SACRAMENTO STATE
Department of Civil Engineering

INSIDE THIS ISSUE

Sacramento State's Earthquake Engineering Research Institute (EERI) student chapter members pose with "stingers up" at the annual EERI Student Seismic Design Competition. — Pg. 23

Your Link to the Department of Civil Engineering

CE CONNECTION

FALL 2018 | ISSUE 27

CHAIR'S MESSAGE

Dear alumni, colleagues and friends,

With the release of the fall 2018 CE Connection, we're two-thirds of the way through the semester and preparing for spring enrollment and an incoming class of transfer students. Time sure does fly!

The department continues to excel in its primary mission to educate and prepare the next generation of civil engineers for California. Our undergraduate programming is packed full of students who are motivated and committed to a career as a civil engineer. Many of them – in fact, 33 percent – are the first in their family to attend college. The student body is also incredibly diverse, with 35 percent comprising underrepresented minorities, and one in two students from low socioeconomic backgrounds. Our student body makeup, combined with 58 of 96 companies at our fall engineering career fair hiring CE students, illustrates one of the most powerful aspects of higher education – increasing inclusivity and diversity to promote upward social mobility.

The local civil engineering industry and our alumni have always been fantastic supporters of the civil engineering program at Sacramento State. Large donations and alumni giving are up significantly in the last several years as our successes have been highlighted and the community understands the need for support beyond state-allocated funds. These donations have made Riverside and Santa Clara Halls better places to learn, and have contributed to an enriched learning environment for the students. On behalf of the students, faculty and staff in the Department of Civil Engineering – thank you to everyone for your generosity. If you would like more information on how to support the department, see page 4 of the newsletter.

Warm wishes for a safe and happy holiday season.

Ben Fell
Chair, Department of Civil Engineering

SACRAMENTO STATE
Department of Civil Engineering

Support the Department

Looking for a way to support the Civil Engineering Department? We have four different funds that enhance our ability to educate students:

- **The Ken Kerri Endowment Fund** – Gifts to this fund faculty and student enrichment activities.
- **The CE Freshman Scholarship Fund** – Scholarships to outstanding freshmen.
- **The Graduate Environmental/Water Resources Scholarship Fund** – Scholarships to deserving graduate students in the environmental or water resources engineering areas.
- **The Department Trust Fund** – These resources support student attendance and participation at conferences and competitions, senior design project team expenses, and equipment for labs when other funds are not available.

To donate to any of these funds, go to www.ecs.csus.edu/ce/support.html and follow the directions for online donations.

Or mail a check made out to the appropriate fund to:

Attn: Ashley Mihok
California State University, Sacramento
Department of Civil Engineering
6000 J Street, MS 6029
Sacramento, CA 95819

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Upcoming Events

Gain access to all of these events through the Department of Civil Engineering Sponsorship Program! Information for 2018 sponsorship is now available at:

2018 Sponsors

April 17, 2019:

Ken Kerri Endowment Fund Luncheon, Sacramento State Alumni Center

September 13, 2019:

Civil Engineering Golf Tournament, Mather Golf Course

Event

RECAP

7th Annual

GOLF TOURNAMENT

The Civil Engineering Department held its 7th annual Golf Tournament on September 7 at Mather Golf Course. It was another great day on the green, matching up Sacramento State faculty, students and industry sponsors to raise funds for scholarships and departmental needs.

"My favorite part of the Civil Engineering Department's golf tournament is spending the day with the Sac State CE students. They are always amazing. Every year, we golf with two students in our Dokken foursome, which turns into a daylong job interview. All four of us end the day knowing a lot about each other, and have a great time doing so."

— ***Rick Liptak***
President, Dokken Engineering

"I am a senior graduating in spring 2019. I was slightly intimidated to attend since I had not played golf before, but knew I had to try. Dr. Fell encouraged me to play and I even asked him for advice on what to wear. I played with Dokken Engineering. They were encouraging and gave me pointers on how to improve my game. I may have not started great, but by the end of the tournament I had improved to the point that I wasn't slicing the ball. I had a great time and learned from both the game and my mentors."

— ***Josue Zuniga***
Sacramento State Civil Engineering Student

INTERNSHIP *Spotlight*

› *From left to right: Michael Hendry, Kevin Labao, Khristin Labao, Luis Martin, Andy Espinoza, Elayna Mascareno and Cody Schwartz*

DOKKEN ENGINEERING

— Feature Your —
INTERNSHIP!

Does your firm or agency employ Sacramento State interns? Or are you a student who wants to share your great internship experience?

Contact us at ashley.mihok@csus.edu and you may be featured in an upcoming CE Connection!

In our second installment of Internship Spotlight, we're featuring Dokken Engineering, a Folsom-based firm that specializes in public works projects such as bridges, highway interchanges and other local, state or federal government-funded initiatives.

"We are lucky to have seven interns from the Sac State Civil Engineering program right now," says Rick Liptak, President of Dokken. "Each of them walked in the door ready to help us in any way they can."

Interns share their perspective on working at Dokken Engineering:

> Prior to working at Dokken Engineering, I've had minimal experience working in professional projects and engaging with experts in the field. In the time since I've started working with them, I've gained invaluable experience that I can apply to my professional career.
>
> ***— Khristin Labao***

> I value the diversity in my team at Dokken Engineering. Each team member has different strengths and experiences that will help me learn many different attributes in my future career.
>
> ***— Luis Martin***

> Working at Dokken has exposed me to many facets of the design and construction process I didn't fully understand before, from environmental review to post-construction documents. I have learned a great deal about what all is involved in the design process of various civil engineering projects, and how the private sector and public sector work together in industry. Also, it has been a great experience being involved in a variety of projects that have been undertaken all across California.
>
> ***— Cody Schwartz***

> On a daily basis I learn about various tasks involving the completion of design for roadway projects. I find the coordination and collaboration between the Dokken Engineering team to be the most valuable; everyone at Dokken is approachable and willing to assist. Overall, my experience as an intern at Dokken Engineering has been an invaluable first step into the field of civil engineering. I find transportation engineering to be an engaging field of work. I am proud to be a part of the team at Dokken Engineering.
>
> ***— Andy Espinoza***

"Sac State students – and graduates – want to be part of a team," said Rick. "Their education and their life experiences have proven to them that they need to seek out and join a good team where they can grow and thrive."

GRAD Spotlight

ZHENGJIAN "ALEX" YANG

Grad student Zhengjian "Alex" Yang came a long way to get to Sacramento State - originally from Shanghai, China, and more recently, Houston, Texas! He's eager to build up his educational résumé and become a professor.

When and where did you get your undergraduate degree?
I graduated in 2015 from the University of Houston with an environmental science degree. I started here in the spring of 2017.

What drew you toward Civil Engineering?
The first time I came to the States I didn't distinguish science and engineering; I thought they were the same major. But when I got more into detail I decided I'd prefer to study engineering.
I'm doing an internship with my professor, Dr. Amir Motlagh, and it's given me the chance to spend a lot of time in the research lab. Right now we have a bioreactor, and I've learned a lot from that.

Why did you choose Sacramento State?
My grandparents live in Davis and my uncle, who also wanted me to be an engineer, works for the UC Davis Utility Department. He said Sacramento State had a really strong civil engineering degree. When I switched to this major, I heard a bunch of students mention that science should be easier than engineering, but not for me. My GPA was 3.2 with my science degree and now it's 3.6 for engineering.

What are your favorite classes?
CE 252 (Environmental Quality Processes). Also Physical, Chemical and Biological Treatment for Water Quality. I also enjoy CE 172 (Design of Urban Water and Sewer Systems), which I'm taking now. I'm learning more software like AutoCAD, but also WaterCAD, which determines the pipelines for drinking water distribution systems. Later, we're going to focus on sewer system design with SewerCAD.

Have you been involved in any campus organizations or student competitions?
Not at Sac State, but I was treasurer in the student chapter of the American Water Works Association at San Jose State. Because I switched from science to engineering, I had to take some background courses, so I took one year at San Jose State to finish that up before coming here.

How do you like living here compared with Texas?
Here in northern California the traffic is worse and there are more crowds of people compared to Texas. Texas has more space, but I prefer the climate here. I don't have to worry about floods and hurricanes every single year!

Do you see yourself choosing one particular branch of civil engineering over another yet?
I'm very interested in environmental engineering so right now I'm doing an internship with Dr. Motlagh and we're dealing with chemicals, and later we'll do DNA extractions. I need to use that to prepare for my Ph.D. application for next year. I'll probably apply to UC Davis, but it's competitive, so I always have a Plan B and Plan C. Plan B is the University of Nevada-Reno since it's the next closest Ph.D. school.

Tell me about the work you're doing with Dr. Motlagh.
I was lucky to be recommended by Dr. Johnston; I worked as a grader for him. Dr. Motlagh was looking for a grad student who was interested in doing research with him, so it was a good chance for me. We started to set up our research in fall 2017 but were waiting for funds and equipment to come in, so we set those up in summer this year.
We set up a bioreactor. It's a lab-scale reactor and we're simulating what they do at Regional San, a real wastewater treatment plant [in south Sacramento]. We borrowed two things from Regional San – wastewater samples and biomass seeds. We use that to put in our bioreactor and try to enrich the biobacteria communities in our reactor. Then we're going to do DNA extraction and try to look at the bacteria and how they grow. That's the first part. Second, we're going to compare the traditional aeration tank with intermittent aeration. If we successfully do intermittent aeration then maybe the results will save energy consumption.

Do you plan to pursue that line of research further?
Yes, I'll graduate next spring and I don't want to have a gap between my master's and Ph.D. This whole year is preparation for my Ph.D. I am doing research and setting up the research lab. These projects can be used as my CE 500 thesis.

What are your plans after graduation?
Pursuing my Ph.D.; I definitely want to be a professor. Ideally I want to study for another four or five years, get more teaching experience, and enhance my research experience as well. Plan B is working in industry near Folsom. We're looking for a house in Sacramento or Folsom.

How would you say your experience at Sac State has been?
Pretty amazing compared with some previous schools, where I had no chance to get working experience specifically focused on my own research. I've been really appreciative of Dr. Johnston and Dr. Motlagh. They gave me these opportunities and are helping strengthen my working abilities. So I believe I will have a bright future career.

Which professors have really stood out?
Dr. Motlagh was my supervisor [for my research] and one of my professors. He gives me guidance, but beyond that he's like a big brother or friend. He's like that with all the students. Every student wants to surround him after class and talk more. Dr. Johnston was also helpful. He was the first person to give me a chance. He always stops by our research lab and gives me more suggestions about our bioreactor. And of course, Dr. Fell. As an international student, when I do any kind of internship he needs to issue me a file, and he's always ready to help me.

Do you find time to do anything besides studying?
I published a paper in August in the Water Environment Research journal called "Electronics and Metal Finishing." I worked with Dr. Motlagh on it. It was focused on how to treat heavy metals in wastewater, and methods of electronics disposal and other solid waste management.

ALUMNI Spotlight

MARK ANDERSEN

Retirement is a time to decompress; to travel; to reflect upon a career well spent. Mark Andersen ('89) did all those things after retiring from the California Department of Water Resources (DWR) after 27 years, serving most recently as Acting Deputy Director of the State Water Project.

But soon after his August 2017 retirement, Mark found himself restless, thinking about the professionals in engineering, science and law with whom he'd worked over the years and the accomplishments they'd shared. Soon he found himself right back in the workforce.

"I had worked with a lot of talented engineers and geologists from MWH, a firm later acquired by Stantec, and they asked me to join their Waterpower and Dams team to help with the practice in California," said Mark. "Besides business development, I'm also working on some existing projects and helping out in a management role. It's fun, and there are so many smart and dedicated people at Stantec and in the water and hydropower fields as a whole. You can't ask for a better situation than one in which you're always learning."

Waterpower and Dams is a discrete business line and global practice with a few hundred people within the 22,000-employee international firm Stantec, which offers engineering and design practices in water resources, construction, community development, environmental services, oil and gas, transportation, and other areas. "It's a great place to work, and a big part of that is the overarching corporate culture," said Mark. "They put people first, and they design with the community in mind."

Before he retired from DWR, Mark spent 38 years in the professional world – initially in the oil and gas industry in the 1980s. "Sacramento Valley is a huge natural gas-producing basin," said Mark. "Over the years, my responsibility level had steadily increased, and I was very fortunate to have had so many great engineering and geology mentors while working there."

Pursuing a degree in mechanical engineering while he worked full time, Mark was well into his studies when he began gravitating toward civil engineering instead. "I was trying to make something more interdisciplinary, like a petroleum engineering degree, but it wasn't offered," said Mark. "So I worked with Professor [Emeritus] Bill Neuman, and he was not only a great mentor, but a huge help in guiding me through the maze" to get a special Bachelor of Science in Civil and Mechanical Engineering, which he earned in 1989. It was a rare arrangement that wouldn't likely occur today.

Once Mark decided to switch from mechanical to civil engineering, "the College of Engineering devised a special major for him that met all the requirements for a civil engineering degree and only required him to take a few extra courses," said Professor Neuman. "To succeed in engineering he had to become licensed, and to qualify for the examination he needed a degree that met the ABET requirements. So CSUS proved flexible enough to meet his needs and yet maintain its standards. The proof that we did the right thing is Mark's not-yet-done, quite remarkable career."

Even after he graduated, Mark was happily entrenched in his work at Texas Oil & Gas, but in late 1990 the company was acquired by Enron and he was faced with a choice: a job in Louisiana or a year's severance pay. He took the latter, and soon he was hired at DWR to work on the State Water Project (SWP), where many of his classmates from Sacramento State already worked.

"I didn't know much about SWP, but over those next 27 years, I really fell in love with it," said Mark. "I was very lucky to have all these mentors and great coaches, and fantastic opportunities to work on different kinds of projects with so many talented professionals at DWR. At the SWP there's a very strong commitment to the project and its mission, which is critically important to California; people stay at DWR for 30 to 40 years. With my 27 years, I'm a short-timer."

Mark's focus as an engineer started in oil and gas reservoirs that exist in the pore spaces (subsurface) of rocks. "Just like with evaluating and recovering groundwater [reservoirs], it's an analogous technical skillset involved," he said. "I worked on a lot of projects at DWR that were a strong marriage of engineering and geology. My interdisciplinary studies and oil and gas exploration and production experience served me well during my DWR career."

He fondly recalls several projects during his time at DWR, including one in which his interdisciplinary team created a long-awaited fix to protect a reach within the 100-mile stretch of the California Aqueduct canal (which is jointly owned by the state and federal governments) from the Arroyo Pasajero watershed. "There were decades of notorious flood and sedimentation problems at the canal as it traverses one of the largest alluvial fans in North America," said Mark, who oversaw the $8.6 million joint Army Corps feasibility study on the project, ultimately resulting in an enlarged detention basin with a 400-foot long rubber dam (the only such dam in the vast SWP system). "That was very satisfying."

> "Sacramento State played a tremendously integral part in my working life and any success I had thereafter."
>
> — Mark Andersen

In another instance, Mark was instrumental in negotiations with a Nevada utility in divesting DWR from a coal plant it partially owned. His oil and gas experience was key to solving a complex puzzle involving groundwater pollution at the coal plant resulting from nearly 30 years of power generation. DWR had initially partnered on the coal plant for part of the roughly 7.5 million megawatt-hours annually needed to pump water across the state, consistent with the 1960 voter-approved SWP mission. Ultimately, DWR did divest and received a refund of $50 million for undepreciated capital improvements.

Having the chance to catch his breath has inspired Mark to get involved with the next generation of engineers; to start, he served as one of six professional panelists at An Evening with Industry on Nov. 1 on campus, offering career advice from his unique perspective to the Sacramento State Civil Engineering students who asked questions at the event.

"Sacramento State played a tremendously integral part in my working life and any success I had thereafter," Mark said. "It was a transformational experience." Pointing out that his wife is also a successful Sacramento State graduate, he's grateful for what the university provided them both. His first piece of advice for engineering students embarking on a fresh career?

"It's great to have a strong focus of where you want to be, but if opportunities aren't presenting themselves, don't give up; broaden your horizon," said Mark. "There is no better foundational education for life than an engineering degree. In terms of really being able to solve problems, to sort what you know from what you don't – it's applicable to so many things in life."

› *Mark and his wife Geraldine hiking in New Zealand in 2017.*

JOSE GARCIA, PH.D.

What got you interested in structural engineering?
When I was working on my undergraduate degree, I didn't really know what I was going to do, just that I wanted to go to grad school. I really enjoyed the structural engineering classes, so I got involved in the lab with one of my professors, helping him out and working with some of his grad students. I really enjoyed it so I applied for grad school, got in and went from there.

I became really interested in concrete durability and sustainability, so I look at long-term issues that deteriorate concrete. More than anything, I look at the chemical reactions that are harmful to concrete.

Where were you before you came to Sac State?
I received all three of my degrees at the University of Texas at Austin. I was a teaching assistant for a couple classes, and I taught a summer class last year at another university as an adjunct professor. It was Mechanics of Materials, the same class I'm teaching this semester.

What kind of research have you performed?
I looked at a type of cement that's new here in the U.S. It's more environmentally friendly than regular cement you would buy at Home Depot. Sustainability is a big issue now in the cement and concrete industry, so we're looking for ways to be more environmentally friendly. We cast a lot of different concrete mixes and exposed them to different conditions. For one part of the research project, we cast concrete blocks and hung them off the sea wall in the Gulf of Mexico and kept monitoring them periodically. Every three to six months we made a trip to the coast and took the blocks out of the water. We would then measure, take pictures, and put the blocks back in so we could come back later and repeat the process. This aspect of the project lasted approximately three-and-a-half years. Even though I left, the specimens will continue to be there and my advisor will keep an eye on things. Research in my field is usually carried out over very long time periods, usually a minimum of five years, but ideally over 10-15 years. In fact, there are some blocks at the [UT Austin] lab that are 20-25 years old, from when my advisor first got there. We're trying to get measurements from real exposure conditions rather than accelerated tests.

How do you accelerate aging with concrete?
There are different ways to do it, depending on what you're trying to achieve. One of the topics for my dissertation was the carbonation of concrete, which happens when concrete is exposed to air and $C0_2$ starts penetrating it, resulting in microstructural changes. In the air we usually have about a 0.04 percent concentration of $C0_2$, so it's a relatively small amount. In the lab, I built a chamber where the concentration of $C0_2$ was about 100 times higher because we were pumping $C0_2$ into the chamber targeting a concentration of about 4 percent. We were trying to correlate those results to specimens that had been sitting in the field for two-and-a-half to three years.

What's the downfall of artificially aging concrete?
When you are bombarding it with very aggressive chemicals at high concentrations, that will change some things. You're not going to get a perfect one-to-one correlation. How it changes things depends on the chemicals and the concentration you use, but our goal was not to try to get the same exact results [as with actual aging]. With these short-term tests we wanted to establish a benchmark so we'd still be able to compare different concrete mixes.

What made you decide to take the job here at Sac State?
When I was here for the interview I felt a connection to the department; I felt this welcoming environment. It's basically a family, and I very much felt that when I was here for the interview. I also had been in Texas my whole life and wanted a change of scenery, so we decided to come out here to California. We were specifically targeting northern California instead of southern. It's closer to San Francisco, Lake Tahoe, and avoids the traffic issues that are famous in L.A. with a relatively lower cost of living.

What classes will you teach?
I am currently teaching Mechanics of Materials and Reinforced Concrete Design. In the future, I plan to develop some classes dealing with concrete durability and concrete repair. I believe repairing our infrastructure and ensuring its durability are very important due to the growing threat of climate change.

Will you be getting involved with any of the student organizations or with the Mid Pac competitions?
When I was at UT we had this student organization I was really involved in called the American Concrete Institute. I noticed there's not a chapter here at Sac State, so I'd be interested in finding some students and seeing if they're up for the task of starting a chapter. It would be very beneficial for them in order to increase networking opportunities, travel to conferences, and participate in student competitions.

How has your experience been so far at Sac State?
I've been super busy developing course materials, but really enjoying it. It doesn't even feel like work most of the time.

What do you hope to accomplish with your students?
My first priority is to prepare them, depending on what path they want to follow. If it's a career in practice as an engineer, I want to be able to teach them everything they need to know so they can start contributing to their employer on the first day. But for the students interested in grad school, I want to provide them the tools necessary to succeed in grad school. I think that's very important if they choose to pursue that route.

MASOUD GHODRAT ABADI, PH.D.

"Here at Sac State, everything is alive, students are active, it's a dynamic environment. Given that this is a teaching-based institution, we put a lot of energy on student learning and one-on-one interaction in classrooms. I really enjoy that and I like that part of Sac State."

— Masoud Ghodrat Abadi

Your focus is transportation engineering. What kind of research have you performed?

In the first part of my research, which formed my dissertation, I worked on active transportation: bicyclists and their needs in terms of transportation infrastructure, and whether we can improve the safety of bicyclists in dense urban environments by introduction of engineering treatments like warning signs or pavement markings. The second part of my research was on traffic control devices and operations. I was looking into something called dynamic red-light extension at signal intersections. At any intersection there's approximately one second when all the lights are red. No one has green; that's because we want to give the chance to someone who enters the intersection at the end of a yellow light to clear it before a conflicting approach. In many cases that one second is not enough, but sometimes it's more than enough. I worked on a dynamic system that would extend or reduce that time based on the conditions happening within the intersection – customizing it according to traffic patterns.

The third part was transportation engineering education. I was involved in two different projects funded by the National Science Foundation. We were trying to improve the quality of coursework within a transportation engineering classroom to bridge the gap between students and practicing engineers to make students more prepared for the professional workplace.

Where were you before you came to Sac State?

I got my Ph.D. from Oregon State University and got my master's and bachelor's degrees in my home country, Iran.

What made you decide to take the job here at Sac State?

Teaching has always been a dream job for me. It's a family business for us; most of my family are teachers. Even at our family gatherings, we try to give lectures! Teaching has always been a very respectable and important job for me. Also, I had some very close friends in Sacramento. I'm very happy and excited to be here. This is probably the best thing that has happened in my professional life.

What classes will you teach?

Statistics. I'm a transportation guy but I also really enjoy statistics. I'm so happy when I work with numbers, statistics, patterns, using data, or data analysis. I'm teaching two classes in statistics: Engineering Statistics, which is a graduate class; and Statistics for Engineers, which is an undergraduate class. I'm also teaching two labs for CE 147, Transportation Engineering.

Ghazan [Khan] is the main instructor for CE 147. He's been a great help. Whenever I knock on his door he always opens it with a big smile and is very welcoming.

Will you be getting involved with any of the student organizations or with the Mid Pac competitions?

I attended one of the ITE student chapter meetings. Ghazan is now the faculty advisor for ITE and we hope that after I get familiar with the student body here and how things are working, I probably would start as faculty advisor. I was president of our student chapter of ITE back at OSU. I know about the relationships with the national ITE and I have good ideas about how to run the organization.

"Teaching has always been a very respectable and important job for me."

— Masoud Ghodrat Abadi

How has your experience been so far at Sac State?

My family and I moved to Sacramento at the end of June. It's been great, I really like the vibrant environment at Sac State. It gives me a great feeling. I've been a student for 23 years and finally this fall I moved to the other part of the room as faculty. Here at Sac State, everything is alive, students are active, it's a dynamic environment. Given that this is a teaching-based institution, we put a lot of energy on student learning and one-on-one interaction in classrooms. I really enjoy that and I like that part of Sac State.

Everyone has been very friendly and I've had very good support. We had a wonderful five-day orientation that covered everything we need, and everyone from the faculty has been very helpful.

What do you hope to accomplish with your students?

Something I'd really like to see in the future is developing my own research agenda and then involving students in that research. I believe when students are working on real-world research problems, it will help them better understand the core concepts of transportation engineering.

Graduate Student Projects
▶ APPLIED PROBLEMS

THE STUDENT | KATIE DUNCAN
(MS '17)

Originally from Grass Valley, she holds a Bachelor of Science in environmental systems with a focus in biology from UC San Diego. After receiving her bachelor's degree, she served for a year with AmeriCorps, assigned to the UC Davis Tahoe Environmental Research Center conducting education and outreach. Katie now works at Stantec.

The Problem | Land subsidence in the California Delta wetlands: In the 1800s, levees were built and the land was drained and used as farmland; decades of crop tilling, planting and harvest caused oxidation that reduces the land to 10-20 feet below sea level. This ongoing subsidence has implications for flooding should levees fail, and for saltwater intrusion that could affect the fresh water supply to nearly 25 million Californians.

Real-World Connection | Now overseen by a collaboration of local, state and federal government entities, the organically rich Delta wetlands are a magnet for research endeavors; and sometimes, political and economic interests. Halting or reversing subsidence is a goal being pursued by California Climate Investments through $10 million in Cap-and-Trade funds to restore Sherman Island, which is adjacent to Twitchell Island, where Katie conducted her research.

The Background | "In 1997 the U.S. Geological Survey (USGS), as part of a study to look at how to reverse subsidence and restore these natural wetlands in some areas, established Research Ponds West and East," says Katie. "They looked at different control methods such as flooding the area or letting it drain; density of planting; and depth of flooding [to try to determine] which conditions would allow for the quickest rate of reverse subsidence."

Since then, the wetlands have expanded and research on them has grown exponentially, with a lab in Berkeley regularly measuring gas flux exchanges at the wetlands. "I think that's how Dr. [Cristina] Poindexter got involved working at the site," says Katie. More recently, "she received grant money to look at how the hydraulics within the wetlands actually affect them. Previous studies had just looked at depth influence or vegetation density influence on rates of subsidence reversal."

Around the time Dr. Poindexter began her grant research, she offered her students the opportunity to join her on the project and receive course credit for independent study (CE 290). With her background in environmental biology, the Delta wetlands project felt like a great match, so Katie jumped at the chance. The paper Katie wrote for the independent study she performed under Dr. Poindexter's advisement served as a foundation for her master's project (CE 500).

The Project | "The Interaction of Wetland Hydraulics and Land Subsidence Reversal in a Sacramento-San Joaquin Delta Wetland" by Katie Duncan

"There's an inlet on one corner of the wetland and an outlet on another, and you assume when water goes in, it just uniformly flows out," says Katie. "But in reality, it pools in certain areas and flows faster in others, so we were looking at how those different kinds of flow and hydraulic characteristics affected how quickly the land elevation was rising, which is synonymous with subsidence reversal."

Katie and Dr. Poindexter took measurements from established piers on Twitchell Island, using a velocimeter to determine how fast the water was moving in certain areas over the course of several months.

"We used two measurements: there's one instrument you leave there for 10 minutes to measure velocity," says Katie. "Another one can be left for three or four days so you can see if there are velocity patterns, like diurnal patterns from day to night."

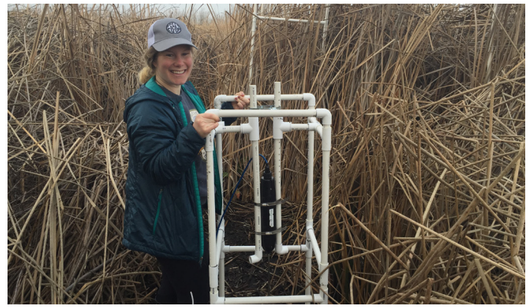
They also measured flow with a tracer release: adding rhodamine dye to the water to measure the direction and speed of water flow. "You'd assume a mass of dye would travel all together from inlet to outlet, but it pushes faster in some spots and slows down in others," says Katie. "If you release a mass at the inlet you see that same mass maybe two days later at the outlet. You see a slow distribution of dye coming through; from that distribution you can tell how long the water stays in."

Challenges | "The wetlands are now managed by a land resource conservation district and they pump water from the river through a series of these managed wetlands, and sometimes they just turn the water on and off," says Katie. "So you could be conducting an experiment with constant conditions and you set something up, come back a week later and the water is off. We worked with the managers there to control it as best we could."

Another challenge was access to the site: after 20 years, the access set up by the USGS is aging, so obtaining uniform measurements throughout the site proved difficult.

The End Result | "We worked with a consulting company to take land surface elevations of measurements of the wetlands using a rod sedimentation elevation table, averaging measurements taken from four different directions," Katie says. They compared previous and current measurements to determine land surface gain.

"Our results showed that hydraulics within the wetlands have an effect on subsidence reversal," says Katie. "We also determined that access to the wetland may necessitate an innovative data collection approach, like drones, to get a more uniform collection."



The Faculty Advisor | "Katie had to deal with unexpected results and data," said Dr. Cristina Poindexter, Katie's faculty advisor. "There were logistical challenges, but she worked hard and was very persistent in fighting to get the data. I've since done other research and found similar results. I've been working on a grant proposal, and having that experience working with Katie made my proposal better."

The Takeaway | Katie's CE 500 project gave her a unique experience that serves her current job, and the chance to work with a professor she admires.

"It's refreshing to have a female mentor and guide who is doing research and teaching," says Katie. "You can tell how dedicated she is to wanting her students to learn. I was impressed how much she let me take the lead and guide the project."

As for the project itself, "Working in the Delta gave me experience in writing, data collection and project management," she says. "All good skills that are necessary for a career – that's what a graduate project is supposed to provide. California has such a complex water system, and the Delta controls a lot of upstream watersheds, so having experience in that gives context to the entire [water] system."

Graduate Student Projects
▶ APPLIED PROBLEMS

THE STUDENT | JOHN HELTZEL
('14, MS DECEMBER '18)

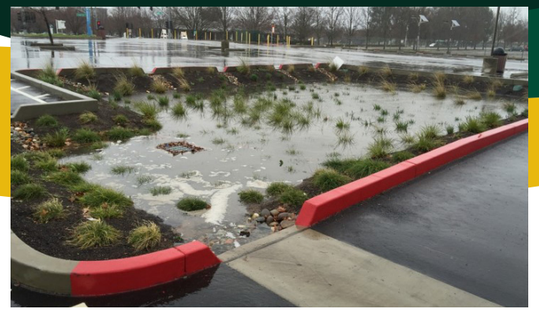
While studying for his bachelor's degree, John worked part-time for Placer County Water Agency (PCWA) and the Sacramento Area Sewer District (SASD). After graduation, he worked with a private consulting firm performing treated water and water efficiency studies. For the past four years he's been an assistant research engineer at the Sacramento State Office of Water Programs (OWP).

The Problem | How do you measure the benefits of implementing sustainable stormwater infrastructure such as rain gardens and permeable pavers in an established neighborhood?

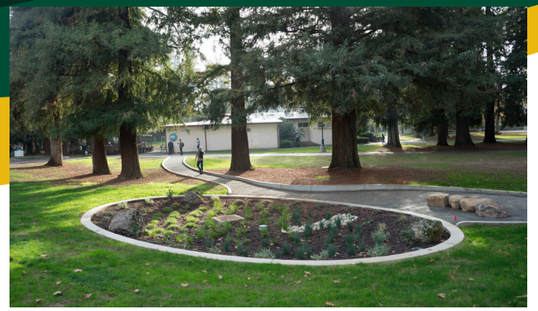
Real-World Connection | The Davis Manor Neighborhood Association needed help. The residents of this 1950s-era neighborhood in Davis wanted to explore "green" stormwater infrastructure that might reduce some local flooding problems and recharge groundwater. Kevin Perry, a Davis landscape architect, helped the group lay out schemes involving rain gardens, new tree plantings, and a central plaza with pervious pavement. In early 2018 the neighborhood council wanted to apply for a California Natural Resources Agency Urban Greening Grant. Kevin and the City of Davis helped in layouts and cost estimates, but it needed a way to estimate the environmental benefit of the project for the application.

The Background | Traditional stormwater management focuses on transporting runoff away from neighborhood streets to a local water body as quickly as possible to avoid flooding. "As an engineering community, we're in the process of rethinking our strategy on stormwater management," says John. "Water quality is an issue because you're potentially transporting stormwater pollutants directly to our waterways." Also the impervious surfaces like rooftops, sidewalks, and roads in urban development increase runoff volumes and flows, which have the potential to increase flood risk. "Over time, higher peak flows generated by impervious surfaces like pavement can alter natural stream beds by increasing erosion," according to John. "Now the thought is to keep as much of the water onsite as you can and give it an opportunity to return to the groundwater in a way that mimics natural systems. This is called Low Impact Development (LID)." LID practices such as rain gardens, bioretention filters, and permeable pavers filter out pollutants like metals, sediment, pesticides, and oil and grease, thereby improving water quality. Cleaned-up water is then allowed to percolate into the ground, which recharges groundwater.

You might say that John does stormwater for a living. At OWP he works on a variety of stormwater-related projects for agencies such as Caltrans and California State Parks. In 2015, the City of Sacramento, OWP, and Sacramento State received $2.6 million in Proposition 84 funds from the State Water Resources Control Board to install more than 20 rain gardens and bioretention planters plus a "green street" consisting of permeable concrete pavement on the campus. The project demonstrates the LID options that are in the Sacramento Stormwater Quality Partnership design manual for Sacramento County and the cities of Sacramento, Citrus Heights, Elk Grove, Folsom, Galt and Rancho Cordova. John was actively involved with collecting water quality samples and monitoring flow during storm events to measure the effectiveness of the facilities.



› *A bioretention planter on the Sacramento State campus.*



› *A rain garden on campus at Sacramento State.*

The Project | "Modeling Low Impact Development (LID) in an Urban Retrofit Scenario: A Case Study at Davis Manor" by John Heltzel

The project suggestion came from Dr. John Johnston, who, as a member of the Davis Natural Resources Commission, was aware of the neighborhood's need. "I saw an opportunity here for John to expand his skill set and finish his MS degree while helping the city and the neighborhood," said Dr. Johnston.

"My project takes Kevin Perry's conceptual design and develops a stormwater runoff model of the neighborhood with an EPA program called SWMM (Storm Water Management Model)," says John. "The program takes rainfall data you input and generates runoff volumes based on how you characterize the drainage areas within the neighborhood. I divided the neighborhood into different drainages and modeled runoff volumes under current conditions and with different levels of LID installed in the neighborhood."

John obtained maps of existing stormwater infrastructure from city staff. "Davis has a variety of mapping data publicly available," says John. He then divided the neighborhood into different drainages and characterized the surfaces within those areas. "The model looks at imperviousness, or nonporous surfaces like rooftops, driveways and roads," says John. "Davis had online files with roadways mapped, as well as edges of pavement and sidewalks. I combined those resources with satellite imagery online to characterize the imperviousness of the neighborhood. Of course, I had to field-check everything by walking the neighborhood as well."

Using 30 years of rainfall data that was entered into SWMM, John created a pre-project model that simulated the existing conditions in the neighborhood. Next he modeled Kevin Perry's design for the neighborhood to quantify the reduction in overall runoff as a result of increased infiltration and evaporation. Under Dr. Johnston's guidance he also analyzed several other alternatives with lower densities of LID placement. "Retrofitting LID in an existing neighborhood is tremendously expensive," notes Dr. Johnston. "We want to see how much 'bang for the buck' we can get in implementing different levels of LID."

Challenges | "Well, learning SWMM in a hurry was a challenge," says John with a smile. "There was not much time to generate the information needed for the grant application. Fortunately, the grant focused on only a few streets within the neighborhood and I could go back and expand the model later."

In practice, installing rain gardens, bioretention planters and the like can be problematic for existing communities, because they take up space already allocated for other purposes like parking, which may not be popular with residents. Also, retrofitting existing infrastructure is much more expensive than incorporating LID into new construction. Funding is a tremendous challenge.

The End Result | Sadly, the Davis Manor proposal was not funded. Nevertheless, John's model will be a useful tool for planning future projects as funding becomes available. For instance, the model shows that significant reductions in runoff can be achieved by simply capturing rooftop flows in front yards rather than sending them to the street. John is planning to present the results to the neighborhood association soon.

The Takeaway | "There's lots of energy among citizen groups for environmental and infrastructure issues," says Dr. Johnston. "What they often lack is technical knowledge and resources, which our students have. When conditions are right, as in this case, working together can be a win for both."

N&N News & Notes

Alumni

2016

Virgil Tenoso, PE ('16), is working at Geosphere Consultants, Inc., a geotechnical consulting firm in San Ramon, where he performs QA/QC on construction sites and conducts geotechnical investigations, "which involves collecting/logging soil samples and assisting our geotechnical engineers on preparing geotechnical reports," says Virgil. "Most of the work we do is usually for schools (Division of the State Architect), hospitals (Office of Statewide Health Planning and Development), public, commercial and also residential jobs." Here's a picture of Virgil on the site of Dougherty Road improvements in Dublin.

Hasib Mohabbat, PE ('16), is having a "fantastic" time since graduating from Sacramento State. He began working for Kiewit almost immediately and he's currently assigned to the emergency repair of the Oroville Dam – taking on a massive workload but gaining a wealth of knowledge. "This project is truly like no other, and I am glad that I was given the opportunity to be part of such an important, fascinating project," says Hasib. In this photo he's posing at the Folsom Dam Phase 4/5 project.

Ava Yaghoobirad, PE ('16), is enjoying her work as an Air Resources Engineer for the California Air Resources Board. "I'm leading the Clean Mobility Options pilot projects, [such as] car and bike sharing, to benefit residents in disadvantaged communities," says Ava. She's also working on a solicitation to be released this fall seeking a statewide administrator to help local communities and neighborhoods more easily access state funds for clean mobility options projects, as well as lead an effort to understand project successes, address areas for potential modifications, and develop policy guidance on best practices. "I am always proud to be a Sac State alumnus, and I'm proud of all my accomplishments!" says Ava.

Faculty

Dr. Julie Fogarty recently led the Sacramento State chapter of the Earthquake Engineering Research Institute (EERI) to an impressive finish in the annual student Seismic Design Competition that took place in Los Angeles in June.

"Our team got 13th out of 40 teams overall," said Dr. Fogarty. "They were third in predicting the behavior of a structure under first ground motion. They were really excited."

About a dozen students made the trek to L.A., with travel expenses covered by fundraising the EERI campus chapter did over the past year. Each year, the main goal of the competition remains the same: to build a structure out of balsa wood and then subject it to tests on a shake table to see if it will stand. But there's always a unique twist, and this year it was designing a structure in which the ground floor is much taller than the others.

The competition is entirely run by graduate students, and the judges are industry professionals or faculty from schools not participating in the competition. With both an oral and poster presentation, the EERI Student Design Competition provides opportunities to practice vital skills. "Each year the students have done a better and better job of communicating with each other in terms of keeping this going, improving, and communicating their results at the competition," said Dr. Fogarty.

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