College of Engineering
UNIVERSITY OF WISCONSIN–MADISON

FALL 2025 NEWSLETTER

DEPARTMENT OF

CIVIL & ENVIRONMENTAL ENGINEERING

Ethan Arterburn helps prepare to drop a tidal camera into a frozen Lake Medota for a test. The camera, designed by Soren Goldsmith and Arterburn, was created for long aquatic deployments to capture photos of wildlife. Photo: Soren Goldsmith.

Greetings from Madison!

To lead and inspire positive change for public and environmental good through world-class engineering research and education. That is our forward-looking vision for CEE, derived from a year-long strategic planning effort that included input from roughly 100 CEE community members. This vision guides our mission to address societal and environmental challenges through transformative research, innovative teaching and the development of engineering leaders committed to producing safe, sustainable and impactful solutions.

These statements show our community, from prospective students to longstanding alumni, that we define ourselves by making communities and ecosystems healthier, safer, more prosperous, more resilient and more sustainable, even when our alternative solutions become more constrained by global climate change, population growth, rapid technological change and fiscal challenges.

To meet our vision, we are developing initiatives under the following five strategic priorities:

- **Curriculum and workforce development:** Build a dynamic talent pipeline that aligns education with industry and societal needs, addressing critical environmental, infrastructure and energy challenges.
- **Research:** Increase research activities that use emerging technologies to improve sustainable infrastructure and envision mutual solutions for the benefit of society, aligning our research agenda with funding opportunities.
- **Recruitment and hiring**: Design and implement a forward-thinking recruitment and hiring plan to meet evolving teaching, research and administrative needs, aligned with campus priorities, emerging fields and optimal workload distribution.
- **Facilities and infrastructure:** Modernize infrastructure through strategic investment and philanthropy to create state-of-the-art facilities that attract talent, support research and education, and foster innovation.
- **Building community:** Foster and support a vibrant, inclusive departmental culture that unites students, staff, faculty, alumni and industry partners through collaboration, well-being and a shared identity.

As noted in our spring newsletter, we face uncertain headwinds in federal support for research and education at a time when artificial intelligence and machine learning will rapidly change our profession. Our plan will help us navigate this uncertainty so that we remain a globally recognized department. I'll keep you all posted on our priorities and their initiatives in coming newsletters.

For more than 150 years, Badger engineers have led the charge to develop creative solutions that meet our vision, integrating advancements in science, technology and automation along the way. With your continued support, I have an undying belief that we will continue this tradition of excellence for years to come.

On, Wisconsin!

Gregory Harrington
Professor and Department Chair

78th Engineers' Day Honorees

In November, two alumni will receive top honors from the College of Engineering. We look forward to honoring Early Career Achievement Award winner Colin Fitzgerald, of Jacobs Engineering Group, and Distinguished Achievement Award winner Dr. Berrin Tansel, of Florida International University.

Scan the QR code for more event information.

Accelerated Engineering Master's Programs

Our accelerated engineering master's programs allow graduates to get the jobs they want by obtaining an advanced degree in as little as one year. Delivered on campus and designed to be finished in 12–16 months, learners can choose from 12 programs in 7 disciplines.

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PhD students Ali Milani and Kaitylyn Gruber work in the lab in the Water Sciences and Engineering Laboratory. Both students are working on projects to monitor how PFAS contaminants, carried by precipitation or in tributaries, get into Lake Superior. Submitted photo.

Through weather and water, PFAS will pollute Lake Superior

UW–Madison environmental engineers are tracking the myriad ways in which "forever chemicals" get into Lake Superior.

PhD student Ali Milani and chemistry PhD student Kaitlyn Gruber are leading projects to monitor how per- and polyfluoroalkyl (PFAS) chemicals move through the atmosphere and through river and tributary systems. Milani's project, in partnership with the National Atmospheric Deposition Program and the Wisconsin State Laboratory of Hygiene, focuses on precipitation. Gruber, collaborating with the U.S. Geological Survey (USGS), is researching PFAS movement through river systems.

In 2022, Gruber and partner researchers from the USGS collected samples from 28 tributaries emptying into the United States side of Lake Superior across three sampling campaigns. Those samples enabled the team to focus on separate aspects of PFAS contamination—the USGS study looks at the effect on fish and potential implications for human health, while Gruber's has focused on how PFAS physically move through the water.

"What we want to know is are we primarily seeing PFAS in sediment at the bottom of a river, or are they more suspended in the water column?" Gruber says. "If a river is choppy and there's a lot of stuff kicked up in the water, we're looking to see if these chemicals might be transported on that particulate matter, or if they're in the water itself."

Milani collected precipitation samples for two years, beginning in summer 2022, at nine sites around Lake Superior—some shoreside, others farther away. The field work yielded a tremendous amount of data, and Milani is still analyzing it.

"Even in some of our preliminary analysis, we see trends in PFAS levels depending on what side of the lake you're on, or the season," Milani says. "I think a lot of long-term studies with big datasets like we've collected through this collaborative research are going to be helpful for evaluating trends not just at Lake Superior, but around the world—because there are similar river systems and atmospheric transportation happening everywhere."

PFAS contamination is a global challenge. They're a class of thousands of widely used chemicals found in everything from consumer products like popcorn bags and nonstick cookware to certain firefighting foams. Some PFAS chemicals break down very slowly, which means if they get into the natural environment, they remain there for years. They're also mobile—meaning they spread through the ground, in water or via weather patterns far from contamination sources.

Milani and Gruber are looking for PFAS at the low parts-per-trillion level. Though that's an astonishingly low concentration (comparable to one drop of water out of 20 Olympic swimming pools), it aligns with current federal regulations for PFAS in drinking water. And with enough time, Lake Superior—the largest freshwater lake in the world by surface area and third-largest by volume—could turn into a reservoir of PFAS contamination.

"Even though these are low concentrations of sometimes less than one part per trillion, they'll still build up in Lake Superior for a very long time," Milani says. "It could be more than 150 years of cumulative contamination—buildup that will also move down into the rest of the Great Lakes. The more we can do now to track and identify contamination sources, the better our chances for mitigating that long-term contamination."

Gruber and Milani are in Professor Christy Remucal's research group. Remucal, an expert in PFAS research, leads UW-Madison's PFAS Center of Excellence.

Wave goodbye: Research yields new knowledge about how ocean action carves icebergs from ice sheets

Nimish Pujara, right, works with one of his students to set up a camera that will monitor wave erosion on an ice block after it's lowered into a wave tank. Photo: Joel Hallberg.

An interdisciplinary team's research may deepen our understanding of how ocean waves wear away massive ice sheets—and how that activity can influence climate around the world.

Honorary Assistant Professor Nimish Pujara says waves can erode sections of ice near the waterline, where wave action is strongest. This erosion forms indentations called "wave-cut notches."

"Wave erosion acts at the top, near the waterline," he says, "but you still have a lot of ice under the water. That underwater ice is less dense than the surrounding water, so it wants to 'float' to the surface—which creates torque that can eventually break pieces of ice (icebergs) off of an ice shelf."

Understanding how, and how quickly, wave notches form in ice can help scientists understand how icebergs form from larger ice formations or even wear down over time. "This wave erosion is one of the main ways icebergs get smaller," Pujara says. "We want to know where they end up. Not only can they be a danger to shipping vessels, but they also can spread meltwater around the oceans—which can influence how ocean currents behave. There are also nutrients locked up in land ice, so as icebergs melt, they distribute those nutrients and can affect ocean ecology."

For its research, the team conducted several experiments on ice blocks—ranging from about 60 to several hundred pounds—placed in specialized wave tanks to closely monitor the notches as they form. Their experiments culminated in a new cryo-wave tank set up in a freezer in the UW-Madison Surface Processes Lab, which is led by Lucas Zoet, a geosciences associate professor and project collaborator. The setup allows the team to mimic cold conditions in which ice sheets form.

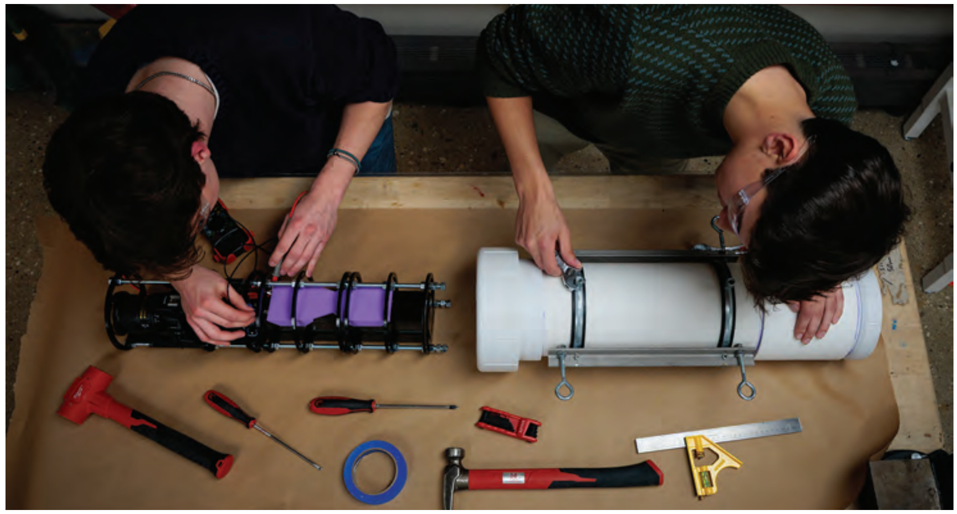
The researchers have converted their work into mathematical formulas in a paper submitted to the *Journal of Fluid Mechanics*. Collaborator Till Wagner, an assistant professor of atmospheric and oceanic sciences at UW-Madison, says it's the kind of data that can ultimately feed into large-scale climate models, which are typically ocean- and atmosphere-based.

"The crucial way to bring ice sheets into our climate models is by resolving the boundaries between the oceans, ice sheets and atmosphere," Wager says. "In this project, we're looking at the boundary between oceans and ice sheets, and that will be critical for our future predictions of climate change and sea level rise."

The team is conducting many more experiments to support its work. Anya Wolterman (MSCEE '25) oversaw those experiments before they graduated. They made ice by freezing water in coolers—it took about two weeks at a time for the ice blocks to freeze all the way through—then tested the blocks in a wave tank in Engineering Hall.

"There was a body of data that was missing from our collective knowledge," Wolterman says. "Since 1977—before me—there had only been seven experiments with ice blocks in a wave tank subjected to waves. In total, I did about 20 experiments, and used eight for my final data series. So even in the final report, that's more than has been done in the last 50 years."

Undergrad's amphibious imaging system captures unseen beauty in New England salt marshes



Ethan Arterburn, left, and Soren Goldsmith assemble the tidal camera in a makerspace in the Grainger Engineering Design Innovation Lab. Photo: Russell Laman/National Geographic.

Soren Goldsmith knows most people don't think about salt marshes that often—but with the help of an innovative amphibious enclosed camera, he's creating connections to those lands through photos of the wildlife that live in these unique environments.

A junior studying geological engineering at UW-Madison, Goldsmith spent much of the 2024-25 academic year working to invent the system, which is meant to survive long deployments in salt marsh tidal zones to capture underwater wildlife. Goldsmith had help on the project from junior mechanical engineering student Ethan Arterburn and group members from Engineers for a Sustainable World.

"Tidal marshes are really dynamic, scientifically important places," says CEE Professor Steven Loheide, who is Goldsmith's advisor for the project. "Changing weather and rising seas are pushing the boundary of marine and terrestrial life further inland, and the ecosystems have to adapt. Soren has built something that can help monitor those changes and hopefully get people, and himself, more excited about that."

Soren Goldsmith checks on his camera in the field in Massachusetts. Goldsmith designed the camera for long deployments in New England tidal marshes. Photo: Russell Laman/National Geographic.

The system consists of a DSLR camera, a small computer, and batteries inside a sealed PVC pipe with a dome port at the camera-facing end. The camera uses customized motion-sensing software to analyze what it "sees" and then snap pictures of aquatic wildlife. It is, to Goldsmith's knowledge, the first system of its type, and has already been deployed several times since May 2025, capturing stunning pictures of fish, crabs and turtles.

The National Geographic Society supported Goldsmith's work through its Young Explorers program.

Goldsmith is from Lexington, Massachusetts, and his project proposal focused on New England's salt marshes. These coastal grasslands regularly flood and drain as the tides push seawater in and out.

He specifically wanted to photograph the diamondback terrapin, a threatened turtle species that lives in salt marshes along the Atlantic and Gulf coasts. "They're these iconic turtles that are really important to salt marshes," Goldsmith says. "But it's almost impossible to get good imagery of their behavior underwater because they're really skittish. I needed to be able to get photos close to them, but I couldn't do that by hand."

Goldsmith, who has a background in wildlife photography, says that developing his camera was trickier than it might seem. He quickly learned there's no suitable underwater equivalent to trapping, or trail, cameras used on land to track wildlife presence and movement in an area.

Infrared cameras didn't work well underwater, and a camera Goldsmith used that snapped pictures every few seconds chewed through its battery and ended up taking pictures of nothing at all. He tried using a GoPro, but that didn't quite work either.

So, like any engineer faced with a challenge, Goldsmith decided to build his own. Working with his team, he designed both the enclosure and the software that powers the camera when it's left in the marsh for up to two weeks at a time.

Goldsmith wants to keep working to improve the camera through the rest of his time at UW-Madison. The hands-on learning project has also given him a new appreciation for how engineering and understanding the world around us intersect.

"I know I want to keep doing engineering and building equipment," he says. "I like the idea of building something that other people can use to help them see something they've never seen before, and how it connects to exploration and using these tools to understand more about the world around us."

For undergrad, international railroad internship connects people and cultures

In the United States, a massive freight network conveys goods from place to place.

But people? Not so much.

Compared with countries such as China, Spain, France, Germany and Japan, the United States lags in implementing high-speed rail to shuttle passengers from point A to point B. Japan's Shinkansen—its network of high-speed bullet trains and rail lines—in particular is among the world's most enviable, efficient and technologically advanced railways.

That's one reason Kyle East chose to spend two weeks in early-August 2025 as an international intern with the Central Japan Railway Company. "The company provides world-class intercity passenger rail service," says East, a fifth-year civil engineering undergraduate. "One of my professional goals is to help improve passenger rail service in the United States, and this opportunity was perfect for me to observe their operations firsthand and build upon my network of high-speed rail professionals."

During the intensive internship, East traveled to various depots throughout Japan to observe rail and non-rail business operations and participate in departmental discussions, including a final presentation about one of the company's main business improvement initiatives. "We spent a lot of time on foot or on the train," he says. "I learned how amazing it feels to travel between regional cities at 171 mph on the ground—something most Americans will never experience."

East's civil engineering education and focus on construction and transportation at UW-Madison prepared him to expand his knowledge of how high-speed rail functions effectively in Japan. "I understood much of how their system operated, and asked many questions following the presentations and tours," he says. "I could see and feel immediately how the fundamental design controls of the Shinkansen make it so reliable, fast and safe."

While in Japan, he and other interns participated in a meeting with Anna Wang, a principal officer with the U.S. Consulate in Nagoya. Coordinated by the Central Japan Railway Company, the meeting served as Wang's introduction to the internship program, as well as to the interns themselves.

At UW-Madison, East is a member of the Wisconsin High Speed Transportation Group, a student organization where he learned about the internship program from fellow members who'd participated in the past. Their endorsement cemented his decision to apply—and he encourages other students to take advantage of similar opportunities.

New project bringing sustainability education to all undergrad engineering students

A new initiative to introduce sustainability into the College of Engineering's curriculum aims to ensure that every undergraduate engineering student learns about sustainability in a manner relevant to their major while they're at UW-Madison.

Associate Professor Andrea Hicks and Chemical and Biological Engineering Assistant Professor Styliana Avraamidou are leading the Undergraduate Sustainability Engineering Education project.

To make the change, they have recruited instructors for classes across all of the College of Engineering's majors, and in biological systems engineering in the College of Agricultural and Life Sciences, that are natural choices to add relevant lessons about sustainability. Embedding the lessons into core classes in different majors could make them more interesting and applicable to students as they progress through their education and begin their careers.

"One piece of feedback I often get from students is that they know sustainability is important, but they don't really understand how to use it," Hicks says. "The goal here is that we go beyond just saying this is important to teaching them this is how you might think about this in your discipline so that you can take it with you when you go out into the real world."

Avraamidou and Hicks are planning with interested faculty throughout the fall 2025 semester for the project and want to begin piloting classes in spring 2026.

The three-year project, supported by the National Science Foundation, uses the Engineering for One Planet framework, which aligns with ABET (Accreditation Board for Engineering and Technology) requirements.

Sustainability often brings to mind a focus on environmentally friendly practices. While that is a part of it, the concept extends to economic and societal considerations. Each of the three "legs" of sustainability—environment, economy, society—can interact with the other.

Hicks is the Keith and Jane Nosbusch Associate Professor in Engineering Education and the Hanson Family Fellow in Sustainability. Avraamidou is the Duane H. and Dorothy M. Bluemke Assistant Professor.

After accelerated MS, alumna creates community solutions to environmental challenges

Civil engineering is a career of problem solving, critical thinking, communication and collaboration for public and environmental good. For water resources engineer Meredith Freeby, it's also an outlet to combine passion with purpose that is close to home.

"I love what I do, and I love doing what's right for our streams," she says. "I have a strong connection to the Great Lakes and streams are a sensitive piece of our surface water network."

Freeby hails from Michigan and grew up with an appreciation for the outdoors and the Great Lakes region. She came to UW-Madison to enroll in the one-year CEE professional master's program after earning an undergraduate biosystems engineering degree at Michigan State University.

"I found it to be a great transition from student to professional life, and I think it really kickstarted my career, too," she says "The coursework was challenging and working through it gave me good experience for the future."

Freeby now works as a project manager for nonprofit Conservation Resource Alliance, which works to restore and revitalize rivers and watersheds in northwest lower Michigan.

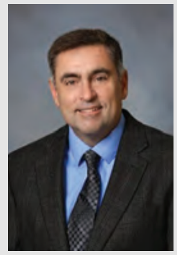
She's currently working on a project to remove the Boyne Falls dam in northern Michigan. The project will restore upstream passage to three miles of the south branch of the Boyne River and 38 miles of its tributaries, while also opening passage to 36 miles of the north branch subwatershed.

Meredith (pictured left) stands with a coworker during a construction inspection of a bridge project on the Jordan River. Submitted photo.

The dam is beyond its 100-year lifespan and is considered a significant hazard. Removing it will promote aquatic habitat diversity, protect and improve water resource quality, maintain recreational opportunities, and support sustainable watershed management practices.

"This project is a great example of a community coming together to work with the river, instead of against it," Freeby says. "By initiating the dam removal, the village is prioritizing community safety, ecological health, sustainable recreation, and an overall resilient ecosystem for both people and wildlife alike."

Alum guides future of environmental engineering master's program



Jeffrey Starke (MSEnvE '01, PhDEnvE '11) is the new program director for the Master of Engineering in Environmental Engineering degree program.

Starke is taking the role after leading the Master's Across Boundaries program at Marquette University's Opus College of Engineering. Before that, he served in the U.S. Army for 25 years, seven of which he was an academy professor with the U.S. Military Academy at West Point. During his time in the Army, Starke worked on several international projects, including building a biogas digester in Uganda with five students.

Now Starke is bringing that wealth of experience to leading the master of engineering in environmental engineering program. As an online program, it connects students from across the country and even internationally. Starke says that's an opportunity to emphasize how different regions may have different needs, but core principles of environmental engineering carry across communities, big or small.

Starke says the program will position its students to tackle new and developing environmental engineering challenges, from monitoring disease outbreaks through wastewater to managing and mitigating toxic "forever chemicals" that are spreading through our soil, air and water.

"When I took my courses here, I remember some were designed so realistically that it felt like I was in a consulting firm," he says. "We want to keep pushing that high level of quality to help students gain the knowledge that's going to be required for these incredibly complex challenges."

The program is "100% online but never alone," with synchronous components that allow students to interact in real time with classmates and professors or instructors. It has a longstanding tradition of bringing in students who do not come from purely engineering backgrounds, and Starke hopes to continue building upon that legacy.

"We can fill in the gaps of knowledge they have in their undergrad experience and help them grow into engineers," he says. "If someone demonstrates that they're serious about their academics, then we can be that bridge for them to grow and achieve goals they might not have seen a way to do otherwise."

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Loheide named NGWA 2026 Darcy Distinguished Lecturer

The National Ground Water Association and Groundwater Foundation has selected Professor Steven Loheide as the 2026 Darcy Distinguished Lecturer.

Loheide will travel throughout 2026 to present his lecture at university and groundwater industry events across the country and abroad.

Established in 1986, the lecture series fosters interest and excellence in groundwater science and technology throughout the groundwater industry.

Loheide's research focuses on the interactions between ecological and hydrological processes in natural and built systems with special attention to the role of groundwater. He will present two lectures throughout the year: "Trees are groundwater stakeholders, too" and "Groundwater recharge regimes are in flux."

Groundwater is a critical resource that provides a reliable source of drinking water for people around the world, enables irrigation for agriculture. and supports a variety of ecosystems. However, Loheide says it's often out of the public mind because it's out of sight.

"As a result, we have not always recognized the unintended consequences of how we live on the land or how we use our water," he says. "I look forward to being an ambassador of groundwater science and sharing the process of how we as researchers come to learn more about groundwater and its interactions with society and ecosystems. I hope the Darcy Lectureship will facilitate discussions on how we can improve our understanding of this key resource, advance groundwater science, and become better stewards of our resources for future generations."