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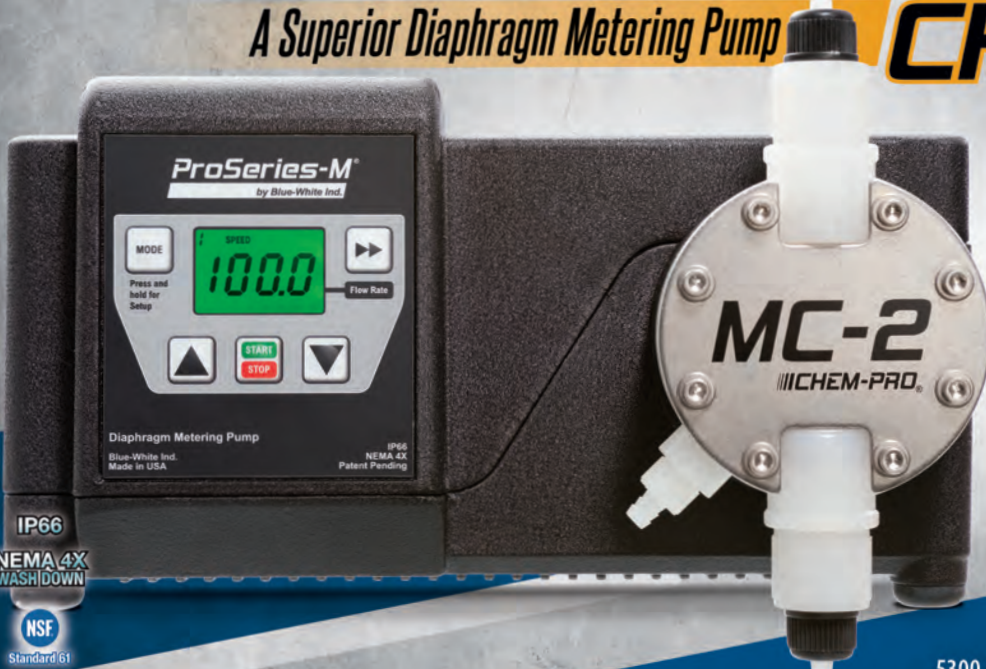
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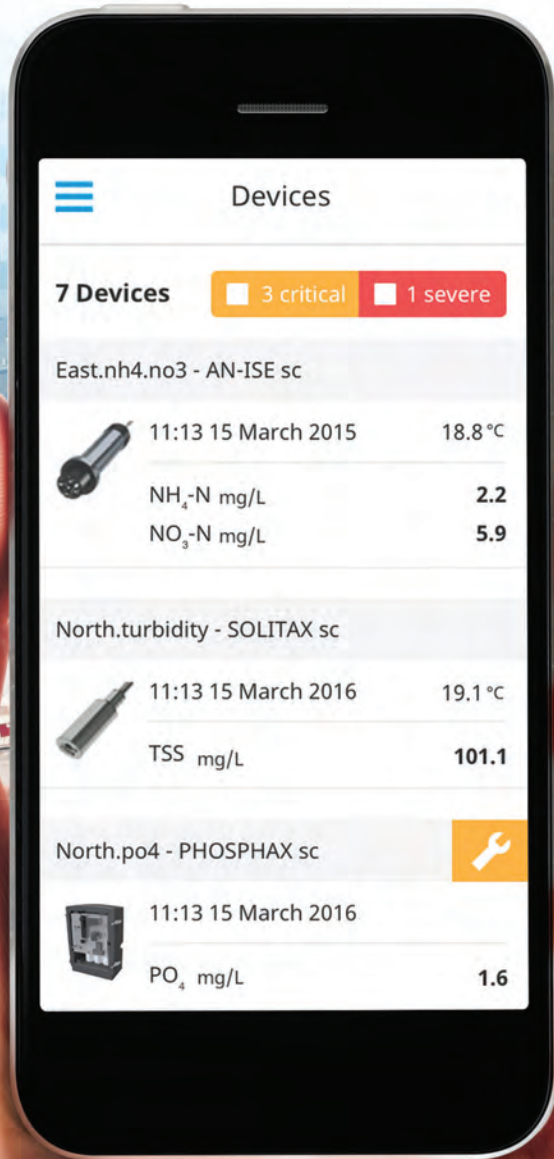


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on the cover

Recycling food waste to preserve landfill space is nothing new, but the California city of Manteca has bigger plans. In a few years, city trucks will be essentially running on methane generated from anaerobic digestion of food waste and FOG. It's a cooperative project involving Heather Grove, Manteca wastewater system superintendent, and Jeremy Kline, solid waste supervisor. (Photography by Lezlie Sterling)

top performers:

WATER: PLANT Page 18

Clear Objectives

A fine-tuned process and effective operator training help a North Carolina water plant win a series of honors for maintaining low turbidity.

By David Steinkraus

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Pleasing Alternative

A new oxidation ditch treatment plant produces high-quality effluent and helps bring an Ohio village into more consistent permit compliance.

By Steve Frank

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Performance Under Pressure

Quick and creative action helped Wichita Falls develop a direct potable water reuse system in the face of a historic four-year drought.

By Jim Force

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Food to Fuel

A California city gears up for a biogas production project that will convert food waste from schools and businesses into clean gas for vehicles.

By David Steinkraus

plant proficiencies

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The Phosphorus Dilemma

There's too much of it in the waterways. There's too much (or not enough) in farm soil. What's the future of managing this nutrient in clean-water plants?

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By Bob Fowler

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Ease of Receiving

Septage acceptance plant from Lakeside Equipment keeps haulers and operators happy.

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Turbidity Testing Made Clear

Accurate turbidity analysis depends on proper sample collection and care, correct calibration and maintenance of analysis instruments and cells.

By Peter Strimple

IN MY WORDS Page 68

The Power of Cover Crops

The National Wildlife Federation looks to engage with utilities in efforts to reduce nutrient pollution from farm runoff in watersheds.

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Murals on Livermore's wastewater treatment facilities remind residents that they have a direct connection with the ocean and its marine life.

By Jeff Smith

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A new cloth-media filter designed for primary treatment and wet weather flow handles high solids loading rates in a compact footprint.

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Energy Management and Sustainability

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Reuse, Recovery and Energy Management

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 - Water Plant: Presidents Award in Hershey, Pennsylvania
 - Wastewater Operator: Chris Cox, Montpelier, Vermont
 - Wastewater Plant: Loxahatchee River District, Jupiter, Florida
 - Agency: Phosphorus reduction in Madison, Wisconsin
- » How We Do It: Flexible liner for an industrial wastewater lagoon
- » Sustainable Operations: FOG-enhanced CHP in Portland, Oregon
- » In My Words: An EPA perspective on biosolids progress
- » PlantScapes: Land that tells a story in New Haven, Connecticut
- » Technology Deep Dive: A new approach to SCADA and HMI

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let's be clear

The Phosphorus Dilemma

THERE'S TOO MUCH OF IT IN THE WATERWAYS.
THERE'S TOO MUCH (OR NOT ENOUGH) IN FARM SOIL.
WHAT'S THE FUTURE OF MANAGING THIS NUTRIENT
IN CLEAN-WATER PLANTS?

By Ted J. Rulseh, Editor

Phosphorus is becoming a riddle for clean-water plant operators. Not so long ago, the nearly sole focus was on getting it out of effluent to keep from fertilizing rivers and lakes and causing blooms of blue-green algae.

Of course, taking phosphorus out of the wastewater generally means putting it into the biosolids. And, now, increasingly, regulators worry about applying that phosphorus to the soil, from which it can migrate into waterways if biosolids aren't carefully managed.

Hanging over these concerns is the issue of peak phosphorus: The mines that produce phosphorus for commercial fertilizers are seeing declines in volume and quality. And phosphorus of course is essential to farm crops (and for that matter to all plants and all life).

So it appears that on a global scale we have the challenge of finding ways to keep phosphorus away from where it does harm and putting it where it does good. That's not easy, technically or economically.

ISSUES ON LAND

Tight effluent phosphorus limits on treatment plants are increasingly common. Reaching a low limit often means a costly plant upgrade. Whether removed chemically or biologically, phosphorus ends up in the solids stream. More and more often, it becomes a constraint on where the biosolids can be applied.

Biosolids are typically applied in amounts to meet the crop's need for nitrogen; phosphorus goes along for the ride. Some farm soils are naturally rich in phosphorus — there is more than enough to nourish the crops. So applying more doesn't make much sense, especially when the excess might end up polluting a stream. Other farm soils are poor in phosphorus and need replenishing. Here, biosolids can provide a great benefit.

State regulators deal with this issue by requiring soil tests and allowing addition of phosphorus only where it's needed. Some states use software programs that assess the pollution risk from applying phosphorus. Risk factors include crop-



ping patterns, distance to waterways, severity of slopes, and the presence or absence of farming practices like no-till and streamside buffer zones.

LOGISTICAL ISSUE

For clean-water utilities, managing biosolids high in phosphorus can become a logistical problem. What if the farms with soils low in phosphorus are far removed from the treatment plant? Hauling biosolids long distances, even if well dewatered, is expensive. So is taking biosolids to land-fill because there are too few close-in, permittable sites.

Perhaps this is where nutrient recovery comes in. A few processes exist that can extract phosphorus from biosolids in the form of struvite, yielding a marketable phosphorus fertilizer than can be transported at reasonable expense.

It appears that on a global scale we have the challenge of finding ways to keep phosphorus away from where it does harm and putting it where it does good. That's not easy, technically or economically.

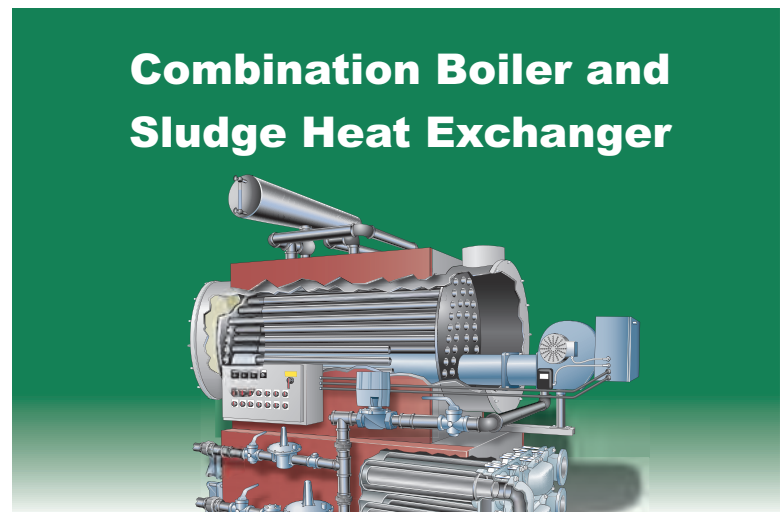
Such processes have the extra benefit of helping to limit troublesome struvite deposits in digesters and related piping and equipment. Of course, phosphorus recovery takes a substantial investment; it's not for everybody.

An alternative or adjunct to nutrient recovery is adaptive management — reducing phosphorus inputs to streams by improving farming practices throughout watersheds. This is beneficial even apart from wastewater treatment; it just so happens that wastewater utilities can become a source of funds for making the improvements. That is, instead of spending on costly plant upgrades, the utilities can help fund more environmentally sound methods of farming.

THINKING BIGGER

More and more, phosphorus in wastewater looks like an issue that is not local, but national and even global in scope. Phosphorus is an essential resource that is at risk of becoming scarce. It certainly makes more sense to capture it so that it can be used optimally than to spread it around willy-nilly.

I suppose I am naïve enough to think there is room somewhere, at some future date, for a national policy and guidelines on managing phosphorus from all its sources. An element among those on which life depends certainly seems to deserve that kind of priority. **tpo**



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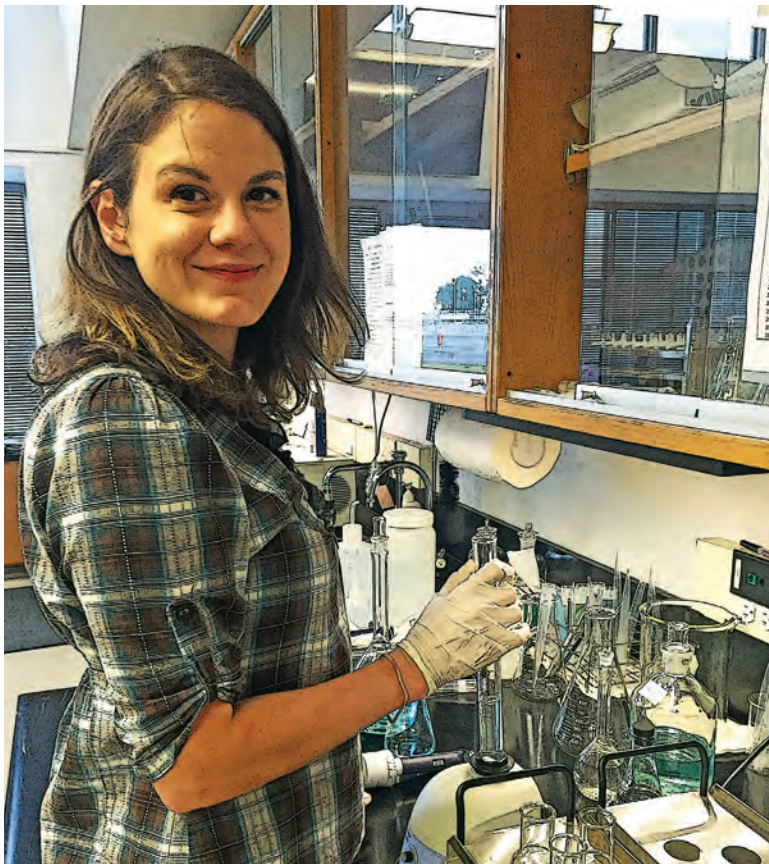
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THE GEOLOGIST OPERATOR Mixing Oil and Water

The water industry wasn't Abigail Foust's first career choice. Instead, her career began in North Dakota's oil industry. In this online exclusive, read about Foust's transition from oilfield geologist to water technician, and see how her skill set proved surprisingly diverse.

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PHOSPHORUS ALLIES Unraveling the Dairy/Wastewater Connection

In the Dairy State, a new partnership is taking form: Municipalities and dairy farmers throughout Wisconsin are teaming up to control phosphorus discharges. Read how this novel approach is bringing point and nonpoint sources together.

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Why You Need to Go Beyond the Wastewater Classroom

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WOODCHIP SOLUTION

Northwoods City Tackles Odor Control

To eliminate odors from foil air drawn beneath its influent channel covers, the city of Rhinelander,

Wisconsin, installed a simple filter consisting of a bed of woodchips. Get the details on this odor control system, which works well in Wisconsin's Northwoods, where woodchips are plentiful.

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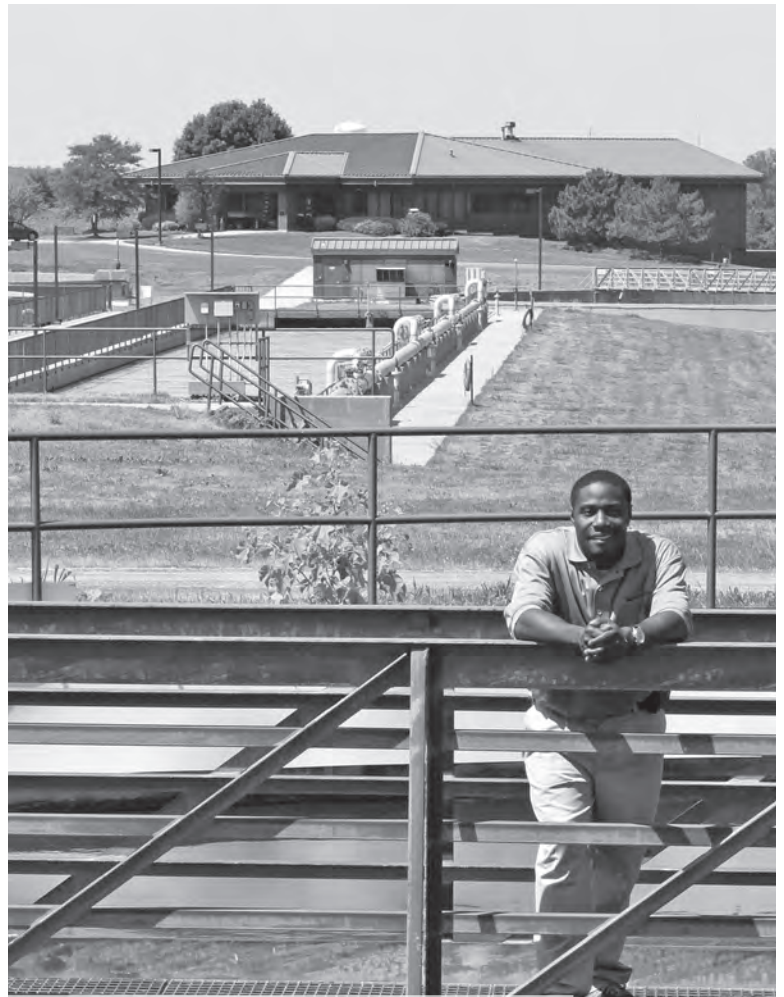
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“ The team members are the greatest resource at this plant. They know it. They’ve been here forever. They do the work. I’m support staff. I coordinate what they do, and the best way for me to do that is to listen to what they have to say.”

Nate Tillis
 Operations and maintenance supervisor
 Beloit (Wis.) Water Pollution Control
 Treatment Facility

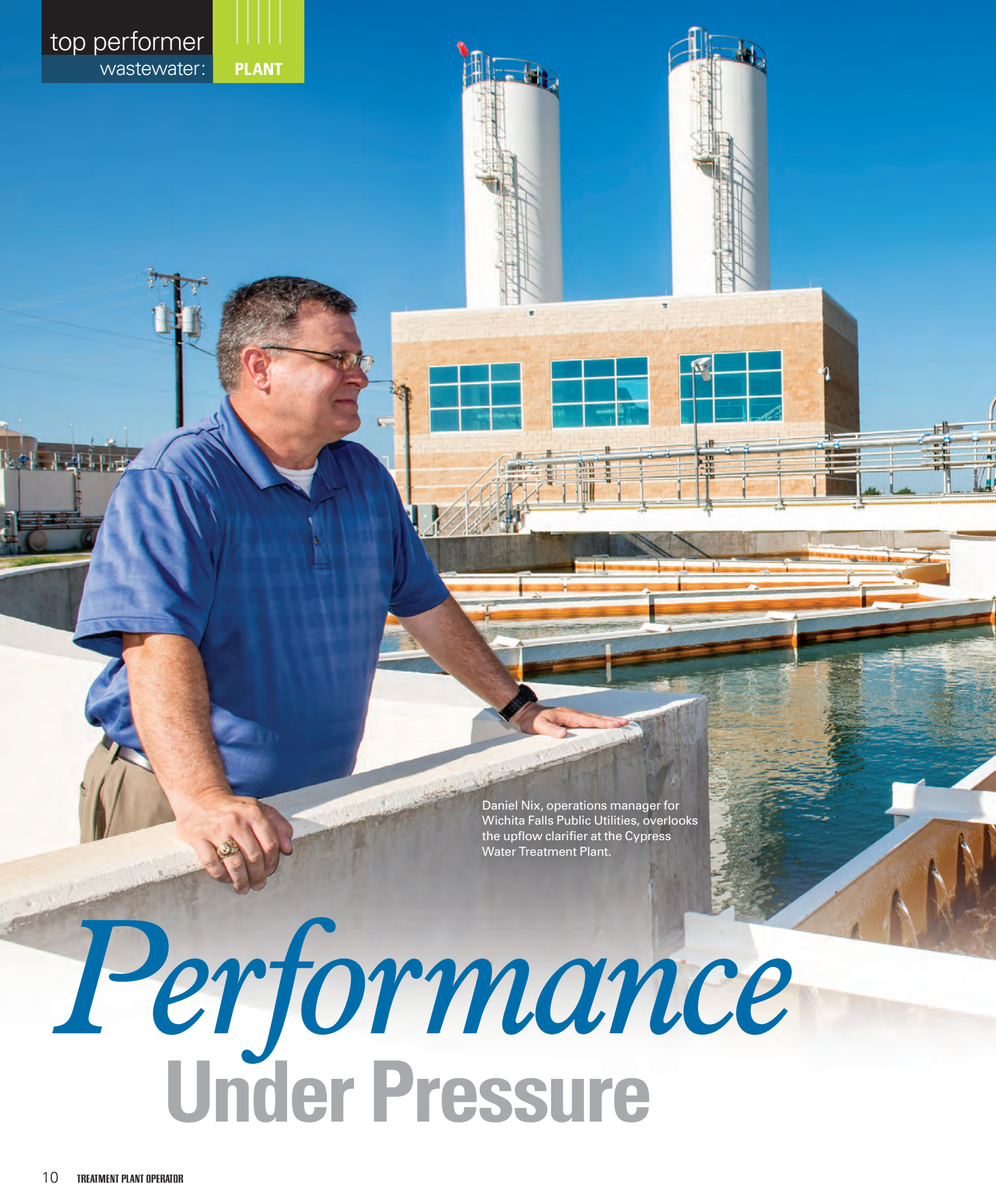
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Daniel Nix, operations manager for Wichita Falls Public Utilities, overlooks the upflow clarifier at the Cypress Water Treatment Plant.

Performance Under Pressure



“When our backs were against the wall and we were facing the drought, with no good news in sight, our people stepped up and found a solution to keep water flowing to our residents.”

GLENN BARHAM

QUICK AND CREATIVE ACTION HELPED WICHITA FALLS DEVELOP A DIRECT POTABLE WATER REUSE SYSTEM IN THE FACE OF A HISTORIC FOUR-YEAR DROUGHT

STORY: **Jim Force**

PHOTOGRAPHY: **Olivia Ogren-Hrejsa**

DROUGHT. YOU WOULDN'T CALL IT A BLESSING IN disguise, but it may have a positive side.

That's becoming evident at Wichita Falls, Texas, where the utility fast-tracked an emergency direct potable reuse (DPR) system three years ago and is now converting it into an indirect potable reuse system (IPR) designed for the long haul. Customers have become well educated about drought and water reuse, and water safety and supply are now top of mind at the city Public Works Department.

“With rains last spring, we're in pretty good shape now,” says Mark Southard, water purification superintendent. But the utility and community are much more water-conscious than before; overall water consumption is down since the drought ended, and the water treatment operation is more focused on saving water.

For one thing, Southard says, “We're concentrating on capturing and reusing as much filter backwash water as possible.”

HIGH AND DRY

Wichita Falls draws its raw water from area lakes that depend on rainfall, normally averaging 28.5 inches a year. In 2011, as temperatures exceeded 100 degrees F for 100 straight days, rainfall dropped to 13 inches, after 19 inches fell in 2012, making the two-year period the driest on record. There were only modest improvements in 2013-2014, and the overall effect was that the source water lakes dropped to record low levels.

The city took bold action in permitting, designing, building, testing, certifying and starting up the direct potable reuse system in less than 27 months. A 12-mile, 32-inch HDPE pipeline laid on the surface (pipe supplied by ISCO Industries) carried 5 to 7.5 mgd of secondary wastewater from the River Road Wastewater Treatment Plant to the Cypress Water Treatment Plant. That represented a large share of the city's potable water output of 10.5 mgd.

“That 10.5 mgd was achieved through water conservation and drought restrictions,” notes Daniel Nix, utilities operations manager. “Before the drought we normally averaged 22 mgd with a summer month average of 30 mgd.”

At the Cypress facility, the water passed through existing microfiltration and reverse osmosis units, then flowed to a lagoon where it was blended half and half with lake water before being sent back through the water treatment plant for conventional treatment. The MF and RO units were already in place since they had been used in the past to treat surface water from a brackish source.

Besides taking advantage of the existing equipment, the new flow scheme yielded savings because the conventional water plant no longer had to use its lime softening and CO₂ restabilization processes.

Public safety was paramount. Nix observes that the city analyzed and tested for corrosion control and used multiple levels of disinfection throughout the process: “We monitored cumulative virus, *Giardia* and *Cryptosporidium* log removal every eight hours.” Concentration and time calculations were tracked across all disinfection zones. In addition to the pipeline (\$9 million), the only other major expense was for online monitoring equipment. “As far as large plant improvements were concerned, there were none,” says Nix.

SMOOTH SAILING

The Wichita Falls DPR system ran for 12 months without any operational issues. It was shut off in July 2015. There were no health effects or quality issues. “Our customers felt the taste and quality of the water was superior to what they had been receiving before,” Nix says. “We actually had some folks ask us to turn the reuse system back on.”

More than adequate rainfall in 2015 allowed the utility to discontinue direct reuse, and allowed time to model the indirect reuse system, obtain permits, complete design and begin installation. The pipeline has been cut into sections and is being reassembled in a trench that will take treated wastewater from River Road to Lake Arrowhead, one of the city’s source water lakes.

Wichita Falls (Texas) Potable Water Reuse System

POPULATION SERVED: | 150,000

SERVICE AREA: | City of Wichita Falls (70 square miles) and
15 wholesale customers

EMPLOYEES: | 34 operations, 22 maintenance

FLOWS: | Wastewater treatment plant 19.91 mgd,
water treatment plant 14.5 mgd

WASTEWATER TREATMENT LEVEL: | Secondary

ADVANCED WATER TREATMENT PROCESS: | Microfiltration and reverse osmosis

WATER TREATMENT PROCESS: | Conventional

WEBSITE: | www.wichitafallstx.gov



There it will mix with the lake water before being pumped to the Cypress and Jasper water treatment plants and fed into the distribution system. The local firm of Biggs & Matthews did the design for the DPR pipeline. The IPR pipeline was designed by Corlett, Probst and Boyd.

Nix expects the indirect system to be up and running by the end of 2017. Capacity will be 16 mgd, but Nix expects the average daily flow to be about 10 to 12 mgd.

No improvements will be required at the two water treatment plants, which employ conventional treatment including pre-disinfection, coagulation and sedimentation, filtration and post-disinfection. Clearwell capacity is 1/2 million gallons; inground storage basin capacity is 18 million gallons at both plants for a total of 36 million gallons.

Southard says the inground storage basins enable the plants to remineralize the RO water, which can be aggressive. Plant production capacity is 52 mgd at Cypress and 24 mgd at Jasper.

RIVER ROAD UPGRADES

Meanwhile, \$30 million is being spent to upgrade treatment at the River Road plant. Improved nitrogen and phosphorus treatment systems are being added. In a design by CDM Smith, a new liquid oxygen system will boost dissolved oxygen to maintain required oxygen levels at the end of the reuse pipeline, and lime will be used for alkalinity adjustment.

Cloth disc filters (Aqua-Aerobic Systems) will provide a barrier against *Giardia* cysts and *Cryptosporidium* cysts while boosting phosphorus removal. The system will be equipped with new high-service pumps. All chlorinators and sulfonators will be replaced with the most current models. To improve monitoring, a new SCADA system with PLCs, servers and several HMI consoles will be installed.

Still, that’s considerably less than what would have been required if Wichita Falls had continued with direct reuse. “If we’d stayed with DPR, we would have had to spend another \$40 to \$50 million on a new advanced water treatment plant,” Nix says.

“Our customers felt the taste and quality of the water was superior to what they had been receiving before. We actually had some folks ask us to turn the reuse system back on.”

DANIEL NIX

The IPR system will sustain the city’s water supply into the future and will also be more efficient. The direct system saw water losses of about 20 percent because MF and RO systems produced brine, which also needed disposal. Nix notes the indirect system will make 100 percent of the water available for reuse: “Indirect reuse will be our long-term solution.”

Hunter Adams, water laboratory supervisor, prepares a water sample for halo acidity analysis.





The reverse osmosis system at the Cypress Water Treatment Plant includes an impressive gallery of membrane modules.

CROSS-TRAINING

Big changes in water treatment like this don't just happen. Staff training has been a key to the success of the reuse innovations. Because the reuse systems involve both the wastewater and water treatment plants, the utility took the opportunity to cross-train the operators.

"We took the water treatment operators to the wastewater plant and showed them how it worked," says Southard. "Then, we reversed the roles and took the wastewater plant staff to the water plant so they could learn about water treatment. They'd been operating parallel to each other for years, but they needed to communicate in order to know what each other needed."

One of the understandings that came out of the cross-training had to do with ammonia. "At the wastewater plant, they'd been trained to take out as much ammonia as they possibly could, but the operators at the water plant explained that they needed some level of ammonia in the feedwater so they could create chloramines in the pre-disinfection process," says Southard. "It was like, 'Please leave some ammonia in the water.' It was important that both operational teams understood why this was so important."

GETTING CERTIFIED

Potable reuse systems create a number of new challenges for operators. For one thing, a new certification process is called for. The utility took the lead in working with the Texas section of AWWA and Water Environment Association of Texas to put together a reuse certification program. "Currently, we're developing a curriculum and training certification process," Nix explains. "Both Texas and California are sharing ideas."



Team members use an Ultrameter II (Myron L Company) to measure the total dissolved solids in the RO system's individual pressure vessels.

He expects the program to be complete within 12 to 24 months, and that the entire Wichita Falls water and wastewater staffs, including operations and maintenance, will become certified before startup of the IPR system.

Training and certification were also critical during the operation of the MF and RO units during operation of the DPR. About half the water plant staff members were on board when the RO units were started up to treat brackish water, but the others had been hired since and required training on the advanced filtration system operation and maintenance.



The team at the Cypress Water Treatment Plant includes, front row, from left, Nolan Mulholland, plant operator I; Warren Richardson, operator II; Steve Forbes, operations and maintenance supervisor; Samantha Reeder, senior laboratory technician; and Sherri Hitchcock, administrative clerk; back row, Mark Southard, superintendent of water source; Michael Miller, lead plant operator; Daniel Nix, operations manager of public utilities; and Hunter Adams, water laboratory supervisor.

“We worked with the Texas Commission on Environmental Quality (TCEQ) to get all our operators fully trained and certified,” says Southard. “The South Central Membrane Association approved the modules.”

Harold Burris, wastewater plant superintendent, says all operators are certified for wastewater by TCEQ. “We also require all mechanics to be certified,” he says. “They need to understand the process and what the potential consequences may be if they make an equipment change. We also have

budgeted for employees to be cross-trained in water treatment. Even though they currently can’t obtain their water operator certification, we feel it will help them understand the process and what is required to treat water to drinking standards.”

STILL CONSERVING

Even though water levels in the source water lakes are back to normal,

ACCEPTANCE THROUGH EDUCATION

Potable water reuse systems, direct or indirect, often spark public controversy. Some people say, "I'll get a second chance to drink my beer." And the media contribute the overused "toilet to tap" label.

Wichita Falls officials credit an effective education program with helping the city's direct and indirect potable reuse systems gain acceptance and understanding. "Education is the key," says Daniel Nix, utilities operations manager.

"We did several things that I believe worked in concert with each other to gain the public's acceptance of the direct potable reuse system. First, we kept them completely informed about the drought situation and how long we were projecting the remaining water would last. That way they knew the seriousness of the situation.

"Second, we relied heavily on the local media. When we proposed the DPR, we brought them all in for a brunch and discussed the entire thing with them from the wastewater plant through the water treatment processes. They did nonstop stories on the drought and the DPR.

"Not only did they do stories on each process and what it accomplished, but they also highlighted the state-of-the-art laboratory we had as well as the training and certification all our operators possessed. In 365 days, our local newspaper ran over 280 stories. We needed the public trust, so we were completely transparent about everything, even if it was bad news."

Finally, Wichita Falls enlisted the help of the medical profession and a local university to help validate the safety of the system. "We felt that if they heard from medical doctors and academic people with pedigrees, the public would be more accepting than just hearing it from city officials," says Nix. "We toured them through the plants and asked them to make statements on a video that we released. It's still on YouTube."

Wichita Falls is taking whatever steps it can to make sure enough water will be available in the coming years to meet demand. Southard says the backwash water from the filtration process is now being pumped into a lagoon, then pumped back into the water treatment plant and retreated.

"We can use up to 50,000 gallons to backwash, and it doesn't make sense to waste that water," Southard says. The RO units are a different story. They're still in use even though the DPR system has been shut down, filtering brackish water from Lake Kemp as a supplement to the other source water lakes.

"We don't have the ability to reuse backwash water from the RO units," Southard notes. "It's a little more difficult because the RO wash water is so concentrated. While we can't recycle it, we are adjusting the recovery rates on the RO units from 70 to 80 percent, again, as a way to conserve water in the treatment process."

TEAM EFFORT

It took a team to get through the most serious drought in Wichita Falls history, and city officials have been generous with praise for the utility management and staff, as well as the citizens. Darron Leiker, city manager, observes, "Bringing the DPR project to life was a team effort, including the citizens who had to implement significant water conservation strategies. These, along with the DPR project, helped extend the life of our water supply."

The project received a Municipal Excellence Award from the Texas



Daniel Nix,
operations manager

Municipal League, the Alan H. Plummer Environmental Sustainability Award from WEAT, and a Project of the Year award from the Texas Public Works Association.

Mayor Glenn Barham adds, "This is special. The awards recognize all the hours, days and months of researching, planning, testing, overseeing and constructing the DPR project.

"When our backs were against the wall and we were facing the drought, with no good news in sight, our people stepped up and found a solution to keep water flowing to our residents." tpo

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The Sturgeon Festival includes demonstrations that allow attendees to touch a live sturgeon.

PHOTOS COURTESY OF FRIENDS OF THE ST. CLAIR RIVER

Big Fish in a Clean Pond

THE ANNUAL STURGEON FESTIVAL IN MICHIGAN'S ST. CLAIR COUNTY CELEBRATES THE FISH'S RESURGENCE WHILE TEACHING PEOPLE ABOUT THE IMPORTANCE OF CLEAN WATER

By Craig Mandli

More lake sturgeon swim in the waters touching Michigan's St. Clair County than in any other spot in the Great Lakes. Now the population of the once-threatened species appears to be growing, thanks in part to clean effluent produced by the Port Huron Wastewater Treatment Plant in partnership with Friends of the St. Clair River.

Sheri Faust, an environmental health educator with the St. Clair County Health Department and president of Friends of the St. Clair River, says the largest known spawning area in the Great Lakes is at Port Huron's doorstep — the St. Clair River just south of the Blue Water Bridge.

While other sturgeon populations around the Great Lakes have declined, they have thrived in the St. Clair. Every year during the height of the fish's spawning run in late May and early June, the Blue Water Sturgeon Festival celebrates that achievement.

GAINING POPULARITY

In its fourth year in 2016, the festival reached attendance of more than 6,000, up from 1,000 in its first year. "It's unique to this

area," says Faust. "That's what makes it so exciting and such a neat opportunity. Families can actually come down and see a species up close that normally cruises the depths of the Great Lakes."

The clean waters of the St. Clair River create a sense of pride for the employees of the Port Huron Wastewater Treatment Plant, an 11 mgd activated sludge facility that discharges into the river near the harbor. The plant is a main sponsor and partner of the festival. Patty Troy, lab manager, says plant staff members are instrumental in planning and assisting, and for fifth-grade sturgeon-sighting field trips on the Huron Lady II.

"We have more sturgeon here than any other place in the Great Lakes," Troy says. "It's a narrow window of time when they migrate through for spawning. It's a great opportunity for us to talk about our work and the importance of clean water."

The Port Huron plant has been on the forefront of several efforts to make the harbor more inviting for spawning fish. Among the accomplishments was the recent removal of the Beach Closings Beneficial Use Impairment designation, due in part to the elimination of combined sewer overflows.

Fifth-graders prepare to board the Huron Lady II for a sturgeon-sighting field trip.

PITCHING IN

Michigan Sea Grant recently funded construction of three spawning reefs in the river for sturgeon and other species. Fish nursery habitat is another project. Community outreach and inspections sharply reduced pollutant loadings and spills by industries and coastal municipalities. Contaminated sediments along the Canadian shoreline have been removed, and plans are in place to address remaining impaired sediments.

“The people who work at our plant are very proud of the river and the work we have done and continue to do to keep it clean,” says Troy. “It’s very important to us to maintain a suitable habitat for fish, and seeing our sturgeon numbers grow shows that the work we’re doing is helping.”

The Sturgeon Festival includes demonstrations where attendees can touch a live sturgeon. The Huron Lady II offers multiple sturgeon cruises, trolling a diver with a camera so passengers can watch live video of sturgeon. Booths focus on the biology and life cycle of sturgeon, water quality, and past work on fish habitat restoration.

“The overall improved health of the river is vital toward supporting the unique resource of the lake sturgeon, which the Sturgeon Festival celebrates,” says Troy. “I don’t think you can find a more concentrated population anywhere than under the Blue Water Bridge during the spawning run. It truly is amazing, and should be celebrated.”

“The more people come in contact with the sturgeon, the more they want to take care of the river.”

SHERI FAUST

Sturgeon for Tomorrow. “We think that brings more families down to the festival,” Faust says.

This year some 500 fifth-graders took the sturgeon cruises on Friday, and another 300 people did so on Saturday. The students earn their cruises by competing in a sturgeon-themed poster contest; winning posters were used to promote the festival.

“The cruises booked up very quickly, and we actually had to turn a lot of people away,” Faust says. “It’s a pretty rare opportunity that we wish we could offer more. The students really get into it.”

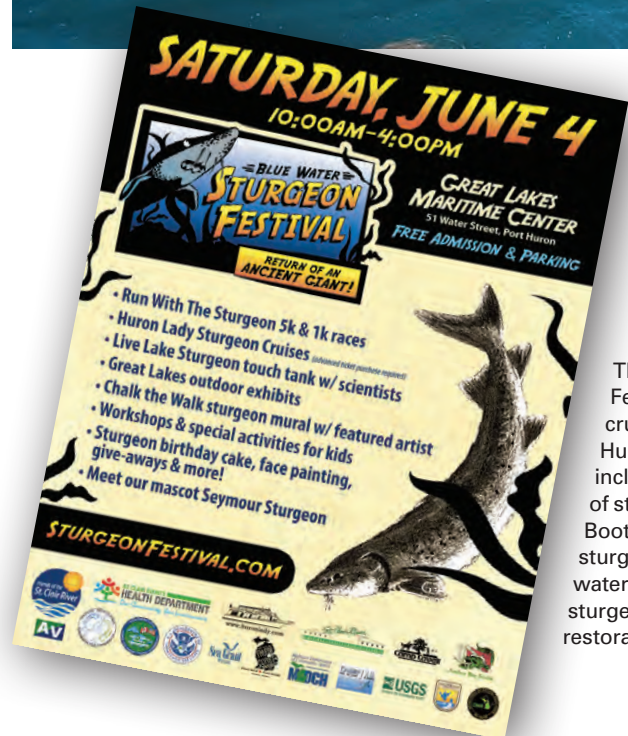
While sturgeon are the highlight of the festival, Faust sees the event to educate attendees on larger issues facing the Great Lakes and each person’s impact: “I’d say the sturgeon are the hook that gets people in, but the broader look is on the health of the water quality and wildlife. All the components we include deal with the overall health of the river and Lake Huron.”

SIGN OF HEALTH

That method has worked; Faust sees more people taking ownership of the environment. “The more people come in contact with the sturgeon, the more they want to take care of the river,” she says.

In the end, Faust believes a strong population of sturgeon is sign of a healthy river:

“They really are a spotlight species. If we manage and protect sturgeon successfully and the area population grows, that means our river and lake are healthy.” tpo



The Sturgeon Festival offers cruises on the Huron Lady II that include live video of sturgeon. Booths focus on sturgeon biology, water quality and sturgeon habitat restoration.

Four chlorine tanks are changed out as they run out at the Robert A. Harris Water Filtration Plant. Don Gelinas shuts off a valve to an empty tank that will be replaced by day's end.

Clear Objectives

A FINE-TUNED PROCESS AND EFFECTIVE OPERATOR TRAINING HELP A NORTH CAROLINA WATER PLANT WIN A SERIES OF HONORS FOR MAINTAINING LOW TURBIDITY

STORY: **David Steinkraus**
PHOTOGRAPHY: **Matt Bell**

THE ROBERT A. HARRIS WATER FILTRATION PLANT keeps adding to its history of low finished-water turbidity. The latest milestone is the 2015 Area Wide Optimization Program award from the North Carolina Water Operators Association.

It was the sixth such award and fourth in a row for the plant in Eden, North Carolina. The drinking water source is the Dan River, a mountain river flowing through agricultural land. That could be a challenge, but the plant design coupled with attentive operation means turbidity readings remain well below the limit of 0.3 NTU. “I can’t think of a time when we’ve ever made it to 0.2 NTU,” says Dena Reid, plant superintendent.

SEVEN-DAY RESERVE

The Dan River begins in the Appalachian Mountains in southwestern Virginia, then wanders through the hilly farm country of northern North Carolina before passing through Eden, about 95 miles northwest of Raleigh, the state capital. A pumping station sends raw water through 7,000 feet of 30-inch pipe to an 80-million-gallon pond where particulates can settle out.

At current usage that pond holds a seven-day supply of water. So, if turbidity in the river begins spiking because of heavy rains or heavy fertilizer use upstream, the utility can shut down the pumps and draw from the pond while turbidity returns to normal. Raw water typically measures 30 to 40 NTU. When it hits 200 NTU, the pumps are shut down. The flowing river keeps other potential problems under control. When the river slows, TOC can increase, and in a drought TTHMs can increase, Reid says.

From the pond, water flows into the rapid mixer where chemicals are added, and then into a flocculation basin. Next come seven sedimentation basins followed by seven filters that are the first point of chlorination. Fluoride, corrosion inhibitor, and more chlorine are added in the final step before distribution.

Next to the water plant are two 4-million-gallon storage tanks. There are five more tanks around the city, totaling 2.25 million gallons. The distribution system comprises 7,000 feet of 30-inch pipe and 11,000 feet of 24-inch pipe.

During summer the plant team adds alum, a polymer, and a pre-caustic to the raw water. In winter, the flocculation agent of choice is polyaluminium chloride because of its better performance in colder temperatures.



The water filtration plant in Eden has seven filters and two 4-million-gallon tanks that store water for customers. A lake behind the plant holds water taken in from upstream.

Although the 80-million-gallon pond settles particulates, it is not accumulating sediment quickly. A couple of years ago the city asked engineers to check how much had accumulated. In 37 years the pond had lost about 8 million gallons of capacity, so it will be a long time before the pond bottom needs cleaning, Reid says.

In addition to serving city residents and businesses, Eden supplies Dan River Water, which distributes water in the surrounding county up to 10 miles from the city limits.

Robert A. Harris Water Filtration Plant, Eden, North Carolina

BUILT: | 1978, expanded 1994

POPULATION SERVED: | 15,500

SERVICE AREA: | 15 square miles

EMPLOYEES: | 8

SOURCE WATER: | Dan River

FLOWS: | 21 mgd design; 3 - 4 mgd average

TREATMENT PROCESS: | Conventional

SYSTEM STORAGE: | 10.25 million gallons

INFRASTRUCTURE: | 18,000 feet of distribution piping

ANNUAL BUDGET: | \$1.3 million (operations)

KEY CHALLENGES: | Running a 21 mgd plant at 1/4 capacity

WEBSITE: | www.edennc.us/watertreatment.cfm



GUIDING SUCCESS

Eden earned AWOP awards in 2010, 2012, 2013, 2014 and 2015. That missing year, 2011, in a way made the subsequent string of awards possible. Reid took over as superintendent in 2010. “We had a huge turnover in staff,” says Reid. “There were retirements and resignations as people went to other jobs. We have only eight people here.”

With all the new operators on staff, Reid needed a way not just to train them in the basics but to train them in a way of thinking. “To achieve

the AWOP award, you need to be able to optimize your basin turbidity,” she says. “As long as you’re not over 10 NTU in the raw water, you should be under 1 NTU in the sediment basins at least 95 percent of the time. We set a higher goal: less than 1 NTU in the basins when the raw water was not over 20 NTU.”

To help her staff, Reid developed an excursion report that is filed when turbidity readings begin spiking in either a sedimentation basin or a filter. These are not simple reports that record the time and date of a problem. They are guides to help operators look at the system and troubleshoot it. It starts with turbidity in the sedimentation basins because optimization here is the key to achieving overall low turbidity readings, Reid says.

At the top of the report are the standard date, time, and other basics, but then the report becomes a checklist of points operators need to consider. “We’re trying to get everyone, especially new operators, to understand that if there is a bad reading, you don’t simply write it down and walk away,” Reid says. “You have to identify the problem that caused the reading.”

The first item on the sedimentation basin report asks whether there was incorrect calibration.

“They have to gain an understanding that equipment fails,” Reid says. “If someone is downstairs and bumps one of the turbidimeters, that can affect its performance.”

Lightbulbs on meters burn out, and meters can go out of calibration. The report form asks: Is there an air bubble in a turbidimeter? If the equipment checks out, the next report section asks about the chemical feeds of coagulant, coagulant aid and pre-caustic. At the bottom of the reporting form is a list of corrective actions to take: a jar test, a chemical feed adjustment, a turbidimeter flushing and cleaning, a calibration check, a sample flow adjustment.

“Operators have to see past the numbers,” Reid says. “Water treatment is not seeing a number and twisting a knob. You won’t see the same numbers

“We’re trying to get everyone, especially new operators, to understand that if there is a bad reading, you don’t simply write it down and walk away. You have to identify the problem that caused the reading.”

DENA REID

every day because water changes. You have to think of water as an organism, a living thing. It will change, and an operator has to change with it and keep it happy.”

TEAMWORK IS KEY

Reid is a Grade A operator, as is Melanie Clark, the chief operator. Also on the team are:

- Operators Keith Johnson, Grade B; Rodney Johnson, Grade C; Anthony Mock, Grade B; and Sammy Setliff, Grade A



The team at the Robert A. Harris Water Filtration Plant includes, from left, Dena Reid, plant superintendent; Keith Johnson, Sammy Setliff, Melanie Clark, and Don Gelinas.



Source water is fed into a lake directly behind the filtration plant.

- Relief operators Don Gelinas, Grade A; Will Clark, Grade B

Operators are strictly dedicated to operating the plant. Relief operators take over during vacations and other absences, and when they are not operating they perform cleaning, equipment maintenance and other vital functions.

When something goes wrong, everyone helps. In summer 2016, turbidity readings in the plant suddenly jumped above the 0.07 NTU alarm set in the plant. The operator went through the standard checks and found no reason for the high reading. He called chief operator Clark and they discussed possible problems. More team members came in, put their heads together and started walking through every inch of the plant.

The problem was under a grating, not clearly visible, where a 1-inch flocculent feed line joined a 36-inch pipe. The 30- or 40-year-old saddle holding the 1-inch line on had broken, and water was pouring out of the joint.

“This is a team,” Reid says. “No one individual runs the plant, and no one person is responsible for keeping turbidity under control. I don’t try to conquer any problem individually because I’m afraid my mind will close in, and I will see the problem only through my own perspective. That’s the way everybody’s mind works, and solving problems requires other people with different perspectives.”

Reid sees turbidity as the first sign that something may be wrong. It comes from her background. “When I started in water, I started at a plant that ran directly off the river,” she says. “When you work at a plant like that you get, I think, a better sense of turbidity challenges. There could be a down-pour way upstream, and you never see it until suddenly you have muddy water coming in.



Melanie Clark performs routine water tests.

“I’ve gained a bit of a nickname around here. They call me the ‘turbidity Nazi,’ but that’s because I have high goals. If something is going wrong, you react. You don’t let the number increase just because the state allows it. And when a plant will naturally run with low turbidity, why not do that?”

tpo

WATER FOR DEVELOPMENT

The Robert A. Harris Water Filtration Plant was built in 1978 as an 11 mgd facility. It was built partly to accommodate a MillerCoors brewery, a few years after Eden was created.

Previously, three cities occupied Eden’s location on the Dan River. Leaksville, Spray and Draper were independent cities, but in 1967 the residents voted to merge them and create Eden. A history of the county says the community’s economic progress is due to its position on the Dan, which is the city’s drinking water source, and the Smith River, which crosses the state border a few miles north of Eden, runs through the city and joins the Dan slightly upstream of the water plant intake.

In 1994, the filtration plant was enlarged to 21 mgd, but all that capacity is no longer needed. The departure of industry has reduced demand to 3 to 4 mgd. The MillerCoors brewery closed in

fall 2016. The loss of customers brought new challenges: running a 21 mgd water plant at about one-quarter of capacity. It’s a balancing act, says Dena Reid, water plant superintendent.

Team members constantly turn the service pumps on and off. Filters running at less than 1.3 mgd aren’t compacted enough to lower turbidity, so operators run about 1.3 mgd through each of the plant’s seven filters in rotation. Once the two 4-million-gallon clearwells are full, the plant is shut down until demand requires more.

Meanwhile, development experts point to North Carolina’s population growth (5.3 percent from 2010 to 2015) and the potential for a strain on public water systems due to climate change. With excess capacity available, water is a talking point for Eden officials trying to attract new businesses. Says Reid, “I sure hope it works.”

A Twist on Fuel Cells

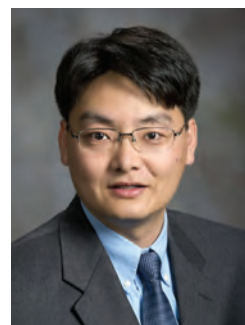
A RESEARCH PROJECT AT A VIRGINIA TREATMENT FACILITY LOOKS AT THE ENERGY GENERATION POTENTIAL OF A MICROBIAL FUEL CELL

By Doug Day

It takes a long time to develop new technologies. The hydrogen fuel cell, now growing in popularity at wastewater treatment plants, was invented in 1839.

But it would take until the 1960s before NASA became the first to use them in a real-life application, generating electricity and water for manned space flights, and many more years before the technology came to the market.

“The government invested so much money, and it still took 40 years for the hydrogen fuel cell to be commercialized,” says Jason He, associate professor of civil and environmental engineering at the Virginia Tech College of Engineering. He’s been working on a similar technology for 12 years.



Jason He

The microbial fuel cell both cleans wastewater and uses electrons released during the digestion process to generate electricity. A small version is now being tested at the 9 mgd (design) Pepper’s Ferry Regional Wastewater Treatment Authority in Radford, Virginia.

THE SCIENCE

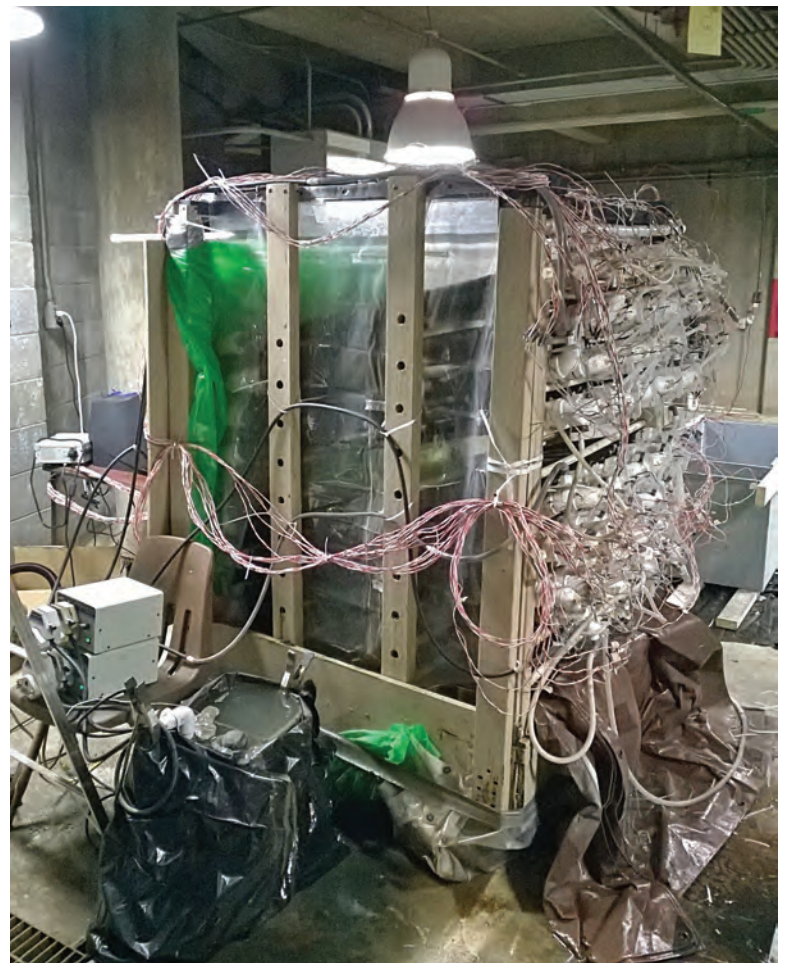
A microbial fuel cell is designed to capture electrons released as organic material breaks down, according to He: “A hamburger is an organic compound. When food digests in our body, it releases electrons through oxidation.”

“In regular anaerobic digestion, the electrons are stored as methane, so we get biogas. A microbial fuel cell is a similar process, except that we put in electrodes so we can harvest the electrons and get electricity.”

JASON HE

“In regular anaerobic digestion, the electrons are stored as methane, so we get biogas. A microbial fuel cell is a similar process, except that we put in electrodes so we can harvest the electrons and get electricity. That’s one of the major benefits of this technology, the direct generation of electricity.”

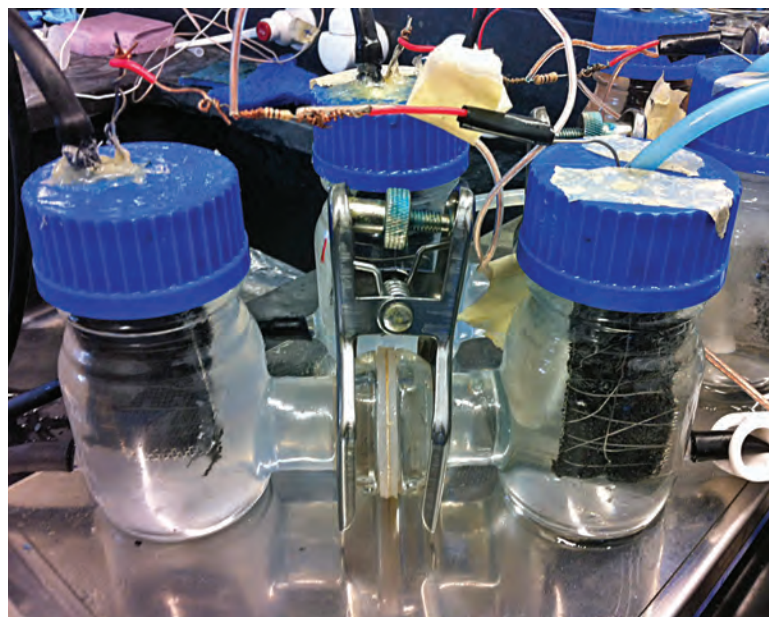
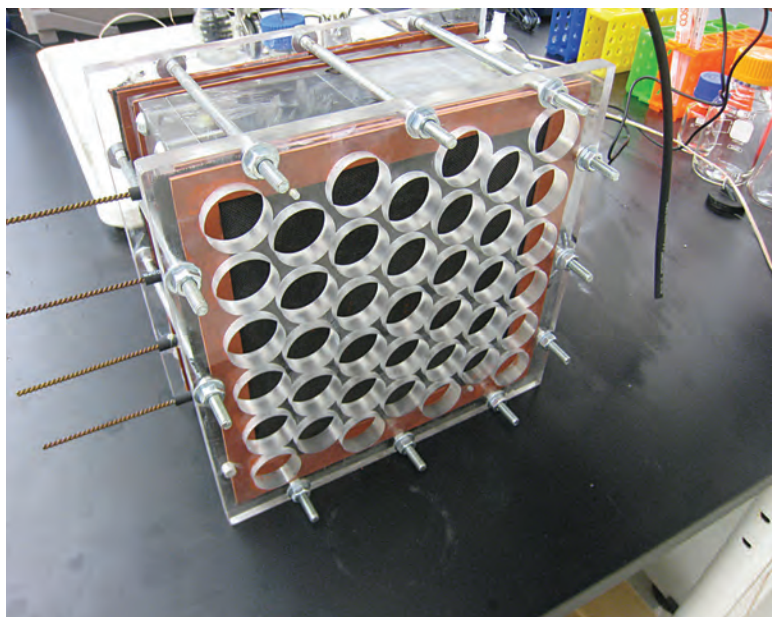
The challenge with wastewater is the relatively low organic loading. “When you use a pure substrate like glucose, you get very high efficiency, 60 to 80 percent of the organics converted to electricity,” says He. “It’s much lower when you use wastewater, around 20 percent.”



This 200-liter microbial fuel cell is being tested at the Pepper’s Ferry Regional Wastewater Treatment Authority.

When he first began exploring the technology, He thought the fuel cell would compete with anaerobic digestion. He now thinks the two can help each other when dealing with higher-strength wastewater. A niche for the microbial fuel cell, however, is probably low-strength wastewater.

“If you have BOD lower than 1,000 mg/L, an engineer probably won’t recommend anaerobic digestion,” he says. “We would look at aerobic treatment like an activated sludge process. In this area, microbial fuel cells could be a competitor.”



Built by hand by students in the lab, the test version has 96 microbial fuel cell modules. It is designed to prove the concept. Once that has been accomplished, the project can move to pilot and full-scale testing.

“When you use a pure substrate like glucose, you get very high efficiency, 60 to 80 percent of the organics converted to electricity. It’s much lower when you use wastewater, around 20 percent.”

JASON HE

TESTING RESULTS

He began his microbial fuel cell project while serving as an assistant professor in the Department of Civil Engineering and Mechanics at the University of Wisconsin-Milwaukee from 2009 to 2013.

A small version of the reactor was tested at Milwaukee Metropolitan Sewerage District’s 300 mgd South Shore Water Reclamation Facility in 2012. The 4-liter system operated for 450 days using primary effluent from the plant’s settling tanks and demonstrated the capability to treat wastewater and recover energy with low biosolids production and low energy consumption.

It was enough to convince He to scale up his test, and he has done so since he moved to Virginia Tech in 2013. A 200-liter system has been in use at Pepper’s Ferry for more than a year with help from a National Science Foundation grant.

Electrical production in the South Shore project was low and variable, depending on conditions such as organic concentrations, conductivity in the primary effluent, and air temperature (the system was set up in an unheated room). Production was generally around 0.02 kWh per cubic meter of treated wastewater, but did show a positive energy balance.

In the Pepper’s Ferry research, electrical production was less than theorized, just below 0.01 kWh per cubic meter. But it made enough to operate a 60-watt DC recirculation pump periodically. There was a slight positive energy balance at lower recirculation but a net energy loss at higher rates. Again, many variables were in play in the design of the system and the ways it was used during the testing.

The results still indicate to He that the microbial fuel cell is a promising wastewater treatment alternative: “Although electrical production is low, electrical consumption is very low. We now see the major advantages being lower energy consumption and low sludge production.”

GETTING TO MARKET

His project is approaching the difficult point all new ideas eventually

reach — bridging the gap between concept and commercial product. “Commercialization is always a big challenge,” He says. “There are limitations for university researchers. I only have my students to make the 200-liter system in the lab. It was tough.”

Having taken the concept from the lab to bench testing to the transitional testing phase at Pepper’s Ferry, he is now waiting for a proposal to take the next step to build a research project about twice the size.

After that, it would be time for a full pilot project. That will probably happen in about five years, and He says it will definitely require an industry partner. He estimates that a full-scale system would have capital costs comparable to a small wastewater treatment plant. “It’s a new concept so there’s high risk, obviously.” tpo

What’s Your Story?

TPO welcomes news about environmental improvements at your facility for the Sustainable Operations column. Send your ideas to editor@tpomag.com or call 877/953-3301.

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Pleasing Alternative

A NEW OXIDATION DITCH TREATMENT PLANT PRODUCES HIGH-QUALITY EFFLUENT AND HELPS BRING AN OHIO VILLAGE INTO MORE CONSISTENT PERMIT COMPLIANCE

STORY: **Steve Frank**
PHOTOGRAPHY: **Amy Voigt**





Jeff Smith, plant operator, measures the final clarifier sludge blanket at the Ohio City treatment plant.

IN THE LATE 1990s AND EARLY 2000s, THE VILLAGE of Ohio City's 150,000 gpd trickling filter plant routinely bypassed 270,000 gpd of its 620,000 gpd peak daily flow.

"Our old plant couldn't meet permit, especially during heavy rains," says Jeff Krugh, village administrator. But a new 0.8 mgd (design) Orbal oxidation ditch plant (Evoqua Water Technologies) that came online in summer 2011 now meets its permit more than 95 percent of the time. It has even handled a peak flow event of 930,000 gpd.

The northwestern Ohio community of Ohio City (population 750) built its old trickling filter plant in 1968. Though it underwent several upgrades between 1993 and 2001, it routinely failed to meet BOD and ammonia limits by 2003.

In addition, the plant was creeping up on 40 years old as it approached its 2007 NPDES permit renewal. Advancing age made it difficult to keep the plant in good repair. The trickling filter design represented a bygone era, and with only one of each process unit, operators could not take a unit out of service for repairs when a maintenance issue reared its head.

SEEKING FUNDING

As permit renewal time approached, the village sought grants to help fund a new facility.

"Our grant writer said it would be easier to get grants if we were under Ohio EPA Findings and Orders," says Krugh. "As an operator, you never want to be under Findings and Orders." But that's where the village ended up.

"We're still operating under Findings and Orders, but we're meeting permit 95 percent or more of the time," Krugh says. Although the village has a \$1.5 million stormwater detention pond project underway, "We still have a lot of infiltration we can't afford to take care of at this moment, and that's where we stand today."

Ohio City engaged Jones & Henry Engineers to investigate and propose design alternatives for the new plant.

“An inch of rain is nice, but not an inch an hour. With a rain of 2 inches or more, we have to watch our solids because with a plant this small, the solids could get washed into the clarifiers.”

JEFF SMITH

The firm looked at several options before the village selected an oxidation ditch/clarifier combination.

The heavy rains Ohio City sees in spring and sometimes fall favored the oxidation ditch: Such systems can typically handle peak-to-average flow ratios of up to 5-to-1. Jones & Henry’s life cycle cost analysis showed that the oxidation ditch design had the lowest net present worth and the lowest maintenance, replacement and labor costs, even though the installation cost was the highest of the three options considered.

SHOPPING AROUND

During plant design, Jones & Henry Engineers took Krugh and Jeff Smith, chief plant operator, to see a number of plants of similar size. What they saw nudged them toward the oxidation ditch concept.

Maintenance and operations costs are important because Smith is usually the sole operator. He runs the plant, does the lab work, maintains the equipment, buildings and grounds, and fills in at the water treatment plant, at which Krugh is the primary operator. Since the oxidation ditch design

usually needs less maintenance and operator attention than other configurations, it works out well, Smith says.

The new plant’s \$2.236 million cost included a \$1 million loan and a \$1 million grant from the Ohio Water Development Authority, and a \$1,236,900 loan from the Ohio Public Works Commission. Wastewater rates went from \$41 per month to \$56 per month per household inside the village limits.

Two years before building the new wastewater treatment plant, the village undertook a \$5 million drinking water project that included a new treatment plant, a water tank and waterlines. Fees for residents rose from \$41 per month to \$51 for debt service and \$4.50 per 1,000 gallons used.

FLEXIBLE PERFORMANCE

As Krugh and Smith had hoped, the Orbal oxidation ditch (Evoqua) can accommodate a wide range of operating conditions, including handling five times the normal flows without washing out solids and degrading treatment.

The oxidation ditch has a 31,020-gallon inner channel and a 48,560-gallon outer channel. It provides 12.7 hours of detention time and has two 7.5 hp drives. In the normal operating mode, influent flows into the system’s outer channel, runs around that channel, and then passes to the inner channel through a submerged conduit. Both channels have surface aeration. Aerated wastewater goes from the inner channel to the clarifiers for settling. Dissolved oxygen is typically zero in the outer ring and 2 mg/L in the inner ring.

“When a big storm is predicted, I can switch to storm mode the night before,” says Smith. “If the rain doesn’t come as predicted, we can switch it back to normal operation the next morning with little or no noticeable effect on the treatment process. But in storm mode, we shut down the outer ring and all the influent goes to the inner ring.

Village of Ohio City Wastewater Treatment Plant

BUILT: | 2011

POPULATION SERVED: | 750

FLOWS: | 0.8 mgd design; 0.089 mgd average

TREATMENT LEVEL: | Secondary

TREATMENT PROCESS: | Oxidation ditch

RECEIVING WATER: | Prairie Creek

BIOSOLIDS: | Drying beds; future land application

ANNUAL BUDGET: | \$41,000 (operations)

WEBSITE: | www.villageofohiocity.org

GPS COORDINATES: | Latitude: 40°46'16.45"N; longitude: 84°36'56.00"W



SHARED DUTIES

In a small community, running the water and wastewater treatment plants means wearing different hats from time to time.

In Ohio City, Jeff Krugh, village administrator, shares those duties with Jeff Smith, chief wastewater plant operator. Both fill in now and then with other maintenance duties. Smith and Krugh hold Class 3 wastewater treatment and Class 1 drinking water treatment licenses. The village also has two part-time electricians who run the municipal electric power plant.

“The water plant needs someone about half a day every day, so I usually do that,” Krugh says.


Smith runs the wastewater treatment plant. What do the villagers think of their dynamic duo? The two agree that “about 80 percent of the people don’t know” what they do.

Outreach consists of giving tours when asked. “But we don’t look for them because we’re too thin-staffed,” says Krugh. They hosted an Ohio AWWA meeting a few years ago when the water treatment plant came online. Both are active in Ohio AWWA and the Ohio WEA.

Ohio City Wastewater Treatment Plant PERMIT AND PERFORMANCE

	EFFLUENT	PERMIT
TSS	3.20 mg/L	18 mg/L weekly 12 mg/L monthly
CBOD	1.80 mg/L	18 mg/L monthly 10 mg/L weekly
NH3-N	Not detected	1.5 mg/ weekly 1.0 mg/L monthly
Phosphorus	0.0877 mg/L	N/A
pH	7.46	6.5 minimum/9.0 maximum





The plant upgrade includes a TrojanUV3000 PTP disinfection system.


“Two-and-a-half to 3 inches of rain in an hour or two can overwhelm a plant. An inch of rain is nice, but not an inch an hour. With a rain of 2 inches or more, we have to watch our solids because with a plant this small, the solids could get washed into the clarifiers. With 3 inches, you have to really pay attention.”

In storm mode, Smith sends all the influent through Muffin Monster grinders (JWC Environmental) in the lift station. Any overflow goes to a bar screen chamber attached to the side of the Muffin Monster used for heavy flows. From there it enters a 6,950-gallon anoxic tank where raw wastewater and return mixed liquor are mixed (WILO mixer). The wastewater then goes into the inner channel.

MANAGING SOLIDS

An 18-inch sewer line brings influent to the plant. The lift station has three 7.5 hp, 400 gpm submersible pumps (Gorman-Rupp Company). “If we get a 3-inch rain, it’ll call for all three of those pumps,” says Smith. The lift station screen has an inclined auger cylindrical screen (also JWC) with a 1.5 mgd peak flow capacity.

The two 20-foot-diameter clarifiers have scrapers from Monroe Environmental and drives from DBS Manufacturing. The clarifiers have bridge mechanisms that push the settling sludge toward the center, where it is withdrawn to a common return and waste activated sludge pump station. A timed valve there either returns sludge to the oxidation ditch or wastes it to the aerobic digesters.



The Village of Ohio City Wastewater Treatment Plant.



Shown on the grounds of the new treatment plant are, from left, Joseph Hotz, consulting engineer; Ohio City Mayor Carol Miller; and Jeff Smith, plant operator.

The return and waste activated sludge pumps with variable-speed drives are 2-foot ABS submersibles (Sulzer) capable of 1,765 gpm at 12 feet of head. Although the plant design calls for running only one clarifier at a time, Smith usually operates both to improve detention time.

Each of the two 51,900-gallon aerobic digester tanks has a 20 hp, 270 scfm blower (Aerzen). The UV disinfection system uses a 24-bulb low-pressure system (TrojanUV) that can disinfect a peak flow of 1 mgd.

The process yields Class B biosolids, but no material has been removed since the new plant came online. Drying beds are used in summer, but it's too wet to use them in winter. "We expect to land-apply some soon," says Smith. "There's a former village councilman who understands the nutrient value, and his fields are only about 1,000 yards away."



Jeff Smith checks on a lift station (pumps from Gorman-Rupp Co.).

“Being under the gun like we were is not a good feeling. With the old plant, the water came in and the water went out. Now we can do a better job of cleaning it.”

JEFF KRUGH

CHEMICAL-FREE

One thing Smith likes about the plant is the UV disinfection: "We add no chemicals during treatment. This is a completely natural process." The receiving stream is Prairie Creek, and the plant is the primary contributor to the stream in summer.

An Ohio EPA regulator visits about twice a year; Smith and Krugh self-report on permit compliance. Krugh observes, "Being under the gun like we were is not a good feeling. With the old plant, the water came in and the water went out. Now we can do a better job of cleaning it."

Smith adds: "Now we need better weather forecasting. The weather is our biggest enemy. The ability to accurately predict storms would help us the most." **tpo**

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Daring to Be Different

INFUSION AERATION TECHNOLOGY AT A FLORIDA WASTEWATER TREATMENT PLANT IMPROVES EFFICIENCY, RAISES DO LEVELS AND REDUCES ENERGY USAGE

By **Bob Fowler**

Changes come slowly in the wastewater treatment industry. That's why a recent process improvement at a Florida plant is gaining attention. An air-infusion aerator installed in the aeration basin at the Suwannee Wastewater Treatment Plant has enabled high-capacity mixing and water movement, increased treatment efficiency, and boosted dissolved oxygen, while using significantly less energy.

The scenario began in 2015 when the Suwannee Water and Sewer District decided to completely renovate the 20-year-old plant and awarded the contract to Waterborne Madison, Florida.

SEEKING INNOVATION

"When this process began, Suwannee asked if we had any innovative ways to reduce their electric bill," recalls Don Drummond, president of

Waterborne and a veteran of some 40 years in the industry. "We had the idea to incorporate an aerator into the aeration basin. We believed it would improve process efficiency and effectiveness and do so while consuming less electricity.

"I had been working for over a year with Dean Caldwell, the president of Airmaster Aerators, and I became convinced that with their air-infusion aerators we could make a serious improvement to the process, even to the point of being a game-changer."

The Suwannee team's goals were challenging: reduce energy usage, increase mixing, raise DO levels, remove sludge, reduce odors, and improve overall efficiency. Overhaul of the plant began in January 2016, affecting half of the plant at a time, so the other half could continue running.

Drummond worked with Bob Bogosta, district general manager, and

Matt Frierson, chief operator. The overhaul took more than three months. After all the waterblasting, welding, re-piping and painting, it was time to add the aerator.

AERATING AND MIXING

“Our aerator, with infusion aeration technology, is designed with no spray holes and has a downdraft tube,” says Airmaster’s Caldwell. “In operation, wastewater is pulled up through the downdraft tube and into the aerator. The wastewater is then pressurized in the aerator discharge manifold, and air from the turbo blower is forced through the air manifold and into the discharge manifold.

“The air infusion tube is terminated on the outside of the discharge manifold. Inside the discharge manifold are a pair of vanes that make the wastewater spiral around the air infusion tube. When the oxygen generator tubes are bolted on the discharge manifold, this creates a negative pressure zone.

“At this point, the aerator disrupts the molecular structure of the wastewater and infuses air into it. The air-infused wastewater is then discharged from the right and left sides of the aerator and mixed from the top of the basin to the bottom. This creates a complete mix of air-infused wastewater in the basin without increasing its temperature. We do this using less energy via a low-horsepower motor.”



A digester at the Suwannee facility.

TAKING THE LEAP

Although no one involved in the project had heard of using an aerator in this way, Drummond pushed for it to be a part of the permitting. “I had several people tell me flat out that it would not work — engineers, operators, biologists,” he says. “But I was thoroughly convinced that it would work.” The Florida Department of Environmental Protection authorized a pilot study after Drummond gave an in-depth description.

Ultimately, Suwannee received a permit to replace its existing air-bubble diffuser with the surface aeration system. On March 15, 2016, Drummond and his crew lifted the Airmaster Turbo Xtreme 25 hp aerator and

gently set it into place in the center of the aeration basin of the refurbished treatment plant.

Before activating the aerator, Frierson let all the air out of the aeration basin and reduced the DO level to zero. He then turned the aerator on and let it start churning, mixing and aerating the water. After one hour, he took the DO readings at three places in the basin. The DO levels were 2 ppm higher than those achieved by the previous diffused aeration system and its 75 hp blower. Frierson then turned the aerator off, took readings in the same places at increments of 30 minutes, 45 minutes and one hour, and found similar DO level readings every time.

“Honestly, when they put it in, I didn’t think it was going to work,” he says. “Now that we’ve used it a while, it has cleaned everything up real well, and it puts a lot of air into the water. With that aerator, it mixes everything well, and it gets all that sludge up off the bottom, too.”

“We are still treating wastewater biologically. The greater efficiency of this method, using contact with dissolved oxygen rather than diffused aeration, yields better treatment for high BOD or accidental shocks to the treatment plant.”

DON DRUMMOND

GETTING VALIDATION

Bogosta observes, “The factors that interested me originally were the energy efficiency and the oxygen transfer. It’s still early, and we really want to see the results of this long term, but so far it is looking good. Also, with the aerator there is less maintenance than with blowers or diffusers. After three months, we saw over 30 percent savings in our electric consumption. We also received our new FDEP permit and the Airmaster system was approved.”

Wanting a third party to evaluate their findings, Drummond and Caldwell invited Jamie Hope, wastewater technician with the Florida Rural Water Association, to see the application.

“To my knowledge, an aerator has not been used in this type of application before,” Hope says. “It was enlightening. You could tell the oxygen was being transferred efficiently, and it was providing mixing as well as oxygen transfer. Looking at the lab numbers, you can see that it is much more efficient than the previous method.”

Drummond adds, “We are still treating wastewater biologically. The greater efficiency of this method, using contact with dissolved oxygen rather than diffused aeration, yields better treatment for high BOD or accidental shocks to the treatment plant.”

Caldwell concludes, “We think we can make the same impact as we did in Suwannee in wastewater treatment plants all across the country.” tpo

Share Your Ideas

TPO welcomes news about interesting methods or uses of technology at your facility for future articles in the How We Do It column.

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Metering pumps offer energy efficiency for water and wastewater treatment

Blue-White Industries has been a leading manufacturer of chemical metering pumps, flow instruments and water treatment accessories for nearly six decades. The company's ProSeries-M line was designed for municipal drinking water and wastewater treatment applications, and it is well suited to pumping the aggressive and viscous chemicals used during these processes.

PROSERIES-M CHEM-PRO MD-3

The Chem-Pro Hybrid MD-3 — the newest addition to the ProSeries-M line — is a diaphragm metering pump with a turndown ratio of 2,500-to-1. It provides smooth chemical dosing with no pulsation dampener required, and features a flow rate range of .03 to 57 gph with maximum working pressure of 145 psig. The MD-3 is equipped with exclusive DiaFlex diaphragms.

The patent-pending design is 50 percent more energy efficient than similar units, and it is equipped with PVDF wetted end fittings with more than 14 inlet and outlet configurations available. The drop-in-place design and built-in controls make ordering and installation quick and efficient.

PROSERIES-M FLEX-PRO PERISTALTIC METERING PUMPS

ProSeries-M Flex-Pro peristaltic metering pumps are available in three models: M-2, M-3 and M-4. Flex-Pro peristaltic metering pumps offer feed rates from .0002 to 158.5 gph.

All Flex-Pro pumps are equipped with the patented Tube Failure Detection system, which detects various conductive chemicals with no false triggering. If the system senses tube failure, the pump automatically shuts off and energizes a relay or switch, permitting communication with external equipment such as a backup pump or alarm.

The ProSeries-M Model M-2 peristaltic pump is designed for use in small to midsize treatment systems. It includes an easy-to-use intelligent control systems design that permits remote connection for chemical dosing control via either a 4-20mA signal, a high-speed digital pulse input, or a slow pulse for batching type applications.

The M-2 is available with an optional advanced SCADA communications command and status system that includes: start, stop, prime, setpoint speed, alarm reset, running hours reset, motor status, pump head cover status, tube failure detection status, touchpad locking and unlocking, and many others. The firmware is field upgradable, and the ProSeries-M Flex-Pro units are NSF 61, IP66, NEMA 4X, CE and ETL listed.

PROSERIES-M CHEM-PRO MC-2 AND MC-3 DIAPHRAGM METERING PUMPS

Chem-Pro MC-2 and MC-3 diaphragm metering pumps are equipped with a tough PVDF pump head design and Blue-White's exclusive PVDF DiaFlex diaphragm. Chem-Pro M's engineered design begins with a substantial control pad that's easy to use and highly intuitive. A protective snap-on polycarbonate cover protects the LCD control pad from UV exposure and the elements.

Flex-Pro M-2



Chem-Pro MD-3



Chem-Pro MC-2

The pump head is equipped with large double-ball ceramic valves and a built-in priming/degassing valve. The large single piece junction box provides easy access to the terminal block connectors and includes additional ports for external wiring, such as PROFIBUS, PROFINET and Ethernet. The units are NSF 61, IP66, NEMA 4X, CE and ETL listed.

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Blue-White Industries, which was founded in 1957, is a leading manufacturer of metering pumps (diaphragm, peristaltic), flowmeters (variable-area, paddlewheel, ultrasonic) and water treatment accessories.

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Mobile Sensor Management from Hach keeps operations running smoothly

Water treatment facilities require complex analytical systems to measure and control water quality. Spectrophotometers, analyzers, probes, sensors, SCADA, controllers and various other instruments provide critical data throughout the day. Keeping those instruments in good condition keeps a plant running smoothly.

The margin for error is small, and the stakes are high. After all, a treatment plant serves families, businesses, nearby communities and might even ripple out to regions downstream. Managing this complex system 24/7 is a big part of keeping a facility — and its water — under compliance. Yet this critical task is often handled by a small crew — sometimes even a single operator.

ONE DEVICE, ACTIONABLE INSIGHTS

In the tradition of making water treatment and analysis simpler for plants, Hach offers the power of clarity — reliable data and instrument performance for instruments — from a single device.

Mobile Sensor Management gives operators the ability to manage water quality anytime and anywhere. With access to crucial sensor information, operators can prioritize daily tasks, focusing on a critical few. The instructions provided from Mobile Sensor Management provide information for daily tasks. Operators can verify process measurements using lab data, adjust process instruments with the click of a button, and plan and perform maintenance.

Accessible from any 3G/4G or internet-connected smartphone, tablet or computer, Mobile Sensor Management provides:

- **Service diagnostics, maintenance instructions and calibrations in real time.** With instrument diagnostics and maintenance guidance delivered directly to a device, the path to smooth operations is clear. Hach sensors and probes require minimal maintenance. However, occasional calibration and cleaning is necessary for accuracy. Mobile Sensor Management delivers equipment diagnostics proactively, identifying minor or major maintenance at the touch of a button. Further, this system provides step-by-step, mobile-friendly maintenance instructions for fast, convenient fixes.
- **Align process and lab data.** Mobile Sensor Management synchronizes process instruments with lab values, letting operators verify readings against grab samples. This further ensures water quality and provides the information needed to make informed decisions about operations. To keep information private, all data is transferred over a secured web server. Mobile Sensor Management records all interactions for logging purposes, making it simple for teams to track records.



For treatment plant operations to run at peak efficiency, facilities need a solution that provides an accurate story behind the water and systems. With the right solutions, operators can improve operational efficiency, uptime and regulatory compliance.



Hach Company is committed to providing high-quality products that are accurate and simple to use. For more than 60 years, the company has created solutions to manage water. Hach's analytical instruments and reagents are used to test water quality in various industries around the world.

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Gorman-Rupp expands ReliaSource municipal lift station line

Gorman-Rupp has expanded its line of municipal lift stations to include the ReliaSource Modular Above-Ground Lift Station. Engineered and manufactured by Gorman-Rupp, this wastewater lift station is the largest such package offered in the industry.

“We made the decision to develop this latest product because our customers were requesting a larger solution to accommodate additional components and more complex controls with a ReliaSource solution,” says Vince Baldasare, Gorman-Rupp engineered systems sales manager. “Now, no matter which size or type of station a customer chooses, the single source of reliability of the ReliaSource line is available for a wide range of solids-handling requirements.”

THE RELIASOURCE PRODUCT LINE

Gorman-Rupp’s line of ReliaSource municipal lift stations includes: ReliaSource Modular, ReliaSource 8x12, ReliaSource 8x9, ReliaSource 6x6T, ReliaSource 6x6, ReliaSource 7x10, ReliaSource Below-Ground, ReliaSource Auto-Start and ReliaSource Base-Mounted lift stations, as well as the ReliaSource Above-Ground Submersible Valve Package (ASVP).

“It’s a nice addition to Gorman-Rupp’s product line,” says Mike Gillespie, Envirep president. “It is really what the customer is looking for — a complete solution for the whole pump station. If you supply pieces and parts, there is a lot of room for error, but when you supply the whole system and make it a complete system, the customers are happy. We have more solutions for the customers, and we get more sales.”

ENGINEERING EXPERTISE

Bob Jordan of Covalen is thrilled with the introduction.

“Gorman-Rupp continues to innovate for the whole water and wastewater industry,” he says. “The ReliaSource Modular Above-Ground Lift Station breaks new ground for Gorman-Rupp distributors and the water and wastewater community with this offering. There are basically only three connections to make — electric, wastewater and fuel — which makes this a very simple option for contractors to install. They can get in and out quickly.”

Equipped to house the latest in Integrinex control technology, the new package is designed to keep wastewater systems up and running — even during power outages. The station is available in sizes up to 11 feet 6 inches wide by 20 feet long and can accommodate 2 inches through 12 feet and flows up to 5,200 gpm. Station enclosures are available in various fiberglass colors and can be upgraded to brick- or stone-finished textures.

Like all ReliaSource lift stations, the new modular above-ground is designed, manufactured and tested by Gorman-Rupp experts to ensure smooth installation at the job site.

“Gorman-Rupp has the in-house horsepower to build the most highly engineered packaged pump systems in the world,” says longtime Gorman-Rupp distributor Randy Keefe.



SOLID WARRANTY

ReliaSource lift stations include genuine Gorman-Rupp pumps, controls and enclosures and are fully assembled and rigorously tested to operating conditions in Gorman-Rupp’s state-of-the-art facilities. Every ReliaSource lift station is backed by a worldwide network of factory-trained distributors, reliable parts service and an industry-leading 60-month warranty.

“You have one warranty and one source of responsibility; it’s a true turn-key product,” Keefe says.



Gorman-Rupp Pumps is a leading manufacturer of pumps and pumping systems for municipal, water, wastewater, sewage, industrial, construction and original equipment manufacturing markets. Established in 1933, Gorman-Rupp provides a quality, competitively priced product backed by superior customer service. The Gorman-Rupp Company boasts a history of innovation, continuous improvement and excellence that sets the industry standard.

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The Pump People®

Bug off: Control midges and filter flies with Strike products

Midges and filter flies are more than a nuisance at wastewater treatment facilities. Their aquatic larvae consume beneficial organisms, deplete water of oxygen and create floating mats of larval and pupal casings. In severe infestations, these pests can alter water quality, clog pipes/equipment, transmit pathogens and generate complaints from the public.

Control of these pests begins with proper identification and an understanding of their life cycles.

SCIENCE LESSON

Chironomid midge flies, or midges, lay egg masses — containing up to 3,000 eggs — on the water's surface. Eggs sink and hatch within a week, and the larvae burrow into sludge, establishing small tubes where they develop into a dark red worm-like stage. This stage lasts two to seven weeks, depending on water temperature, before the adults emerge. Adults resemble mosquitoes with bushy antennae, and they are ready to reproduce within days.

Filter flies, also known as drain or moth flies, are also frequently found in wastewater treatment facilities. After a two-day incubation, eggs hatch into small, pale larvae that feed on slime layers or nutrient-rich films in treatment beds. After a nine- to 15-day feeding period, they pupate and emerge as flies with a hairy appearance and pointed moth-like wings. Adults live for a few days, during which time females lay between 10 and 200 eggs.

For effective control, operators need to break the life cycle. Strike products interfere with larvae development, eventually killing flies in the pupal stage. Because adults or larvae that have pupated are not affected, population reduction occurs two to three weeks after treatment. Continuous treatment ensures these pests will not rebound to reach infestation levels.

STRIKE PRODUCTS

Strike products are available in three options:

Strike Professional Midge Control (Liquid) is a microencapsulated formulation that is time-released for downfield control, making it ideal for facilities with chironomid midges in various stages and areas. Strike Liquid is added after sand and grit have been removed from the main channel, upstream of midge fly breeding. It must be introduced far enough ahead for the material to properly mix in the water, before the primary clarifiers. Typically this application controls midges through secondary clarification. Depending on holding times and flow, Strike treatment can control midges in tertiary treatment. However, it might be necessary to set up another injection point or treat with Strike Pellets.

Strike Ultra (Liquid) is a water-dilutable, emulsifiable concentrate that is ideal for treating trickle filters and smaller areas where flies are a prob-



lem. Strike Ultra Liquid isn't microencapsulated, so control downfield is reduced. Strike Ultra Liquid is an economical solution at facilities where fly breeding is concentrated and contained to a defined area.

Strike Pellets offer control in areas with extended holding times. In some cases, lagoons and ponds can be treated with a 20-foot perimeter band of Strike Pellets. It is always best to treat the entire surface area.

All Strike formulations can be applied to biosolids drying beds. Liquids can be metered into the sludge flow, while pellets can be spread over beds. Flies are controlled as biosolids dry. When applying to trickle filters, use liquid formulations during low flow — typically overnight — with a metering device.

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Strike is a product of the **Central Life Sciences** strategic business unit of Central Garden & Pet. Central Life Sciences creates healthier environments and makes life better for people, plants and companion animals around the world.
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Kohler introduces large diesel industrial generator line

Kohler has unveiled an all-new range of large diesel industrial generators. The company's KD Series includes generator sets in nodes between 800 kVA and 4,200 kVA, which are powered by an entirely new line of G-Drive engines. The generators will be available globally under the Kohler and Kohler-SDMO brands and are designed to deliver durability and reliability in various emergency and prime applications. Targeted industries include: data centers, health care, water treatment, oil and gas, telecommunications, mining, and more.

"This is an exciting and transformational product launch," says Tom Cromwell, group president-power for Kohler. "After a very collaborative and thorough worldwide development process, we're very pleased to be rolling out this new line of generators. We expect strong response to these advanced new gensets that will offer beneficial cost savings and unrivaled performance to our customers around the globe."

The KD Series generators offer cost savings because the line delivers the best fuel consumption at more nodes between 800 kW and 2,500 kW. The new generators are designed to meet global emissions regulations and are highly customizable to match an end user's specific requirements. Multiple options are available to ensure optimal performance for the most demanding applications.

Products are designed for high ambient temperature conditions. Thanks to high technology regulation and monitoring control systems on each component, the KD Series offers a very high power quality and best transient response in compliance with the most stringent regulations standards.

"These generators are powered by our new state-of-the-art G-Drive engines, which were developed to provide outstanding power density and complete dependability in the field," Cromwell says. "Plus, because these are fully integrated Kohler generators, we'll be able to stand behind this line in an elevated manner, which includes a comprehensive global three-year warranty."

When service is needed, Kohler has a global dealer and distribution infrastructure consisting of more than 800 facilities offering 24/7 parts availability. Distributor technicians are factory-trained to provide fast and accurate assistance and have expertise in power specifications, equipment integration and more.



A global force in power solutions since 1920, Kohler is committed to reliable, intelligent products, purposeful engineering and responsive after-sale support. Kohler's acquisition of SDMO in 2005 created one of the world's largest manufacturers of industrial generators. Combined, the companies have 150 years of experience in industrial power and now benefit from global R&D, manufacturing, sales, service and distribution integration.

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Kohler Co., which was founded in 1873 and is headquartered in Kohler, Wisconsin, is one of America's oldest and largest privately held companies. With more than 50 manufacturing locations worldwide, Kohler is a global leader in the manufacturing of engines and power systems; kitchen and bath products; premier furniture, cabinetry and tile; and owner/operator of two of the world's finest five-star hospitality and golf resort destinations in Kohler and St Andrews, Scotland.

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SEE AD ON PAGE 5

Keller's non-fouling level transmitter solves tough measurement problem

In wastewater measurement, accurate readings are essential to ensuring proper pump operation. A failure in this area can result in unhygienic liquid waste overflow and costly repairs to pump mechanisms.

In Newport News, Virginia, several restaurants were built in an area serviced by the same municipal wastewater lift stations. These restaurants introduced heavy grease content to the wastewater and caused the municipality's existing level measurement equipment to foul and fail.

ANTIQUATED SOLUTIONS

Before development of the commercial district, Newport News Waterworks and Hampton Roads Sanitation District relied on a combination of mechanical floats and traditional submersible level transmitters. However, with the restaurants in operation, the increased volume of grease clung to both instruments and, as a result, the primary and redundant level measurement failed to properly transmit level data to the pump controller.

The accumulation of grease to the submersible level transmitter clogged the pressure ports that blocked the free flow of liquid and proper application of hydrostatic pressure to the sensing diaphragm. On the redundant float switch, which should trigger the pump in the event of a failed level transmitter, the accumulation of grease blocked the mechanical operation of the float ball. With the level transmitter and backup system inoperable, the affected lift stations failed, either reading too much wastewater or too little, thus causing the pumps to run continuously or not at all.

IDEAL SOLUTION

Several instrumentation companies offer non-fouling solutions with only minor variations of the existing and unsuitable solutions. These instruments use a Teflon-coated elastomer diaphragm, which is relatively weak and prone to puncture. Their answer is to use a bulky protective cage, consisting of a shield mounted on bolts and standoffs. However, these shields can collect rags, grease and biosolids in the wastewater, which leads to erroneous readings.

Newport News officials contacted Keller America, whose LevelRat provided a unique approach to wastewater level measurement.

The tougher Kynar diaphragm used on the LevelRat provides superior abrasion and puncture resistance relative to other wastewater level transmitter solutions. This design also minimizes the 36 XKY profile, creating a sleeker design without the need for bulky shields. The result is a truly non-fouling instrument that provides superior operation in environments that would clog traditional level transmitters.



The LevelRat is specifically designed for extended service in lift stations and, thanks to Keller's guaranteed lightning protection, the unit is ideal for areas prone to chronic lightning damage. The LevelRat is assembled in the U.S. to customer specifications, including custom pressure ranges and cable lengths.



Keller America specializes in pressure measurement solutions, offering a complete line of pressure transmitters, gauges and loggers. For more information on how the LevelRat can provide accurate and reliable level measurement, contact:

877/253-5537 • sales@kelleramerica.com • www.kelleramerica.com



Penn Valley's Double Disc Pumps solve problems at Illinois plant

Moline, Illinois, is located on the Mississippi River in northwestern Illinois. The city of 44,000, which is one of the Quad Cities, has two wastewater treatment facilities — the North Slope and South Slope plants.

In April 2010, plant staff needed to replace a piston (plunger) pump at the North Slope facility. The pump, which fed a unique blend of wastewater and lime blowdown sludge at up to 8 to 10 percent solids to the belt filter press, needed to pull a small suction lift, and it needed to operate against a discharge pressure between 10 and 20 psig because the belt filter press was across the plant.

The city of Moline turned to Penn Valley for answers. A 6-inch Penn Valley Double Disc Pump Model 6DDSX76 was installed on a trial basis in May 2010. The trial pump performed well, and the plant purchased it in August 2010. In May 2011, Moline purchased a second Penn Valley pump to replace another piston pump for belt filter press feed.

In the next three years, the city chose Penn Valley pumps for other replacements at the South Slope plant, including a 4-inch pump for waste activated sludge transfer, a 6-inch pump for primary sludge transfer, and a 4-inch pump for WAS transfer. In 2014, the city took bids for a \$40-million plant upgrade at the North Slope facility. Because of success with the city's five existing Penn Valley pumps, plant staff urged the consulting engineer to use Penn Valley in the new plant design, which resulted in the purchase of seven additional Penn Valley 6-inch pumps.

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Penn Valley Pump Company, Inc. has been developing, manufacturing and marketing Double Disc Pumps for the municipal, industrial and chemical industries since 1980. The company has created a range of positive displacement solids handling pumps that provide unmatched durability, reliability and performance.
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Freeport, Maine, plant saves money and energy with hybrid blowers

In 2010, engineering firm Woodard & Curran conducted an energy analysis at the Freeport (Maine) Wastewater Treatment Facility. The plant was consuming more than 8.9 kBtu per gallon of wastewater treated, which is double the national average. While an outdated oil heating system contributed, the plant's multistage centrifugal aeration blowers accounted for 80 percent of electricity consumption.

The .44 mgd facility has an average daily flow of .25 mgd. However, the plant's existing blowers were delivering a larger volume of air, particularly during the slower winter season.

Following the 2010 energy assessment, the plant went through extensive upgrades. The aging multi-stage blowers were replaced with two Aerzen Delta Hybrid blowers, which achieve power savings comparable to turbo blowers while retaining the advantages of a positive displacement blower.

In addition to accommodating seasonal fluctuations, the blowers had to meet the plant's mixing energy requirements and physical limitations, which included combined aeration basins and clarifiers in a package design. The treatment units were also converted from an airlift pump system to an electric pump system, reducing air requirement and providing better return-activated sludge flow control.

The hybrid blowers went online in December 2011, with one blower handling the plant's aeration requirements and a second blower installed for redundancy. Before the upgrade, the facility's electricity use was between 110,000 and 120,000 kWh per month. With the upgrades, energy consumption dropped to less than 40,000 kWh per month. At full load, the old centrifugal blower consumed about 62,240 kWh per month, compared to 50,560 kWh per month for the new hybrid blower.

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SEEPEX ALPHA Systems offer complete process control

The environmental industry assumes chemical metering pumps must be subject to heavy monitoring, frequent parts replacement and regular disposal. Pumps are expected to pulsate, allowing a greater opportunity for unstable flow as operators over- or underfeed chemicals. These practices cause unplanned variances, water quality issues and increased cost and downtime, but it doesn't need to be this way.

SEEPEX ALPHA Systems — a market-driven chemical metering process control solution — offer complete process control with self-priming NSF/ANSI 61-certified SEEPEX progressive cavity pumps. Progressive cavity pumps offer advantages over conventional chemical metering pumps thanks to accurate, repeatable metering with minimal pulsations and no vapor lock.

SEEPEX ALPHA Systems can be used in chemical metering applications such as disinfection, pH control, flocculation and contaminant removal. These plug-and-play packaged skids minimize time and cost associated with engineering, procuring, assembling and installing flow control systems. The systems can be adapted to any layout and are available in simplex, duplex or triplex pump configurations for floor or wall mounting. They are equipped with user-customized color display touchscreen controls and all necessary components for chemical metering. SEEPEX ALPHA Systems handle pres-

sure ratings up to 175 psi and flow rate capabilities from 0.1 gph up to 350 gph. Flow turndown capabilities can exceed 2,000-to-1. All wetted components are corrosion resistant.



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SEEPEX Inc. is an ISO 9001-2008-certified manufacturer and a leading international supplier of progressive cavity pumps, systems, accessories and services. SEEPEX takes a consultative approach to offering innovative products and customized solutions for fluids handling and processing applications in nearly every industry.

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Star, Idaho, solves MBR fouling issues with Huber RPPS fine screen

The Star (Idaho) Water and Sewer District knew change was coming. The plant's existing grinder wasn't just aging; it was obsolete and required costly repairs that resulted in downtime.

Engineers recommended the plant replace the unit with a Huber RPPS fine screen to prevent harmful screenings from reaching the plant's membrane bioreactor. Although the plant's MBR is a premier solution, solids can easily damage the membranes, causing costly repairs.

Huber's RPPS Star fit the district's needs perfectly. Operator Ken Vose was excited to use another Huber unit. With the solid performance of a screw press already in place, Vose was confident in the success of a Huber fine screen.

"We enjoy our working relationship with Huber," Vose says. "The units are highly efficient in producing exactly what we need: cleaner channel flow."

The RPPS's success shows up in the dumpster. Before its installation, operators emptied the dumpster every two weeks. Now, the Huber unit screens so much from the flow that the dumpster must be emptied weekly.

Huber's experience with municipalities and with wastewater processes is extensive, as is its knowledge of the technologies it provides. This industry technology insight helps Huber work with organizations to go beyond technology to ensure that systems are geared to perfectly match up to immediate tactical challenges and long-term strategic goals.



Huber Technology provides state-of-the-art equipment for municipal and industrial water and wastewater treatment. The company's main focus is liquid/solid separation in general, and headworks equipment in particular.
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AdEdge's biotta system treats contaminants through microbial digestive process

AdEdge Technologies' biotta, which stands for *biologically tailored, two-stage treatment approach*, is a natural process that cultivates native microorganisms found in groundwater aquifers. To survive in the aquifer, these microbes adapt to feed on inorganic and organic constituents, which often pose a health risk to humans. Biotta promotes the growth of these benign bacteria, and in turn, they completely consume targeted contaminants. The microbial digestive process of nitrates results in low levels of nitrogen gas.

The technology is used to help municipalities and public agencies cost-effectively treat contaminated groundwater sources.

Operating costs are very competitive — if not lower — than traditional drinking water treatment. In cases where wastewater is transported or a secondary treatment process is required for multicontaminant reduction, biotta is the lowest cost option for small-community water systems. The biotta treatment process can be applied across a wide range of contaminants. Unlike ion exchange and reverse osmosis, biotta does not require additional treatment stages for contaminant removal.

biotta has gone from benchtop testing to full-scale implementation over the past 16 years and has gained regulatory approval in states such as California and Minnesota.



AdEdge Water Technologies is headquartered just north of Atlanta, Georgia. The company specializes in the design, development, manufacturing and supply of innovative water treatment solutions that remove contaminants from process or aqueous streams.

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The biotta packaged plants are offered in three models: 8, 10 and 12 corresponding to the diameter of the vertical pressure vessels.

biotta® offers an affordable and sustainable solution for wellhead treatment of inorganic and organic contaminants.

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Reliability, ease of operation mark Komline-Sanderson product line

Since 1946, Komline-Sanderson has supplied reliable equipment solutions that are easy to maintain and exceed expectations.

- The K-S Kompress Belt Filter Press is ruggedly designed and used for dewatering municipal biosolids and industrial sludge. It is easy to maintain and exceeds production goals.
- The K-S Biosolids Drying System operates with full integration of all components. The company has successfully installed systems for more than 20 years, which illustrates the equipment's durability and the company's commitment to supporting customers over the long haul.
- The K-S Gravabelt gravity belt thickener is available for very small to extremely large flows and includes Roto-Kone performance enhancing technology. With several models available, the unit can meet specific requirements and exceed performance expectations.
- K-S Plunger Pumps continue to perform after 40 years of operation. These rugged pumps are the workhorse of the industry.

K-S employs highly skilled and technical field service engineers who know the equipment and listen to and respond to customer needs and concerns, which results in installations that perform well. The company provides factory-made original equipment parts and filter fabrics for belt filter presses, gravity belt thickeners and more, and it works with customers to ensure that equipment exceeds expectations.

The company's experience ranges from simple one-machine installations to complex multistep processes and systems. Reliability, ease of operation, rugged design, proven performance and superior customer service are hallmarks of Komline-Sanderson installations.



Since its incorporation in 1946, **Komline-Sanderson Engineering Corporation** has provided quality equipment for process/production filtration, drying, wastewater treatment, sludge processing and pollution control.
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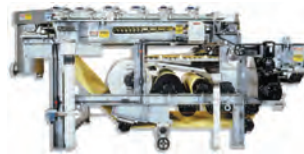
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- high rates
- low polymer cost



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- wastewater clarification
- high float solids



Rotary Vacuum Filter

- sludge dewatering
- wastewater clarification
- continuous operation



Plunger Pump

- sludge transfer
- positive displacement
- high suction lift



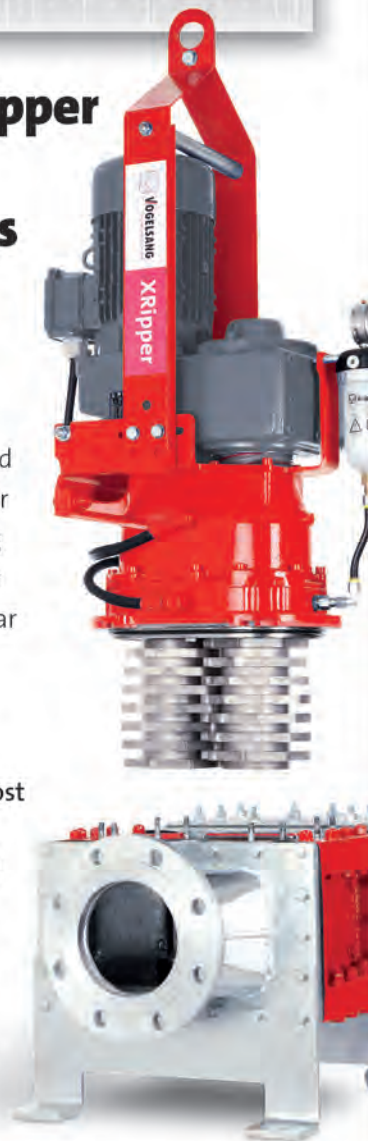
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Vogelsang's XRipper twin-shaft grinder saves city thousands annually

The Ashbridges Bay (Toronto) Wastewater Treatment Plant had ongoing trouble with a twin-shaft grinder, which was installed for high-grit application. As a result of high grit, the unit required thousands of dollars of refurbishment each quarter.

The city found a better solution with Vogelsang.

Through local distributor Directrik, Vogelsang installed an XRipper XRC 186 grinder, and used the existing rail system. The retrofit required no rail system changes and used the same control panel, which required no system modifications.

The XRipper twin-shaft grinder system has been installed for almost a year and has required no repairs.

"We are pleased with the decision to replace our existing unit with Vogelsang," says a city representative. "We have had Vogelsang pumps in our facility for years and have found them to be one of the most reliable products in our plant."

XRipper wastewater grinders from Vogelsang are the most powerful twin-shaft grinders in the industry — outperforming competitors in power, size, output and maximum pressures. The XRipper also comes with a best-in-class, two-year, 100 percent parts and labor warranty, which gives customers two years of fixed operational costs plus service and support covered directly by the manufacturer.



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For more than 80 years, **Vogelsang** has provided pumping and processing solutions to customers around the world. The company's innovative, high-performance products are designed for reliability, efficiency and easy maintenance. With grinders, macerators, pumps and more, Vogelsang can tailor a complete wastewater processing solution to meet even the most challenging customer application.

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Centrisys Corporation announces installation of 48 dewatering centrifuges

Centrisys Corporation, a global innovator of decanter centrifuges and dewatering systems for municipal applications, has announced it will install 48 CS26-4 dewatering centrifuges at three New York City wastewater treatment facilities. This marks coast-to-coast coverage for the American-made centrifuges. The company has already worked with cities such as Seattle, Denver, Green Bay, Austin and Cleveland.

In a fiercely competitive market, Centrisys' domestically produced technology and local supply network allow the company to produce higher quality and equitable pricing. Behind its commitment to U.S. manufacturing, Centrisys leverages a network of U.S. suppliers to meet municipalities' individual needs. The company also services any brand of centrifuge equipment with parts, repair and the retrofit of machines.



Centrisys Corporation has been a U.S. manufacturer of dewatering and thickening centrifuges since 1987. The company's focus is centrifuge equipment, including the award-winning sludge thickening centrifuge THK series. Centrisys provides global service, repair and parts for all brands of centrifuges. 262/654-6006 • info@centrisys.com • www.centrisys.com

CNP technologies boost plant efficiency, provide revenue stream

AirPrex, a flagship technology from CNP – Technology Water and Biosolids Corporation, is a sludge optimization process that recovers high-phosphate mineral struvite after anaerobic digestion but before dewatering. AirPrex saves significant operating and maintenance costs while creating a revenue stream for municipal treatment plants.

PONDUS is a thermochemical hydrolysis process. PONDUS injects a small dose of sodium hydroxide (caustic soda) to break down microorganisms' cell walls in waste-activated sludge, which renders the sludge digestible by anaerobic digesters. A treatment plant using PONDUS can expect a 25 to 30 percent increase in methane production. CNP installed the first U.S. instance of this technology at the Kenosha (Wisconsin) Wastewater Treatment Plant.



CNP – Technology Water and Biosolids Corporation designs and supplies nutrient recovery and biosolids treatment optimization systems. CNP's key technologies are AirPrex, a phosphorus recovery technology, and PONDUS, a thermochemical hydrolysis process. 262/764-3651 • info@cnp-tec.com • www.cnp-tec.com



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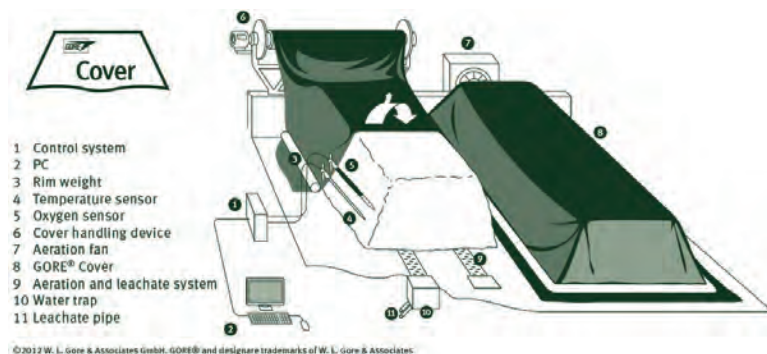
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plant proficiencies



Gore Cover offers biosolids composting solutions

Changing land application rules and rising landfill rates have forced many wastewater treatment plants to look at alternatives for biosolids disposal. The Gore Cover system offers a four-season, encapsulated, in-vessel technology that eases many of those operational challenges.

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The system's simple design keeps treatment cost per ton low, and because it includes few moving parts, one person can operate the system. The encapsulated technology means the system is not influenced by weather or climate, so the Gore Cover does not need an enclosed building. It also reduces odors and VOC emissions by 90 percent compared to open or uncovered systems.

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Available with capacities of 200 to 200,000 tons per year, Gore Cover has been approved to operate in more than 20 countries, meeting strict environmental requirements for odors, VOC emissions, water protection management and pathogen reduction. Gore Cover compost facilities produce Class A and Class AA exceptional-quality compost and meet state, U.S. EPA and Canadian requirements for CCME and BQN standards.

Sustainable Generation provides the SG Mobile System on a trial basis to test odors, mix recipe, process performance and compost quality. Wastewater treatment facilities can then use data to configure a full-scale compost facility.



Sustainable Generation LLC is the authorized supplier for equipment and services for GORE Cover technology in North America. More than 200 Gore Cover systems have been installed in more than 20 countries.

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Enviro-Care's mobile screening system handles tough applications

Sometimes, it's not enough to describe the benefits of a piece of equipment. So when you have something as innovative as the SAVI BEAST, a septage, FOG, sludge screening system, why not put it on a trailer and go on tour?

The BEAST's design makes it mobile and flexible. With no requirements for a rock trap or grinder, it requires little preparation. However, each plant on the tour was prepared to test the BEAST with its toughest applications — FOG, primary sludge, portable restroom waste and vacuum truck discharge.

The BEAST includes a tank-mounted, dual-drive, internally fed SAVI Flo-Drum screen, which uses 6 mm perforated media with a dual seal on the screen cylinder, designed to prevent bypass. The screen and discharge auger are independently driven to maximize capture. By operating the drum screen at a lower speed and increasing the auger's speed, the BEAST can capture more solids and remove them faster. The screen is mounted on a large-diameter, heavy-duty industrial bearing assembly, which eliminates support arms on the influent end that would otherwise snag solids.

To find out more about the BEAST's unique design features, schedule a pilot test at your facility.



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Stenner Pump's S Series provides programmable features for reliability

In municipal water and wastewater treatment, reliable chemical injection and pump monitoring are critical. Built to NEMA 4X for demanding applications, the S Series from Stenner Pump Company offers an advanced peristaltic pump that can be monitored for peace of mind and fine-tuned per application. Operators can select from multiple operational modes and programmable performance indicators for efficient interface with process control systems.

Thanks to a large, accessible keyboard, operators can easily navigate through multiple pump configurations and program parameters for specific applications. The pump's operational modes include scalable, invertible 4-20mA or 0-10VDC input, Hall effect, PPM feed, pulse, manual and timer functions. Users can also program up to three output relays for conditions such as tube leak, motor drive fault, process alarms or transfer to a backup pump. The tube's life expectancy can be programmed to initiate a tube change indicator on the operating display when set runtime is reached.

Tube replacement without tools is standard with Stenner pumps, and the S Series is equipped with the patent-pending QuickPro pump head. The totally enclosed pump is outdoor-rated, and the brushless DC motor has ball bearing support. Agency listings include NEMA 4X, NSF 61 and 372, cULus indoor/outdoor and CE IP65.

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1,000-year flooding tests 3DP Model belt press

When it's time to replace dewatering equipment, the options can seem endless, with newer designs claiming increased performance and reduced O&M. Although larger plants traditionally choose centrifuge technology to achieve high-end dewatering at high loading rates, the three-belt filter press has become a viable option. By using an independent gravity belt in conjunction with a heavy-duty pressure section, the three-belt filter press has proven it's in a different league than traditional two-belt units.

NATURAL DISASTER REVEALS CAPABILITY

In May 2010, Tennessee was hit with 1,000-year flooding. At Nashville Metro's Dry Creek Wastewater Treatment Plant, many buildings flooded, including the dewatering building that housed four 2.2-meter belt filter presses. Emergency dewatering services were provided with belt presses on mobile trailers. BDP provided a 1-meter three-belt unit on a trailer and then a 1.5-meter 3DP trailer-mounted belt press, which operated at the facility until September 2011.

Initially the 1-meter BDP unit processed 200 gpm and produced better results and a drier discharge consistency than the existing four units combined. When the 1.5-meter 3DP arrived on site, it processed 300 gpm while still providing drier discharge solids. Because of the success of the mobile units over almost 18 months, the Dry Creek plant purchased a 1.5-meter press to operate permanently.



BDP Industries is a leading supplier of dewatering, thickening and composting equipment with hundreds of installations throughout the world. The company's main products include belt filter presses, screw presses, gravity belt thickeners, rotary drum thickeners, and in-vessel composting systems.
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iWaterPRO web application streamlines RO system management

iWaterPRO — a web application from King Lee Technologies — streamlines reverse osmosis system management with unbiased diagnostics, automated recommendations and alert notifications on interactive trend graphs.

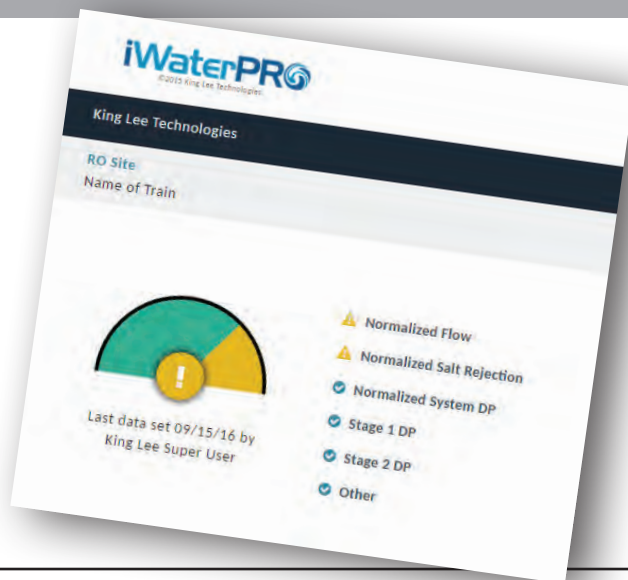
“The tremendous demand for high-quality drinking water is rapidly rising in the U.S. and globally,” says Craig Netwig, president of King Lee Technologies. “But desalination plants are facing issues, such as increasingly challenging feed water, that can make scheduling proactive cleanings difficult.”

The software diagnoses system health through a user-friendly dashboard view that allows secure access and management of multiple RO systems from a centralized location. Individual health gauges interpret data for each train and provide instant feedback and recommendations. The app makes it easy to predict optimal cleaning times, which lengthens membrane life by avoiding excessive fouling and cleaning. This proactive approach saves facilities time and money.

iWaterPRO’s interactive and customizable long-term graphs also let users establish performance baselines. Operators can compare performance from operational changes and make decisions based on real-time data of what works best for a system long term.

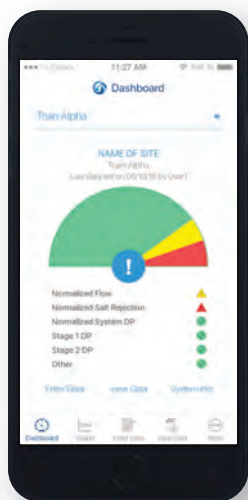
“We’re excited to strengthen and improve RO management and conversations about data by providing a universal standard for communication between team members and with consultants,” says Netwig.

More information is available at iWaterPRO.com.



King Lee Technologies was founded in 1977 by Craig Netwig. Headquartered in San Diego with five distribution points in the U.S. and 14 worldwide, the company develops and refines product lines in antiscalants, membrane cleaners and specialty products. As a leader in the membrane chemical industry, King Lee Technologies continues to support operators, OEMs and consulting engineering firms.

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Hurst Hybrid S600 saves plant \$1.5 million annually

Seaman Paper Co. is a 60-year-old privately held paper plant in rural Massachusetts that produces lightweight specialty papers. Under the guidance of George Davenport Jones III, the plant underwent an energy-efficiency upgrade that was implemented over a 10-year period.

As part of the upgrade, the company installed a Hurst Hybrid Model Super 600, equipped with a baghouse and finned-tube waste heat recovery economizer. Initially, 23,709 barrels of oil were replaced by 15,002 tons of shredded pallet wood. Changes in operations, equipment and fuels resulted in significant decreases in oil usage and electricity as well as an annual savings of \$1.5 million in operating costs.

RESULTS

In June 2008, the Massachusetts Office of Technical Assistance and Technology held a Cleaner Technologies Demonstration Site Event at Seaman Paper Co. Plant managers, corporate executives and elected officials attended the event, which focused on the plant's energy efficiency.

At the event, Gregory W. Smith of Global Energy Solution, Inc. fielded technical questions about solid fuel procurement and boiler installations. Smith, an exclusive solid fuel boiler agent for Hurst Boiler & Welding Co. Inc. shared similar success stories of wood-fired boiler systems installed at other manufacturing facilities and institutional campuses in the Midwest and elsewhere.



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ACE17 offers premier speakers, professional sessions

Education is a key component of any operator's work life. Training credit hours (TCHs) or continuing educational units (CEUs) are necessary to maintain a license and are most often earned through instructor-led classes. However, trade shows also offer important learning opportunities.

AWWA's Annual Conference & Exposition (ACE) brings together experts from around the world to exchange ideas about water. Operators and water industry personnel experience premier speakers, professional sessions, and more than 500 exhibitors from all aspects of the water industry. Operators are able to network with established industry leaders from around the world, building professional relationships that advance their water industry careers.

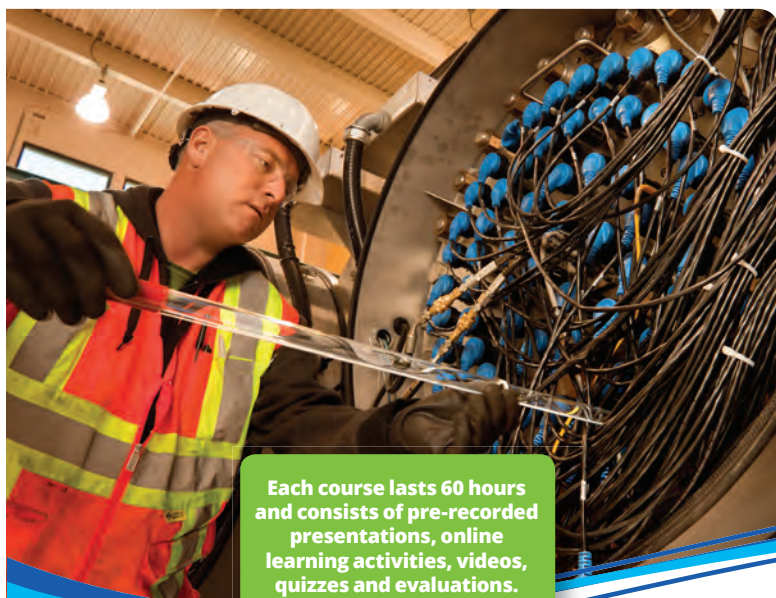
ACE attendees are exposed to new techniques and trends in distribution and water treatment technologies through workshops and sessions, and are able to earn continuing education credits. And the beauty of a trade show? It's all under one roof.

Operators are eligible for an ACE17 discount, which ends March 30, 2017.



AWWA is the professional organization for the drinking water industry. Learn more at **800/926-7337, www.awwa.org/ace17**

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REXA actuators provide reliable control of UV system water levels

If you have an open-channel UV system with a modulating gate actuator for level control, you've likely experienced problems. In this setup, the actuator must maintain proper water level above the bulbs. Otherwise, low water levels can cause bulbs to overheat and high levels can interfere with proper disinfection standards. Additionally, downtime can result in lost treatment capacity.

ON THE HUNT

Historically, a multiturn electric actuator is used with a weir gate on the effluent side of a channel for regulating water levels. However, these actuators are not rated for modulating service and tend to exhibit problems. It's common for electric actuators to hunt for proper level control setpoints, thereby swinging flows and creating problematic level control. Seizures and electrical failures are also common.

ADDRESSING ISSUES

UV system providers and consulting engineers have therefore moved toward the use of a ballasted flap gate, which does not exhibit automation, or fixed weirs, which add footprint to the plant designs. These solutions do

not address the root cause, which is having a reliable actuator that can regulate water levels.

TRUE SOLUTIONS

REXA provides reliable and accurate control of UV effluent level control gates, maintaining water level setpoints and meeting disinfection standards while prolonging bulb life. With REXA, plants can seamlessly balance flows across multiple UV channels, regardless of flow condition.



REXA is an industry leader in actuator design and technology. In the past 20 years, the company has become a major international supplier of control valve actuators and damper drives.

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Trouble with UV Gates Maintaining Proper Levels or Being Unreliable?

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plant proficiencies

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All wastewater treatment systems have one thing in common: They need dissolved oxygen — and lots of it. Thanks to a breakthrough in aeration technology, affordable, highly effective aerators can help wastewater treatment plants economically meet regulatory requirements.



VaraCorp offers the Next Generation surface aerator, which promises low power consumption, affordable price and easy installation. The lightweight Next Generation surface aerators control ammonia, work well in cold temperatures and eliminate wind-whipped spray, all of which create an affordable option for municipalities.

The aerators can be installed in many different locations within a treatment plant, including the last basin of a stabilization system for final treatment or the first basin to jump-start the aeration process.

The Next Generation includes no-cost 24/7 tech support. Units typically ship within five days.



VaraCorp LLC manufactures and sells floating and dock-mounted aerators for many industries, including wastewater.
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**LaMotte's waterproof chlorine colorimeter
meets tough field standards**

LaMotte Company's DC1500 waterproof chlorine colorimeter now includes a rechargeable battery and is packaged with DPD tablets for 100 tests or liquid DPD reagents for 140 tests. The unit can be used in the field or lab, and it covers the entire critical chlorine range of 0-4 ppm with an MDL of .03 ppm.



The colorimeter includes a sturdy carrying case and six glass vials, a USB cable and wall adapter. The unit meets IP67 waterproof criteria so users in high-moisture environments can take the DC1500 anywhere.

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The mix system can be used for anaerobic digestion, biosolids storage, blending tanks, excess flow tanks, septage or leachate, anoxic zones, CSO handling, aerobic digestion, assisting secondary treatment and biosolids holding ponds.



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The quiet, contained operation, combined with Nema Premium efficient motors, makes the blowers a perfect option for residential wastewater treat-

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Utility barges from American Pleasure Products provide operator stability

When it comes to maintenance work or routine inspections on ponds, lagoons or reservoirs, utility service barges from American Pleasure Products provide a safe, stable working environment for treatment plant operators. The Aqua Cycle 8-by-12 utility service barge offers stability, thanks to two 12-foot-long by 23-inch-diameter pontoons. The barge includes aluminum-frame construction with stainless steel hardware and pressure-treated, marine-grade plywood flooring.

Cleanup is a breeze because of the barge's vinyl decking. A protective heavy-duty handrail keeps employees stable, while a protective lower rail secures tools on board.

Depending on your plant's needs, the utility service barge is available with optional solar chargers, boarding ladder, 1,000-pound-capacity crane or a galvanized trailer. Additionally, the barge can be equipped with life-ring pivot arms that can secure the barge to aerator tubes when servicing diffuser drop tubes.



American Pleasure Products provides American-made paddleboats, rafts and service barges. The Michigan-based company produces its own tubing, using 5052-H32 aluminum.

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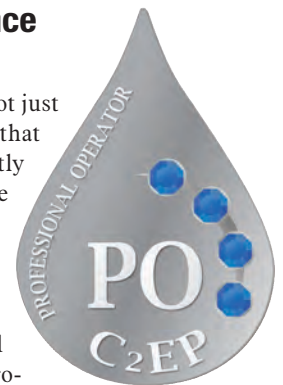


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The redesigned Kuhn Knight SL 100 Series ProTwin Slinger spreaders allow for fast, efficient land application of biosolids and composted materials.



With a unique twin-auger design and exclusive body construction, the Slinger spreader can handle a wide variety of wet and dry materials. The all-new, fully adjustable shroud improves material breakup for more consistent, accurate spreading. A new hammer design provides more wear surface on the bottom edge to extend hammer life.

The hydraulically adjustable deflector offers the ability to regulate spread pattern while spreading, allowing close control of spreading width for accurate nutrient placement. The deflector stores in the down position and although not watertight, it completely closes off the discharge area to help prevent material loss during transport.

Spreaders are available in 1,000- to 2,400-gallon capacities.



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With tight budgets in mind, efficiency has become a top priority for municipal treatment plants. Water and wastewater treatment machinery must save energy and lower operating costs.

Enter the skid- and trailer-mounted belt presses from Bright Technologies.

Bright Technologies' belt presses efficiently dewater a plant's solids, which leads to lower hauling costs and landfill fees for a treatment plant. The belt filter press systems are manufactured, tested and serviced by Bright Technologies, and rentals are typically replaced within four years.



Mobility makes the belt presses even more functional. The system can be moved to different areas of a plant to dewater, and a folding conveyor and operator walkways make setup easy. Two men can typically have the unit ready to operate in two to four hours.

Mobility makes the belt presses even more functional. The system can be moved to different areas of a plant to dewater, and a folding conveyor and operator walkways make setup easy. Two men can typically have the unit ready to operate in two to four hours.



Bright Technologies, a division of Sebright Products Inc., manufactures high-quality recycling equipment as well as equipment for dewatering and solidification of wet materials.

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Ease of Receiving

SEPTAGE ACCEPTANCE PLANT FROM LAKESIDE EQUIPMENT KEEPS HAULERS AND OPERATORS HAPPY

By Jennifer West

Keep it fast for haulers, and keep it maintenance-free for operators. That's what Lakeside Equipment set out to do with its Raptor Septage Acceptance Plant, displayed at the 2016 Water & Wastewater Equipment, Treatment & Transport Show in Indianapolis last February.

"We never had a display at the show," says John Olson, regional sales manager, who attended the show many times before exhibiting. "We walked the floor and said, 'Why don't we display here?' We came to this show because these tankers have to go somewhere with their waste."

The self-contained, fully automated unit removes debris and inorganic solids that pass through a conventional bar screen. The stainless steel construction and inspection port make it easier for operators to maintain, and the optional hauler-access system means septic waste haulers can be in and out within 15 minutes. It's that ease of use that kept show attendees flowing through the Lakeside Equipment booth.

STRONG RESPONSE

"We've had operators and haulers come by," says Olson. An optional Lakeside Automated Data Acquisition System allows wastewater treatment plant administrators to manage haulers coming into the plant while tracking load size, sampling and more. Approved haulers can activate the acceptance plant using a PIN keypad, and then operators can print a summary of the unload that includes time and date. Volume information can be recorded with the addition of a line flowmeter.

"The PIN number or swipe card opens the pinch valve," says Olson. "When it opens, it can discharge by flow or force. We find a pinch valve works much better for this type of purpose." A 3,000-gallon load with 3 percent solids can be processed in 10 minutes, and advanced administrative features mean treatment plants can attract more haulers and manage data for easy billing.

The Raptor plant can be built with two valves so that two haulers can unload side by side. The unit isn't just fast; it efficiently pretreats septage with help from the 1/4-inch Raptor Fine Screen and a rotating rake. The screenings are sent to a stainless steel central screw conveyor that leads to a transport tube.

Two stages of spray washing, over the screen basket and in the transport tube, return organics to the liquid stream while the solids move to a compaction zone and then a storage container. At that point, the material is typically over 40 percent solids and will pass the U.S. EPA paint filter test.



Bill Hoak, right, product specialist with Lakeside Equipment, discusses the Raptor Septage Acceptance Plant with 2016 WWETT Show attendees.

The septage receiving plant, installed at more than 120 locations in the U.S., is fully enclosed, reducing odors and excluding nuisance insects. Although the plant is not new to the market, Olson says the company is constantly looking to improve it. "At the show, we had operators stopping in to talk about it," he says. "We've also had a lot of people who've said they want to buy." 630/837-5640; www.lakeside-equipment.com. tpu



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Manteca's \$29 million food-waste-to-fuel project will include construction of receiving stations for food slurry and FOG, a control building, two digesters, gas compressors and fueling stations.

Food to *Fuel*

A CALIFORNIA CITY GEARS UP FOR A BIOGAS PRODUCTION PROJECT THAT WILL CONVERT FOOD WASTE FROM SCHOOLS AND BUSINESSES INTO CLEAN GAS FOR VEHICLES

STORY: **David Steinkraus**

PHOTOGRAPHY: **Lezlie Sterling**

REMOVING FOOD FROM SOLID WASTE STREAMS TO preserve landfill space is nothing new, but one utility in California has plans to turn that waste into a big cost benefit.

In a few years, if plans in Manteca bear fruit, city trucks will be essentially running on food — more specifically, methane generated from anaerobic digestion of food waste.

The project is the result of two sets of state regulations. One is the standard to reduce food waste entering landfills. The other is the set of air pollution rules from the California Air Resources Board that provide an incentive to leave diesel engines behind in the quest for cleaner air.

Although the California food recycling law is just beginning to take effect, the city of Manteca plans to have a food waste collection and composting system up and running for all of its large food waste producers by the end of summer 2016.

For 2016, the state says that any entity producing 8 cubic yards or more of food waste per week must recycle it. That drops to 4 or more cubic yards in 2017, and may decrease to 2 cubic yards in 2020 if the state determines there is less than 50 percent recycling. “Rather than waiting to get to that point, we decided to come up with a plan now,” says Jeremy Kline, the city’s solid waste supervisor.

CREATING THE PLAN

The food waste collection will focus on businesses and schools. “If you look at a map of Manteca, it’s broken up into four or five major shopping areas,” Kline says. There are some small independent restaurants in-between, but the chain restaurants in the large shopping centers account for most of the food waste. Some of the city’s independent restaurants are small enough that their waste volume may not meet the state threshold.

All participating restaurants receive a 30-gallon orange trash can. As in other municipalities, Manteca’s waste bins are color-coded: brown for trash, blue for recyclable plastics and glass, green for yard waste. “With this system, once we start diverting it to the wastewater treatment plant, the food waste is as pure as you can get,” Kline says.

For the moment, the food waste the city collects is not going to the wastewater treatment plant for methane production. Instead, it is taken to a county-owned waste transfer facility where it is mixed with yard waste and other green materials and then shipped to a composter. Methane generation will happen when the treatment plant is expanded to accommodate more anaerobic digestion and when a new food waste separator is added to the waste transfer station.



Samantha Barretta dumps food waste into a bin at one of the Manteca businesses involved in the food waste collection. California law says cities must reduce food waste by 50 percent by 2018; Manteca will convert the material to fuel to power vehicles.

“It’s like the ounce of prevention. It made more sense to start now and break the project into bite-sized pieces than to wait and be overwhelmed in 2017 or 2018.”

JEREMY KLINE



Manteca (California) Wastewater Quality Control Facility

BUILT:
1959, upgraded 1970

POPULATION SERVED:
100,000

SERVICE AREA:
City of Manteca

FLOWS:
9.87 mgd design, 6 mgd average

TREATMENT LEVEL:
Tertiary with UV disinfection

TREATMENT PROCESS:
Activated sludge, cloth-media filtration

RECEIVING WATER:
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BIOSOLIDS:
Landfill

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WEBSITE:
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Jeremy Kline, solid waste supervisor

LAYING THE GROUNDWORK

Although the biogas project at the Manteca Wastewater Quality Control Facility has not begun, work with the community is in progress. The city handles all food waste collection, domestic and commercial. That means picking up waste from the city's four large shopping areas and from 17 elementary schools and two high schools.

Since December 2015, Jeremy Kline, solid waste supervisor, has been meeting with businesses and agencies to explain the food waste recycling system. "When I meet with customers, I explain that if they divert food out of their trash, their bill should get smaller because they're not throwing away as much," Kline says. "We're not charging for the food recycling."

Charges are based on the size of the waste bin each business uses. "So in theory, if they're diverting 30 or 40 percent of the material that would go into a bin, they should be able to reduce their trash bills by 30 or 40 percent, too," Kline says.

The only objection came from custodians at area schools because the food waste bins become another trash container they must look after and manage. But here the city took a step to ease the load on the school staff. "We enlisted the help of the fifth- and sixth-graders to help manage that recycling," says Kline. "We educate the kids about how much food they throw away, but the kids are also helping with separation."

Students used to dump all their trash into a single container. Now they approach a series of bins where the fifth- and sixth-graders direct the younger students where to put waste food, waste paper and recyclable foam trays.

are now partners in this project, and we are working on the facilities we'll need," says Heather Grove, wastewater systems superintendent. The plan is to construct two receiving stations, one for the food slurry and another for fats, oils and grease. There will be a new control building, two new digesters, gas compressors and fueling stations. The estimated cost for the projects, including the separator, is \$29 million.

The city has discussed allowing other haulers to use the turbo separator at the county transfer facility. "That is a long-term vision, something we'll look at once we have the process functioning with Manteca-only material," Kline says. "At that point we would work out a price structure."

The project also includes rehabilitation of the plant's two existing digesters. "They're aging. They need new mechanicals inside and new lids," says Grove. "The existing lids are concrete, and they're cracked. Even without this project, we would have to put new lids on." The new digesters will be 65 feet in diameter, versus 60 feet now, with a capacity of about 750,000 gallons each.

At the treatment plant receiving station, food slurry will be mixed with sludges and fed to the digesters. The city now takes in about 36 cubic yards of food waste per week. When collection expands to the entire city, trucks will bring in about 1,500 wet tons per week.

NO FRACKING, NO DRILLING

In the digesters this additional feedstock will produce nearly 18,000 cubic feet of methane per day. Gas coming out of the digesters is processed through a scrubber to remove water and contaminants and then through a SulfaTreat (Schlumberger) system to remove hydrogen disulfide. There has been talk about selling the resulting compressed natural gas to the public, Kline says. Waste management in nearby Stockton is converting its fleet to CNG, but there is only one fueling station in that city.

MECHANICAL SEPARATION

The team is looking at a turbo separator (Scott Equipment Company) that will accept even packaged food. Waste coming from restaurants and other sources will dump into a bin, where an auger will push it into the separator. Inside is a shaft fitted with paddles and rods of various shapes. Some of these break open food containers by pinching them against the separator housing; others squeeze the material through screens. The resulting slurry drops out the bottom of the separator. Pieces of plastic and metal fall onto a conveyor that deposits them in another bin for shipment to a materials recycler.

When the treatment plant expansion is complete, the food slurry will be trucked the 5 miles from the transfer station. "Solid waste and wastewater

“That provides an opportunity for us,” says Kline. “Being on the edge of the San Francisco Bay Area, clean energy is an emphasis here, so more people have natural gas vehicles.” CNG sales would be primarily to fleet or transit vehicles because most average motorists do not have CNG autos.

The primary gas user will be the city’s own fleet of solid waste trucks. The city now owns four natural-gas-fueled trucks: one for the wastewater department and three for solid waste. Beginning in 2017, the city will replace four diesel-fueled trucks with CNG equivalents each year, Kline says. This falls within the normal replacement cycle, but is also driven by state air pollution laws. When the change is complete, about 20 city trucks will run on CNG.

Included in the CNG expansion plans are 22 fueling stations at the treatment plant. Two will have high-pressure pumps and lines to fill tanks within minutes. These may be available to the public, and they will be able to quickly top off the supply for any of the city’s trucks. The other 20 will be low-pressure stations where trucks can be plugged in to fill overnight. If plans and funding come together as expected, construction will end in November 2017.

THE WASTE PROCESS

The Manteca Wastewater Quality Control Facility uses activated sludge treatment followed by Aqua-Disk cloth-media filters (Aqua-Aerobic Systems)

for tertiary treatment and UV disinfection (WEDECO - a Xylem Brand). Waste activated sludge thickened with dissolved air flotation moves to the two existing anaerobic digesters. A centrifuge (Centrisys) dewater the material to produce cake. Biosolids are sent to a landfill to be used as alternate daily cover.

The plant also has several treatment ponds. The largest holds secondary effluent only. Next to it is a small pond that takes wastewater directly from a food processor on the east edge of the city; this pond is aerated with rotary brushes. Water from the two ponds is blended to irrigate alfalfa and other forage crops on 200 acres surrounding the plant. A third pond equalizes flow through the UV system, followed by discharge into the San Joaquin River. Chlorination of a portion of this water qualifies it as recycled water. At the moment,

Manteca’s only permitted use for this water is in dust control, but an upgrade will allow more uses.

Running the wastewater operation are: Dustin Valiquette, chief plant operator; Jonathan Clark, William Jenkins, Justin Nave, Cody Robinson, Chris Rudolff and Josh Zamora, wastewater operator III; and Robert Bennett and Kevin Mello-Hall, wastewater operator II.

“Solid waste and wastewater are now partners in this project, and we are working on the facilities we’ll need.”

HEATHER GROVE

SPENDING MEANS SAVING

The Manteca team hopes to offset the cost of the plant expansion and



Heather Grove, wastewater system superintendent, and Jeremy Kline walk the wastewater treatment plant grounds where digesters will soon be updated as a step toward producing fuel for vehicles.



For the time being, food waste collected by Manteca is trucked to Harvest Power in Lathrop, California, where it is converted to compost.

**Manteca Wastewater Quality Control Facility
PERMIT AND PERFORMANCE**

	INFLUENT	EFFLUENT	PERMIT
BOD	320 mg/L	2 mg/L	10 mg/L
TSS	260 mg/L	0.6 mg/L	10 mg/L
Ammonia	36.8 mg/L	0.6 mg/L	2.1 mg/L
Nitrate + Nitrite	N/A	6 mg/L	10 mg/L

biogas project in three ways. First is a \$1.8 million grant the utility received through the San Joaquin Air Pollution Control District, and that is enough to build some of the CNG refueling stations.

Next are diesel fuel savings once the biogas operation is producing at full capacity and the city is running trucks on its own fuel supply. Last is a rate hike. The city is completing a rate study now; the price structure has been the same since 2003. “This project aside, it’s generally time for us to consider rate increases,” Kline says.

At a time when food represents about 15 percent of all municipal solid waste but only 2 percent of waste recovery, the Manteca waste team is setting itself apart and ahead with its efforts. “It’s like the ounce of prevention,” Kline says. “It made more sense to start now and break the project into bite-sized pieces than to wait and be overwhelmed in 2017 or 2018. Now we have cities around us calling and asking how to do this.” *tpo*

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The Manteca Public Works Department uses “Feed Freddy” to encourage kids to recycle food waste in schools.

Turbidity Testing Made Clear

ACCURATE TURBIDITY ANALYSIS DEPENDS ON PROPER SAMPLE COLLECTION AND CARE, CORRECT CALIBRATION AND MAINTENANCE OF ANALYSIS INSTRUMENTS AND CELLS

By Peter Strimple

Turbidity is regularly measured at water treatment plants on both compliance and process control samples using hand-held or bench-top turbidimeters. It is also measured on reclaimed water samples at wastewater treatment plants.

Turbidity in drinking water and wastewater effluent can adversely affect water quality in several ways that include supporting bacterial growth, reducing the efficacy of chemical disinfection, and harming aesthetics.

Although often considered a relatively simple test, turbidity analysis can result in a number of problems that adversely affect sample results. This is especially true with low-level turbidity samples, which can be exceedingly problematic to analyze accurately. As a result, turbidity troubleshooting analyses can be challenging.

TURBIDIMETERS

The first essential step is to be sure to follow an approved method and that the turbidimeter meets the minimum requirements detailed in Standard Methods (SM 2130 B) and EPA method #180.2. This includes:

- Detector at 90 degree to incident light
- Sensitivity that allows detection of turbidity differences of 0.02 NTU or less in samples with turbidities of less than 1.0 NTU
- No more than 10 cm distance traveled by light within the sample tube

If your turbidimeter does not meet all required criteria, you should acquire one that does.

To ensure reliable and defensible sample results, turbidimeters must be properly calibrated, following the manufacturer's procedure. They should be calibrated at least quarterly using primary turbidity standards.

Care and maintenance of turbidimeters is crucial to proper performance and reliable sample results. It is imperative to follow manufacturer-recommended service schedules. Furthermore, excessive humidity or dust is detrimental to the operation of these instruments; it is important to keep the inside of the cell compartment as clean and dry as possible.

For good sample results, make sure that any turbidimeter is warmed up adequately before sample analysis. Consider leaving the instrument turned on, if the manufacturer approves.

SAMPLE CELLS

When troubleshooting turbidity analyses, it is extremely important to inspect the sample cells frequently. These cells must be made of clear, colorless plastic or glass and should be kept scrupulously clean, inside and out. Cleaning entails washing with hot, soapy water and rinsing with reagent water (distilled or deionized), then capping the cells to prevent contamination.

Acid-washing or use of an ultrasonic bath may be necessary to clean excessively dirty cells.

Immediately discard any damaged cells (such as those with deep scratches or cracks) or cells that cannot be cleaned. Minor imperfections in sample cells can be masked using a thin layer of silicone oil, which should have the same refractive index as glass. Follow the manufacturer's procedure for applying the oil.

Unreliable or questionable sample results can also be caused by the use of multiple sample cells for turbidity analyses. To alleviate this, use one sample cell or a matched pair of cells to ensure the most reliable results.

Finally, for optimal results be sure to index sample cells (containing samples or standards) according to the manufacturer's procedure, if applicable. Indexing is the process of slowly rotating a sample cell 360 degrees, noting the position that yields the lowest value, and then placing a mark on the top of the sample cell neck. Then, the cell can be oriented to this position for subsequent sample measurements until it is indexed again.

CALIBRATION

To ensure reliable and defensible sample results, turbidimeters must be properly calibrated, following the manufacturer's procedure. They should be calibrated at least quarterly using primary turbidity standards. Over time, some turbidimeters may need to be calibrated more often, as evidenced by drift, reading instability, or failed check standards. This is usually more common in instruments that are older or have been heavily used.

Only primary standards can be used to calibrate turbidimeters. The calibration standards you use should be dilutions of a stock formazin standard, manufacturer-prepared formazin standards, or styrene divinylbenzene standards, whichever the instrument maker recommends. Whether you use bulk standards or sealed standard cells, be sure they are not expired.

Only primary standards can be used to calibrate turbidimeters. The calibration standards you use should be dilutions of a stock formazin standard, manufacturer-prepared formazin standards, or styrene divinylbenzene standards, whichever the instrument maker recommends. Whether you use bulk standards or sealed standard cells, be sure they are not expired.

(Continued on page 69)

The Power of Cover Crops

THE NATIONAL WILDLIFE FEDERATION LOOKS TO ENGAGE WITH UTILITIES IN EFFORTS TO REDUCE NUTRIENT POLLUTION FROM FARM RUNOFF IN WATERSHEDS

By Jim Force

For many clean-water utilities, the possibility of stricter nutrient removal requirements looms on the horizon. New total maximum daily loadings for water bodies and increasing concern over algae buildups are driving new measures to curtail phosphorus and nitrogen.

But point-source discharges are only part of the issue. Much of the nutrient loading to streams and lakes comes from nonpoint sources, especially agricultural runoff. What's the best strategy for dealing with the overall problem?

One organization taking a proactive approach is the National Wildlife Federation. In 2013, the federation began a concerted effort to encourage sustainable agriculture in the Upper Mississippi River Basin, specifically through its Cover Crop Champions program.

At the same time, NWF has begun to engage utilities, linking them with farmers to help spread the message about the benefits to area water quality through cover crops. The premise is that treatment facilities can significantly reduce costs by working with growers and producers to protect source waters and surrounding watersheds.

Elizabeth Lillard, an agricultural program specialist based in Ann Arbor, Michigan, is spearheading the federation's utility engagement program and is eager to share the message of cover crops with municipal water and wastewater utilities. She talked about the program in an interview with *Treatment Plant Operator*.

tpo: What is the NWF program and how do you see it connecting with water and wastewater utilities?

Lillard: The objective is to get utilities and the agricultural community working in harmony to help improve source water and address nutrient

“Utilities often don't have the resources to meet nutrient removal requirements, and we believe that by taking a holistic watershed view, money invested in nutrient control will have a bigger payoff.”

ELIZABETH LILLARD

pollution problems. Utilities often don't have the resources to meet nutrient removal requirements, and we believe that by taking a holistic watershed view, money invested in nutrient control will have a bigger payoff.

We started the program in 2013 and are ramping it up. Our specialty is agricultural communications. We know how to start the conversation between municipalities and agricultural groups. We take a broader view than governments or watershed groups. We are starting with four or five utilities, helping them engage the communities at large, but homing in on farmers and the agricultural community.

tpo: Why is the National Wildlife Federation involving itself in source water quality?

Lillard: NWF works on a variety of issues. We have a considerable number of our staff working on water quality. Our agricultural program has wildlife benefits — cropland can take away habitat, grasslands benefit wildlife. Clean water benefits all creatures.

tpo: What are cover crops?

Lillard: Cover crops are non-commodity crops planted between rows of crops or on bare fields during fallow periods, usually after harvest and before spring planting, to prevent soil erosion and loss of nutrients. Cover crops improve farm profitability by increasing yields, improving soil health through increased soil porosity and infiltration, and reducing fertilizer and weed management costs. They also retain nutrients that would otherwise leave the field via runoff or leaching, making those nutrients available for the next crop. In addition, they remove carbon dioxide from the atmosphere, storing it safely in soils. Overall, cover crops can protect water quality and enhance wildlife habitat.



Elizabeth Lillard

tpo: Please explain the Cover Crop Champions program.

Lillard: Our Cover Crop Champions program covers all states in the Upper Mississippi Basin, including Ohio. Champions are farmers and local outreach professionals —

people from an organization or county — who pair together to reach out to at least 150 farmers and 10 crop advisers per year, communicating the cover crop story. Their effectiveness is measured by field and farm data, and things like the number of presentations or media interviews. The program started in 2013, and we have partnered with more than 60 Cover Crop Champions.

tpo: How would you characterize the program's effectiveness?

Lillard: A survey conducted by the Lincoln Extension Center indicated that for every 400 farmers reached by our cover crop program, about 50 will

try it. That's 12 percent. Since 2013, we've reached more than 19,000 farmers with the cover crop message, and more than 300,000 acres of cover crops have been planted.

tpo: To what extent are communications necessary to the program's success?

Lillard: As mentioned, our team specializes in agricultural communications. We identify leaders in the farming community who are employing cover cropping and other sustainable practices. Through outreach education and communications training, we help them go back to their communities to spread the word about cover crops. We understand that farmer-to-farmer communication is the most effective. In many instances, farmers will help their neighbors work through barriers and develop sustainable practices for their farms.

tpo: How is your program involving municipal water and wastewater utilities, and why is their assistance important?

Lillard: Water facilities treat for many contaminants, but for rural communities nitrate is consistently a problem, often due to the mismanagement of fertilizers and animal manure on private lands. Utilities can significantly reduce the cost of water treatment and facility upgrades by working with growers and producers to better manage nutrients and protect source waters and the surrounding watersheds.

Starting this fall, NWF will directly engage with a few utilities that are struggling with nitrate pollution. We will help them develop source water protection programs. NWF hosted two webinars in 2016 as part of our utility engagement program. PDFs of the presentations are available upon request.

tpo: Are success stories starting to appear?

Lillard: Yes. Oconomowoc and Waupaca, Wisconsin, are communities that have developed their own programs. In Oconomowoc, the wastewater treatment plant is spearheading a local effort to involve the entire watershed in monitoring and controlling nonpoint source pollution and sediment erosion. It's called the Oconomowoc Watershed Protection program. Waupaca has cropping agreements with a couple of farmers. The city hires a crop consultant to work with the farmers to develop plans to keep nitrate runoff low. The city started these agreements in the 1990s, and has not had to remove nitrates at the treatment plant for years.

tpo: Is there a reason why Wisconsin communities seem progressive in taking watershed-based approaches?

Lillard: Utilities in Wisconsin can work with farmers as part of their permit compliance plans using adaptive management, an alternative option for dealing with phosphorus. Most utilities don't have that option, so they need alternative strategies. Even if a utility has the adaptive management option, our program helps improve outreach effectiveness to farmers to get them to adopt practices like cover crops that dramatically reduce nonpoint pollution. We are communicating with them and will draw on their experiences to help shape our program.

tpo: Are there any other exemplary programs that deserve mention?

Lillard: The city of Griswold is one of 15 Iowa Source Water Protection Pilot Projects, part of the Iowa DNR Source Water Protection program. This is a much more recent activity. The city coordinated a Source Water Protection Team, investigated the groundwater in the area, and identified nearby farmers. The team has since worked with others in the agricultural community and has started planting cover crops in critical runoff zones.

tpo: What should a municipality do if it is interested in working with NWF?

Lillard: We encourage utilities to get involved. They can contact NWF by calling me at 734/887-7134, or emailing me at lillarde@nwf.org. We're happy to answer their questions and help them become knowledgeable about the issue and our program. **tpo**

(Continued from page 67)

Daily or more frequent verification of turbidimeters will also help ensure accurate results. Check standards used for instrument verification can be primary or secondary, the latter typically being gel standards, such as Hach Gelex standards. Some manufacturers may provide solid check standards, such as HF Scientific ProCheck Solid NTU Standard, for performing verifications.

It is imperative to follow the manufacturer's recommendations for using secondary standards, as some require assigning new values to these standards immediately after calibrating the instrument. Failure to do so can mean inaccurate and questionable verifications and sample results. Manufacturers typically provide acceptance criteria for secondary standards, and you should follow these closely to optimize results. When acceptance criteria fail, you will most likely have to recalibrate the turbidimeter and then perform another verification.

SAMPLES

Even with a properly calibrated and verified turbidimeter and clean sample cells, you may from time to time obtain sample results that seem questionable. When this occurs, you can take several steps to troubleshoot the problem:

- Keep sample bottles scrupulously clean using soap and water, and rinse them with distilled or deionized water.
- Collect a representative sample.
- Mix samples thoroughly but gently before analysis.
- Slowly pour the sample down the side of the cell to minimize formation of small air bubbles.
- Allow samples to stand for a few minutes before analysis to allow small bubbles to dissipate. (It can be challenging to find a balance between allowing enough time for bubbles to dissipate but not enough for particles to settle out.)
- If necessary, degas samples with excessive bubbles, such as by drawing a vacuum or using an ultrasonic bath.
- Avoid interference or unstable readings from settling of particles or condensation. To avoid condensation, allow samples to warm to room temperature, then invert to mix.
- Avoid diluting samples.

Federal regulations for drinking water and wastewater allow a holding time of 48 hours for turbidity samples, provided they are refrigerated at less than 6 degrees C during that time. While this practice is acceptable, it is best to analyze turbidity samples as soon as possible after collection.

REGULATORY REQUIREMENTS

In addition to federal regulations and method requirements, some state regulatory agencies have procedures or guidelines for laboratory analyses of turbidity. For more information about turbidity analysis methods, consult your manufacturer's user manual. Other recommended resources are:

- Standard Methods for the Examination of Water and Wastewater Method 2130 B (Nephelometric Method), latest method revision: 2001.
- EPA Method 180.1 (Determination of Turbidity by Nephelometry), Rev. 2, August 1993.

ABOUT THE AUTHOR

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The whale's fin at the top of the digester is 2.5 feet tall and made of stainless steel. It was an afterthought because the artist's sketch made before the painting did not fit.

A Message in Paint

MURALS ON LIVERMORE'S WASTEWATER TREATMENT FACILITIES REMIND RESIDENTS THAT THEY HAVE A DIRECT CONNECTION WITH THE OCEAN AND ITS MARINE LIFE

By Jeff Smith

Each year from spring through autumn, migrating humpback and California gray whales are a major attraction in coastline waters near San Francisco Bay, which is also the receiving water for the city of Livermore Water Reclamation Plant.

All year long, the likenesses of those whales can be seen on the disinfection buildings of the plant (8.5 mgd design capacity) at the discharge near the Bay's eastern shore, 16 miles from the plant proper.

Huge murals of humpbacks, gray whales, dolphins and other ocean creatures cover the entire walls of the concrete structures. They were painted by Livermore's director of Public Works, Darren Greenwood. "It's a great location for the murals because they can be seen by airline passengers on the final approach into the Oakland Airport," says Greenwood. "They're also seen by hikers and bikers on the San Francisco Bay Trail, which passes right in front."

AMBITIOUS PROJECT

Greenwood has painted similar total-wall murals with the same theme on three buildings at the pumping station that pushes effluent from the Livermore plant over the coastal mountains on its journey to the deep-water discharge in the bay. He has also painted a mural on a neighboring utility's 60-foot-tall surge tank.

But the murals seen by the greatest number of passersby are the first ones he painted, on two digester buildings and a solids handling building at the water treatment facility. "Like many treatment plants around the country that were built out in the boondocks, the city has grown and is now our neighbor," Greenwood says. "People in thousands of cars that pass near the

plant each day on two major highways can see the murals."

Those were painted in two phases. In 2007, the city provided the paint and Greenwood donated his time to paint the actual-scale murals on two walls of the digesters,

Share Your Ideas

TPO welcomes news about interesting features of your facility's grounds, signage or buildings for future articles in the PlantScapes column. **Send your ideas to editor @tpomag.com or call 877/953-3301.**

“I chose the marine mammal theme to remind people they have a direct connection to the ocean through their local wastewater treatment plant.”

DARREN GREENWOOD

which are more than 40 feet wide and 70 feet long. The other two murals were completed in 2010 with the help of a grant he received from the city's public art commission.

"I chose the marine mammal theme to remind people they have a direct connection to the ocean through their local wastewater treatment plant," says Greenwood.

SENDING A MESSAGE

Public education is important to Greenwood and the plant team. Operations staff members use the murals as a big draw for the hundreds of students and residents who tour the plant each year. "It's the clearest way for



All four sides of the solids handling building show whales. A sandy ocean floor with coral outbreaks can be seen at ground level.



The waterfall feature and the new sign near the plant entrance were completed in 2015.

talking to the kids about not putting things down the drain,” says Greenwood. “They get the message when they see that we discharge out in the ocean where the dolphins and whales live.”

Public reception to the murals has been astounding, Greenwood says. An open house held after the first murals were completed drew more than 800 people. One citizen sent cookies to the plant at Christmas with a card saying, “Thanks for the whales.” People have called and asked whether the plant was an aquarium.

“It changes the perception and gets you a lot of goodwill,” says Greenwood. More than half of the activated sludge facility’s average flow of 7 mgd is recycled and used for irrigating a golf course and the landscaping at the nearby airport and shopping center. Some is stored for use in fire protection systems.

A portion of the recycled water is used in a fountain to cascade down a waterfall that is in the background of the plant’s entranceway sign. The water feature and sign were built on the corner of the plant site to finish off an intersection that is a heavily traveled gateway to the airport and a shopping center.

Greenwood’s career with the city started in the lab and grew to include public education through art in the community, and especially the schools. He says every agency will eventually have a spill or something beyond control go wrong.

When that happens to his agency, the public will be tempted to think someone messed up and is not doing their job. But if the plant already has a good reputation, the public is more likely to think the good people who clean the water to save the whales are just having a bad day.

Says Greenwood, “I think that’s what this is buying us.” **tpo**

Legacy Building Solutions ranked among Inc. 5000

Legacy Building Solutions ranked 1,952 on the 2016 Inc. 5000 list of fastest-growing private companies in America. This is the first time Legacy has been featured on the list that is determined by rate of revenue growth over a three-year period. Since its inception in 2010, Legacy has expanded markets domestically and internationally, achieved ISO 9001:2008 and CSA A660-10 certifications, and added a sales office in Canada.

Analytical Technology acquires Entech Design

Analytical Technology, manufacturer of water quality monitoring instruments and toxic gas detection products, acquired Entech Design of Denton, Texas, manufacturer of ultrasonic interface level measurement products.

Grundfos names executive VP for water utility business

Grundfos named Thomas Morrison executive vice president of its U.S. Water Utility business. He will be responsible for the company’s sales and operations. Morrison takes over for Dieter Sauer, who was promoted to regional managing director for Grundfos Americas.

Asahi/America adds business development manager

Asahi/America named Jon Alanis business development manager for industrial products in the western region. Based in Arizona, he will work on preconstruction sales and engineering specifications.



Jon Alanis

Bionomic Industries redesigns product website

Bionomic Industries launched a new product website that provides ease of use and viewing on desktop computers and mobile devices. Users can access product and related services information. Tabs provide information about the company, news, product, services, industries/product applications, sample literature, quote/contact forms, sales rep locator, technical articles and cases studies.

Mainland Machinery partners with Zeroday Enterprises

Mainland Machinery partnered with Zeroday Enterprises and was named distributor and manufacturer of Zeroday’s Z ChemGear product line of flocculant, chemical and reagent mixing and feeding systems. **tpo**

Every day is Earth Day.™

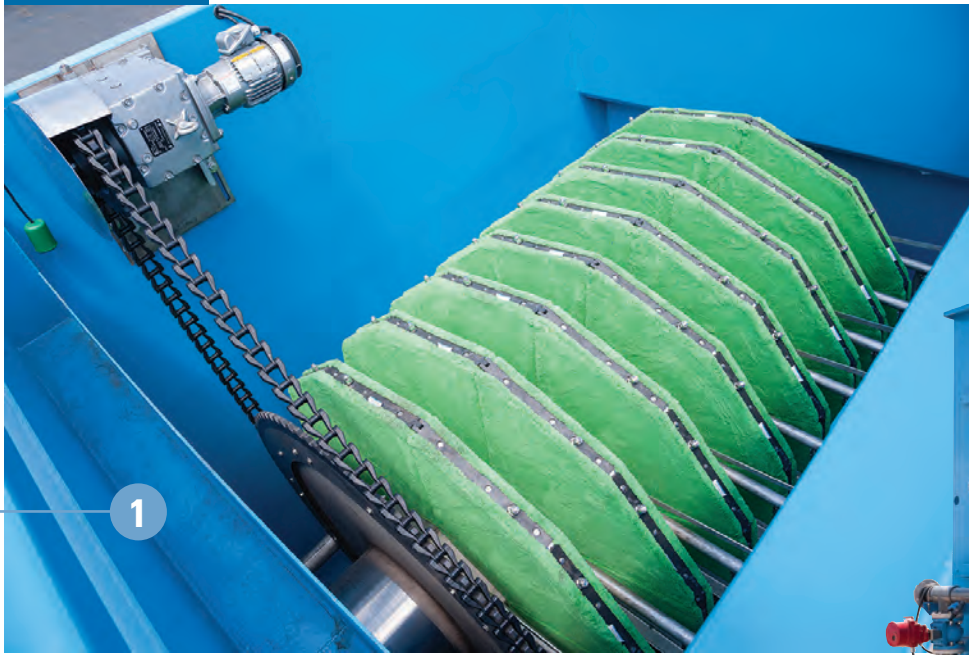
“Water really motivates me. I grew up on the shores of Lake Huron ... This work has great variety and plenty of challenges. It offers me the opportunity to be a real environmentalist. I’m serving on the front line of environmental protection.”



Phil Webster
An Original Environmentalist

MANAGER, WATER POLLUTION CONTROL DEPARTMENT
Alliance Water Resources, Sedalia, Mo.

Read about original environmentalists like Phil each month in *Treatment Plant Operator*.



1

1. The AquaPrime filtration system uses a pile cloth filter media.

2. The technology can remove solids without using chemicals. The filtered water can be disinfected and discharged or blended back with the plant effluent.



2

Front-End Solution

A NEW CLOTH-MEDIA FILTER DESIGNED FOR PRIMARY TREATMENT AND WET WEATHER FLOW HANDLES HIGH SOLIDS LOADING RATES IN A COMPACT FOOTPRINT

By Ted J. Rulseh

Clean-water plants are constantly challenged to improve efficiency and meet increasingly strict permit limits. When new regulations or community growth demand plant expansion, space can be at a premium, especially for older facilities hemmed in by surrounding development.

Cloth-media filtration has been used for years in tertiary treatment; now an industry supplier is offering the technology as a front-end solution, for primary treatment as well as for handling high wet weather flows.

Aqua-Aerobic Systems says its AquaPrime cloth-media filtration system can perform reliable primary treatment in a fraction of the footprint of conventional primary settling basins, while also reducing load on biological treatment and potentially helping increase production of biogas that can be recovered as an energy source.

The company says the system uses well-proven filtration with its OptiFiber cloth media to filter screened, de-gritted wastewater. John Dyson, product channel manager, explained the technology in an interview with *Treatment Plant Operator*.

tpo: What market needs drove development of this offering?

Dyson: First, some facilities face footprint constraints. They are landlocked yet need more treatment capacity, and primary clarifiers are gener-

“It can be designed so that in dry weather conditions it does tertiary filtration, and in wet weather it can convert over to handle the excess flow while the treatment plant still runs at its baseline design flow.”

JOHN DYSON

ally quite large. Second, enhanced primary treatment benefits the secondary process — there are savings on energy or the secondary process can get smaller. Third, more facilities are looking to turn biogas into energy, and solids removed in the primary phase have much greater potential to produce biogas in anaerobic digestion.

tpo: How does this method of filtration apply to wet weather flows?

Dyson: In wet weather flows, the solids after the initial flush are generally low in concentration. The beauty of this technology is that in most cases, those solids can be removed without using any chemicals, and the water

can be either discharged after disinfection or blended back with the plant effluent. It can be deployed not only at the treatment plant but also remotely, for combined sewer or sanitary sewer overflows or to treat storm runoff.

tpo: Can this technology also be used for tertiary treatment?

Dyson: It can be designed so that in dry weather conditions it does tertiary filtration, and in wet weather it can convert over to handle the excess flow while the treatment plant still runs at its baseline design flow.

“Although the technology is new for primary and wet weather applications, the actual mechanics are proven through more than 1,500 cloth-media filter installations. This is really the reapplying of an existing technology to a new application.”

JOHN DYSON

tpo: How is this cloth filter able to function in a primary treatment application?

Dyson: The base concept is our proven tertiary filter with a pile cloth media. In that design, there is a little bit of solids settling and then filtration through the media. In the case of primary and wet weather treatment, we have more developed solids removal. We allow heavy material to settle by using a hopper bottom design. We also include a weir to collect the floatables. So combined with filtration, we have three modes of removing solids to provide a total solution. The filter captures close to 90 percent of the solids.

tpo: Does the process in primary applications require any special backwashing method?

Dyson: Due to the design of the system and the nature of the application, the solids mat on the surface of the media. Our normal design backwash is extremely efficient in achieving the cleaning that's required. We backwash by pulling solids off the media using a backwash shoe. The shoe makes contact with the cloth and as the disc rotates, the backwash system basically vacuums the solids off the media.

tpo: How has this been tested and proven before being offered commercially?

Dyson: We've done more than 3 1/2 years of research, including long-term studies in California on the primary application. We have a research and development facility here at our headquarters in Rockford, Illinois, where we have tested the technology multiple times, and we've done several strategic pilot studies across the country on wet weather and primary applications at customer sites. So we have thousands of hours of operation on the system, and we continue to do testing. One customer in California has purchased a unit for a 1 mgd full-scale pilot study, where we are testing it on primary treatment, in parallel with an existing treatment train with conventional primary clarifiers and the same secondary biological treatment process.

tpo: Is there any particular sweet spot for this technology in terms of size?

Dyson: It is suitable for flows from 1 mgd to tens of millions of gallons per day, depending on the application. There is really no constraint on size.

tpo: What has been the market's response to the technology so far?

Dyson: Customers have been very much impressed with the technology; we've seen a lot of interest. We have a decent pipeline of projects already in place, and all of our pilot units are booked up almost for the next 12 months.

tpo: How would you sum up the difference between this system and your company's established cloth-media filtration offerings?

Dyson: Although the technology is new for primary and wet weather applications, the actual mechanics are proven through more than 1,500 cloth-

media filter installations. This is really the reapplying of an existing technology to a new application. The difference is that the hopper bottom is a little bit larger, and we have a way to remove floatables, but the mechanics of how it backwashes and how it operates, such as the drives and mechanical systems, have all been full proven out in many years of operation.

Utilities need more enhanced primary treatment that provides benefits throughout the treatment plant. The ability to handle wet weather conditions at the treatment plant or remotely, without chemicals, is an advantage.

And the fact it can be used in some cases in dual applications for tertiary and wet weather treatment is an additional benefit. **tpo**



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Energy Management and Sustainability

By Craig Mandli

Asset Management

AQUA-AEROBIC SYSTEMS AQUAPRIME

The AquaPrime cloth-media filtration system from Aqua-Aerobic Systems is an economical and efficient solution for primary wastewater treatment and wet weather applications. It uses a disc configuration and OptiFiber cloth media to filter screened, de-gritted, raw municipal sewage. It can handle high solids applications and sustain low-effluent TSS, making it ideal for both wet weather treatment and primary treatment in lieu of conventional sedimentation systems. It operates in less than 10 percent of a footprint compared to conventional primary settling basins and offers the added advantage of improving gas production in the anaerobic digestion system. **800/940-5008; www.aqua-aerobic.com.**



AquaPrime filtration system from Aqua-Aerobic Systems



Cooling towers from Delta Cooling Towers

DELTA COOLING TOWERS

A line of towers from Delta Cooling Towers is constructed from antimicrobial resin, which is fully compounded into the base cooling tower material. The resin contains additives that operate on a cellular level to continuously disrupt and prevent uncontrolled growth of microorganisms and biofilm within the cooling tower. The tower designs have a sloped basin and/or basin sweeper system to keep water from becoming stagnant, which can lead to microorganism development. Stagnant water areas are also prime breeding grounds for *Legionella* to grow. **800/289-3358; www.deltacooling.com.**

development. Stagnant water areas are also prime breeding grounds for *Legionella* to grow. **800/289-3358; www.deltacooling.com.**

HAYWARD FLOW CONTROL FLUID HANDLING PRODUCTS

Hayward Flow Control's thermoplastic fluid handling products can be used in the harshest chemical feed environments. The complete family of solutions includes solenoid diaphragm metering pumps, pressure relief and back pressure valves, calibration cylinders and columns, corporation stops and injection valves and quills. They are easy to install and can help keep systems working with years of maintenance-free service. **336/712-9900; www.haywardflowcontrol.com.**



Thermoplastic fluid handling products from Hayward Flow Control

LYSTEK INTERNATIONAL THERMAL HYDROLYSIS SYSTEM

The Thermal Hydrolysis System from Lystek International optimizes digesters and biological nutrient removal systems, contributing

to diversion and sustainability. Nonhazardous materials are transformed into nutrient-rich, federally recognized biofertilizers and other multipurpose products. High-speed shearing, alkali and low-pressure steam are applied simultaneously in a reactor to convert organic materials into LysteGro, a commercial-grade, Class A EQ biofertilizer with applications in horticulture, agriculture and soil revitalization. The end product can also be used as a safe, cost-effective, alternative carbon source (LysteCarb) in BNR systems. When used in conjunction with anaerobic digestion (LysteMize), the system can reduce volumes by 25 percent while boosting biogas production by 40 percent. The biogas can then be converted into green energy to help power wastewater treatment plants. **888/501-6508; www.lystek.com.**



Thermal Hydrolysis System from Lystek International

PHILADELPHIA GEAR – A TIMKEN BRAND CORE

The CORE (Continuous Oil Rescue Equipment) filter from Philadelphia Gear – A Timken Brand can remove particles as small as 1 micron. At the center is a series of annular magnets shrouded by steel plates. When the oil is filtered through these plates, it is subjected to a high magnetic flux gradient caused by the focusing of the magnetic field at the tips of the plates. The result is that contaminants are drawn into collection areas between the plates and out of the oil flow. This filtering process results in a negligible pressure drop, while at the same time helping to prevent “wash off” since the contaminant is isolated and cannot wash back into the oil. **800/766-5120; www.philagear.com.**



CORE filter from Philadelphia Gear – A Timken Brand

Automation/Optimization



ACOS Advanced Chemical Oxidation Systems

ACOS ADVANCED CHEMICAL OXIDATION SYSTEMS

The ACOS Advanced Chemical Oxidation Systems process can help destroy hazardous organic contaminants in wastewater. Designed to meet individual needs and degradation goals, the process generates and applies hydroxyl radicals in a precisely controlled, precisely designed environment.

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ORENCO CONTROLS OLS SERIES

Corrosion-resistant OLS Series control panels from Orenco Controls contain integrated variable-frequency drives to optimize system operation, reduce energy usage and decrease hard starts and water hammer. They're ideal for any pumping application where consistent flow and energy-efficient operation are essential, such as lift stations, dewatering or sludge pumping. They can also be used as a SCADA patch, connecting peripheral equipment to an existing SCADA system. Each



OLS Series control panels from Orenco Controls

panel is designed and built specifically for the application and setup needs. Multiple drives can be configured through one user-friendly human-machine interface. Engineers preprogram user interfaces to the site-specific needs of an installation, making the panel virtually plug-and-play. Maintenance staff can easily adjust settings and monitor the system remotely. These outdoor-rated control panels, housed in a weatherproof enclosures, also offer circuit protection, heat dissipation systems (fan or A/C), phase and voltage protection, and level controls. **877/257-8712; www.orencocontrols.com.**

Biogas

AERZEN BIOGAS BLOWER

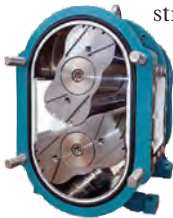
Aerzen Biogas Blowers are designed for digester gas applications. These blowers ensure process safety and reliability. Operators can choose from a variety of sizes with intake volume flows from 50 to 1,500 cfm and positive pressure up to 15 psig. **610/380-0244; www.aerzenusa.com.**



Biogas Blowers from Aerzen

BOERGER BIOGAS ROTARY LOBE PUMP

The Biogas Rotary Lobe Pump from Boerger offers biogas operators an effective and wear-resistant solution for pumping biogas substrate from renewable resources. At the core of the pump is the Premium profile steel rotor that ensures fibers in the pumped medium actually become part of the short-term surface. They attach themselves in the grooves and are continuously renewed each time the rotor turns. This organic short-term surface provides full protection from wear and the profile rotor itself shows virtually no signs of wear even when subjected to long-term exposure. It is constructed using a maintenance-in-place design, which allows for all wetted parts to be replaced without the removal of pipe or drive systems. **612/435-7300; www.boerger.com.**



Biogas Rotary Lobe Pump from Boerger

FCI - FLUID COMPONENTS INTERNATIONAL ST75 SERIES

The ST75 Series air/gas flowmeter from FCI - Fluid Components International operates in hot, wet, dirty environments to provide accurate measurement of mixed composition gases, including hydrogen, carbon monoxide and trace methane for biomass gasification. With its advanced thermal dispersion mass flow-sensing element, it measures mixed composition gases, can be configured to operate in cramped areas with limited pipe runs, and is safe for potentially flammable or explosive combustible gas environments. It operates over a wide flow range in mixed gas environments from 0.01 to 559 scfm, depending on line size. For variable process conditions such as those in biomass gasification plants, it is factory preset to a turndown range of 10-to-1 to 100-to-1. It has dependable accuracy to plus-or-minus 2 percent of reading with plus-or-minus 0.5 percent repeatability in line sizes from 0.25 to 2 inches. **800/854-1993; www.fluidcomponents.com.**



ST75 Series flowmeter from FCI - Fluid Components International

JDV EQUIPMENT CORPORATION DOUBLE MEMBRANE BIOGAS HOLDER

The Double Membrane Biogas Holder from JDV Equipment Cor-



Double Membrane Biogas Holder from JDV Equipment Corporation

poration allows variable biogas storage within the inner membrane at constant pressure during gas production and usage, while the air-inflated outer membrane provides gas pressure and protection. The outer membrane is constructed of a high-tech cross-woven fabric, coated with PVC and UV protection. Sensors monitor gas volume, allowing operators to optimize the use of biogas to feed generators or heating systems. **973/366-6556; www.jdvequipment.com.**

UNISON SOLUTIONS BIOCNG

The BioCNG from Unison Solutions converts biogas to renewable natural gas with a methane quality that meets SAE J1616 fuel requirements for compressed natural gas vehicles. Systems remove hydrogen sulfide, moisture, siloxanes and carbon dioxide from the gas using technology from biogas to energy systems. All components are based on each location's specific gas quality and requirements. The systems are capable of producing up to a 2,400 gasoline gallon equivalent per day, and can be supplemented with natural gas. Existing biogas cogeneration systems may also be upgraded to provide both fuel for the current cogeneration equipment and produce renewable natural gas for vehicle fueling. Systems provide fuel to both time-fill and fast-fill fueling stations. **563/585-0967; www.unisonsolutions.com.**



BioCNG from Unison Solutions

Boilers

PARKER BOILER TC SERIES

The TC Series condensing hot-water boiler from Parker Boiler is available in 399,000 to 5,443,000 Btu input, with stainless steel construction for corrosion resistance at low operating temperatures. It offers efficiencies to 99.7 percent as witnessed and verified by a nationally recognized test lab. Units are available with conventional gas burners, digester gas, oil, propane or a combination of either. **323/727-9800; www.parkerboiler.com.**



TC Series boiler from Parker Boiler

U.S. BOILER COMPANY - BURNHAM BRAND BOILERS X-C

The X-C high-efficiency boiler from U.S. Boiler Company - Burnham Brand Boilers is available in five sizes from 80 to 180 mbH, and provides up to 95 percent annual fuel utilization efficiency. A factory-preset Sage 2.2 control system and LCD display offer straightforward setup and diagnostics, while a standard outdoor reset control saves fuel for the end user. It is system tested at the factory. **717/397-4701; www.usboiler.net.**



X-C boiler from U.S. Boiler Company - Burnham Brand Boilers

(continued)

Drives

DANFOSS VLT DRIVES VACON 100 FLOW

The VACON 100 FLOW from Danfoss VLT Drives is designed to offer versatile flow control in water systems and industrial pump and fan applications. It combines the core functionality of the VACON 100 drive with dedicated functions that can benefit flow-control processes and improve the efficiency and redundancy of pump systems. It includes multipump solutions and application selection menus. The enhanced pump performance protects pipes and equipment to ensure reliable operation. Standard PID control uses a sensor to control pump speed instead of an external controller. This helps the drive to quickly react to fluctuations in demand for accurate process control and optimized energy savings. Versions are available in 0.75 to 1,000 hp and in a voltage range of 230 to 690 volts. **800/432-6367; www.danfossdrives.com.**



VACON 100 FLOW drive from Danfoss VLT Drives

Heat Exchangers/Recovery Systems



BELL & GOSSETT, A XYLEM BRAND, BPX

The BPX 2-inch double-wall brazed plate heat exchanger from Bell & Gossett, a Xylem brand, offers a high level of leak protection, safety and thermal efficiency for commercial building and water heating applications. Its double-wall construction provides dependable protection of freshwater streams for cooling of oils and refrigerants — not just heat transfer surface. It delivers a maximum flow rate of 230 gpm, and meets evolving plumbing code requirements for domestic water heating. It provides four dedicated leak detection ports and complete double-wall plate design, providing air vent leak paths to detect leaks. A true dedicated air gap facilitates leak detection should a leak occur, ensuring system control. Stainless steel plates are vacuum-brazed together to form a durable, integral piece that can withstand high pressure and temperatures. **847/966-3700; www.bellgossett.com.**

BPX heat exchanger from Bell & Gossett, a Xylem brand

complete double-wall plate design, providing air vent leak paths to detect leaks. A true dedicated air gap facilitates leak detection should a leak occur, ensuring system control. Stainless steel plates are vacuum-brazed together to form a durable, integral piece that can withstand high pressure and temperatures. **847/966-3700; www.bellgossett.com.**

High-Efficiency Motors/Pumps/Blowers

BBA PUMPS BA180E D315

The BA180E D315 compact 8-inch dry self-priming pump from BBA Pumps provides a maximum capacity of 3,150 gpm and a maximum head of 135 feet at 59 psi. It is driven by a Caterpillar diesel engine that meets stringent global emission standards. It is built according to strict U.S./EU emissions legislation and is suitable for use worldwide, and comes in a sound-attenuated enclosure, ensuring a low noise level and protection against dust, wind, rain and snow. It has a high-end LOFA control panel with support in 10 languages. Its light weight makes it easy to move around on site, or it can be mounted on a trailer. **843/849-3676; www.bbapumps.com.**



BA180E D315 pump from BBA Pumps

EURUS BLOWER ZG

ZG trilobe aeration blowers for MBBR, bio-solids and/or equalization tanks from Eurus Blower are rated to 15 psig and flows to 3,950 cfm. They have integral-shaft ductile iron impellers, dual splash lubrication, oversized roller bearings, piston ring air seals, Viton lip seals, plus low vibration and noise characteristics. Packages have an integrated intake filter/silencer with washable filter media, heavy-duty base/integrated discharge silencer, vibration dampers, OSHA guard and a V-belt drive with auto belt tensioner. Options include motors, check valves, safety valves, flexible connectors and sound enclosures. **630/221-8282; www.eurusblower.com.**



ZG blowers from Eurus Blower

FLYGT – A XYLEM BRAND CONCERTOR

The Concertor smart, interconnected wastewater pumping system from Flygt – a Xylem Brand senses the operating conditions of its environment, adapts its performance in real time and provides feedback to pumping station operators. It offers energy savings, a reduced inventory due to flexible performance, clog-free pumping operation and clean wet wells, saving in vacuum cleaning costs and a compact design that can reduce cabinet size by up to 50 percent.



Concertor pumping system from Flygt – a Xylem Brand

It offers a wide performance field from which to choose the right operating point. This makes selection simple, and facilitates performance fine-tuning. **855/995-4261; www.xylem.com.**

FPZ SCL K10-MS

The SCL K10-MS blower from FPZ incorporates regenerative/side-channel technology to provide up to 556 scfm with continuous pressure up to 7.6 psig. It is available in 7.5, 10, 15, 20 or 25 hp versions, depending upon pressure requirements. Standard motors are suitable for use with variable-frequency drives, so the blower can operate at slower speeds to minimize power consumption. It has an integral, direct-drive TEFC motor (no belts/transmissions) and is oil-less, requiring virtually no maintenance. Optional intake/exhaust ports maximize installation flexibility. It weighs less than 300 pounds and has a noise level under 82 dBA. **262/268-0180; www.fpz.com.**



SCL K10-MS blower from FPZ

GRUNDFOS PUMPS SL SUBMERSIBLE WASTEWATER PUMP

SL Submersible Wastewater Pumps from Grundfos Pumps are designed to handle raw, unscreened sewage; effluent; large volumes of surface water; and process water in municipal, utility and industrial applications. The solids-handling pump series, in motor ranges from 1.5 to 15 hp, is available in two types of impellers — the SLV/SuperVortex impeller provides the free passage of solids up to 4 inches in diameter, making it ideal for liquids with a content of solids, fibers or gassy sludge; the SL1/S Tube impeller accommodates solids up to 4 inches, but is designed particularly for large flows of



SL Submersible Wastewater Pumps from Grundfos Pumps

raw sewage. They are designed for permanent submerged installation in demanding applications, such as municipal wastewater, network pumping stations, wastewater treatment plants, public buildings, housing projects and other commercial applications. The series is designed with IE3 premium-efficiency motor components, quick-removable pump housing clamps, cartridge seals, quick-removable plug-in cord, and smooth exterior components for high-efficiency performance. **800/921-7867; us.grundfos.com.**



827 DVJ Whispair dry vacuum exhausters from Howden Roots

HOWDEN ROOTS 827 DVJ WHISPAIR

The Roots 827 DVJ Whispair dry vacuum exhausters from Howden Roots eliminate problems associated with high temperatures at vacuum levels beyond 16 inches Hg. They can be arranged to operate in two- and three-stage systems. Their heavy-duty design is suited for V-belt or direct-drive applications with integral-shaft ductile iron impellers. The casing, headplates, gear cover and drive-end cover are gray iron. Carburized and ground alloy steel spur timing gears are taper-mounted on the shafts and secured with a locknut. Cylindrical roller bearings are splash-lubricated at both the gear and opposite gear ends of the unit. Piston rings reduce air leakage through the headplate bores and lip-type oil seals prevent lubricants from entering the air chamber. Steel mounting feet permit field adaptability to either vertical or horizontal installation requirements. **800/557-6687; www.howdenroots.com.**

PULSAFEEDER PULSATRON

PULSAtron pumps from Pulsafeeder have a guided check valve system with a seat-and-ball design that ensures reliable and accurate metering year after year. Their fin-cooled solenoid enclosure dissipates heat, ensuring that the pressure-handling capability of the pump can be maintained. The thermally protected solenoid protects the pump from seizing up in extreme heat conditions with an automatic reset feature, allowing the pump to resume operation upon cooldown. Units are tested and rated under hot conditions so flow and pressure ratings meet specifications. They offer flows up to 600 gph and pressures up to 300 psi, with a wide range of flows and pressures. **800/333-6677; www.pulsatron.com.**



PULSAtron pumps from Pulsafeeder

SCREENCO SYSTEMS PATZ SYDEX



Patz Sydex pumps, distributed by ScreenCo Systems

Patz Sydex progressive cavity pumps, distributed by ScreenCo Systems, are multiple-application, high-performance industrial pumps available in block or long-coupled configurations. They are designed to ensure trouble-free long service life. By using this system, the pumps supply the coupling rod as a complete preassembled kit, making assembly and maintenance easy. The pin joint is securely sealed with an elastomer cover and protected by a metallic sleeve.

The joint is oil-lubricated to ensure heat dissipation. **208/790-8770; www.screencosystems.com.**

SMITH & LOVELESS STAR ONE

The STAR ONE non-clog pump from Smith & Loveless raises the bar on pump efficiency anywhere from 3 to 5 percent higher than pre-

vious pump models. It has an oversized, stainless steel shaft that minimizes overhang, reducing shaft deflection and improving pump efficiencies. This is achieved through minimal pump heights and rigid construction. Shaft end play is limited to bearing shake. Shaft runout is limited to 0.003 inch. Close tolerances are tighter than even NEMA specifications. The impeller is designed for maximum efficiency, as by trimming the impellers inside the shrouds, it leaves the back shroud full diameter to prevent stringy material from winding around the shaft and reducing efficiencies. **913/888-5201; www.smithandloveless.com.**



STAR ONE pump from Smith & Loveless

STENNER PUMP COMPANY SVP SERIES



SVP Series pump from Stenner Pump Company

The SVP Series from Stenner Pump Company is an adjustable, variable-speed peristaltic metering pump that can accept a 4-20mA signal to pace the pump, making it suitable for industrial applications and municipal water and wastewater treatment plants.

It has a DC motor and an LED keypad to adjust the output by increasing or decreasing the motor speed. The turndown ratio is 20-to-1 with 1 percent increments. They offer a maximum of 40 gpd with pressures to 100 psi. The SVP1 is manually adjusted using the keypad. The SVP4 is designed to respond directly to a 4-20mA input signal from water treatment controls, including pH and ORP monitors to maintain proper water chemistry and treatment of effluent discharge water. The SVP4 includes an external port to accept the signal, or it can override the 4-20 mode and be adjusted manually with the arrows on the keypad. **800/683-2378; www.stenner.com.**

VERTIFLO PUMP COMPANY SERIES 900

The Series 900 industrial vertical immersion vortex sump pump from Vertiflo Pump Company provides an unrestricted flow since the impeller is not normally in contact with the solids being pumped. Applications include chemical slurries, fragile food-processing solids, paper and pulpy solids, petroleum and oils, sewage, wastewater treatment, and textiles. It handles solids up to 4 inches in diameter. It is designed for long life in severe services with heads to 170 feet, temperatures to 350 degrees F, pit depths up to 26 feet with flows to 1,600 gpm. Construction options include cast iron, 316 stainless steel fitted, all 316 stainless steel, Alloy 20 and CD4MC. **513/530-0888; www.vertiflopump.com.**



Series 900 sump pump from Vertiflo Pump Company

WASTEWATER DEPOT PACKAGED BLOWER MOTOR UNITS

Packaged Blower Motor Units from Wastewater Depot are pre-assembled units, housed in a fiberglass sound-reduction enclosure with optional electrical controls. Packaged air systems are available as a standard factory package or are engineered to meet specialized requirements. The units are built using a choice of Roots, Sutorbilt or Tuthill positive displacement blowers and use a standard ODP motor or an optional TEFC motor (explosion-proof motors are also

available). The discharge piping includes a pressure relief valve, pressure gauge and check valve to prevent pressure backflow from entering the blower. The vented fiberglass housing includes vibration isolation mounts to reduce both vibration and noise emitted from the system. A rubber hose connection is provided with the package for ease of installation at the project site. All packages enable simple on-site installation, whether going into a service building or outdoors. **513/732-0129; www.wastewaterdepot.com.**



Packaged Blower Motor Units from Wastewater Depot

Turbines

CAPSTONE TURBINE C1000S SIGNATURE SERIES

The C1000S Signature Series microturbine from Capstone Turbine produces 1 MW of clean and reliable power. With just one moving part, and utilizing air-bearing technology, it can operate in a wide range of applications and environments, generating low-cost, continuous power with minimal maintenance requirements. The ultralow emission microturbine has remote monitoring and diagnostic capabilities, multi-fuel capabilities, integrated utility synchronization, and an optional heat recovery module for CHP and CCHP applications. Multiple microturbines can be combined to serve larger electrical needs. **818/734-5300; www.capstoneturbine.com. tpo**



C1000S Signature Series microturbine from Capstone Turbine

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- ACOS Advanced Chemical Oxidation Systems
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Biogas

- Aerzen Biogas Blowers
- Boerger Biogas Rotary Lobe Pump
- FCI - Fluid Components International ST75 Series flowmeter
- JDV Equipment Corporation Double Membrane Biogas Holder
- Unison Solutions BioCNG

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- Parker Boiler TC Series boiler
- U.S. Boiler Company - Burnham Brand Boilers X-C boiler

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- Eurus Blower ZG blowers
- Flygt – a Xylem Brand Concertor pumping system
- FPZ SCL K10-MS blower
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- Howden Roots 827 DVJ Whispair dry vacuum exhausters
- Pulsafeeder PULSAtron pumps

- ScreenCo Systems Patz Sydex pumps
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By Craig Mandli

Submersible pump a fit for petroleum coke sump service

Problem

PABTEX, an affiliate of Kansas City Southern Industries in Port Arthur, Texas, is a major bulk commodity handling facility specializing in exporting petroleum coke. When the raw petcoke is transported to PABTEX's terminal in bottom-dump railcars, the coke goes to a system of shakers, which breaks it into smaller chunks that are easier to transport on a conveyer system. However, below the shakers is the open conveyer shaft that goes down 70 to 80 feet below the ground. Due to the risk of rain-water filling up the conveyer shaft, a large sump was sunk into the bottom of the shaft to make sure that water could be pumped out to an existing retention pond. With the shakers directly above the bottom of the conveyer shaft, pieces of petroleum coke fall into the shaft and eventually washed into the sump.

Solution

Todd Wilkes, maintenance supervisor of Savage Gulf Services, had tried several submersible pumps. However, the petcoke was too abrasive and, without an integral agitator, solids settled out and clogged the pumps. Tim Weber, sales manager of Saladin Pump, suggested a **KZN110H**: a 15 hp high-head, hard-metal-agitator **slurry pump** from **BJM Pumps**. All wetted parts are constructed of abrasive-resistant 28 percent chrome iron. A replaceable hardened wear plate is located on the suction side, where erosion harms pump performance. An integral agitator fluidizes settled solids into a slurry, making them easier to pump with less chance of clogging. The semi-open impeller handles abrasive solid concentrations as high as 70 percent by weight.



RESULT

Saladin Pump installed a KZN110H in the sump for a 60-day trial. The trial was so successful, with no clogs or wearing issues, that Savage Gulf bought the pump, and 60 days later bought a backup unit. **877/256-7867; www.bjmpumps.com.**

Cleaning system eliminates biomass, increases productivity

Problem

Shane Donoghue, a wastewater facilities manager in a large Australian city, saw accumulation of FOG and biomass up to 4 feet deep in a month in a lift station. This required tens of thousands of dollars in maintenance, including weekly to biweekly vacuum truck services and confined-space entry to clean the well by hand. "Sometimes the FOG would build so thick, it was too great of a load for a single truck, and they would have to come back again," says Donoghue.

Solution

Donoghue purchased the **EP-1300 conditioning and cleaning**

system from **Anue Water Technologies** to relieve the department's operations budget. The unit operates by recycling a small amount of discharged flow to create ongoing surface agitation that prevents FOG buildup and promotes aerobic activity.



RESULT

The installation immediately reduced maintenance checkups from weekly to monthly, and the lift station no longer required continuous vacuuming. "Our need for confined-space entry was just about eliminated," says Donoghue. When considering the reduction in labor costs, vacuum truck cleaning and tipping fees, a single unit saved \$15,000 in the first year and nearly \$22,000 in the second year. The change in cleaning routines reduced maintenance costs by nearly 50 percent. **760/727-2683; www.anuewater.com.**

City chooses electromagnetic variable-speed drive for pump application

Problem

A city waterworks in southern Indiana had operated vertical turbine pumps for high and low service using eddy current drives from Dynamatic and another manufacturer. Motors were nominally rated at 200 and 500 hp, operating at 4,160 volts. The pumps, motors and drive units had operated successfully since 1980. After 33 years of service, the city engaged a consulting engineer to evaluate and specify rebuilding the pumps and replacing the motors, drives and motor control equipment.

Solution

The engineer evaluated replacing the eddy current drives with new 480-volt variable-frequency drives (with transformers to reduce the 4,160-volt supply) and low-voltage motors, versus direct replacement of the eddy current drives with new units and 4,160-volt motors. After considering costs, energy consumption and equipment longevity, it was a split decision: The 200 hp applications were redesigned for low-voltage VFDs, while the 500 hp high-service pump unit received a new **DSI Dynamatic SPMV-8180**, equipped with a high-efficiency 500 hp 4,160-volt motor and EC-2000 controller. To facilitate integration of the eddy current drive with the plant's PLC-based SCADA system, the controller was equipped with an internet IP interface to enable the unit to exchange data and command signals digitally.



RESULT

The project was successfully started up in early 2016, and has operated as designed. **800/548-2169; www.dynamatic.com.**

Highly loaded waste ponds become biogas banks

Problem

Uncovered anaerobic systems can generate significant odors in addition to methane. A Missouri project, believed to be the largest and most comprehensive livestock manure-to-energy system of its type in the world, is underway. The existing facultative basins collect waste from some 3 million hogs. The challenge was to convert more than 40 basins to covered anaerobic systems that would capture the biogas.

Solution

The earthen basins were covered with 80-mil linear, low-density polyethylene membrane covers from **Industrial and Environmental Concepts (IEC)**. The air-tight covers are sealed around the basin perimeters in an earthen anchor trench. A pipeline encircles the water's edge to collect and channel the biogas to equipment on the berm that scrubbed and compressed the gas for use on site or to sell.



RESULT

The basins were upgraded with minimal disruption to the operation. The cover captured the biogas and contained the sulfides, significantly reducing hauling and pumping costs, as rainwater was excluded from the wastewater treatment facility. 952/829-0731; www.ieccovers.com.

Delay coupling saves wear on gearbox bearings

Problem

The Eugene (Oregon) Wastewater Treatment Facility saw premature wear in the bearings of the gearbox connecting the motor to a double-flight Archimedean screw pump. Because a belt drive was used to transfer torque between a 200 hp motor and the gearbox turning a 90-inch-diameter, 63-inch-long screw, there was premature wear in the bearings. The lateral forces of the belt drive on the gearbox shaft created an unbalanced load.

Solution

Gregory Watkins, project manager for the city Wastewater Division, replaced the belt-driven system with **Model MGD-18/250 delay couplings** from **MagnaDrive** for four pumps.



RESULT

The city saw a 35 percent reduction in energy required to operate the pump, saving \$34,831 per year. There was no wear on the bearings resulting from the lateral tension of the belts and virtually no maintenance after installation. The city also saw longer bearing life, as no vibration was transmitted between system components. "The initial price of the MGD was a little higher than other coupling technologies, but when we looked at the total cost of ownership over the life of our system, it was definitely the right decision," says Watkins. 425/463-4700; www.magnadrive.com. tpo

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2. BLUE-WHITE PERISTALTIC METERING PUMP

Proseries-M M-3 and M-4 NSF 61-listed peristaltic metering pumps from Blue-White Industries are designed for use in mid- to high-volume municipal water and wastewater treatment applications, including sodium hypochlorite and hydrogen peroxide. The no-maintenance pumps feature a brushless variable-speed motor, 10,000-1 turndown ratio and high-resolution motor speed adjustment. Additional features include digital touch pad, backlit LCD, NEMA 4X/IP 66-rated for washdown, tube failure detection system and single-piece rotor for increased accuracy. Feed rates range from 0.0002 to 158.5 gph (depending on model) and pressures to 125 psi. **714/893-8529; www.blue-white.com.**

3. FCI THERMAL FLOWMETERS

Model ST51A, ST75A and ST75AV thermal mass flowmeters from Fluid Components International feature a new surface mount, lead-free RoHS compliant electronics and repeatable all-welded, equal-mass flow sensors. The HART digital bus communication and its associated device driver have been tested and certified by the Fieldcomm (HART) Group to meet the latest Version 7 standards. They have also been independently verified to meet International Electrotechnical Commission's standard IEC 61508 for safety integrity level (SIL-1) rating. The ST51A is an inser-

tion-style flowmeter for use in pipe diameters from 2.5 to 24 inches. ST75A and ST75AV flowmeters are inline (spool-piece) style for pipe diameters from 0.25 to 2 inches. **800/854-1993; www.fluidcomponents.com.**

4. MAGNATROL SOLENOID VALVES

Type A, L and Type K solenoid valves from Magnatrol Valve Corp. are available for pipe sizes from 1/2 to 3 inches (Type A and L bronze and Type K stainless steel). Features include globe pattern bodies with threaded or flanged ends and packless construction with continuous-duty coils for all voltages. The valves do not require differential pressure to open and are easily inspected, cleaned or replaced while the valve body remains in the pipeline. All valves are normally closed (energize to open) and available with Buna N, Viton or glass-filled PTFE orifice seal materials, depending on application. **973/427-4341; www.magnatrol.com.**

5. SINGER SURGE-ANTICIPATING VALVES

RPS-L&H and RPS-R&R surge-anticipating valves from Singer Valve are installed downstream of the pump check valve(s) and feature two pilots. The 106 RPS-L&H valve, mounted in a tee, is designed to anticipate surges to avoid severe water hammer. The valve may require a flow limiter set during commissioning to ensure the valve will reclose. The 106 RPS-R&R valve is designed for applications where static pressure is less than 100 feet and where the existing valve size may be too large. Unlike the RPS-L&H, the RPS-R&R is guaranteed to close, even if the valve is oversized. **888/764-7858; www.singervalve.com.**

6. SCHNEIDER ELECTRIC MEDIUM-VOLTAGE SWITCHGEAR

The Premset medium-voltage switchgear from Schneider Electric is designed for power distribution management in industrial applications. Main circuit components are insulated by a layer of solid material covered by an external conductive coating with ground potential. Features

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water: product spotlight

Integrity Municipal Systems liquid ammonium sulfate system produces solution on location

By Ed Wodalski

The **liquid ammonium sulfate feed system** from **Integrity Municipal Systems** is designed to be a safe, economic alternative to aqueous ammonia in municipal water and wastewater applications. The standard LAS saturator and feed system is 5 feet 6 inches long, 3 feet 8 inches wide and 5 feet 8 inches high.

“The difference between our system and other LAS feed systems for chloramination is the capacity to produce the chemical on site,” says Kingston Leung, IMS product manager. “Our system allows you to purchase the salt, store it and produce the solution. In some places LAS is widely used and you can get it quite cheaply, but there are other locations where it’s difficult and expensive to purchase LAS solution.”

The IMS system can produce 75 gallons of liquid ammonium sulfate per salt fill. LAS has an indefinite storage life, is odorless and nontoxic.

“The purpose of this system is to provide ammonia downstream of chlorine, and by doing that you produce chloramines for disinfection,” Leung says. “This is a system that you would use as part of a chloramination disinfection system. Any plants of adequate size that already use chloramination or are planning to use chloramination could use this system.”

Unlike conventional one-tank saturator systems, the two-tank system design consists of separate saturator and solution tanks, reducing suspended solids in the solution tank and minimizing the chance of the metering pump plugging. The upflow saturator design including automatic, preset saturator operation ensures complete saturation, high degree of reliability and low maintenance.

“The system is completely automatic,” Leung says. “The saturator tank is where the salt goes in. As water flows through the saturator tank and up through the bed of salt, the salt dissolves, producing a near-saturated solution. As the water flows through, solution overflows from the

include a shielded solid insulation system and screening of all live parts. The modular design simplifies installation and upgrades. Advanced protection, control and monitoring technology is fully integrated for greater reliability and energy efficiency. Other features include automated redundancy (auto source transfer), load management with integrated smart metering, asset management with advanced switchgear and transformer monitoring, and VIP self-powered protection and communication relay for higher MV network availability. **888/778-2733; www.schneider-electric.us.**

7. ENDRESS+HAUSER ANALYTICAL TRANSMITTER

The Liquiline CM44P multichannel analyzer transmitter from Endress+Hauser can simultaneously measure 16 different parameters and transmit them via 4-20mA, HART, Profibus, Modbus or EtherNet/IP. The transmitter accepts inputs from up to two process photometers and four analytical sensors simultaneously. Sensor types include pH, ORP, conductivity, dissolved oxygen, nitrate, turbidity, free chlorine and ion selective. Diagnostic functions include monitoring of imped-



Liquid ammonium sulfate feed system from Integrity Municipal Systems

saturator tank into the solution tank, providing a solution that can be dosed into the waterline.”

The fully contained system eliminates the risk of liquid ammonium sulfate solution from entering floor drains. In the event of a leak in the secondary containment, a switch activates, notifying personnel.

A skid-mounted FRP enclosure including lighting, ventilation fan and breaker panel is available for protection from the environment in outdoor and remote locations. **858/486-1620; www.integrityms.net.**

ance of pH glass, measuring signals for stagnation, monitoring the condition of electrodes and the degree of electrode aging, checking for overcurrent conditions, and comparing measured values of conductivity and temperature against tables defined in USP and EP specifications for pharmaceutical water. **888/363-7377; www.us.endress.com.**

8. AQUA-AEROBIC OZONE GENERATION SYSTEM

The Aqua ElectrOzone ozone generation system from Aqua-Aerobic Systems, in partnership with Metawater, is designed for potable water treatment, wastewater/water reuse and industrial applications that require ozone treatment for taste and odor control, bleaching/color removal, oxidation and disinfection. **815/654-2501; www.aqua-aerobic.com.**

(continued)

wastewater: product spotlight

Nidec variable-frequency drives reduce energy use, pump wear

By Ed Wodalski

The **AD1000 high-performance variable-frequency drive** and the **AD700E general purpose drive** from **Nidec Motor Corporation** can reduce energy consumption in a range of water, wastewater and other pump applications.

“They could go on any type of pump — from a vertical turbine type to horizontal split-case,” says Patrick Hogg, Nidec vertical motor product manager. “It’s going to allow that pump to operate at the highest efficiency possible by realizing when the pump is wasting energy and adjusting to run the pump at its most efficient point.”

The AD1000 automatically adjusts to changing operating conditions in applications from 30 to 600 hp. While plug-and-play for most standard applications, its modular design can be easily configured to meet the most challenging applications and can be configured to run multiple pumps.

Features include quick start for reduced pump stress, auto-tuning menu, shortcut options, advanced control option and safe data storage and transfer, enabling information to be saved and transferred to other devices. A password security option prevents tampering.

Process PID controller functions include dead band delay; feed-forward; feedback supervision and input pressure supervision; pressure, flow and level view; and analog feedback loss.



AD1000 high-performance variable-frequency drive

AD700E general purpose drive



“Key benefits include the preloaded pump software, which includes programming that allows you to detect if there’s a blocked or a burst pipe, along with other pump-specific programming,” Hogg says. “The drives can ramp up and ramp down, which helps you prime pumps and detect loss of suction and other issues that may pop up.”

The AD700E general purpose drive provides precise motor control and energy savings for variable-speed applications up to 30 hp and all types of motors, including induction, permanent magnet, brushless DC and synchronous reluctance. Features include 14 basic parameters and 50 total parameters. The integrated I/O, Ethernet and Fieldbus communication options easily connect with control and monitoring systems.

The optional AD700-Optistick provides fast and accurate multiple-drive setup by copying parameters from one drive to another at the touch of a button. **888/637-7333; www.usmotors.com.**

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people/awards

Fulton County (Georgia) renamed its treatment plant in Johns Creek the **Tom Lowe Atlanta-Fulton County Treatment Plant**. The late Tom Lowe served on the county commission for 40 years and was the longest-serving commissioner in county history.

Thomas R. Holliman was appointed to serve the Ductile Iron Pipe Research Association as regional engineer in the western continental states as well as Hawaii and Alaska. Holliman brings more than 35 years of experience in planning, management, operations and consulting in water and wastewater engineering services.

The **Greer (South Carolina) Commission of Public Works' Maple Creek Wastewater Treatment Plant** received a Gold Peak Performance Award from the National Association of Clean Water Agencies.

The city of **Lumberton**, North Carolina, was awarded \$50,000 by the State Water Infrastructure Authority for a regional wastewater study. The grant will be used to study consolidation of multiple utilities into a single utility or provision of regional treatment. The city also received \$150,000 to continue mapping its sewer system and create an asset management plan.

The city of **Pembroke**, North Carolina, was awarded \$150,000 by the State Water Infrastructure Authority to evaluate the condition of the wastewater system and determine what repairs are needed.

Donna Davis, utilities director for Stanly County, earned the Utility Management Certification credential as announced by the Water University and North Carolina Rural Water Association. Davis has served as the utilities director for 14 years and is a 27-year veteran of the water and wastewater utility industry.

Patrick Terrell, operator III at the city of Tyler Westside Wastewater Treatment Plant, received the 2016 Operator of the Year award for the East Texas Region for cities with a population of more than 10,000 from the Texas Water Utilities Association.

The town of **Winkelman** received the Wastewater Treatment Center of the Year award from the Rural Water Association of Arizona after making facility upgrades.

John Miller was recognized for 40 years of service to the Clear Lake (Iowa) Sanitary District Board of Trustees. He has seen the district improve lift stations, complete more than \$20 million in upgrades and grow its annual budget from \$130,000 to \$2.6 million.

High scores in safety, preventive maintenance and operation procedures earned honors for the **Athens Utilities Wastewater Treatment Plant**. Roger Miller, relief operator, accepted the community's third-straight Best Operated Plant award from the Alabama Water and Pollution Control Association (5 to 10 mgd category).

The **Greer (South Carolina) Commission of Public Works** received the Gold Peak Performance Award from the National Association of Clean Water Agencies for its Maple Creek Wastewater Plant.

The city of **Cromwell**, Minnesota, was recognized for its commitment to protecting the community's drinking water source. Tom Johnson, water/

wastewater and maintenance supervisor, and LuAnn Freiermuth, clerk/treasurer, received a certificate signed by Gov. Mark Dayton at City Hall.

The **El Dorado Wetlands and Water Reclamation Facility** in Kansas received a Platinum Peak Performance Award from the National Association of Clean Water Agencies.

Mount Pleasant Waterworks was named one of the Best Places to Work in South Carolina in a program created by SC Biz News and the South Carolina Chamber of Commerce and Best Companies Group.

The Orange Water and Sewer Authority's **Jones Ferry Water Treatment Plant** in North Carolina received the Phase IV 5-Year Excellence in Water Treatment Award from the Partnership for Safe Water.

Macon Water Authority received two awards for outstanding performance from the Georgia Association of Water Professionals. **Ronnie Evans**, operator at the Frank C. Amerson Jr. Water Treatment Plant, received the Operators Meritorious Service Award. The authority received the 2016 President's Volunteer Service Silver Award for Environmental Stewardship.

TPO welcomes your contributions to this listing. To recognize members of your team, please send notices of new hires, promotions, service milestones, certifications or achievements to editor@tpomag.com. tpo

events

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Florida Section AWWA Annual Conference, Orlando. Visit www.fsawwa.org.

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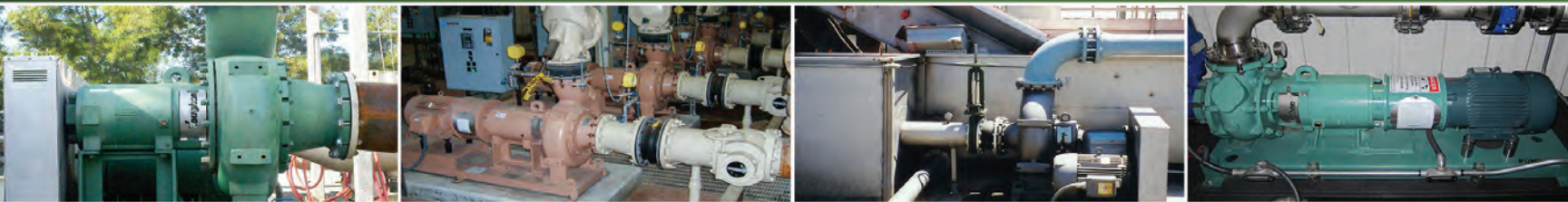
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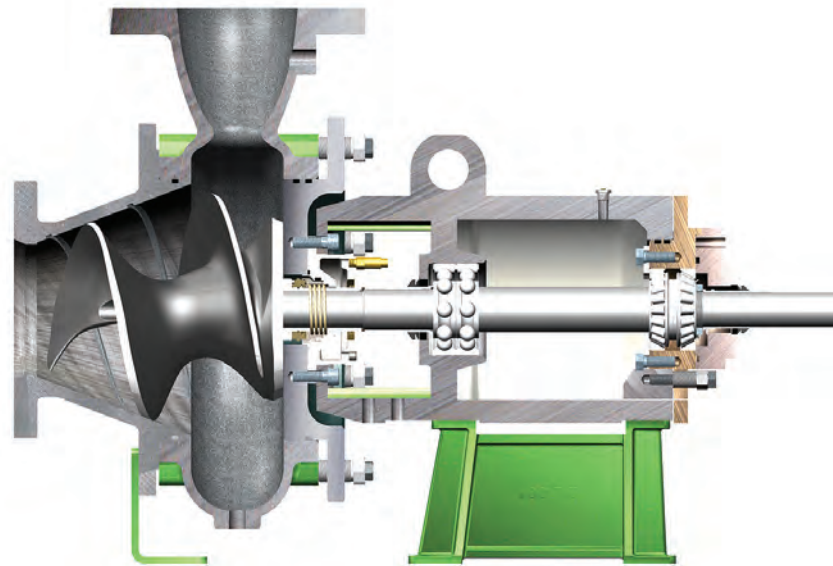
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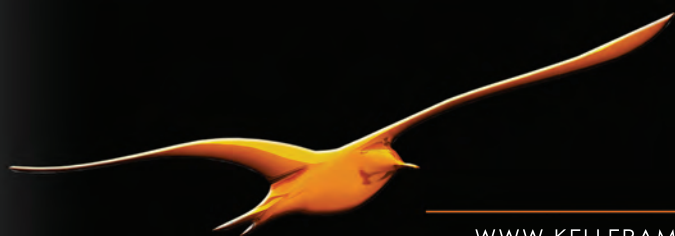
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By KELLER

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