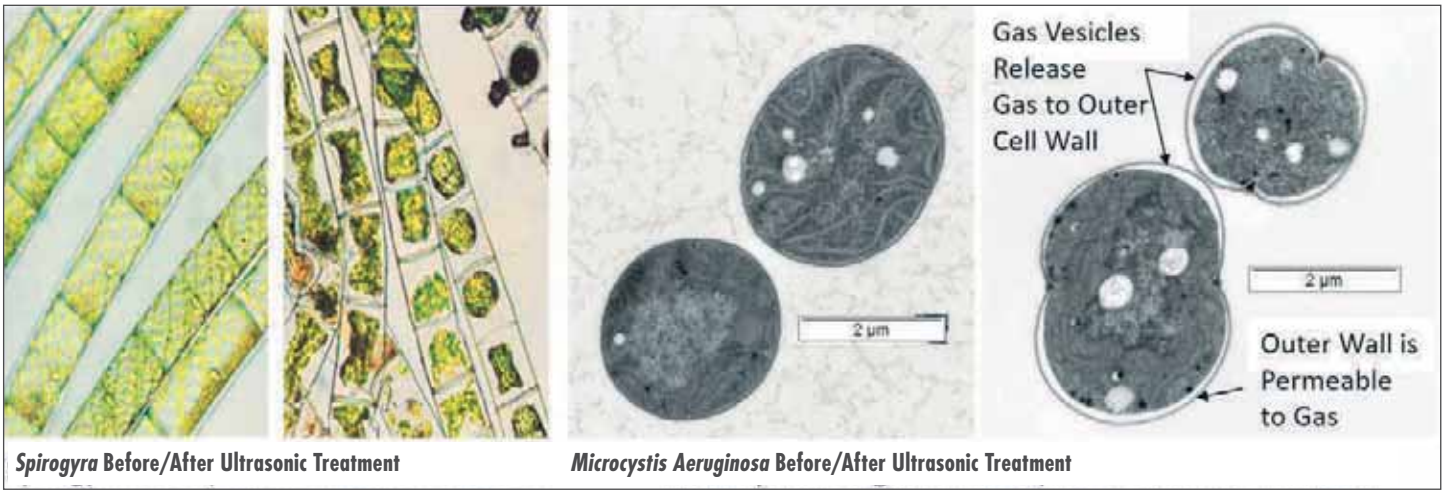


Figure 3. ***Spirogyra*** **(left) and** ***Microcystis aeruginosa*** **(right) before and after ultrasonic treatment. Scanning electron microscopy of** ***Microcystis aeruginosa*** **was prepared by Dr. Paul Zimba of Texas A&M University, Corpus Christi.** *SonicSolutions Algae Control, LLC*

nal fluid flow in green algae and most diatoms (Bacillariophyceae). When the inner cell wall (plasmalemma) is torn, internally pumped fluid flow and internal pressure is disturbed causing collapse of the inner cell wall and loss of nutrient transfer. It also compromises the cell's defense mechanism ultimately allowing bacteria to invade and begin digesting the algae. The damaged algal cells begin to float after about three weeks due to collection of digestion gases caused by internal bacterial attack.

The Research

The Centre for Aquatic Plant Management demonstrated with light microscopy how ultrasonic waves result in separation of plasmalemma from cell walls of green algae *Spirogyra* and *Selenastrum* under controlled conditions. Ultrasound exposure times for *Spirogyra* and *Selenastrum* were three weeks and eight weeks, respectively. The investigation summarized that ultrasound exposure caused irreversible structural damage to the cells, loss of chlorophyll and loss of viability *(CAPM 2004)*. The ultrasonic effect on algae is illustrated in ***Figure 3***.

Spirogyra, a green filamentous type of algae, is damaged by the inner cell wall or plasmalemma being torn from the contractile vacuole pumping mechanism such that it collapses inside the stronger outer cell wall. *Microcystis aeruginosa,* a cyanobacteria, loses buoyancy when the extremely small gas vesicles are internally broken and the gas that they hold is slowly diffused through the unbroken outer cell wall over a period of three to four days. Gas vacuoles are made up of stacks of cylindrical gas vesicles which are closed by conical ends *(Bowen and Jensen, 1965; Walsby, 1994)*. Lee et al. (2001) investigated the concept of using ultrasonic radiation to damage gas vacuoles of algal cells, causing them to sink within the water column and reducing their access to sunlight. Transmission electron microscopy of the cells showed that the gas vacuoles were intact before sonication and collapsed after sonication *(Lee et al., 2001)*. As water depth increases, ultrasonic technology becomes more effective in controlling cyanobacteria. Both types of damage indicated above occur due to CSR that can occur when the natural resonance frequencies match the ultrasonic frequencies being emitted by the device.

Deployment in the Reservoir

Five ultrasonic units of type model SS600 manufactured by SonicSolutions Algae Control, LLC, were installed around the reservoir perimeter. The original SS600 sonic heads each created 18 frequencies with an average difference between frequencies of 1.3% or 580 hertz (Hz) and a range of about 9.4 kilohertz (kHz), centered on 42.2 kHz. The estimated maximum green algae (Chlorophyta) control range for this device was 850 feet, covering up to 6.5 acres. In 2009, the SS600 model frequency set was increased to 79 frequencies, the range was about 40 kHz and was centered on 44 kHz with the difference between frequencies at 1.4% or about 525 Hz on average. This was the first attempt at increasing the frequency density to increase the odds of hitting CSR frequencies of more species.

Although the model SS600 units initially appeared to be effective in controlling *Chroococcus* Type II cell counts, a new form of cyanobacteria, identified as *Cyanobium,* became dominant in the reservoir in the summer and fall of 2007. The model SS600 units and copper sulfate treatments were not effective in controlling *Cyanobium* growth. Monthly cell counts for the summer/fall 2007 season averaged 6,210 cells/mL (July), 6,306 cells/mL (August) and 11,997 cells/mL (September). Post examination of these units by AlgaeControl.US, a distributor of the SonicSolutions products, indicated that the piezos (high frequency sound emitters) had cracked, causing the sound output to be substantially diminished.

From 2007 through 2015, 77 copper sulfate treatments were applied, totaling 77,850 pounds. *Cyanobium* was consistently the dominant form throughout this period, ranging from 34.1% to 76.4% of annual cell counts. Elevated cell counts persisted throughout summer and fall seasons, with maximum cell counts for individual months totaling 14,240 cells/mL (July 26, 2008), 17,074 cells/mL (Aug. 11, 2010) and 18,223 cells/mL (Sept. 15, 2014).

Transforming Algal Control

From 2016 through 2020, a different approach in algal control was implemented using a combination of diffused aeration and improved ultrasonics.

Diffused Aeration

In 2016 two Robust-Aire Diffused Aeration systems (RA3XL model) were installed in the reservoir. Robust-Aire systems pump compressed air from a shore-mounted compressor through self-weighted tubing to diffuser stations on the reservoir bottom. The diffusers continuously release microbubbles that are typically two millimeters in diameter and rise at 1 foot per second through

continued on page 14

continued from page 12

Figure 4. Orthoimagery of Woodland Reservoir showing algal control stations. *Rich Abbott*

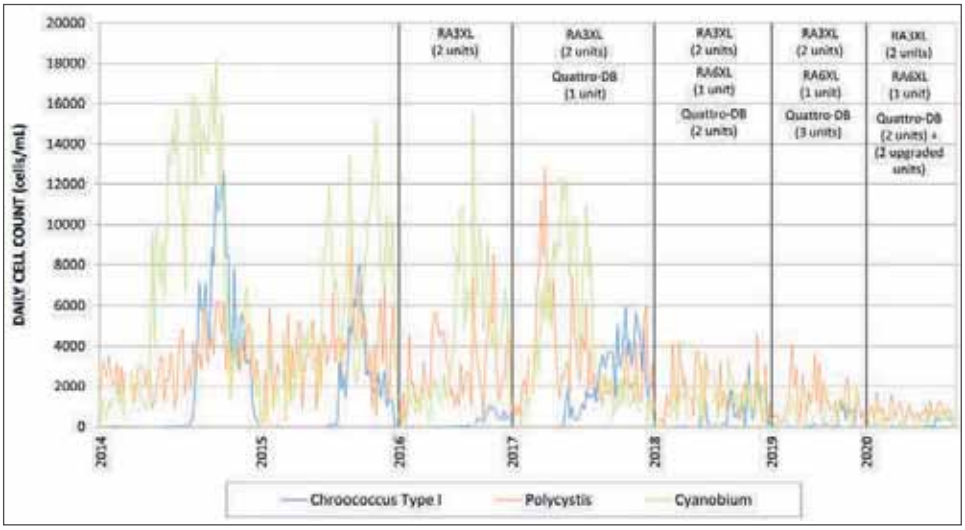


Figure 5. Dominant cyanobacterial algal forms, 2014 through 2020. *Rich Abbott*

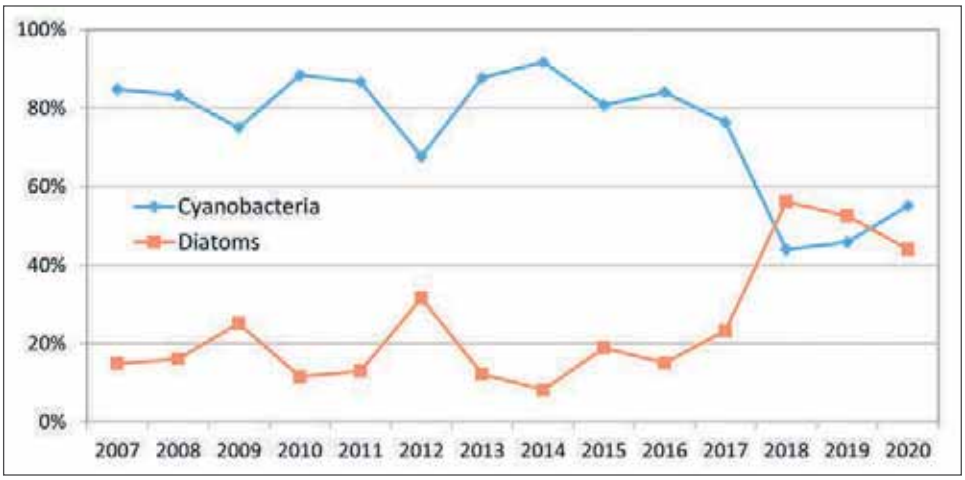


Figure 6. Percent of algal total cell count. *Rich Abbott*

the water column to the surface. As the bubbles rise, they push and drag large volumes of water from the reservoir bottom to the surface allowing for beneficial water movement and mixing. Exchanging gases with the atmosphere induces oxygen transfer and allows gases such as carbon dioxide to be expelled. Continued mixing of the reservoir allows for uniform chemical and physical properties including temperature and pH. Since cyanobacteria require extended photoperiods and warmer water, continuously mixing the reservoir disrupts cyanobacteria's ability to dominate the upper water column. Cyanobacteria cells traveling up and down through the water column encounter a mixture of dark and light environments and cooler water conditions, both of which discourage their ability to proliferate in the reservoir.

The two RA3XL diffusers were positioned at depths of 25 to 35 feet, each displacing approximately 16.7 MGD, totaling approximately 100 MGD. Due to the reservoir's kidney shape and location of the inlet and outlet, flow studies, water quality observations and cell counts indicated that stagnant zones form within the reservoir. Since the inlet is located along the southeast perimeter and the outlet's location is at the north end, influent water short-circuits along the east side of the reservoir. To enhance mixing, the RA3XL models were placed along the northwest and south sections of the reservoir ***(Figure 4)***. An additional unit (RA6XL model) was installed in 2018 in the north basin of the reservoir.

Ultrasonic Boost

In July 2017, a Hydro BioScience Quattro-DB ultrasonic algal control unit was installed in the reservoir's north basin. The unit generates over 1,582 different frequencies in two separate bandwidths:

- The lower bandwidth has a range of 34 kHz centered on 41 kHz with an average difference between frequencies of 0.053% or 22 Hz. There are 1,565 unique frequencies in this lower bandwidth.
- The upper bandwidth has a range of 10 kHz centered on 200 kHz with an average difference between frequencies of 0.31% or 625 Hz. The upper bandwidth was installed to target cyanobacteria like *Microcystis*. It produces 17 frequencies that are repeated 27

times each per 34-minute cycle for 459 generated frequencies.

In all, there are 2,024 frequencies generated at one per second for 34 minutes. The high number of frequencies assures that CSR can occur within the operating frequency ranges. A 0.6 second pause is included between each pulse, added to improve biofilm control in water treatment facilities. The Quattro-DB has the same coverage area as about three of the SS600 units due to having the sound emit from four emission points. All the SS600 and Quattro-DB units were purchased to be used with 120-volt AC power.

The coverage area for this device includes up to 17 acres for green algae and diatoms (radial range of 150 meters) and up to 120 acres for cyanobacteria (radial range of 400 meters). Another Quattro-DB unit was installed in 2018 within the south basin, and in 2019 an additional Quattro-DB was installed in the north basin.

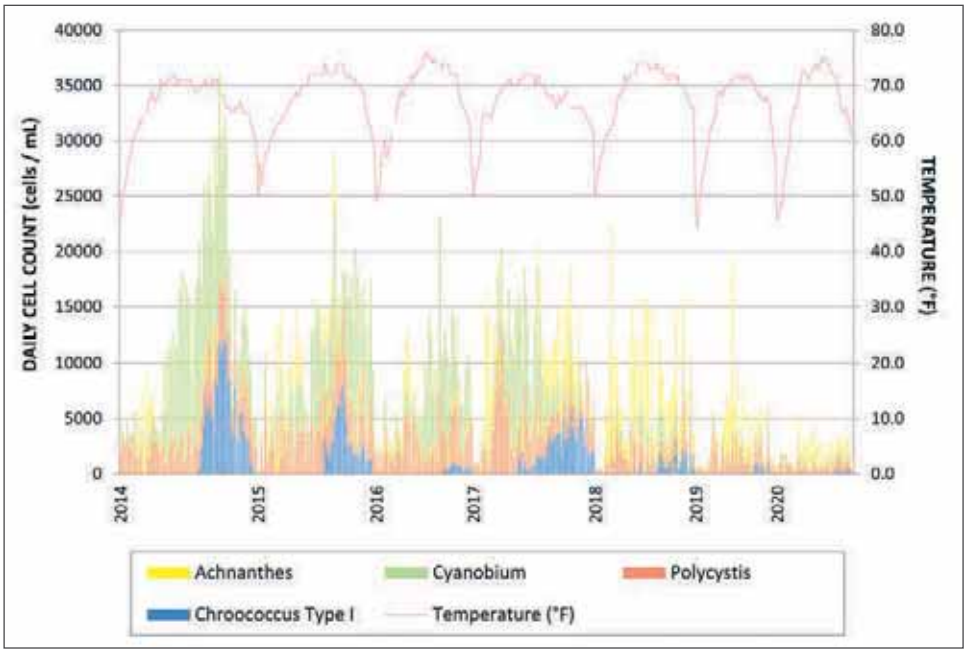


Figure 7. Dominant algae, 2014 through 2020. *Rich Abbott*

Results

Installation of Robust-Aire Diffused Aeration systems and Quattro-DB units from 2016 through 2020 resulted in an exponential decline in algal cell counts. Before the initial Robust-Aire Diffused Aeration system installations in 2016, maximum cell counts exceeded 30,000 cells/mL in 2014 and 2015. The highest cell count recorded in 2020 was 5,261 cells/mL. Average cell counts totaled 13,752 cells/mL (2014) and 13,008 cells/mL (2015), compared to 2019 and 2020 counts of 4,330 cells/mL and 2,127 cells/mL, respectively.

The impact of expanding and upgrading devices has been most pronounced in the reduction of dominant forms of cyanobacteria. ***Figure 5*** illustrates the steep decline in cell counts of *Chroococcus* Type I, *Cyanobium* and *Polycystis,* corresponding to additional Robust-Aire Diffused Aeration systems and Quattro-DB units. *Chroococcus* Type I, *Cyanobium* and *Polycystis* have decreased by 96%, 94% and 77%, respectively, from 2014 to 2020.

Figure 6 illustrates a significant shift in algal dominance beginning in 2018. Cyanobacteria accounted for 82% of the annual average cell count from 2007 through 2017, whereas diatoms accounted for just 17%. From 2018 through 2020, annual average cell counts of cyanobacteria remained suppressed, accounting for only 48% of cell counts. Diatoms exceeded cyanobacteria as the dominant phylum during this period, accounting for 51% of the annual average cell count.

The steep decline in *Cyanobium* cell counts from 2014 to 2020 and transition from *Cyanobium* dominance to *Achnanthes* dominance in 2018 is apparent in ***Figure 7***. *Cyanobium* average cell counts declined from 7,175 cells/mL to 397 cells/mL. For the same period, *Chroococcus* Type I average cell counts declined from 2,440 cells/mL to 136 cells/mL. Note the elevated cell counts of *Cyanobium* and *Chroococcus* Type I in 2014, despite seven copper sulfate applications totaling 9,650 pounds targeting the two cyanobacteria.

Time and Material Savings

At a contract price of $92.50 per 50-pound bag of medium crystal copper sulfate, the material cost from 2004 to 2015 averaged $16,110 per year, with a total cost of $193,325. Staffing and miscellaneous costs, although difficult to quantify, were a significant seasonal expense, involving a three- to four-person crew necessary to transport, bag and apply the product. Applying copper sulfate in ideal conditions (i.e., full sunlight and a dedicated crew available during the peak vacation season) frequently posed operational challenges. Continuous monitoring of the reservoir's water quality through visual observations, cell counts and physical parameters (temperature and turbidity) accounted for numerous hours, especially in the late summer and fall months.

To reach the goal of eliminating copper sulfate treatments in the reservoir, Syracuse invested $26,056 in diffused aeration units and advanced ultrasound algal control devices from 2016 through 2019. The average annual algal control material cost throughout the four-year transition phase was $9,081, divided as follows:

- Diffused aeration and ultrasound units: $6,514.
- Copper sulfate: $2,567.

Employing additional and improved units and devices within the reservoir has allowed for consistently exceptional water quality, suppressed daily cyanobacteria cell counts and consecutive years (2019 and 2020) of no copper sulfate applications following 44 years of treatment. As a result of lower cell counts and improved water quality, algal monitoring and cell counting have been gradually reduced from 67 days in 2014 to 44 days in 2020.

Seasonal operation and maintenance of the Quattro-DB 120-volt AC powered ultrasonic algal control units involves approximately a half-day of installation in the spring, monitoring and removal of biofilm and mineral deposits on the transducers in the summer/fall and a half-day removing and cleaning units in the fall. Basic maintenance of the Robust-Aire Diffused Aeration systems consists of cleaning or replacing air filters and cleaning the compressor cabinets. Following two or three seasons of operation or if reduced air flow or preferential air flow is observed between diffusers, additional maintenance includes replacing compressor

continued on page 17

SOLID SOLUTIONS!

Reducing Plant Maintenance with Grinding & Screening Technology

Franklin Miller's broad line of grinders and screens makes your system free-flow and cuts maintenance costs. These units are built tough for the tough jobs! Our grinders reduce plugging and maintenance problems due to sanitary wipes, providing major savings in time, money and aggravation. Our commitment to customer satisfaction is forged with over three generations of family ownership.

SCREENMASTER®
Bar Screens

SPIRALIFT® SC
Screenings Wash System

SPIRALIFT® SL
Screen System

TASKMASTER®
TM851208
Inlilne Grinder

TASKMASTER® TITAN
Innovative High Flow Grinders

DIMMINUTOR®
Low Maintenance
Comminutor

SPIRALFT® SR SEPTAGE
RECEIVING STATION
with a TASKMASTER® TT

Represented by:

SIEWERT EQUIPMENT
175 Akron Street | Rochester, NY 14609 | 800-333-0598 • 585-482-4149 | www.SiewertEquipment.com

PSI PROCESS
201 Lincoln Blvd. | Middlesex, NJ 08846 | (732) 469-4540 | www.psiprocess.com

Franklin Miller®
SEE THE DIFFERENCE

Visit our website to view our full line of grinders, screens, septage receiving and washing systems.

www.franklinmiller.com

Call Toll Free! **1-800-932-0599 • 973-535-9200**

continued from page 15

piston cups. Head compressor rebuild kits supplied by the manufacturer are serviced in the field. The kits include cups, cylinder, gaskets/O-rings and valves.

Acknowledgment

The author would like to thank Kaylyn Dion, Environmental Engineering, Syracuse University 2020 for her valuable contributions to this article. Special thanks to technical contributors/reviewers George Hutchinson and Kenneth Rust and technical reviewers Dan Robbino and Mike Cole.

Rich Abbott is the City of Syracuse Watershed Quality Coordinator for the Skaneateles Lake Watershed Protection Programs and can be contacted at rabbott@syrgov.net.

References

Bowen, C.C. and T.E. Jensen. 1965. "Blue-green algae: fine structure of the gas vacuoles." Science, 147(3664): 1460–1462. https://doi.org/10.1126/science.147.3664.1460.

CAPM. 2004. *Centre for Aquatic Plant Management Annual Report 2003.* Sonning-on-Thames, Berkshire, England, UK.

Lee, T.J., K. Nakano, and M. Matsumara. 2001. "Ultrasonic irradiation for blue-green algae bloom control." *Environ Technol.* 22(4): 383–390. https://doi.org/10.1080/09593332208618270.

U.S. Census. 2019. *Quick Facts: Syracuse, New York, Population Estimates July 1, 2019.* https://www.census.gov/quickfacts/fact/table/syracusecitynewyork#.

Walsby, A.E. 1994. "Gas vesicles." *Microbiological Reviews,* 58:94-144.

Utilizing Sludge Dryers to Solve Biosolids Management Concerns

by Danielle Hurley, Philip Grayson and Timothy O'Brien

In a 2015 survey of publicly owned treatment works, conducted by the New York State Department of Environmental Conservation (NYSDEC), it was estimated that 68% of the biosolids annually produced in the state were disposed of in landfills due to low tipping fees and the limited infrastructure and biosolids treatment required to landfill *(NYSDEC 2018)*. The remaining biosolids were incinerated (16%), beneficially reused (16%), or disposed of by other methods (<1%) *(NYSDEC 2018)*. Uncertainty surrounding future landfill acceptance of biosolids, increasing transportation and disposal fees, and the need to upgrade aging equipment have led some municipalities to rethink their disposal strategies.

In evaluating future biosolids management, the City of Auburn, Onondaga County, and the Village of Endicott separately decided on similar solutions – upgrading their facilities to include biosolids drying technology. All three municipalities are in the initial stages of upgrading their facilities. The City of Auburn is in the pre-design phase, Onondaga County is in the design phase, and the Village of Endicott's sludge-drying facility is under construction. This article will focus on the decision-making processes that led to the conclusion that sludge drying was the best path forward for biosolids management in these facilities.

City of Auburn – Pre-Design Phase

The City of Auburn's road to considering sludge drying as an option began in July 2009. Historically, the city incinerated 177 wet tons per week of its own treatment plant's undigested sludge and dewatered sludge from other municipalities. The original incinerator was replaced in 1996 with a six-hearth unit, which fired on a combination of Auburn's landfill methane and natural gas. In 2009, a partial collapse of the floor of Hearth #2 created an abrupt shutdown of the incinerator and initiated a scramble to secure an alternate disposal option. Luckily, Auburn was able to secure immediate authorization for landfill disposal at 147 wet tons per week to an outside landfill and trucking from a third party. The city now combines primary and waste-activated sludge in a gravity thickener and utilizes a belt press to dewater to approximately 21% solids for direct loading to an end dump trailer.

With increasingly more stringent air quality regulations, high operational cost and $1.2 million required for refurbishing the incinerator, it became obvious that restoration of incineration was not an option when weighed against the relatively low cost of landfill disposal. In 2012, Auburn reduced landfill disposal costs by obtaining NYSDEC approval to dispose of a maximum of 10 tons per weekday (Monday through Friday) in the city's landfill, which was recalculated in 2013 to 70 tons per week with no daily maximum, resulting in further disposal cost savings.

The city's decision to pursue alternate sludge handling and disposal was threefold:

- Lack of available landfill options.
- Uncertain future of landfill acceptance of unstabilized sludge.
- Lack of solids processing capacity.

Lack of available landfill options. In 2018, while searching for landfills that could accept Auburn's sludge, it was discovered that no municipal landfills would accept unstabilized sludge generated outside of their county, which left only two large private companies as disposal options. Only one proposal was submitted in response to the city's issued RFP for sludge disposal resulting in a 42% increase in disposal costs per wet ton. In addition, the city's landfill was slated for closure in June 2020, which would eliminate 70 tons a week of "free" disposal. This has already substantially increased tipping fees with total annual disposal costs around $625,000 per year.

Uncertain future of landfill acceptance of unstabilized sludge. The U.S. Environmental Protection Agency and NYSDEC's intentions were unclear as to approved disposal methods for unstabilized sludge in the future. This has also raised concerns: is there a possibility that landfill disposal of unstabilized sludge will no longer be allowed and how much advance notice of this would be afforded?

Lack of solids processing capacity. With the ability to only load and dispose of one trailer a day, five days per week, the plant has reached its maximum removal capacity of 150 tons per week. With sludge volume anticipated to increase to 160 tons per week during the warmer months and increased industrial activity, a sixth day may need to be added. This would mean an increased expense of adding personnel to operate the dewatering process one additional day per week.

To address these concerns, Auburn hired an engineering firm in late 2019 to study the benefits of other sludge handling and disposal options. Using conservative inflation rates, it was estimated that by 2040, landfill disposal of unstabilized sludge would cost the city a minimum of $1.6 million per year. The study evaluated lime stabilization, aerobic digestion, anaerobic digestion and sludge drying. It was determined that installing a dryer in a new building along with solids equalization and anaerobic digesters to process primary and waste-activated sludge would provide the greatest operational, social and environmental benefit. The solids reduction from digestion will reduce the number of days needed to process sludge. With the addition of the dryer and a storage barn with six-month capacity it will no longer be necessary to ship a trailer load out five or six days per week. Over a 20-year life cycle, it is projected that digestion and sludge drying could yield up to a $15 million savings over Auburn's current disposal method. In addition, the installation of digesters offers the following benefits:

City of Auburn Water Pollution Control Plant. The decommissioned trickling filters and recirculation building in the center of the image will be the location of the digesters, dryer building and product storage barn. *City of Auburn*

- Creates Class B biosolids, even while the dryer is offline, which will increase disposal markets and regulatory resiliency.
- Improves dryer operation by creating a more stable, homogenous feed.
- Reduces solids mass allowing for the installation of a smaller dryer and provides a renewable fuel in biogas to offset dryer energy requirements.

While still in the preliminary stages of weighing alternative design options and configurations, the City of Auburn hopes to finalize a plan for this $30 million to $38 million project with 30% design completion targeted for the spring of 2021.

Onondaga County – In-Design Phase

Onondaga County's Department of Water Environment Protection (WEP) owns and operates six wastewater treatment plants that treat an average of over 33 billion gallons of wastewater per year. Solids handling for five of the six facilities is completed centrally at WEP's largest facility, the Metropolitan Syracuse Wastewater Treatment Plant (Metro WWTP). Liquid biosolids from four of WEP's smaller facilities (Meadowbrook Limestone WWTP, Brewerton Water Pollution Control Plant, Wetzel Road WWTP and Oak Orchard WWTP) are hauled to Metro at varying stages of treatment to be anaerobically digested and/or centrifuged. The Baldwinsville-Seneca Knolls (BSK) WWTP is equipped with its own thermophilic aerobic digesters and belt filter press dewatering equipment and processes all solids on-site.

Metropolitan Syracuse Wastewater Treatment Plant.
Onondaga County Department of Water Environment Protection

Metropolitan Syracuse Wastewater Treatment Plant Sludge Dewatering Complex Construction.
Onondaga County Department of Water Environment Protection

The Metro WWTP's solids handling consists of three gravity thickening tanks, three gravity belt thickeners, three 1.8-million-gallon primary anaerobic digesters, one 1.6-million-gallon secondary digester, and three centrifuges. The digester complex is currently undergoing a $24 million improvement project to upgrade digester mixing, pumping, heating, gas handling and cogeneration equipment, which will improve biogas production and optimize beneficial reuse of the biogas. The secondary digester, which was historically used for biogas storage, has been upgraded to include heating, mixing, and the installation of a fixed cover. Upon completion of the project, biogas will be stored in two dual membrane biogas storage spheres. On average, the centralized biosolids processing at the Metro WWTP processes 36,000 wet tons of Class B biosolids at 27% to 28% total solids per year.

Relatively low transportation and disposal fees have made landfilling an economical option for the disposal of all biosolids from both Metro and BSK WWTPs over the past decade. However, in the last few years transportation and disposal rates have increased by 65%. At approximately $3.5 million per year, sludge disposal now makes up approximately 40% of WEP's operations budget. Increases in disposal costs and uncertainty surrounding the future of biosolids acceptance in landfills led WEP to reevaluate biosolids management and pursue enhanced biosolids treatment. In 2016, the New York State Energy, Research and Development Authority funded a FlexTech study, which initially identified sludge drying technology as an Energy Conservation Measure (ECM) that could improve WEPs biosolids processes and reduce sludge disposal fees. WEP's goal is to increase sludge percent solids to 75% to 90%, produce Class A biosolids, and expand disposal options, thus reducing costs while providing better biosolids management resiliency.

WEP is approaching the completion of final design documents for their $15 million Sludge Dryer Project. The project includes the addition of a new building equipped with two modular sludge dryers, which will have an initial capacity to dry 21 wet tons per hour at 25% to 30% solids. As this type of dryer is modular, the building is being designed to allow for expansion of the dryers in the future and the addition of a sludge offloading station to accommodate dewatered sludge from WEP's BSK WWTP and possibly other small municipalities in the area if capacity allows. WEP expects to see an overall savings of approximately $1.6 million per year resulting in a payback period of just over nine years. This estimate was based on continuing to landfill the dried Class A biosolids; however, WEP anticipates expanding the disposal/reuse options that may result in additional cost savings. WEP anticipates construction beginning in fall of 2021 with the new system going into operation in 2022.

Village of Endicott – Under Construction

The Village of Endicott WWTP produces approximately 500 dry metric tons of biosolids per year and anticipates this volume will increase due to additional phosphorus removal with chemical precipitation. This material is typically sold for field top dressing or blending with soils to add carbon and nutrients.

The Endicott WWTP was commissioned in 1966 and began composting biosolids utilizing a Taulman-Weiss in-vessel system starting in 1985. This system successfully produced Class A biosolids compost for approximately 20 years. In 2005, it was determined that the Endicott WWTP was no longer able to achieve Class A biosolids with that system due to operational challenges. To continue producing a Class A biosolid, the in-vessel system was used for mixing

continued on page 21

continued from page 19

Village of Endicott WWTP showing gravity thickener, anaerobic digester, primary clarifiers, biotowers, secondary clarifiers and windrow compost.
Philip Grayson

the biosolids with amendments followed by a windrow composting method.

By 2017, the anaerobic digester complex and composting equipment were approaching the end of their useful lives and the village evaluated options for future solids management. The village wanted to continue anaerobically digesting solids and producing a Class A biosolid product but wanted to explore options other than composting with its existing process of windrowing.

The Village of Endicott was presented a few options that would allow the continued production of Class A biosolids. These included:

- Upgrading to a new windrow composting process.
- Adding an aerobic digestion process.
- Installing a biosolids dryer.

Once the alternatives were compared, it became clear that the dryer provided the strongest benefits for the village. Installing a sludge dryer will allow the village to significantly reduce operating costs by eliminating the use of sawdust as carbon addition in the composting process, reducing maintenance costs that were associated with composting, and eliminating the significant labor costs required to create and monitor the compost windrows. The combination of these cost reductions made the installation of a sludge drying system an attractive option for this facility.

The village evaluated dryer equipment options based on the ability to fit within newly freed up in-vessel systems space, as well as the open space located adjacent to their existing belt filter press. Finding an appropriately sized system was a key financial factor for the project to move forward.

The Village of Endicott recognizes that regulatory changes may occur regarding biosolids beneficial reuse and/or landfill disposal in the future. This made selecting a technology that offers the flexibility needed to adjust to potential regulatory changes critical to the success of this project. Based on the goal to continue recycling biosolids, the village feels that installing a sludge dryer will be a great treatment method for this wastewater facility. Although the dryer portion of this upgrade requires an approximately $2.5 million capital investment it was deemed worthwhile due to the following benefits:

- The dryer will produce Class A biosolids that can be sold for use in agriculture and landscaping applications.
- Installation of the sludge dryer will reduce maintenance and labor costs compared to the current composting methods.
- Current composting equipment has reached the end of its useful life and needs replacement.

The Village of Endicott believes that installing a sludge dryer will put this facility on strong footing for the future.

A Proactive Approach

With the future of landfill disposal fees and options unknown, these facilities are taking proactive measures that benefit their communities by providing the best available disposal options, reducing operating costs, and producing a more environmentally friendly end product. The addition of a dryer system will give these municipalities greater resiliency as regulations on biosolids disposal change. Sludge drying technology can be a viable solution for a wide range of municipalities, from villages and small cities to counties operating multiple treatment facilities.

Danielle Hurley is a Sanitary Engineer I with the Onondaga County Department of Water Environment Protection and may be reached at daniellehurley@ongov.net. Philip Grayson is Chief Operator with the Village of Endicott, New York, and may be reached at pgrayson@endicottny.com. Timothy O'Brien is the Technical Director of Municipal Utilities and Industrial Pretreatment Coordinator with the City of Auburn, New York, and may be reached at tobrien@auburnny.gov.

Reference

NYSDEC. 2018. *Biosolids Management in New York State.* New York State Department of Environmental Conservation Division of Materials Management. https://www.dec.ny.gov/docs/materials_minerals_pdf/bsmgmt2015.pdf

LET'S MAKE THIS PERFECTLY CLEAR!

The heart of any biological process is the operation and performance of the final clarifiers and the Lakeside design is clearly superior. Our Spiraflo Clarifier's peripheral-feed design provides the best hydraulic flow pattern and performs two to four times better hydraulically than centerfeed clarifiers. The Spiraflo produces the highest quality effluent, and eliminates short-circuiting and sludge wall creep, problems associated with competing centerfeed designs. Our Spiravac Clarifier offers rapid suction removal of activated sludge. Compare performance, warranty and cost, and you'll see why Lakeside is clearly your best choice!

REPRESENTED LOCALLY BY:

www.gafleet.com

G.A. FLEET
New Construction
T (914) 835.4000
F (914) 835.1331

FLEET PUMP
Aftermarket
T (914) 835.3801
F (914) 835.2946

Serving the tri-state region

J. ANDREW LANGE, INC.
Water & Wastewater
Treatment Products
& Services
T (315) 437.2300 • **F** (315) 437.5935
mmele@jalangeinc.com

LAKESIDE
EQUIPMENT CORPORATION
Water Purification Since 1928

Cleaner Water for a Brighter Future®

Speak to one of our experts at 630.837.5640, email us at sales@lakeside-equipment.com, or visit www.lakeside-equipment.com for more product information.

Clarification Components

Spiraflo Clarifier
Spiravac Clarifier
Full Surface Skimming

Recuperative Thickening to Promote Co-Digestion

by Amy Hait and George Bevington

Recuperative thickening: a mouthful of a method that can increase anaerobic digester capacity to facilitate outside waste acceptance as well as promote increased biogas production!

Process Overview

The anaerobic digestion process is widely employed at water resource recovery facilities (WRRF) for the stabilization and decomposition of sludge. To put it simply, during decomposition a portion of the carbon in the feed sludge is converted to biogas. Water remains a byproduct of digestion. So, digesters are both biogas producers and water producers. This results in a typical anaerobic digester operating at 1% to 2% total solids (TS), even when the feed sludge is more concentrated.

The goal of recuperative thickening is to assist digesters in operating at higher solids concentrations to improve digestion. To achieve higher solids concentration, recuperative thickening removes water from the digester. Digesters that are not complete-mix can remove supernatant from the top of the tank to remove excess water. Complete-mix digesters need recuperative thickening in order to concentrate solids in the digester. Digester sludge is removed from the tank, mechanically thickened to about 5% solids and returned to the digester. Thickening can occur via a multitude of technologies including gravity belt thickeners (GBT) and rotary drum thickeners (RDT). The filtrate from the thickening device is the water removed from the digester and it is returned to the headworks of the WRRF. This recuperative thickening loop of pumping the thin sludge, removing water to concentrate sludge (i.e., thickening), and returning the sludge to the digester increases the digester operating solids concentration to a target, typically about 3% TS for a conventional complete-mix WRRF anaerobic digester.

Recuperative thickening is analogous to maintaining a mixed liquor suspended solids (MLSS) concentration in a conventional activated sludge process. To promote better treatment in aeration tanks, operators return activated sludge (RAS) to increase the population of "bugs" (MLSS) and to provide the required target mean cell residence time (MCRT) for adequate treatment. To promote better treatment in anaerobic digester tanks, operators will return thickened digester sludge to increase the population of anaerobic "bugs," resulting in a longer detention time for more complete digestion.

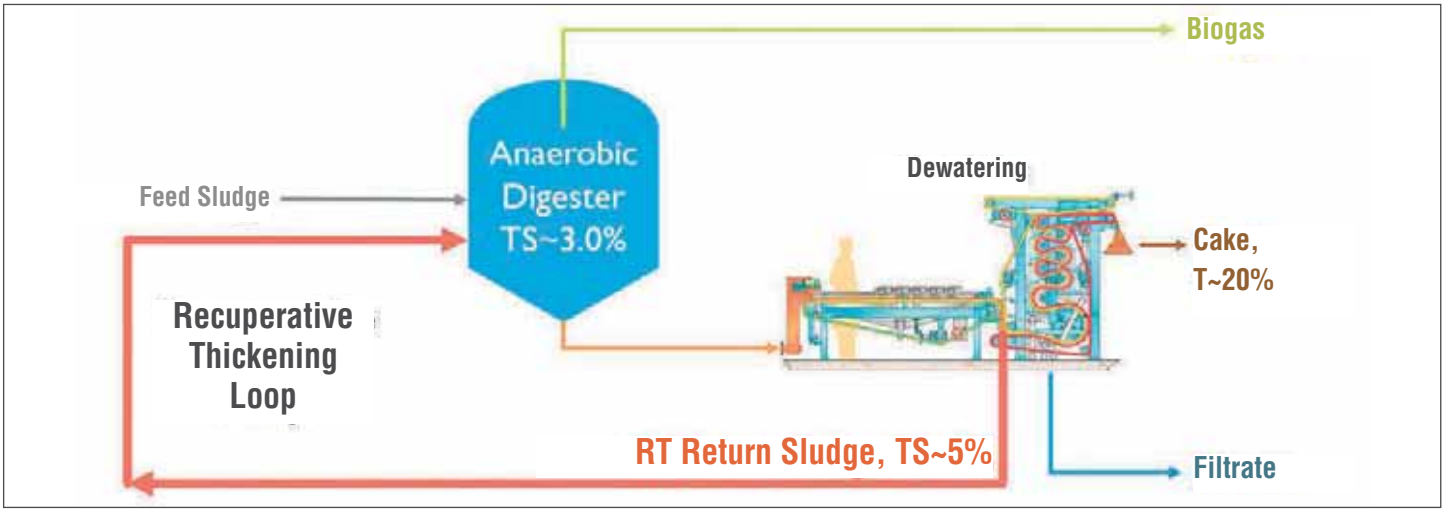
Literature Review

The first recorded implementation of the recuperative thickening process was in New York City in the 1960s. Sludge disposal was expensive and city management began looking for ways to reduce cake to save on annual expenses. The Bowery Bay plant had been pre-thickening their digester feed sludge in gravity thickeners, reducing the volume of water to the digesters. Operators tried recirculated digester sludge to co-thickening with the feed sludge in the gravity thickeners. They tracked the data for a few years and found volatile matter destruction in the digester increased about 20% after implementing the recuperative thickening loop. This achieved their goal of reduced cake production *(Torpey and Melbinger 1967)*.

Since its inception almost 60 years ago, recuperative thickening appears in the literature relatively infrequently. In 1992, recuperative thickening was studied with bench scale tests by researchers in Taiwan. They used complete-mix digesters and a clarifier to concentrate sludge for return. They utilized Monod kinetics to verify the process theory and postulated that the optimal recirculation rate was approximately 50%. The bench scale test showed increased digester stability, as measured with alkalinity values, and increased biogas production in the digesters that incorporated recuperative thickening. The study called for better thickening technology in order to implement this process efficiently at full-scale. The clarifier in their lab setup was unable to effectively settle and concentrate the anaerobic sludge (*Ouyang and Chang 1991, Ouyang and Lin 1992*).

In the early 2000s, full-scale recuperative thickening was installed in Spokane, Washington. Before implementing this system, there was some concern with using the aerated thickening mechanism due to the fragility of methanogens. To verify that this process would not cause digester upsets, digester sludge was aerated in the lab vigorously for 15 minutes. Compared to the non-aerated digester sludge, the aerated sludge produced about 10% less biogas. Researchers deemed this was acceptable due to the other digestion benefits provided by recuperative thickening and an understanding that dissolved air flotation thickener (DAFT) aeration would not be as vigorous as the lab experiment. The facility started with a 25% recuperative thickening loop and noticed substantial benefits. The solids retention time (SRT) in the digesters increased from 15 to 24 days with recuperative thickening

continued on page 25



A typical process flow diagram of recuperative thickening. *Amy Hait, B&L*

continued from page 23

and volatile solids reduction (VSR) increased from 50% to 64%. The facility co-thickened their feed sludge with the recirculated sludge in their existing DAFT and reported an easy transition due to existing equipment. Operators needed to use more polymer in their DAFT to keep up with the co-thickened sludge, but due to the digestion benefits they were dewatering less cake and found a big dewatering polymer reduction. In all, the facility experienced a net 15% reduction in polymer usage after the implementation of recuperative thickening *(Reynolds, Cannon and Pelton 2001)*.

In 2008 another full-scale implementation of recuperative thickening was report at the Bondi Sewage Treatment Plant in Sydney, Australia. This facility was investigating methods for cake generation reductions, as biosolids management accounts for about 60% of their annual operating costs. The plant used rotary drum thickeners to thicken and return concentrated sludge to the digester. As the digester thickened, operators observed increasing biogas production and decreasing cake production. As they pushed the system, operators realized that when the digester was too thick the existing gas mixing system could not keep the digester completely mixed. This limited recuperative thickening to maintain a total solids concentration in the digester of 2.5% for effective mixing. The plant observed an SRT increase of 15 days to 40 days, biosolids generation decreased by 22% and biogas production increased by 20%. Odor generation was also notably reduced, quantified by an 80% reduction in hydrogen sulfide *(Bharambe, et al. 2015)*.

Recuperative thickening returned to New York state in 2011 with its implementation at the Gloversville Johnstown Joint Wastewater Treatment Facility (GJJWTF). With an anaerobic digester SRT of 13.4 days and trending downward, the facility installed recuperative thickeners and was able to maintain an SRT of greater than 15 days while accepting additional high-strength waste. Use of recuperative thickening allowed GJJWTF to accept more outside waste to digesters from a local dairy industry. With this additional waste, the facility doubled its biogas production and began supplying 95% of the facilities electricity demand *(Ostapczuk, et al. 2011)*.

Most recently, the University of Wollongong, Australia, has published several laboratory studies on the optimization of recuperative thickening. Researchers found at the bench scale that there are diminishing returns of recuperative thickening after the SRT has exceeded 30 days. Recuperative thickening provides the most benefit when the hydraulic retention time (HRT) of the system is less than 15 days. Researchers developed the "5-S" theory hypothesizing the mechanisms of recuperative thickening *(Yang, Nghiem, et al. 2015, Yang 2017)*:

1. Increase SRT independent of HRT.
2. Reduction in short circuiting.
3. Microbial selection (gradual shift in methanogens toward more resilient population).
4. Sequestration of soluble biodegradable macromolecules in thickening (by polymer).
5. Impact of shearing during thickening (release of biodegradable substances).

Review of recuperative thickening literature indicates consistent benefits to the digestion system. The body of research is still relatively young, calling for greater study of full-scale implementation at a wide range of facilities and a greater understanding of the mechanisms of recuperative thickening.

Benefits of Recuperative Thickening

Recuperative thickening improves the anaerobic digestion process and therefore provides several benefits to WRRFS including:

- Reduced biosolids (cake) production.
- Net reduction in polymer usage.
- Increased biogas production.
- Increased digestion capacity in existing digesters (no need for new concrete tanks).

The increased digestion capacity presents an opportunity for existing facilities to accept outside waste into their systems such as high-strength organic waste (HSOW), outside sludge from other facilities, or source-separated organics (SSO).

These benefits each have a fiscal impact as well, making recuperative thickening attractive from a management perspective. Reducing cake generation can save the facility on landfill tipping fees due to volume reduction. By reducing polymer usage, operators save on annual chemical costs. Increasing biogas production allows a WRRF to offset energy costs either via heating or electricity generation. Finally, by increasing capacity and allowing for the acceptance of outside waste streams the facility is posed to collect tipping fees for each of those waste streams. Tipping fees for outside waste can provide substantial revenue to the facility and often aids in rate stabilization for municipal users.

Case Studies

While there are nearly 150 municipal anaerobic digesters operating in New York state, there are three active recuperative thickening facilities in the state:

- Niskayuna Wastewater Treatment Plant (WWTP)
- Rome Water Pollution Control Facility (WRRF)
- GJJWTF

Niskayuna WWTP

Niskayuna WWTP is a 3.0 million-gallon-per-day (MGD) facility that required an upgrade as part of a consent order. The Town of Niskayuna utilized a design-build implementation for the project with a focus on energy efficiency and recovery. Upgrades included updating the anaerobic digestion system, with the addition of recuperative thickening. The facility wanted to include recuperative thickening to be able to accept HSOW from a local soft beverages producer without need to build additional digester tanks. Additional biogas generation was also desired to run an engine for electricity generation.

A dedicated GBT was installed to facilitate recuperative thickening. Recuperative feed pumps and thickened sludge return pumps were installed to convey the sludge. The WWTP is currently using recuperative thickening equipment as designed to thicken the digesters.

continued on page 26

The City of Niskayuna WWTP gravity belt thickener for recuperative thickening. *George Bevington, B&L*

continued from page 25

Rome WRRF

The Rome WRRF is a 12.0 MGD facility that required anaerobic digestion upgrade. A 2018 dewatering project had been planned for the potential of adding recuperative thickening in the future. The 2020 Digestion Improvements Project was driven by a desire to increase HSOW acceptance from a local dairy industry, promote energy generation, and maintain positive cash flow at the plant. By installing recuperative thickening, the existing Rome WRRF digesters will be able to accept 18,000 gallons per day more HSOW without needed to construct new tanks. This additional feed equates to more biogas generation and more energy production. Additionally, the increase acceptance maximized revenue generation from HSOW tipping fees.

To implement recuperative thickening, the existing dual mode belt presses were utilized. The existing belt press feed pumps withdraw sludge from the digester and convey it to the GBT portion of the belt press. The thickened sludge is intercepted before it reaches the vertical belt portion of the press, as it falls into a hopper. New recuperative thickening pumps will convey the thickened sludge from the GBT hopper to the digesters. This project is currently under construction and anticipated completion is in fall 2021.

The Rome WRRF recuperative thickening return pump.
George Bevington, B&L

GJJWTF

The GJJWTF is a 13.0 MGD facility with a 1.5 MGD digester. As referenced in the literature review, this facility accepts a

GJJWTF's combined heat and power (CHP) generator producing electricity from co-digestion. *George Bevington, B&L*

large quantity of pumpable HSOW from the local dairy industry that requires treatment. Without the capital available to build more anaerobic digestion capacity, recuperative thickening was installed to allow for the continued acceptance of HSOW.

Recuperative thickening has been in continuous operation at this facility for the last decade. The year-round recuperative thickening allows this facility to load digesters at a greater rate than typical municipal systems. Without recuperative thickening, the GJJWTF must accept less HSOW, meaning less digester food, less biogas and less electricity production, as well as less revenue generated via tipping fees. GJJWTF was able to leverage recuperative thickening to aid in co-digestion and optimize biogas production. Biogas is combusted in generators to offset the facility electricity demand. GJJWTF became the first net positive energy WRRF in New York state with recuperative thickening an important facet in that outcome.

Current Opportunities

There are several current conditions that make recuperative thickening attractive. There is an abundance of HSOW searching for sustainable disposal. Co-digestion in municipal anaerobic digesters is a great candidate for disposal, as described in the case studies. HSOW could include several waste streams from industries such as diary processing facilities (cheese, yogurt, etc.), soft beverages and fats, oils and grease (FOG). Industries desire long-term disposal options and the WRRFs are the stable and dependable disposal method they need. HSOW in the area drives recuperative thickening projects as municipal facilities "make room" for HSOW by removing excess water from the digesters.

Another driver for recuperative thickening implementation is the emerging source-separated organics (SSO) market. With new New York state legislation requiring the phased diversion of food waste from landfills, the SSO feedstock market will grow. Depackaging equipment makes food waste a suitable digester feedstock for co-digestion. Recuperative thickening provides capacity for co-digestion with SSO.

Additionally, as landfill disposal costs across the state continue to increase, WRRFs are looking for cake reduction methods. Recuperative thickening was first implemented to reduce cake generation and could serve current municipal wastewater treatment facilities in reducing cake.

The additional biogas from recuperative thickening could be beneficially utilized for heating, electricity generation or even renewable natural gas. There is a political motivation for green energy projections. Increasing this renewable energy source can aid communities in meeting sustainable initiatives. This green energy is also favorable for securing state and federal grants.

The benefits of recuperative thickening have financial value and can aid WRRFs in maintaining balanced budgets. Cake reduction, polymer reduction, and biogas increase can all help WRRF budgets at a time of financial uncertainty. Accepting outside waste diversifies the municipal revenue generation, can provide significant capital generation, and can stabilize resident rates.

Acceptance of high-strength organic waste (HSOW) at the Rome WRRF.
Amy Hait, B&L

Conclusion

Recuperative thickening is a digestion booster tool. It removes water from the digester to promote better digestion. Recuperative thickening decouples the HRT from the SRT and allows increased solids concentration in the digestion, resulting in higher volatile matter destruction, more biogas production, less cake generation, and the opportunity to accept outside waste.

Recuperative thickening has been successfully implemented in New York state and there are several current opportunities that make recuperative thickening attractive. Recuperative thickening is a tool to aid in co-digestion capacity without needing to construct additional tankage.

Amy Hait is an Engineer II with Barton & Loguidice, DPC and may be reached at ahait@bartonandloguidice.com. George Bevington is a Senior Project Manager with Barton & Loguidice, DPC and may be reached at gbevington@bartonandloguidice.com.

References

Bharambe, G., J. Cesca, H. Bustamante, D. van Rys, J. Kabouris, and S. Murthy. 2015. "Anaerobic digestion with recuperative thickening minimizes biosolids quantities and odors in Sydney, Australia." *Ozwater'15.* http://www.awa.asn.au/documents/118%20GBharambe.pdf.

Ostapczuk, R.E., P.C. Bassett, C. Dassanayake, and G. Bevington. 2011. "Recuperative thickening: decoupling the SRT from the HRT reduces capital expenditures and increases biogas production for CHP utilization." *Proceedings of the Water Environment Federation,* 2011(15). 2348-2355. DOI:10.2175/193864711802712974.

Ouyang, C.F., and H.Y. Lin. 1992. "A study of controlled recirculation of anaerobic activated sludge digestion reactors." *Water Science & Tech* 26 (9-11): 2449-2452. https://doi.org/10.2166/wst.1992.0759.

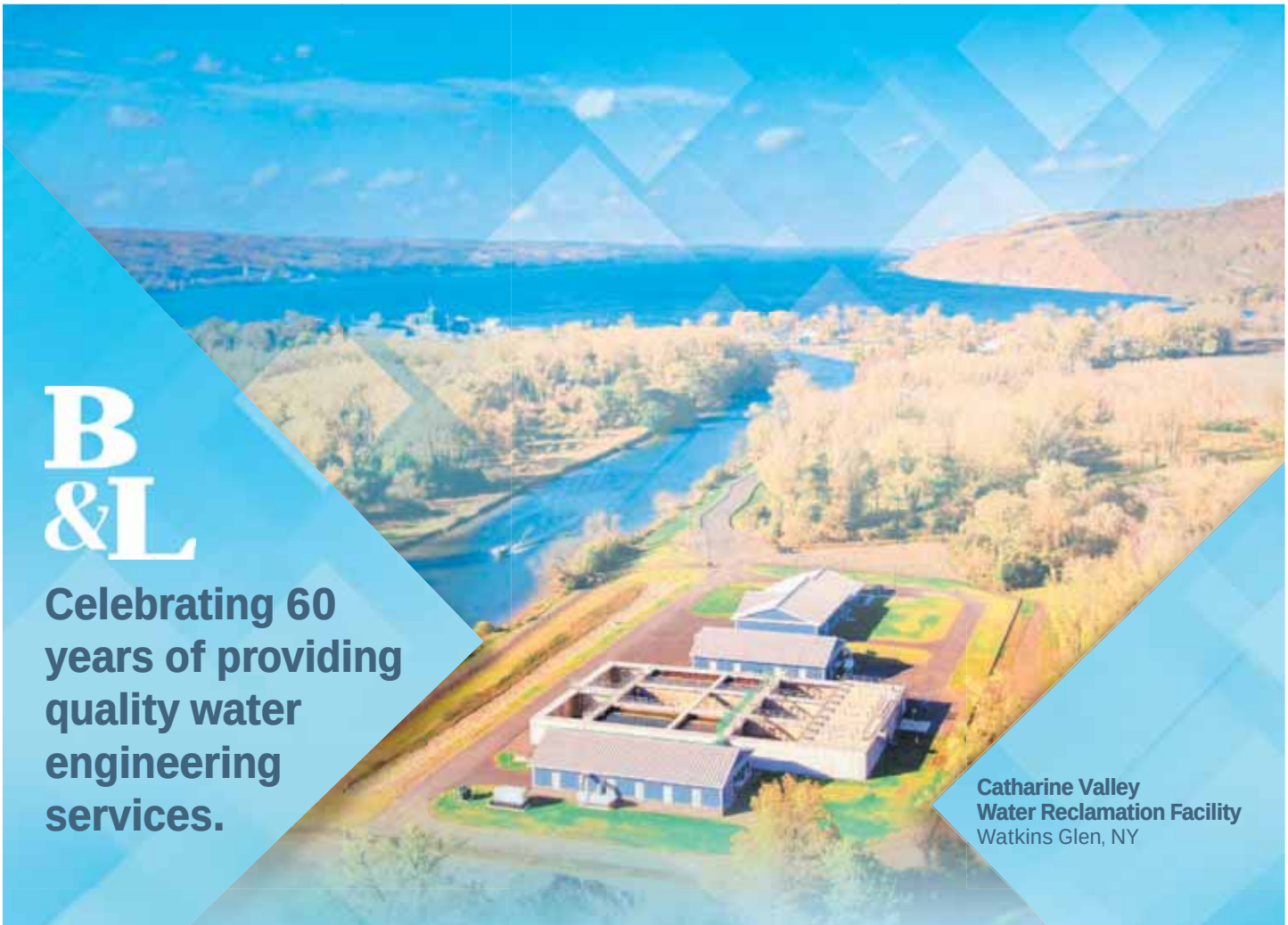
Ouyang, C.F., and T.G. Chang. 1991. "Increased stability of anaerobic digestion by controlled recirculation." *Water Science & Tech* 23 (7-9): 1229-1237. https://doi.org/10.2166/wst.1991.0574.

Reynolds, D.T., M. Cannon, and T. Pelton. 2001. "Preliminary investigation of recuperative thickening for anaerobic digestion." *Proceedings of the Water Environment Federation* 2001(14). 389-410. DOI:10.2175/193864701802779233.

Torpey, W.N., and N.R. Melbinger. 1967. "Reduction of digested sludge volume by controlled recirculation." *J. Water Pollution Control Fed.* 39(9): 1464-1474. September 1967. http://www.jstor.org/stable/25035800.

Yang, S. 2017. *Wastewater Sludge Treatment by Anaerobic Digestion with Recuperative Thickening.* Doctor of Philosophy thesis, School of Civil, Mining and Environmental Engineering, University of Wollongong.

Yang, S., L.D. Nghiem, H. Bustamante, D. van Rys, and S.N. Murthy. 2015. "Recuperative thickening: a possible tool to improve anaerobic digestion of wastewater sludge." *Ozwater'15.* http://www.awa.asn.au/documents/119%20LongNghiem.pdf.



B&L

Celebrating 60 years of providing quality water engineering services.

Catharine Valley Water Reclamation Facility
Watkins Glen, NY

- Water & Wastewater Systems Asset Management
- Water & Wastewater Treatment Facilities
- Distribution & Transmission Systems
- Water Source Development & Assessments
- Wastewater Collection & Pumping
- Grants Writing & Grants Administration
- Instrumentation & Control
- Operations & Troubleshooting Assistance
- Start-up & Training

For clients who seek a relationship-driven partner, Barton & Loguidice is a multi-disciplinary consulting firm that produces solutions that enable communities and businesses to thrive. Since 1961, B&L's practice-centered business has helped hundreds of municipalities, governmental agencies, and private entities solve complex planning, design, maintenance, and operations challenges related to infrastructure and development.

"As leaders in the water sector, it is our job to facilitate transformation in our communities through our work and personal interactions. We need to throw out the idea of wastewater infrastructure being "out of sight, out of mind" and integrate it into the daily exchange of information. It's up to us to change the vernacular: we are not removing waste, but reclaiming water. To meet our goals, our communities need to be informed, supportive and active participants in protecting water quality and the environment."

Lauren Livermore, P.E., BCEE
Managing Engineer, Barton & Loguidice

Barton & Loguidice

The Experience to **Listen**. The Power to **Solve**.

1.800.724.1070
bartonandloguidice.com

Digesters Find New Opportunities for Processing Packaged Food

by Kristine Ellsworth

Food waste – it's everywhere. From the fields to our supply chains, restaurants and homes, food waste unnecessarily fills our trash cans, although it is not waste. A paradigm shift has begun recognizing that food is a resource that can be utilized for energy production, recycled, and given back to the earth to feed our soils.

Laws and Mandates

Along with five other Northeastern states, New York state is implementing organics diversion mandates or laws. In 2019, the state passed the Food Donation and Food Scraps Recycling Law. This law will continue to push the development of the organics recycling industry and it does not stand alone. New York is also currently revising its Solid Waste Management Plan and preparing for the progressive climate targets outlined in the Climate Leadership and Community Protection Act, which will dictate future initiatives and goals advocating for the growth of the organics recycling industry in the state.

Organics diversion mandates or laws have been implemented at the local level as well. In 2013, New York City passed Local Law 146, landmark legislation requiring the diversion of organics from specific types of businesses almost unanimously based on minimum square footage requirements. July 31, 2020, marked the final phase established by Local Law 146, identifying 12 types of establishments that must comply (e.g., food service establishments with a minimum of 7,000 square feet, retail food stores with a minimum of 10,000 square feet). This legislation was recently complemented by Ulster County's Food Waste Prevention and Recovery Act, effective Jan. 1, 2021, which implements a tiered approach to requiring businesses to recycle food scraps over time based on the amount of food scraps generated.

These local and state laws and mandates for organics diversion and food waste recovery are driving the need for co-digestion development and technology innovation.

NYS's Food Donation and Food Scraps Recycling Law Update

In 2019, New York State passed the Food Donation and Food Scraps Recycling Law. Effective Jan. 1, 2022, under the law businesses that generate an annual average of 2 tons or more of wasted food per week must donate excess edible food and recycle all remaining food scraps if the business is within 25 miles of an organics recycler (e.g., composting facility, anaerobic digester). These businesses will be identified annually by the New York State Department of Environmental Conservation (NYSDEC) as 'designated food scraps generators.' Examples of these businesses include grocery stores, colleges, large restaurants, event centers and stadiums.

This law includes several exemptions, including New York City (where a local law is already in place), hospitals, nursing homes, adult care facilities and K-12 schools.

In late January 2021, NYSDEC released proposed Part 350 regulations to accompany the implementation of the Food Donation & Food Scraps Recycling law. NYSDEC accepted public comments on the draft regulations until April 27, 2021. For more information on the proposed Part 350 regulations, visit the website *https://www.dec.ny.gov/chemical/122245.html.*

On June 1, 2021, NYSDEC will release the list of designated food scraps generators required to comply with the law. Businesses deemed designated food scraps generators under the law may apply for a one-year waiver from some, or all, of the law's requirements.

The New York State Food Donation and Food Scraps Law is intended to increase food donation and facilitate the development of food scraps recycling facility infrastructure. New York State currently has a limited number of composting and anaerobic digestion facilities that process food scraps, and the new requirement for large businesses to divert food scraps for recycling will bolster organics recycling facility development.

For more information on the Food Donation and Food Scraps Recycling law: *https://www.dec.ny.gov/chemical/114499.html.*

Opportunities for Co-Digestion Development

New York state has a limited number of digestion facilities that process food scraps and the growing requirements for businesses to recycle their food scraps present an opportunity for further co-digestion development. Food scraps hold a higher energy potential than biosolids and therefore return a greater energy production, offsetting a site's energy usage. The idea of incorporating food scraps into digesters is not a new concept and one that has seen its issues with contamination and packaging over the years. However, the introduction of depackaging systems has revolutionized the field.

Digesters have long relied on consistent and clean feedstocks and have had an unsteady past trying to incorporate food scraps. Digesters currently accepting food are most commonly partnering with food processors able to provide a consistent, clean, and pumpable food processing waste slurry. The difficulties of contamination in the digestion process have kept most digesters from partnering with commercial entities, such as grocery stores, restaurants, and others in the food retail and food service industries, where the food packaging itself poses a challenge to cleanly and efficiently processing the food waste. A number of depackaging systems are hitting the market, enabling the growth of digesters by efficiently and effectively tackling this once-impossible material stream.

Depackaging Systems

So, what exactly is a depackager? A depackaging unit is an emerging piece of pre-processing technology used to separate packaging from the food inside it. Until recently, this food has been stuck behind packaging, unable to be processed unless painstakingly unpackaged by hand. With a number of different settings, this new equipment works to break apart the packaging with as little force or energy as possible while simultaneously extracting the organics held within it. Water is often added to create a food slurry that can then be pumped into the digestion facility.

Depackager systems have already begun to establish themselves across New York state. This type of equipment can be housed at the site of the digester or serve a greater regional area while dispersing to various digesters in the surrounding communities. Individuals who operate depackaging systems, including digesters, can charge a tipping fee from food waste transporters that utilize the operation. Oneida-Herkimer Solid Waste Authority's Food2Energy program is an example of what can be achieved when a facility

incorporates a depackaging unit into digestion operations.

Between emerging technologies and an increasing number of policy developments in New York state, opportunities for digesting food scraps are growing, marking the beginning of a new era in organics recycling capacity.

Kristine Ellsworth is an Assistant Environmental Engineer with the New York State Department of Environmental Conservation and may be reached at kristine.ellsworth@dec.ny.gov.

Preparing to load packaged food into the depackaging unit at the OHSWA Food2Energy Facility. *Christian Glander, NYSDEC*

Oneida-Herkimer Solid Waste Authority Case Study: Food2Energy

by Emily Albright

In May 2019, the Oneida-Herkimer Solid Waste Authority (OHSWA) completed construction of a Source Separated Organics Processing Facility (SSOPF) that allows for the recovery of food scraps in order to divert this waste from the Regional Landfill. The organic material collected here serves as a supplemental feedstock to the Oneida County Water Pollution Control Plant's (WPCP's) anaerobic digestion system. Through this new program called "Food2Energy," residents, schools and commercial businesses are encouraged to deliver bagged, packaged or palletized food waste to the SSOPF. The recovered material is then de-packaged and emulsified into a slurry, and is delivered to the WPCP's digesters, allowing for the collection of methane gas that is turned into electricity. The OSHWA provides free staff training and educational materials for all participating and interested businesses/organizations.

The Food2Energy program conserves landfill airspace, reduces greenhouse gas emissions, reduces disposal costs for source separated organics by $22 per ton and increases the energy production generated in the anaerobic digesters by providing a comingled feedstock to the WPCP's independent collection and anaerobic digestion of biosolids. The WPCP is getting 25% to 30% of their energy needs met by the biogas generated from the anaerobic digesters. To date, Food2Energy has recovered over 4,300 tons of organic material for anaerobic digestion. This project is expected to add one to seven years to the life span of the Regional Landfill.

Currently, about 10 large food processors, grocery stores, and manufacturers are consistently participating in Food2Energy. Pilot programs have been conducted at all five colleges in the Oneida-Herkimer region, with one college adopting the program permanently. Over 100 residents consistently take advantage of our Food2Energy drop off location at the Utica EcoDrop.

Emily Albright is the Director of Recycling with the Oneida-Herkimer Solid Waste Authority and may be reached at emilya@ohswa.org.

Depackager unit processing and separating packaging from food at OHSWA Food2Energy Facility. *Emily Albright, OHSWA*

MOTT MACDONALD

From New York Harbor to Niagara Falls

Clients of Mott MacDonald are strengthening water and wastewater infrastructure, meeting increased demand, protecting waterways, cutting energy use, reducing carbon emissions, and achieving cost-effective solutions.

Find out how you can join them.

New York City
1400 Broadway
New York, NY 10018
212.532.4111

Buffalo
438 Main Street
Suite 300, Buffalo, NY 14202
716.854.1181

Rye Brook
800 Westchester Avenue
Suite N-641, Rye Brook, NY 10573
914.292.1810

mottmac.com

What I Learned about Water from Filming "Brave Blue World"

by Paul O'Callaghan

It is now three years since I first presented an idea for a documentary to the Water Environment Federation. What has been achieved in that time – the funding, creation and global release of "Brave Blue World" on Netflix – has been phenomenal, and what began as a passion project has worked out beyond all expectations.

I have been lucky enough to have been invited to speak at industry events to share the story of "Brave Blue World," how it snowballed from a seed of an idea, how we secured the vital support of our corporate partners – as well as activists and actors Matt Damon, Jaden Smith and Liam Neeson – and how our research led us to the technological pioneers whose stories became the beating heart of our documentary.

A recurring question from these interviews is, what did I learn from making "Brave Blue World"? As a scientist and engineer, with zero experience of filmmaking, cutting my teeth with some of the world's leading production teams was a huge privilege that taught me more than I ever thought possible about the art of documentary making.

But aside from the production process, there were unexpected lessons around communication, people and, of course, water and wastewater treatment and technology. These learnings have been enriching in ways I had not envisaged, both for me personally and for BlueTech Research.

A New Perspective

Spending time with different communities during the filming process was a tremendous education and gave me a new global perspective on the value of water and sanitation. I have been in water for 20 years but had not traveled extensively in the developing world to study water exclusively.

Seeing water and sanitation issues firsthand made me fully appreciate the difference access to clean water and sanitation makes to people's lives. This acquired knowledge in areas such as atmospheric water capture or building a sanitation economy to create value from providing sanitation has found its way back into our research work at BlueTech, so has really added value that we can share with our clients.

Nature's Big Systems

The technology and processes we saw on our travels have proven to me beyond doubt that we must look to nature when designing water and wastewater solutions. Water recycling and resource recovery and reuse became key themes that wound through the film and many of the projects we highlighted. One example is the Stickney Water Reclamation Plant in Chicago, the world's largest nutrient recovery facility, which is extracting phosphorus from the city's wastewater and turning it into valuable fertiliser.

In the city of Chiclana, Spain, an algae-based wastewater treatment system is producing bio-methane to fuel vehicles. This project by the All-Gas EU project and developed by Aqualia is particularly resonating with audiences.

Looking to nature is the thread that unites all the innovations we explored, whether it was direct biomimicry or simply borrowing from natural recycling systems. If we look at our infrastructure and treatment systems in the context of the ecosystems in which they sit, we realise everything interconnects and our priority should be to sustain and enhance existing systems.

As a sector, we haven't been thinking like that, but we have to start. Currently, when water utilities and municipalities build a drinking water treatment plant, they focus on that facility in isolation. Later, they might build a wastewater treatment plant and focus only on that.

The documentary "One Strange Rock" shows how dust from the Sahara Desert feeds plants in the Amazon rainforest, as revealed by a NASA 10 02 TRENDS WATCH satellite in 2015. I found this a

fascinating revelation and it shows how we have to think of water at both the local and the planetary level.

Digital Technology

Post-production, we were conscious of the amount of information audiences can absorb and, therefore, had to make difficult decisions to narrow down the featured subjects. On the plus side, this means we have a stockpile of ideas and content for subsequent films we may make, including innovations in digital technology.

One interesting example is Aquarevo, a collaboration between South East Water and Villawood Properties in Melbourne, Australia, where they are using technology to create a residential development with unprecedented water-saving features. These include on-site rainwater storage tanks fitted with smart technology that receives weather forecasts, then triggers release of water prior to heavy rainfall events. This minimises overflows and flooding in local waterways.

We believe the Aquarevo project is a shining light for developers around the world to follow and named it as a winner of the Brave Blue World Foundation's Lighthouse Awards 2020. I look forward to being able to highlight more digital solutions when time allows. Perhaps there's scope for "Brave Blue World 2"; I'd love to hear from anyone who has stories, inspiration and ideas.

Communication and Storytelling

In the communities we visited there was a strong sense of wanting to solve problems locally, which taught me that when designing water projects and solutions, engaging with the local community is the best place to start. Solutions should always be viewed as communications projects, not just engineering works.

The Groundwater Replenishment System, which is the world's largest water purification system for indirect potable reuse in Orange County, California, was viewed as a communications project from the start. The system takes highly treated wastewater that would have previously been discharged into the Pacific Ocean and purifies it to produce water that meets or exceeds all state and federal drinking water standards.

The success of the project depended on winning the hearts and minds of the local population. That was the project team's biggest priority, and it was risky – they had to be very open and very honest. Engagement and trust are what brings us together as a society and allows us to do fantastic things when it is channelled.

Water is an industry stacked with technologists and scientists and we have exciting solutions we can bring to bear, but we need policy, finance and government structure, and we most definitely need public engagement.

People

Perhaps the biggest lesson "Brave Blue World" taught me is that human beings achieve happiness by working together toward a common shared goal. We're in this together and we can be part of the solution. There was an incredible amount of optimism from everyone we interviewed that inspired us all.

The belief that the water crisis can be solved is deeply ingrained in the sector and that is what unites and motivates us. While there is no silver bullet for the water crisis, all the technology we saw can be scaled up.

As people in society, we must be willing to accept that we need to change, and that it is time to consider having a reuse system in our city or to aim for carbon neutrality when we treat our wastewater.

The biggest obstacle is really what is between our two ears – the constraints in how we think. Being part of this puzzle and unlocking new ways of thinking has been the most rewarding part of the "Brave Blue World" journey.

Paul O'Callaghan is the CEO of BlueTech Research and Brave Blue World Foundation. He served as the executive producer and co-director of the documentary film "Brave Blue World." Enquiries may be sent to Leilah Nicola at leilah@wiseonwater.com

Co-Digestion in Construction

by John Waite, Amy Hait and Sara Martin

Background

The City of Rome, New York, owns and operates the 12.0 million-gallon-per-day (MGD) Rome Water Resource Recovery Facility (WRRF), a water resource recovery facility first constructed in 1932. The Rome WRRF leadership has been proactively upgrading their liquid treatment infrastructure at the facility for many years. For example, in 2019, the Rome WRRF started construction on a large dewatering and ultraviolet (UV) disinfection upgrade project.

The WRRF leadership was faced with an aging anaerobic digestion system that needed an upgrade. The original Primary and Secondary digesters were constructed in 1945 with the last upgrades completed in 1971. Most of the digestion equipment was approaching 50 years in service and needed replacement.

At the same time, the WRRF leadership was presented an opportunity to develop co-digestion capacity when a local dairy manufacturer requested disposal of high-strength waste from its manufacturing processes. The high-strength organic waste (HSOW), comprised of acid whey and other dairy byproducts, is well suited for anaerobic digestion. Accepting this HSOW from the dairy manufacturer would allow the Rome WRRF to start co-digesting with residual primary and secondary solids in their anaerobic digestion system.

The WRRF leadership recognized two benefits of this opportunity. First, integrating co-digestion at the WRRF would promote increased biogas production for beneficial utilization. Second, the additional revenue from the HSOW tipping fees could be used to help offset the cost of the improvements project in the short term and aid in the stabilization of future sewer rates for city residents. Moreover, this green project was eligible for, and was awarded, multiple state grants to further offset resident costs.

HSOW screen and influent piping with flow meters. *Amy Hait/B&L*

The Rome WRRF began accepting the dairy waste on a limited basis as part of a pilot program. This pilot program helped demonstrate the viability of co-digestion to city leadership. Operators were able to showcase dramatic increase in biogas production and discussed ways to capture and use the biogas to create savings in

Inside Digester 2 with pump and nozzle mixing system. *Amy Hait/B&L*

Demolition of Digester 2 Cover. *George Bevington/B&L*

Inset Photo: Dual membrane gas holder cover on Digester 2. *Amy Hait/B&L*

energy costs. The pilot program also demonstrated the economic value of accepting outside HSOW due to revenue generated from the tipping fees.

The Digestion Improvements Project

The City of Rome decided to move forward with the Digestion Improvements project and contracted Barton & Loguidice, D.P.C. to design the upgrade. The project called for a new HSOW receiving facility that included screening and automated flow measurement to assist with billing. The HSOW would be transferred to a new stainless steel equalization tank to provide storage capacity and facilitate consistent flow to the digesters, critical to prevent overloading. Overloading can create low pH conditions and upsets in the digestion process. Consistent loading also optimizes biogas production.

The City of Rome wanted to reuse or repurpose the existing digester tanks to take advantage of the infrastructure already at the plant and reduce project capital costs. Each of the digesters would be cleaned and upgraded with new equipment including new heating systems, mixing systems and covers. The Secondary Digester would be converted into an additional, parallel, Primary Digester (Digester 2). The Digester 2 cover would be upgraded to a dual membrane gas holder cover to create additional biogas storage. Digester 2 mixing would be upgraded with a pump and nozzle mixing system and digester heating would be upgraded with a new biogas boiler, heat exchanger and recirculation pumps.

The cover for the original Primary Digester (Digester 1) would be replaced with a new fixed steel cover as well as upgrading to a

continued on page 40

Cold joint along Digester 2. *Amy Hait/B&L*

continued from page 39

linear motion mixing system to improve the mixing in the tank. The Digester 1 heating system would be replaced with a new boiler, heat exchanger and recirculation pumps.

The project also includes a gas cleaning and conditioning system for use with a combined heat and power (CHP) unit. The CHP unit would use two 200-kilowatt microturbines to combust biogas for electricity generation and to recover heat to keep Digester 1 and the control building at temperature. The CHP unit is anticipated to offset most of the facility's electricity consumption by utilizing the increased biogas production from co-digestion.

Construction Phase

Construction for the Rome WRRF Digester Improvements Project began in March 2020. This project is currently under construction with Digester 2 and a HSOW receiving facility is completed. Digester 1 construction will start this spring once Digester 2 is fully acclimated.

To maintain system operation during construction, the upgrades to the digester tanks and control buildings had to be sequenced to have only one digester removed from service at any time. The existing secondary digester was the first to be taken offline for implementation of upgrades. The digester tank was drained and cleaned by the City of Rome WRRF operators. The existing floating steel cover was removed by cutting away sections at a time to be craned out and sent to be recycled. A new pump and nozzle mixing system was installed for the upgraded Digester 2 tank. The new dual membrane cover for gas storage has been installed and is operating.

Non-potable water was used for testing of the upgraded digester, during which several leaks were observed along the common wall with the control building. Cracking was identified in the Digester 2 tank, which was originally constructed in 1945. Mitigation of the leaks was part of the project in order to seal the digester. When the tank was upgraded in 1971, 3 feet of additional concrete wall was added along the perimeter of the tank. The cracking along this cold joint was the suspected cause of the leakage. The contractor utilized an injectable cold grout to seal the identified areas of leakage and achieved a water-tight seal.

HSOW stainless steel equalization tank. *Amy Hait/B&L*

Another unforeseen complication associated with utilizing existing aging infrastructure occurred on the electrical installation. Generation and utilization of biogas requires the ability for the plant's electrical system to simultaneously utilize generated electricity and supplement with grid electricity as needed through an automatic transfer switch. Upon tie-in to the electrical system it was noticed that some components of the existing electrical system needed improvement due to age. A temporary generation system was brought on-site to power critical process equipment and allow the existing electrical system to go out of service to perform these improvements safely.

Once the improvements to Digester 2 were complete, including the unforeseen repairs required from utilization of existing infrastructure, the digester was seeded from Digester 1 (existing Primary) to bring the tank back online. As the Digester 2 feed began, the Rome operators simultaneously fed the digester bicarbonate to provide additional alkalinity during startup. Operators meticulously evaluated feed rate and digester chemistry (pH, alkalinity and volatile acid concentrations) to facilitate a smooth digester start-up. Digester 2 is now 100% online and contractors and operators are preparing to take Digester 1 offline for cleaning.

In addition, the new HSOW Receiving Building and Equalization Tank are in the process of being commissioned. Once these additional facilities are operational the Rome WRRF will resume bulk receipt of HSOW. This HSOW acceptance and resulting co-digestion will provide revenue to the city and initiate additional biogas production for electricity generation.

Conclusion

The Rome WRRF leadership was able to combine the required digester upgrade project necessary to keep aging infrastructure in service, with the synergistic opportunity to start co-digesting at their facility. The project is currently under construction to allow the facility to co-digest HSOW from a local dairy industry at the Rome WRRF anaerobic digesters. The anticipated construction completion date of the entire project is fall 2021.

John Waite is the Chief Operator with the City of Rome Water Resource Recovery Facility and may be reached at jwaite@romecitygov.com. Amy Hait is an Engineer II with Barton & Loguidice, DPC and may be reached at ahait@bartonandloguidice.com. Sara Martin, PE, is the Principal at Critical Path Engineering Solutions and may be reached at sara.martin@cpesoln.com.

How the Coronavirus Has Catalyzed a More Resilient Water Future

by Rich Loeffler

As the coronavirus spread across the globe last year, the water sector faced unprecedented challenges. The largest health and economic crisis in recent history revealed just how vital – and fragile – our water and wastewater services are. Utilities worked around the clock to deliver critical water services for the communities they serve, and while they were able to maintain operations for the most part, they often did so at considerable risk and cost.

Those utilities with digital capabilities fared better than those who relied on legacy systems, a trend that has focused attention on the role of digital solutions in promoting greater resiliency and is fast-tracking our sector's transformation.

A Departure from the Status Quo

Water management has traditionally focused on how to maintain operational stability in terms of processes and outcomes, but the pandemic has shown us that there is a real danger in maintaining the status quo. During the pandemic, many operations were required to move remotely, and the need for enterprise mobility strategies, remote monitoring and data acquisition technologies became clearer. These technologies enable utilities to untether from the physical workplace with secure virtual private networks, digital workflows and connected platforms – all of which help deliver continuity of service.

As a result, digital technologies that were once considered peripheral to the core operation of a utility have become central to resilience strategies. Utilities are now investing in solutions like remote sensors, real-time decision support systems and automated operations to help them overcome the next shock.

Leveraging Digital Solutions to Turn on the Lights

By taking a data-driven approach, water managers can essentially "turn on the lights" within their systems and better prepare for unprecedented events. "Decision Intelligence" solutions provide operators with the real-time information they need to optimize processes, allowing them to focus their time and resources where they are needed most.

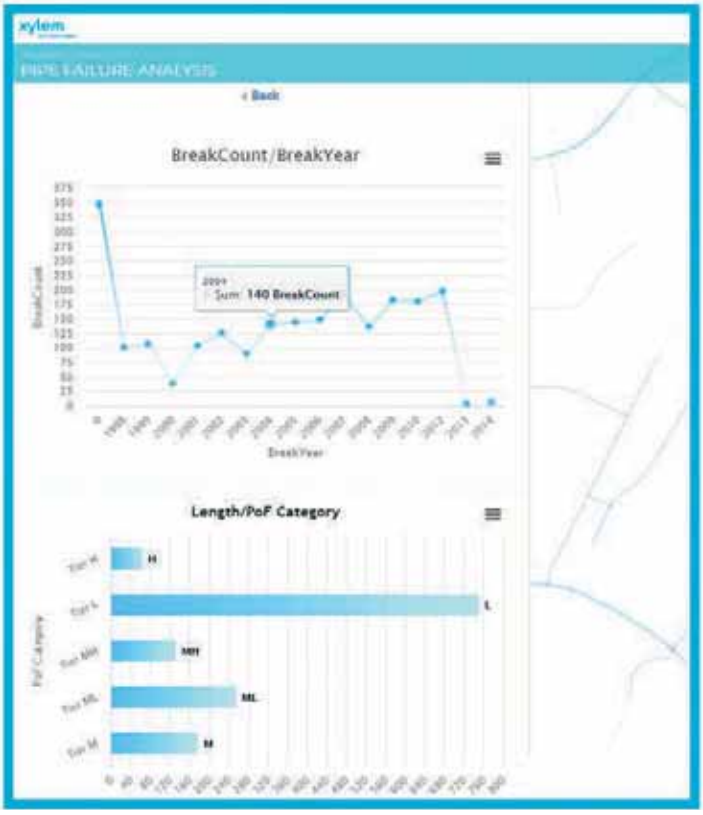
Sensors in water and sewer networks can detect problems in real time, and artificial intelligence (AI) based solutions can predict network failure before it happens. Recently, one mid-Atlantic water utility in North America leveraged an AI powered pipeline analysis solution to accurately predict pipeline failure and increase operational efficiency and reliability.

Developed by Xylem, in collaboration with Esri, a leader in geographic information system (GIS) technology, the solution leverages machine learning to collect data and identify variables that could lead to future pipeline failure. As more data is collated over time, the GIS and machine learning algorithms are updated to give a continuous understanding of the overall health of the system.

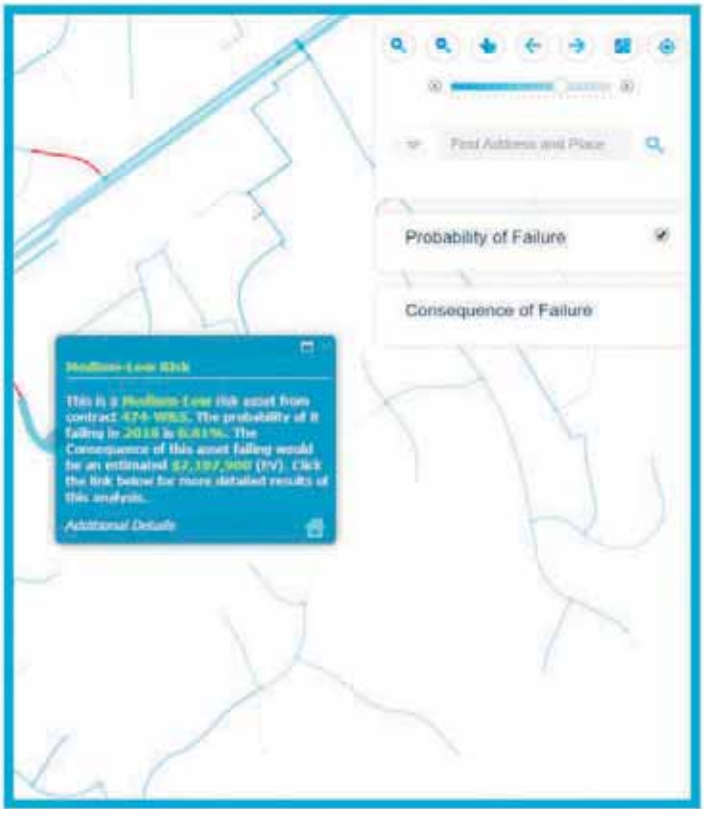
The innovative solution has allowed the utility to realize dramatic operational improvements by integrating various sources of data more effectively and efficiently. Through better visibility and system analysis, the utility has reduced pipe replacement costs by $70 million, while reducing overall pipeline failure by 400%.

Digitization: An Imperative for Future Resiliency

Digital solutions have the power to revolutionize our industry, and the good news is, they are deployable today. While digital transformation can be a slow and incremental process, by prioritizing



Summary view of Pipe Failure Analysis showing break counts and Probability of Failure categories. *Xylem Inc.*



User interface of software, showing results of the analysis for a selected pipe. *Xylem Inc.*

investments based on data insights, utilities can allocate resources accordingly and become more resilient in the face of unforeseen events.

As an industry, we are at a critical juncture. We are experiencing a moment of extraordinary opportunity and the promise of a more resilient future for utilities and the communities they serve. Let's make it a reality.

Rich Loeffler is a client solutions manager at Xylem and may be reached at Richard.Loeffler@xylem.com.

NYWEA
LEADING THE WAY IN WATER QUALITY MANAGEMENT

Buffalo Sewer Authority's Smart Sewers are Going to College

by Kristina Macro, Taylor Brown and Rich Loeffler

The Buffalo Sewer Authority (Buffalo Sewer) is one of the pioneers in "smart sewer" management and control. Buffalo Sewer's real-time control (RTC) structures have prevented over 3 billion gallons of combined sewer overflows and over 200 sewer patrol point (SPP, Buffalo Sewer's term for their combined sewer overflow regulator structures) activations since reporting began in 2017.

The smart sewer management program began in 2010 with the initial selection of up to 16 RTC in-line storage sites for inclusion in Buffalo Sewer's Combined Sewer Overflow Long Term Control Plan. The first RTC structures were installed at Bird Avenue and Lang Avenue in 2014. Buffalo Sewer has implemented projects on an adaptive management basis since then, and there are currently six RTC sites in operation with four more in an advanced stage of design or under construction at the time of publication submission ***(Figure 1)***. Buffalo Sewer is monitoring system performance to improve RTC operations and respond quickly to issues to minimize downtime. The lessons learned at each stage of RTC implementation have helped Buffalo Sewer maximize their return on investment in these structures.

Buffalo Sewer is now exploring how coordinated control and a distributed sensor network can turn their "smart sewers" into "genius sewers".

Globally Coordinated Control Strategy

Currently, Buffalo Sewer's RTC sites primarily utilize local programmable logic controller (PLC) where the control decisions are based on local sensors and sites that operate individually. As the program grows, Buffalo Sewer has begun implementing coordinated remote control of RTC sites, so that sites communicate with each other during wet weather events to locate and signal capacity in the system. Buffalo Sewer first applied this concept in 2019 when the Hazelwood RTC site was constructed upstream of the Lang RTC site. These two sites coordinate during storm events so that the in-line storage at Lang is utilized first. The Hazelwood site serves as a secondary source of storage when the Lang site indicates it will likely need relief. In this way, the Hazelwood site can store additional volume that would have previously overflowed at the downstream SPP. The addition of the Hazelwood site with coordinated control is expected to provide an additional 60% reduction in overflow volume at the downstream SPP compared to Lang operating independently.

A natural evolution of this coordinated operation between sites is a globally coordinated control strategy. In this scheme, all RTC structures communicate with each other and critical assets throughout the network to decide where and when to store or dewater by activating gates, valves or pumps. The decisions are driven by market-based optimization, a type of operational control strategy that treats RTC structures as commodity brokers. The "brokers" talk to each other every few minutes to make the optimal "buy" and "sell" decisions to manage flow. The commodity being traded is wastewater capacity in the form of conveyance and storage. Each RTC site is a consumer of downstream capacity as well as a seller of capacity to upstream consumers. They are each provided supply and demand curves of prices and quantities at which to buy and sell wastewater capacity and make control decisions.

Applying this approach empowers the entire system to work as a well-tuned machine, optimally adjusting operations in response to each unique wet weather event.

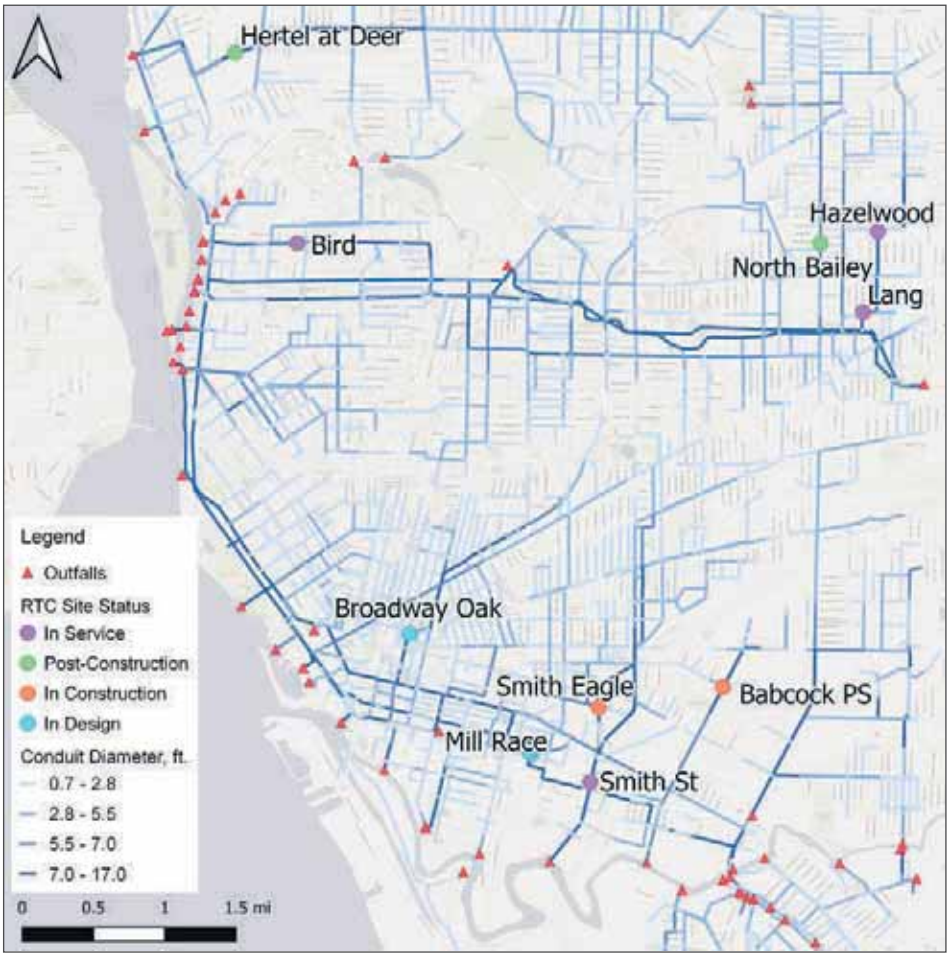
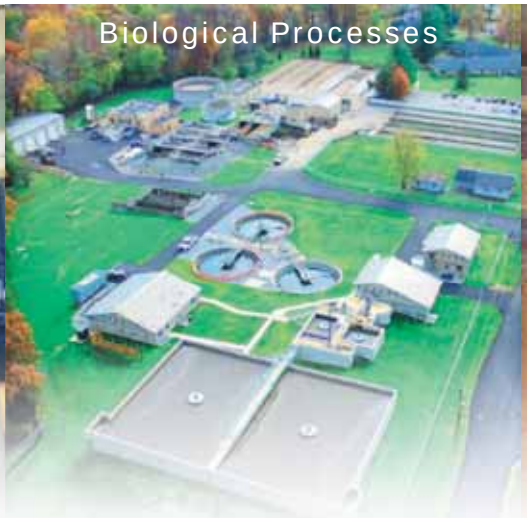


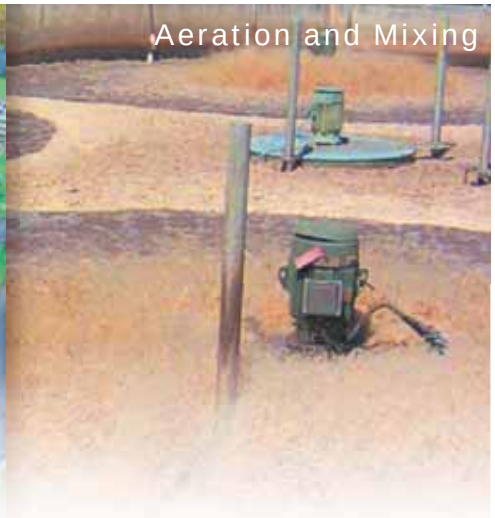
Figure 1. Buffalo Sewer Real-Time Control Project Status as of March 15, 2021. Purple indicates sites in service, green indicates completed sites undergoing post-construction tuning, orange indicates sites in construction, and blue indicates sites in design. *Xylem Inc.*

Putting Theory into Practice

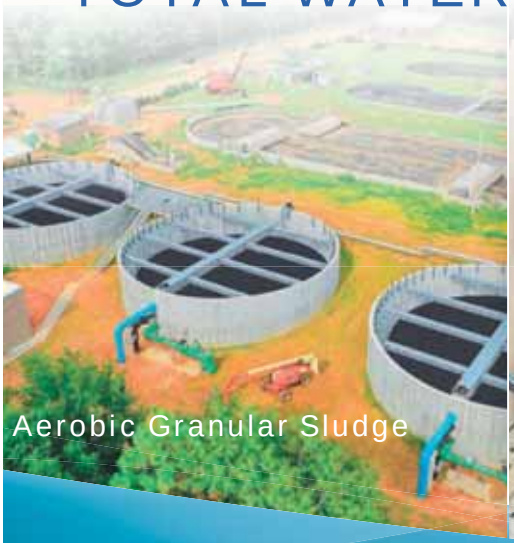
Initial analysis of operational RTC sites shows that this novel approach can help achieve the highest value results for overflow capture and create a cohesive system-wide strategy between the collection system and the treatment facility. Since the implementation of RTC sites across the system changes the behavior of flow coming into the treatment facility, a globally coordinated control strategy will unlock the potential for operational behavior such as dewatering at each RTC site based on conditions

continued on page 47





TOTAL WATER MANAGEMENT SOLUTIONS



ADVANCED TREATMENT FOR CHANGING DEMANDS

Aqua-Aerobic Systems, Inc. provides municipal and industrial customers with advanced water and wastewater treatment technologies that easily adapt to changing demands. From primary filtration to enhanced nutrient removal, stormwater treatment, water reuse and disinfection, Aqua-Aerobic has proven solutions that offer the lowest cost of ownership with life-time customer service.

New Plant Construction | Existing Plant Upgrades and Retrofits | Plant Expansions

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

www.aqua-aerobic.com | 815-654-2501

Proudly Represented By:

GP Jager Inc.

Buffalo, NY Office | **Dave Boshart**
105 Bristol Road | Fayetteville, NY 13066
p 315.256.3071 | **e** dboshart@jargerinc.com
www.jagerinc.com

Corporate Office
PO Box 50 | Boonton, NJ 07005
p 973.750.1180 | **e** gjager@jagerinc.com
www.jagerinc.com

Syracuse, NY Office | **Dave Boshart**
105 Bristol Road | Fayetteville, NY 13066
p 315.256.3071 | **e** dboshart@jargerinc.com
www.jagerinc.com

continued from page 45

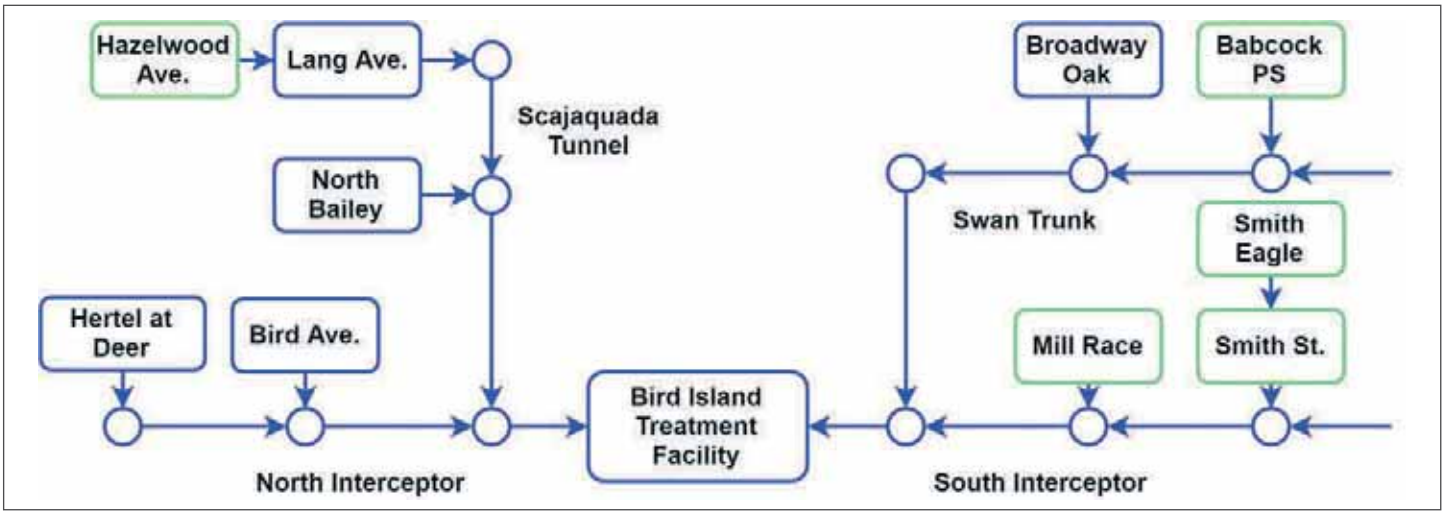


Figure 2. Schematic of Buffalo Sewer's RTC network, with sites that are designed to make coordinated control decisions highlighted in green. *Xylem Inc.*

at the facility. For example, RTC sites could continue to store flows even after local conditions have returned to normal, to allow for increased flows from surrounding suburban municipalities and other parts of the city into the facility.

The RTC sites that are operational and in design are closely related to the main interceptors into which they drain. The schematic diagram of RTC structures ***(Figure 2)***, shows how each site is connected for use in a global control strategy. Like Hazelwood and Lang, the new Smith Eagle RTC site will use coordinated control to store based on downstream conditions at the existing Smith Street RTC site. The Broadway Oak RTC in-line storage and Babcock Pump Station RTC upgrade will make control decisions based on the capacity available downstream in the Swan Trunk. Like the existing Smith Street site, Mill Race RTC will send flows that have already overflowed upstream SPPs into the South Interceptor when it has available capacity.

In the current phase of RTC implementation, half of the RTC sites make local reactive control decisions, while the other half make coordinated control decisions. Applying a globally coordinated control strategy for all 10 RTC sites will close this gap, maximize systemwide storage utilization, and balance flows coming to the Bird Island Treatment Facility. Orchestrating storage based on systemwide conditions will reduce overflows, while controlling the sequence of dewatering will reduce peak flows coming to the facility. These watershed-scale, coordinated, operational decisions are built into the market-based optimization approach.

Managing Localized Storm Events

A globally coordinated strategy often yields the most impact during intense storm events that only impact one area of the city. These types of short duration, high intensity storms are becoming more common compared to long duration, low intensity events *(Shaw et al., 2011)*. Buffalo's proximity to Lake Erie also poses a risk for unique, localized weather patterns during "lake effect" storms and flooding during seiche events.

Consider a hypothetical storm that only covers neighborhoods that contribute to the North Interceptor in Buffalo ***(Figure 3)***. In-line storage sites that contribute to the North Interceptor ("North RTC sites") would fill, and SPPs along the North Interceptor would be at risk for overflow. In the market analogy, the price per gallon of capacity would be high. Meanwhile, the South Interceptor would remain virtually unaffected by the storm, and the price per gallon of storage at in-line storage sites that contribute to the South Interceptor ("South RTC sites") would be low. In a globally coordinated system, South RTC sites could receive the message that the North RTC sites are starting to fill – the market prices would be increasing. The North could "buy" capacity from the South by triggering storage at South RTC sites. This would reduce South Interceptor flows and allow more flow to get to the treatment facility from the North Interceptor, reducing overflows at northern SPPs.

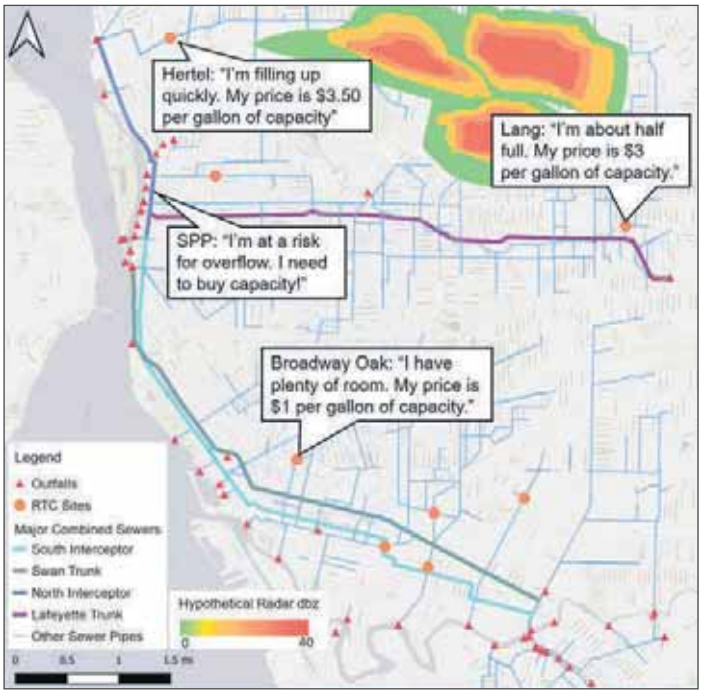


Figure 3. Hypothetical storm and responses from "brokers" in the market-based optimization approach. *Xylem Inc.*

While this localized storm in the North district of the collection system is a hypothetical scenario, it is a common occurrence that the North Interceptor peaks before the South Interceptor. This phenomenon was observed for multiple storms during a short-term monitoring effort ***(Figure 4)***. Given the sewer length and number of tributaries to North Interceptor compared to the South Interceptor, it makes sense that the North peak flows would reach the treatment facility first. Estimating the timing difference between the North and South peaks for different storms will allow for the optimization

continued on page 49

continued from page 47

of peak flow timing in each interceptor. For example, if flows contributing to the South Interceptor are held back longer, the combined peak flow reaching the treatment facility will be lower. This can reduce the amount of time the facility is operating under wet weather conditions. ***Figure 5*** demonstrates that by simply delaying the South Interceptor measured peak flows by one or two hours, the combined flow peaks can decrease by as much as 20 million gallons per day in the beginning of the storm event. This delay in South flow peaks can be accomplished by starting storage earlier and/or dewatering storage later at South RTC sites.

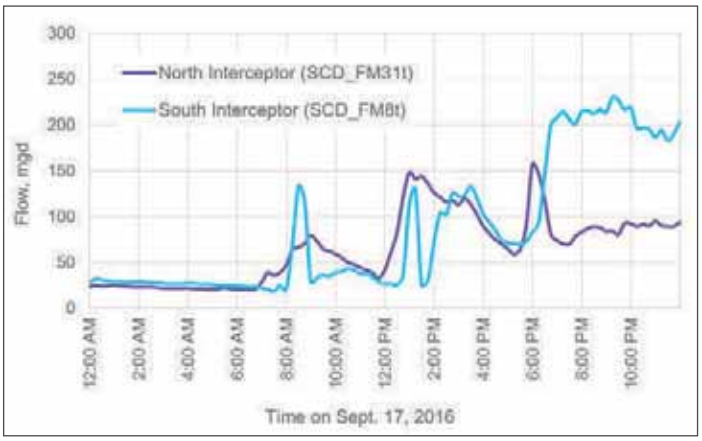


Figure 4. Timing Differential: Flow Meter Data. North Interceptor and South Interceptor flows observed at flow meters during the Sept. 17, 2016, storm event. *Xylem Inc.*

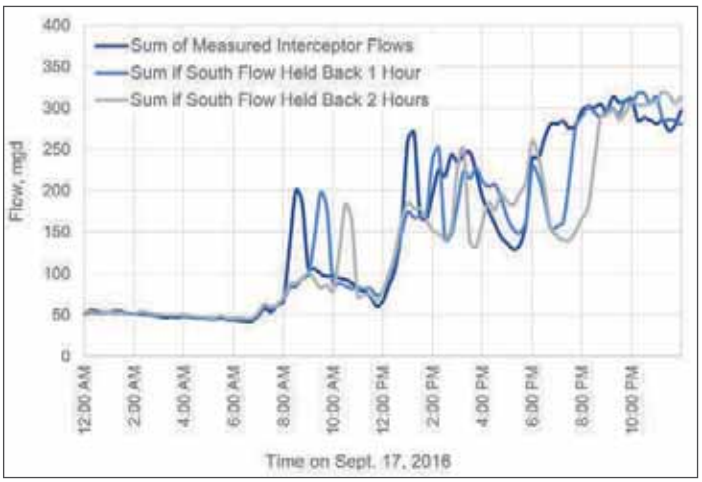


Figure 5. Combined North and South Interceptor Flow. Sum of measured data for North Interceptor and South Interceptor flows during the Sept. 17, 2016, storm event, with additional scenarios for South Interceptor flow data being delayed one hour and two hours. *Xylem Inc.*

Real-time Information is Key

To accomplish this optimal systemwide control, real-time information and data are needed about the rainfall intensity and accumulation, as well as additional information about level and flows inside the collection network itself. As a result, the market-based optimization strategy will be informed by a distributed sensor network. These sensors will measure flow, level, and rainfall throughout Buffalo Sewer's service area. Each RTC site will have substantially more information to make informed, intelligent local decisions that have watershed-scale benefits once the network is combined with the RTC sites' supply and demand curves.

Having this real-time information and visibility for the collection network provides additional benefits to Buffalo Sewer's teams. Along with RTC system management, the flow and level data can help identify causes of surface and basement flooding, characterize flow dynamics and performance, and optimize sewer cleaning schedules. Being able to track, monitor, and identify silt or grit buildup will help Buffalo Sewer clean sewers when they need to, rather than sending out crews for maintenance on an arbitrary schedule, only to have them find clean pipes. This will help BSA deploy their resources more effectively while reducing service issues.

Oh, The Places Buffalo Sewer Will Go!

Buffalo Sewer's collection system is already "smart," but it is ready for higher education through globally coordinated control and a distributed sensor network. While the design and deployment of this innovative system is still in the beginning phases, the relationships among Buffalo Sewer's sewer districts observed in previous RTC modeling efforts show there is great potential for market-based optimization to minimize overflows. The globally coordinated control strategy will help Buffalo Sewer realize additional benefit from existing RTC sites and will help inform their adaptive management approach to select and prioritize future projects, to benefit both the utility and the communities that Buffalo Sewer serves.

Kristina Macro, EIT, is a Hydroinformatics Engineer with Xylem and may be reached at kristina.macro@xylem.com. Taylor Brown, EIT, is a Junior Sanitary Engineer with the Buffalo Sewer Authority and may be reached at tbrown@buffalosewer.org. Rich Loeffler IV, EIT, is a Client Solutions Manager with Xylem and may be reached at richard.loeffler@xylem.com.

Reference

Shaw, S., R. Schneider, A. McDonald, S. Riha, L. Tryhorn, R. Leichenko, P. Vancura, A. Frei, and B. Montz. 2011. "Chapter 4: Water Resources." in *Responding to Climate Change in New York State: The ClimAID Integrated Assessment for Effective Climate Change Adaptation*. Final Report No. 11-18. Editors C. Rosenzweig, W. Solecki, A. DeGaetano, M. O'Grady, S. Hassol, and P. Grabhorn. New York State Energy Research and Development Authority (NYSERDA), Albany, New York. ISBN: 978-1-936842-00-1. Retrieved from: https://www.nyserda.ny.gov/About/Publications/Research-and-Development-Technical-Reports/Environmental-Research-and-Development-Technical-Reports/Response-to-Climate-Change-in-New-York.

GOWANDA AREA REDEVELOPMENT CORP.

Project Profile: Zoar Valley Gateway Park

by Gowanda Area Redevelopment Corporation

Site Reuse Development

In 1996 the Cattaraugus County Legislature established the Cattaraugus Creek Task Force to address environmental issues in Gowanda, New York. In 1997 the task force received a Technical Assistance grant from NJIT, thanks to the efforts of Bill Larow from the New York State Department of Environmental Conservation (NYSDEC).

In 2001 the Village of Gowanda received a $100,000 U.S. Environmental Protection Agency (EPA) Superfund redevelopment grant, and partnered with the University of Buffalo to develop site reuse and resolve legal issues affecting site re-use.

In 2002 after extensive public input and assistance from the UB school of Toxicology and the UB School of Law, passive/active recreational use with a commercial option was determined to be the best site reuse.

Site Ownership History

The site was the home of Eastern Tanners Glue, later known as Peter Cooper Glue, from 1904 to 1976 (formerly, the world's largest glue factory).

The site was sold to Rousselot Gelatin Corporation in 1976. They made synthetic adhesives until 1985.

In 1988 the site was sold to Jim Car Corporation, a no-asset corporation that conducted salvage operations at the site.

In 2009 the Gowanda Area Redevelopment Corporation (a not-for-profit IRC 501(c)3 corporation acquired the site.

In December 2009 the Gowanda Area Redevelopment Corporation leased the site in perpetuity to the Village of Gowanda.

Site Cleanup

In 2005 EPA and NYSDEC signed the Record of Decision requiring the responsible parties (PRPs) to clean up the site.

In 2008 the Village of Gowanda, Gowanda Area Redevelopment Corporation, EPA, NYSDEC and the PRPs signed the Site Agreement and EPA consent order requiring the PRPs to clean up the site.

In 2009 the PRPs completed site environmental remediation at a cost of $2.65 million. The PRPs also established an environmental trust to cover the annual cost of site operation and maintenance.

On August 2, 2011 EPA reclassified the site as a Class 4 site no longer posing a threat to public health and the environment.

September 2019 EPA de-listed the site.

The Gowanda Area Redevelopment Corporation owns the site property. The GARC is a 501(c)3 not for profit corporation, with officers Wayne Awald (president), Michael Hutchinson (vice president), Robert Gaylord (treasurer) and John Walgus (secretary). Website https://gowandaredevelopment.weebly.com/.

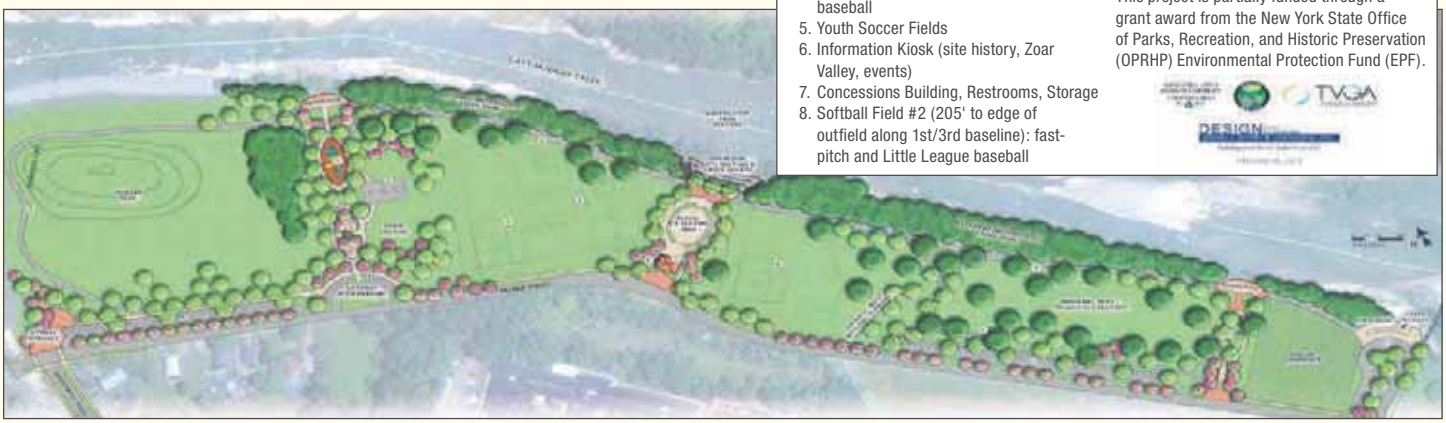
Project Partners

- ***Village of Gowanda (Mayor David Smith)***
- ***Cattaraugus County***
- ***NY Empire State Development Corp.***
- ***NYSDEC***
- ***USEPA***
- ***Benchmark Engineering, Inc.***
- ***C&S Companies***
- ***Joy Kuebler Landscape Architect***
- ***Kheops Architecture, Engineering & Survey, DPC***
- ***S. St. George Enterprises, Inc.***
- ***D&H Excavating, Inc.***
- ***Gernatt Asphalt Products, Inc.***
- ***University at Buffalo***
- ***Kirk Wilson, Lu Engineers, PC***
- ***Deborah Chadsey, Esq., Kavinoky Cook, LLP***

Accomplishments through July 2020

- Environmental Remediation completed 2009 – $2.65 million (PRP funded).
- 2010 Placement of 13,000 yards of NYSDEC part 375 compliant silt at the east end of the site.
- Park design completed 2013 ($76,500) New York State Environmental Protection Fund (EPF grant).
- Site clearing and sub-base grading plan completed 2014 ($540,333) (EPF grant $250,000, Gernatt's Asphalt donation $204,000, donated resources $86,333). Purchase and placement of 20,000 yards of sub-grade material (NYSDEC Part 375 compliant silt donated by Gernatt's Asphalt).
- On-going site operation and maintenance 2009-2014 ($31,000) (PRP trust account funded).
- Bid Engineering for phase 2 construction including EPF and Cattaraugus County Grant ($121,897) (KHEOPS Engineering).
- Play Structure bid January 2015 ($72,856) (Cattaraugus County Grant).
- Finish grade material bid – January 2015 ($113,648.50) (Cattaraugus County Grant).
- February 2015 completed design and bid documents for site finish, landscaping and trail construction.
- Finished site grading plan 2016. 9,400 yards of cover material, 1,740 yards of sub base material for trail system, 10,450 square yards of geotextile stabilization, 1,155 tons of blacktop parking lots and main trail system, 15 acres of hydro seed, 94 trees planted.
- 2017 Constructed 24'x2' gazebo at the west end of the site $10,000 ($3,500 Estate donation).
- 2017 constructed youth baseball field and backstop $15,057 (Cattaraugus County Grant).
- 2018 Received $1.7 million New York State Smart Growth grant for water front development at the Peter Cooper site.
- September 2019 EPA de-listed the Gowanda Peter Cooper Site.
- November 2019 hired consultant (Joy Kuebler, C&S Engineering and Lue Engineering) to design $1.7 million Smart Growth grant funded amphitheater and boat launch.
- June 2020 awarded construction contract for $1,786,705 to St. George Construction, Fredonia, NY.
- July 2020 Start construction of the NYS Empire State Development-funded amphitheater and small craft launch.

Master Plan
Zoar Valley Gateway Park
Gowanda, NY



NOTES:

1. Playground
2. Basketball Court
3. Gazebo
4. Softball Field #1 (275' to edge of outfield along 1st/3rd baseball line): slowpitch, fastpitch and Little League baseball
5. Youth Soccer Fields
6. Information Kiosk (site history, Zoar Valley, events)
7. Concessions Building, Restrooms, Storage
8. Softball Field #2 (205' to edge of outfield along 1st/3rd baseline): fast-pitch and Little League baseball
9. Frisbee Golf incorporated along park loop trail
10. Picnic Grove
11. Bus Loop: load/unload
12. Automobile Parking

This project is partially funded through a grant award from the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) Environmental Protection Fund (EPF).

Rendering of the proposed play structure.

Above: Play structure constructed on-site.

Inset photo, right: Constructed gazebo.

Baseball field construction.

Baseball backstop, 2017.

Finished amphitheater.

YOUR FUTURE

Water must be recovered, recycled, and returned to the environment. Your support of innovative solutions and technology helps us transform operations for greater efficiency, productivity, and long-term sustainability.

IT'S AN INVESTMENT IN YOUR FUTURE.

THE F**ACT**S

- Water resource recovery facilities are "green factories" that recycle used water and responsibly dispose of waste by producing valuable resources like clean water, renewable energy, natural fertilizer, nutrients, and transportation fuel.
- The used water you send down your drain contributes organic matter to water resource recovery facilities, where it can be consolidated, treated, and transformed into biosolids—a natural, safe, and endlessly renewable fertilizer.
- An energy-efficient wastewater sector could result in 95% reduced emissions and up to USD $40 billion in net savings. One of the world's first energy neutral facilities, in Marselisborg, Denmark, produces 40% more electricity than it needs to operate.
- Recycled water helps replenish sensitive ecosystems, recharge groundwater aquifers, and can be further treated to meet drinking water standards. Some communities in Australia, Namibia, Singapore, and the United States already drink recycled water. Some even use it to make beer!

Sources: https://bit.ly/2LFKr14

SMALL **ACT**IONS, BIG IMP**ACT**

- Only flush the 3Ps. Everything that goes down a pipe or storm drain ends up at your local water resource recovery facility or waterbody. Limit what you flush to (toilet) paper, pee, and poo—and responsibly dispose of, or recycle, the rest.
- Take a tour of your local water resource recovery facility to learn about water careers and the innovative ways water is managed in your community.
- Review your water/wastewater bill, ask about your community's stormwater plan, and stay informed about local, national, and global water issues.
- Invest in your local water infrastructure, become a water advocate, and volunteer for community clean-up and awareness activities.

YOU NEED WATER.
WATER NEEDS YOU.

WATER'S WORTH IT®

Water Environment Federation
the water quality people®

www.WatersWorthIt.org
#WatersWorthIt

CUT, GRIND & KISS YOUR SOLIDS GOODBYE

Vogelsang manufactures full lines of macerators and twin-shaft grinders, so it's not a question of which technology is better--only what's best for your application.

RotaCut
In-Line Macerator

- Heavy Solids Removal Pot
- Automatic Cut Control (ACC) For Consistent Performance
- Unparalleled Sludge Conditioning for Dewatering/Digester Applications

XRipper*
Twin-Shaft Grinder

- Monolithic Ripper Rotors
- Easy, Onsite Maintenance
- 2-Year Warranty, Parts & Labor, Including Wear Parts

***Special XRipper Offer:**

Don't pay another expensive grinder repair bill. Ask us about "Cost of a Repair" pricing.

Vogelsang Distribution, Sales & Support

KOESTER®

Upstate New York
(315) 697-3800

NYC, Long Island, New Jersey
(973) 492-0400

sales@koesterassociates.com
service@koesterassociates.com
parts@koesterassociates.com

VOGELSANG
ENGINEERED TO WORK

sales@vogelsangusa.com
(330) 296-3820
vogelsang.info

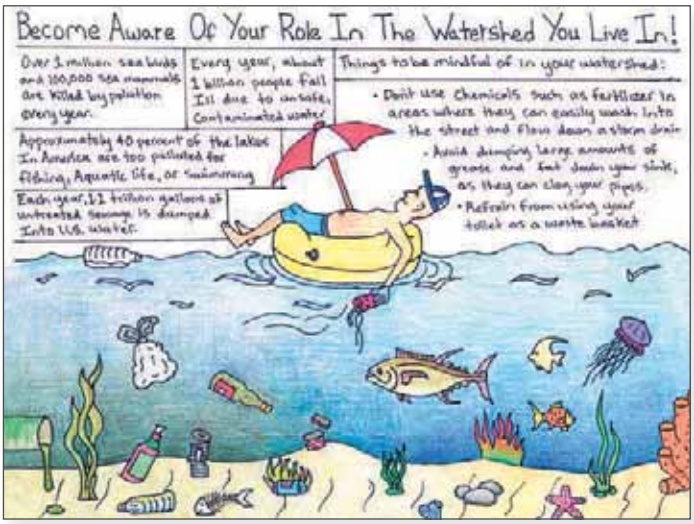
Congratulations to Our 2021 "Protect Our Watersheds" Poster Contest Winners!

NYWEA continues our partnership with the New York State Department of Environmental Conservation (NYSDEC) for the 2021 "Protect Our Watersheds" Calendar Contest! This contest engages middle school students in Grades 6 to 8 from across New York state to learn about their role in their own watershed. Students created fantastic artwork around the theme of conserving and protecting our watershed and water resources – now and for future generations. NYWEA members and NYSDEC staff selected the top 14 posters to be included in a 2022 calendar, which will be distributed throughout New York state.

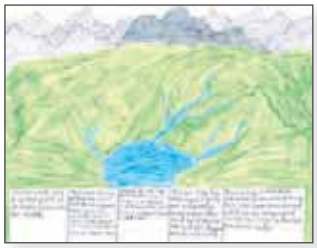
Contest Winners

1. **Top Winner:** Elijah Donlon, P.S. 195–City Honors School, Buffalo, NY
2. Alexander Randall, Northern Adirondack Central School, Ellenburg Center, NY
3. Billie Leet, Whitney Point Tioughnioga Riverside Academy, Whitney Point, NY
4. Brooke Ryan, Spencer-Van Etten Middle School, Spencer, NY
5. Cassel Koss, Long Beach Middle School, Long Beach, NY
6. Emily Bishop, Marcellus Driver Middle School, Marcellus, NY
7. Hannah Frank, School of the Holy Child, Rye, NY
8. Iverson Menjivar Quintanilla, Finley Middle School, Huntington, NY
9. Jack Klang, Long Beach Middle School, Long Beach, NY
10. Jhoselin Palacios, Corona Arts and Sciences Academy, Corona, NY
11. Nguyent-Vien Le, Lisha Kill Middle School, Albany, NY
12. Prushti Purohit, Thomas J. McCann Woodside Intermediate (I.S. 125Q), New York City, NY
13. Sophia Torres, Our Lady Star of the Sea School, Staten Island, NY
14. Tara Land, P.S. 195 City Honors School, Buffalo, NY

#1

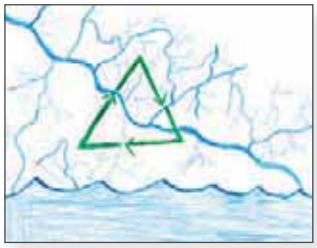


#2



#3

#4



#5

#6

#7

#8

#9

#10

#11

#12

#13

#14

Well done, everyone!

NYWEA™
LEADING THE WAY IN
WATER QUALITY MANAGEMENT

2021
Upcoming Training Classes & NYWEA Meetings

June 15-17, 2021	**2021 Spring Technical Conference & Exhibition** Virtual
June 22, 2021 **Part 1 of 4** 10:00 am-11:00 am	**Anaerobic Digestion Master Class: Learn How to Optimize Your Digestion Process and Generate More Gas from This Class** Virtual via Zoom
June 24, 2021 **Part 2 of 4** 10:00 am-11:00 am	**Anaerobic Digestion Master Class: Learn How Sludge Gets Rid of Your Sludge** Virtual via Zoom
June 29, 2021 **Part 3 of 4** 10:00 am-11:00 am	**Nutrient Management: Optimizing Nutrient Flows and Removal across the Plant via Nutrient Removal/Recovery in Biosolids** Virtual via Zoom
July 1, 2021 **Part 4 of 4** 10:00 am-11:00 am	**Biogas Utilization: Improving Biogas Quality in Three Key Areas** Virtual via Zoom
July 8, 2021 12:00 pm-1:00 pm	**Emergency Response & Crisis Management Lunch & Learn Webinar** Virtual via Zoom

For more information and to register, visitnywea.org.

Operator Quiz Spring 2021 – Administrative Duties

The following questions are designed for individuals/trainees pursuing certification as they prepare to take the ABC wastewater operator test. It is also designed for existing operators to test their knowledge. Each issue of *Clear Waters* will have more questions from a different process of wastewater treatment. Good luck!

1. The main purpose of a supervisor is to …
a. Only get in involved when the situation is warranted.
b. Provide training, guidance, discipline and safety to a facility.
c. Fill out paperwork.
d. Make sure the new employees are picking up the slack.

2. When disciplining an employee, it is important not to …
a. Remain calm and make sure the employee understands their actions.
b. Let the employee know mistakes happen and use this as a training moment.
c. Remind the employee to use appropriate SOPs when performing a task.
d. Be fair with discipline so all employees are treated equally.

3. The most effective way for supervisors to communicate with their staff is to …
a. Send an email.
b. Post a memo in the Break Room.
c. Have a face-to-face meeting.
d. Tell one person and make sure they distribute the information.

4. The Clean Water Act was established in …
a. 1776
b. 1972
c. 1976
d. 2001

5. What federal agency oversees worker health and safety?
a. EPA
b. OSHA
c. DEC
d. DOL

6. When an accident occurs that results in injury, what is the most important factor in creating preventable measures?
a. Time of accident.
b. Medical cost.
c. Amount of work employee missed.
d. Cause of accident.

7. What paperwork should be on file for every type of chemical used at your facility?
a. SDS
b. SPDES
c. Environmental hazards
d. EH&S

8. Which is the EPA part that provides rules and regulations for the disposal of wastewater residuals?
a. 750
b. 503
c. 305
d. 570

9. What should be done if a neighbor complains about odor?
a. Explain to them that they live by a WRRF and you really have no control.
b. Evaluate the source of the odor and use best practice to reduce the odor.
c. Make a note and only follow up if more people complain.
d. Shut the odor-causing part of the facility down.

10. Given the following data, what should be the annual chlorine budget?
• Plant flow = 115 MGD
• Effluent dosage = 6.25 mg/l
• Chlorine cost = $0.25 per pound
a. $2,188,000
b. $547,000
c. $1,500
d. $65,600

Answers below.

For those who have questions concerning operator certification requirements and scheduling, please contact Tanya May Jennings at 315-422-7811 ext. 4, tmj@nywea.org, or visit www.nywea.org.

NYWEA
LEADING THE WAY IN WATER QUALITY MANAGEMENT

Answers: 1. (b) Provide training, guidance, discipline and safety to a facility. **2.** (c) Remind the employee to use appropriate SOPs when performing a task. **3.** (c) Have a face-to-face meeting. **4.** (b) 1972. **5.** (b) OSHA. **6.** (d) Cause of accident. **7.** (a) SDS. **8.** (b) 503. **9.** (b) Evaluate the source of the odor and use best practice to reduce the odor. **10.** (b) $547,000.

Spring 2021, Vol. 51, No. 1

Clear Waters

New York Water Environment Association, Inc.

SIEWERT EQUIPMENT
A Division Of
CUMMINS-WAGNER
100% Employee Owned

RSP Systems
AUTHORIZED CAPSTONE DISTRIBUTOR

UNISON SOLUTIONS

TESTIMONIAL

Combined Heat & Power

The Oneida County Water Pollution Control Plant is utilizing the digester gas produced onsite in two new egg-shaped digesters that receive pre-processed food waste and sludge for co-digestion.

To handle the variable digester gas production, with less maintenance and fewer emissions, the plant operators and their engineer selected a highly efficient Capstone C600S Power Package for the 600kW combined CHP system.

The modular design of the C600S allows the system to run efficiently under dynamic plant electric loads as well as digester gas flow rates. The system was designed to accommodate plant growth, and can easily be expanded from current 600 kW output up to 1000 kW. The system output is used for on-site electric loads, while the microturbine's thermal energy is used to heat the digester and buildings.

The CHP system is generating 50-60% of the plant's electrical power. The plan is to produce more power once the project is completed and the CHP is expanded.

The digester gas treatment and energy recovery system was furnished by a single, system supplier. The digester gas is conditioned before use in the microturbines by removing hydrogen sulfide, moisture, and siloxanes.

The plant received funding from the New York State Energy Research and Development Authority (NYSERDA). The grant requires the owner to monitor the CHP system's performance and to collect and transfer the operating data to NYSERDA.

Contact your local Siewert Equipment Outside Sales Engineer to discuss CHP systems for your application.

Call 800-333-0598 or visit SiewertEquipment.com