Rian Savage, superintendent and chief operator, University of Connecticut Water Resource Recovery Facility

Part Plant. Part Lab.

UCONN'S CLEAN-WATER PLANT DELIVERS HIGH-QUALITY EFFLUENT WHILE SERVING AS A PLACE FOR PROCESS INNOVATION AND INDUSTRY RESEARCH

STORY: **Ted J. Rulseh** | PHOTOGRAPHY: **John Marinelli**

Rian Savage will tell you there are definite advantages to operating a major university's clean-water plant.

For one, as within the university itself, research and innovation are actively encouraged. At the University of Connecticut Water Resource Recovery Facility, Savage and his team take that to heart.

"The crew and I have adopted an unconventional way of thinking about the plant and the process," says Savage, plant superintendent and chief operator. "We've been willing to try different things and see if we can get a better result.

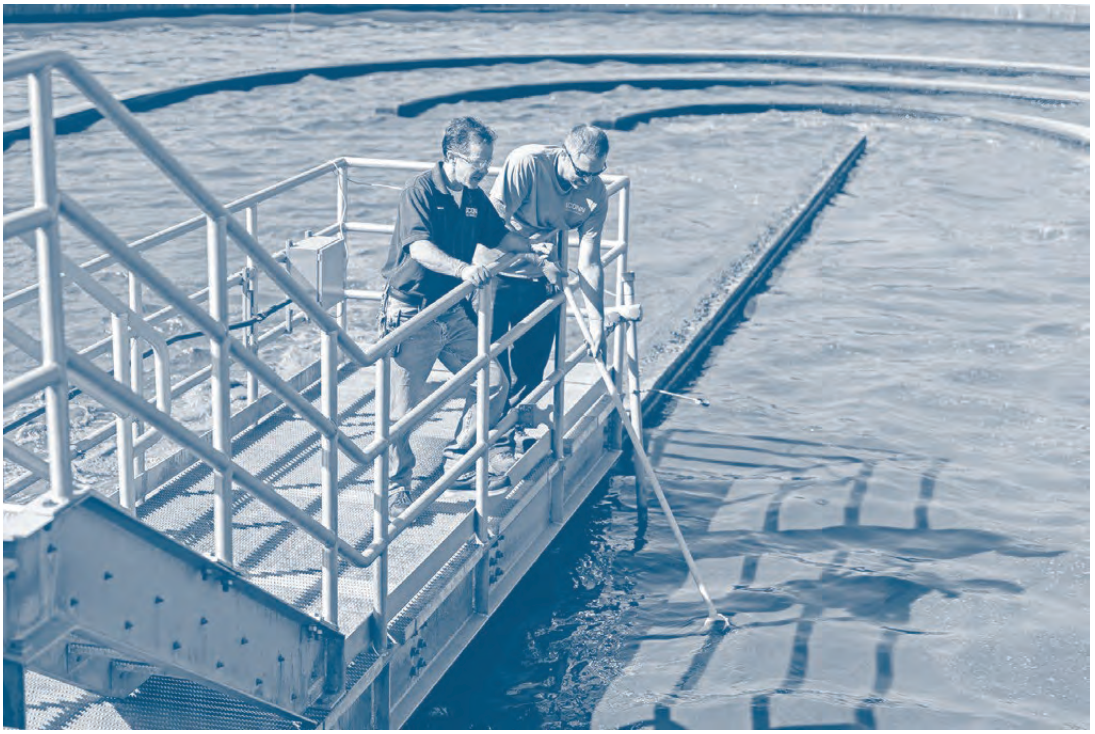
"We've been nearly 100% successful on the innovations we've tried. And for those that haven't worked out, we've noticed well in advance, so that we never came anywhere near a permit violation."

The work hasn't gone unnoticed. Savage received a 2024 Wastewater Treatment Plant Operator of the Year award from the U.S. EPA Region 1. In 2016 he was named the New England Water Environment Association Operator of the Year for Connecticut.

The secondary treatment plant, built in 1996, also serves the surrounding town of Mansfield. It uses an Eimco oxidation ditch process (Ovivo) and has a design flow of 3 mgd with 7.2 mgd peak capacity. Average flow is 1.3 mgd during the school year and 0.75 mgd during summer when the campus population drops sharply.

"This is a really nice facility," Savage says. "We've had people on tours say, 'This doesn't seem like a wastewater treatment plant; it looks more like an administrative

> "I like to fish, and I like the idea of putting clean water back into the environment. That's really what drives me."
>
> **RIAN SAVAGE**



Savage, shown with technician Scott Bender taking process control samples, received a 2024 Wastewater Treatment Plant Operator of the Year award from the U.S. EPA Region 1. (Aeration tank by WesTech Engineering.)

building.' That's a huge compliment and a tribute to our team. We have very little odor. That's because of process control and keeping the place clean, keeping things hosed down."

CHANGING DIRECTION

Savage, a native of Chaplin, Connecticut, started work life as a plumber and eventually was employed by the state in 2005. In 2008 he was transferred to the university' water resource recovery facility where, he says, "My career blossomed."

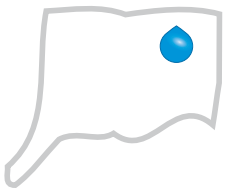
He was able to transfer a share of course credits he earned as a plumber's apprentice toward his wastewater operator licensing. He advanced quickly to Class IV (highest) through hands-on experience, Sacramento courses and community college studies as needed. He became assistant plant superintendent in 2012 and superintendent in 2019. Today the plant team includes:

- Megan Ambrose, assistant superintendent; Paxton Mallard, operator; and Scott Bender, technician; all with Class III licenses.
- Brian Delventhal and Spencer Mason, operators; and Dan Smith, mechanic; all with Class I licenses, and John Henderson, mechanic trainee.

The wastewater collection system includes 28 lift stations. Influent first passes through a pair of 3 mm STEP SCREEN units (HUBER Technology) and a grit chamber, from which Gorman-Rupp pumps feed a grit classifier (also HUBER).

The wastewater then enters an anoxic zone with a 25 hp mixer (Philadelphia, an SPX Brand), followed by two aeration tanks, each with two 75 hp surface aerators (WesTech Engineering). The treated water proceeds to two secondary clarifiers and then disinfection with sodium hypochlorite, dechlorination with sodium bisulfite and discharge to the Willimantic River.

Rian Savage, University of Connecticut Water Resource Recovery Facility



POSITION:
Superintendent and Chief Operator

EXPERIENCE:
17 years in the clean-water industry

CERTIFICATIONS:
Class IV Wastewater Operator, P2 plumbing license

AFFILIATIONS:
Plant memberships in NEWEA, WEF

AWARDS:
2024 Wastewater Treatment Plant Operator of the Year, U.S. EPA Region 1; 2016 Connecticut Operator of the Year, NEWEA

GOAL:
Meet nitrogen permit limits, produce the cleanest effluent possible

Solids are delivered from the secondary clarifiers at 1.1-1.8% solids to two Q-PRESS screw presses (HUBER), which yield cake at 17-19% solids. That material is hauled to the South Meadows Incinerator at Hartford.

STEPPING UP

Savage took on the superintendent role with limited process control experience. "I found out on a Thursday that my predecessor was moving on, and on Friday I was in charge with an assistant," he recalls. "I had book knowledge, but hands-on process control wasn't something that I knew.

"The numbers coming from the lab are a language that tells you whether you're going in the right or wrong direction based on your permit. After

The team at the UCONN Water Resource Recovery Facility includes, from left, Rian Savage, superintendent and chief operator; Scott Bender, technician; John Henderson, mechanic; Brian Delventhal and Paxton Mallard, operators; and Megan Ambrose, assistant superintendent. Not pictured are operators Dan Smith and Spencer Mason.

The UCONN Water Resource Recovery Facility has a design dry-weather capacity of 3 mgd, and average flows of 1.3 mgd during the school year and 0.75 mgd during summer.

looking at those numbers for a while, I was able to understand what they were saying."

To help him along, the university enabled him to work for six weeks with two engineers from the Woodard & Curran consulting firm, Paul Dombrowski, chief technologist and senior principal, and Amine Hanafi, technical manager.

"It was a back and forth collaboration," says Savage. "They helped me understand what I was looking at and whether I was looking at it in the right frame of reference. They would say, 'We understand you're going to do X; watch for this and this.'

"Those six weeks gave me the base knowledge of what I was doing, what I was looking at. Then I just had to learn where the plant liked to be in terms of solids retention time and other parameters, and how it fluctuated when the students were here and when they were not. That was a really great gift the university gave to me."

OPTIMIZING PERFORMANCE

Since then, Savage and his team have used innovative approaches to improve solids handling, nitrogen removal efficiency and more.

On the solids side, the facility has no digesters, and for a time it was a struggle to send waste activated sludge from the clarifiers to the screw presses with the required minimum of 1% solids. The team accomplished that by changing clarifier operation.

"We usually run two clarifiers," says Savage. "When we come in the morning, we take our solids sample, and then we shut off the return activated sludge pump in one clarifier, and leave it off for about an hour. By turning off the RAS pump, we thicken the WAS mass in the bottom of the clarifier, so our WAS solids concentration increases."

After an hour, they put the RAS pump into the manual mode, and the RAS and WAS pumps pull from the same clarifier sump. The RAS pump then operates at 25 gpm for the duration of wasting. Once wasting is complete the WAS pump shuts off and the RAS pump is restored to the automatic mode.

"That's the process we've come up with to get the needed solids concentration to our screw presses," Savage says. "Our average solids content to the presses is 1.3%."

ADJUSTING AERATION

The team also fine-tuned aeration to improve nitrification-denitrification, enabling the plant to earn credits for the past five years from the state Department of Energy and Environmental Protection's Nitrogen Credit Exchange Program.

The inside loop of the racetrack-style oxidation ditch is fully aerated with setpoints maintained by two Hach SCH 200 controllers, while dissolved oxygen in the outside loop is restricted to 0.25 to 0.30 mg/L. Besides optimizing nitrogen removal, the process cuts operating costs during summer, when the 75 hp aerator in the outside loop is shut down and a 4 hp sludge mixer (Flygt, a Xylem Brand) keeps the mixed liquor solids suspended.

Aeration adjustments also come into play as the students return to the campus in fall. A fact of life for a university treatment plants is seasonal "feast or famine" in influent loading, Savage observes.

Savage, student intern Valerie Berrios Torres and operator Brian Delventhal perform motor maintenance on return activated sludge pumps (Vaughan).

The plant's two Q-PRESS screw presses (HUBER Technology) yield cake at 17-19% solids.

featured products from:

Environmental Operating Solutions, Inc. (EOSi)
866-642-7621
www.microc.com

Flygt, a Xylem Brand
855-995-4261
www.xylem.com/en-us/brands/flygt/

Gorman-Rupp Pumps
419-755-1011
www.grpumps.com
(See ad on page 29)

Hach
800-227-4224
www.hach.com

HUBER Technology, Inc.
704-949-1010
www.huber-technology.com

Ovivo USA, LLC
855-466-8486
www.ovivowater.com

Philadelphia, an SPX Brand
800-956-4937
www.spxflow.com/philadelphia/

Vaughan Company, Inc.
888-249-2467
www.chopperpumps.com
(See ad on back cover)

WesTech Engineering, LLC
801-265-1000
www.westech-inc.com

"The students come and go in a matter of a couple of days," he says. "Before they come in for the fall semester, we may be running influent ammonia at 7-11 mg/L, BOD at 67-88, TSS at 100-110. They start arriving on a Friday, and by Monday the influent ammonia goes up to 38 mg/L, TSS averages 179, BOD around 150-160. The process isn't ready for that, and we have to prep the plant."

In the past the team added MicroC (EOSi) for BOD augmentation, plus urea to enhance nitrifying bacteria and magnesium hydroxide for alkalinity. After three years of experimenting, they arrived at a method to prepare the plant with only minimal chemical addition.

"Instead of having higher aeration on the inside loop and lower aeration on the outside, we aerate the whole tank," says Savage. "We sacrifice our denitrification for about seven days. Then we cut the air back slowly and bring the plant back to where the inside aeration is higher and outside aeration is lower, and our ammonia stays under permit levels.

"We've been able to do that for two years, saving $90,000 to $92,000 per year on chemicals. The only chemical we need to add is magnesium hydroxide, and that is less than 100 gallons for the whole week."

GOING SLOW AND STEADY

In these and other process adjustments, Savage takes a methodical approach: "I go at things practically, and I go very slowly. I set up a certain plan and its execution and see whether it works, moving things slowly with not a lot of variables.

"Our crew does really well with that. A lot of good ideas came from them when I was put in the superintendent's seat. I like to hear people's ideas. We cross-train our team, so that even our Class I operators have lab experience. We train our people up so they have the opportunity to attain higher-level licenses."

Savage enjoys working in the university environment: "We do a lot of tours here because we're an educational facility. I like the fact that working for a college, we're allowed to make the cleanest water possible, instead of just running at our permit level.

"I like to fish, and I like the idea of putting clean water back into the environment. That's really what drives me." tpo

Savage checks the controls logic on the Department of Energy grant project for greenhouse gas reduction.

CLIMATE RESEARCH

Research projects are part of the program at the University of Connecticut Water Resource Recovery Facility.

At present Rian Savage, superintendent and chief operator, is co-principal investigator for UCONN's Department of Civil and Environmental Engineering Department, under professor Baikun Li, Ph.D., P.E., on a project with the U.S. Department of Energy.

The university received a $2 million grant to design a target-orientated solution to capture and measure nitrous oxide through a process called high spatiotemporal resolution monitoring with multizone automated controls.

N_2O is a greenhouse gas produced in the aeration basins of activated sludge treatment plants. Formed during the biological reactions that remove nitrogen from the wastewater, it is coming under scrutiny because it is 310 times more potent as a greenhouse gas than carbon dioxide.

The researchers are building a pilot treatment plant that will operate on a stream of the UCONN plant's influent. "Nitrous oxide is one of the easiest off-gases to remove with the most benefit to greenhouse-gas-related climate change," says Savage.

"They're building a miniature version of our plant. They're going to capture the nitrous oxide from that, based on making their pilot plant run under the same conditions as our plant." The goal will be to determine how to optimize the aeration process to minimize N_2O releases without compromising treatment.