

CE 110: Water Systems of the Future
Course Syllabus
Spring 2025

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Lecture¹ MWF 2-3 PM, 502 Davis Hall

Discussions* Tu 4-5 PM, 502 Davis Hall
W 4-5 PM, 502 Davis Hall

Office Hours* Wed 12:00 - 1:00 PM (Dr. Stokes-Draut, 537 Davis Hall)
Thu 3:00 - 4:00 PM (Vera Luu, 305 Davis Hall)
Fri 10:30 - 11:30 AM (Prof. Nelson, 663 Davis Hall)

Course website: You should have access to the class site when you log in to [bCourses](#). We will be using bCourses to manage most aspects of the class so you should plan to check it regularly.

Course introduction: The water and wastewater systems that serve human populations are diverse, complex, expensive, and have long lifetimes. The infrastructure (reservoirs, canals, pipe networks, treatment plants) also has significant impacts on the environment (modification of ecosystems, energy and materials use, greenhouse gas emissions, nutrient cycles). An interdisciplinary understanding is needed to design and manage these systems to provide equitable and affordable access while meeting the needs of urban, agriculture, and energy systems in the face of challenges from population growth and environmental change. US water systems need major investments, while in many parts of the world adequate infrastructure has not yet been built. This context presents exciting opportunities to integrate innovative technologies, institutional arrangements, policies, and financial structures. What should water systems of the future look like? To address this question from an interdisciplinary perspective, this course will explore key scientific, technical, environmental, economic, political, and social aspects of water systems.

Specific objectives for the course are:

1. Provide overview of the complex infrastructure systems that are used to supply and manage water and wastewater, including the One Water paradigm.

¹ Lectures and discussion sessions will be recorded via “course capture” and the recordings will be posted to bCourses, usually within 24 hours. Office hours via zoom can be arranged in advance if you contact the instructor.

2. Introduce the technologies that are currently in use for treating and managing water and wastewater, as well as innovations that have the potential to dramatically change water infrastructure.
3. Explore the innovation ecosystem in the water sector, its opportunities and challenges, and analyze case studies.
4. Provide overview and examples of concepts and methods for analyzing the sustainability of water systems.
5. Consider costs and tradeoffs in water supply planning under uncertainty for real-world water systems.
6. Critically evaluate water planning and innovation potential for real-world utilities given future uncertainties and competing priorities.

Grading	10%	Reading quizzes
	10%	Participation
	30%	Homework assignments
	20%	Midterm exam (tentative date Mon, March 17, in class)
	30%	Final exam (Tues, May 13, 11:30 – 2:30, location TBD)

Health: If you are ill, please do not attend lecture or discussion. Instead, watch the recorded class sessions, which will be posted to bCourses (usually within 24 hours). Excused absences due to illness will not affect your participation grade. To request an excused absence, you must email Dr. Stokes-Draut with the “Subject line: CE110 Attendance”.

If you have cold symptoms but have tested negative for COVID, please wear a mask to prevent transmission of your “regular” cold to your classmates and instructors.

Participation: Your participation in class and discussions is expected! There are many ways to participate, but your participation grade is based on completing questions asked during class and discussion (using polls). If you attend and answer questions during $\geq 90\%$ of lectures and discussions, you will receive 100 points (for the semester). If you attend and answer questions during less than 90% of lectures and discussions, the points you receive is equal to the fraction of lectures and discussions attended. For example, if you attend 42/50 lectures, you will receive 84 points. If you will miss class due to an illness (see above), family emergency, or a school/work-related conflict you must email Dr. Stokes-Draut with the “Subject line: CE110 Attendance”.

Discussion attendance: Attendance and participation in discussion sections is mandatory (see participation grade). Please attend the discussion section that you are registered for.

Readings: There are reading assignments for (almost) every lecture. You are expected to read the material before coming to class. Reading assignments will be posted to bCourses at least one week in advance. The readings are essential to your learning throughout the course. They provide background that we will build on in lecture and be used as the basis for discussions.

Reading quizzes: You will take a short reading quiz before class to assess your understanding of the reading material. If you respond correctly to $\geq 90\%$ of the reading questions over the course of the semester, you will receive 100 points (for the semester). If you respond correctly to $< 90\%$ of questions, the points you receive is equal to the fraction of correct answers. For example, if you answer 64/100 questions correctly, you will receive 64 points.

Homework assignments: There are homework assignments *almost* every week. Homework will *typically* be assigned on bCourses every Friday and will be due the next Friday by 11:59 pm, unless other instructions are provided. Assignments will be turned in electronically via bCourses or Gradescope, unless otherwise specified. You may need to create a Gradescope account if you haven't done so previously, using the link on bCourses. You are responsible for ensuring the electronic files submitted to Gradescope are complete and readable.

Homework assignments will consist of four types of activities:

- Calculations and analysis to build your problem-solving toolbox.
- Analysis related to a specific Urban Water Management Plan (UWMP).
You will be assigned a specific UWMP for a water supplier in California during the third week of class. Some assignments will ask you to review or analyze information related to your UWMP. Many of these will be group assignments.
- Group project on your UWMP. You will work with the other students that have the same UWMP to synthesize information about your system and propose innovative strategies embracing the One Water approach. During the last few weeks of class, you will prepare a short video presentation to showcase your ideas for the rest of the class.
- Reading and commenting on water-related news. Some assignments will ask you to post a news article related to water systems on bCourses. You will also comment on other news stories that have been posted and discuss them in discussion section.
- Reflections. You will respond to open ended prompts that provide an opportunity to reflect on what you are learning and the learning process.

Late policy for assignments: Late assignments will be docked 20% for each additional day they are late. If you need an extension on an assignment due to an illness, family emergency, or a school/work-related conflict, email Dr. Stokes-Draut with the "Subject line: CE110 HW Extension".

Exams: Exams will consist of short- and long-form questions. Some will require quantitative calculations (similar to problems in homeworks) and the rest will be based on material from readings, lectures, and assignments. Sample exam questions will be provided in advance to help you prepare.

Course Policies

Inclusion: We are committed to creating an environment welcoming of all students where everyone can fulfill their potential for learning. To do so, we intend to support a diversity of perspectives and experiences and respect each others' identities and backgrounds (including

race/ethnicity, nationality, gender identity, socioeconomic class, sexual orientation, language, religion, ability, etc.). To help accomplish this:

- If you feel like your performance in the class is being impacted by a lack of inclusion, please contact the instructors, an academic advisor, or the departmental Faculty Equity Advisor (<https://engineering.berkeley.edu/about/equity-and-inclusion/faculty-equity-advisers/>). An anonymous feedback form is also available at <https://engineering.berkeley.edu/about/equity-and-inclusion/feedback/>.
- If you feel like your performance in the class is being impacted by your experiences outside of class (e.g., family matters, current events), please don't hesitate to come and talk with the instructor(s) or academic advisors in Engineering Student Services. We want to be a resource for you.
- There is no tolerance for sexual harassment or violence. If your behavior harms another person in this class, you may be removed from the class or the University either temporarily or permanently.
- You may designate a preferred name and pronouns for use in the classroom at: <https://registrar.berkeley.edu/academic-records/your-name-records-rosters>.
- As a participant in this class, recognize that you can be proactive about making other students feel included and respected.

Accommodation policy: We honor and respect the diversity in our student body, and thus are committed to ensuring you have the resources you need to succeed in our class. If you need accommodations that provide equitable access (e.g. religious observance, physical or mental health concerns, insufficient resources, etc.) please check <https://diversity.berkeley.edu/> and, if needed, discuss with your specific case with us. The disabled student program is a related resource, listed below.

Berkeley honor code: Everyone in this class is expected to adhere to this code: "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."

Collaboration: You are encouraged to form study groups and work together to understand course material, but all written work as well as responses to in-class questions should be your own. You may not copy other students' work. Academic integrity and ethical conduct are of utmost importance in the College of Engineering and at U.C. Berkeley.

Student Conduct: Ethical conduct is of utmost importance in your education and career. The instructors, the College of Engineering, and U.C. Berkeley are responsible for supporting you by enforcing all students' compliance with the Code of Student Conduct (<https://sa.berkeley.edu/code-of-conduct>) and the policies listed in the CoE Student Guide (<https://engineering.berkeley.edu/students/undergraduate-guide/policies-procedures/>). The Center for Student Conduct is your central source for guidance in these matters (<https://sa.berkeley.edu/conduct>).

Email: We will do our best to respond to emails quickly, but we can only guarantee a response within 48 hours. Please do not expect us to respond to last minute emails right before assignments are due. Substantive questions should be saved for class or office hours.

Grading questions: All questions about grades should be directed to Prof. Nelson or Dr. Stokes-Draut (not the TA).

Technology policy: Use of laptops, phones, tablets etc. for purposes not related to class is not allowed in lecture or discussion.

Approximate course outline

Week	Topic
1	History and current status of water systems
2	What do we want water systems of the future to look like? Opportunities and challenges of water innovation
3	Innovative approaches to managing surface water and groundwater
4	Water justice; drought and climate change; water institutions & policy
5	Energy use; conservation
6	Water quality; drinking water and wastewater treatment
7	Water quality: wastewater treatment
8	Water reuse (non-potable and potable) and desalination
9	Resource recovery from wastewater (energy, nutrients, feedstocks); decarbonization
10	Costs and pricing; Communication in the water sector
11	Sustainability metrics; Stormwater capture and green infrastructure
12	Energy, food, and special issues
13	Data and planning
14	Case studies and discussion

COLLEGE AND CAMPUS RESOURCES

For academic performance:

The Center for Access to Engineering Excellence or CAEE (325 Davis Hall <https://engineering.berkeley.edu/student-services/academic-support>) is an inclusive center that offers study spaces, nutritious snacks, and tutoring in >50 courses for Berkeley engineers and other majors across campus. The Center also offers a wide range of professional development, leadership, and wellness programs, and loans iclickers, laptops, and professional attire for interviews.

For disability accommodations:

The Disabled Student's Program (DSP 260 César Chávez Student Center #4250; 510-642-0518; <http://dsp.berkeley.edu>) serves students with disabilities of all kinds, including temporary disabilities (e.g., broken arm impacting ability to write). Services are individually designed and based on the specific needs of each student as identified by DSP's Specialists. If you have already been approved for accommodations through DSP, please know that DSP is ready to quickly adjust your accommodations if your situation changes.

For mental wellbeing:

Counseling and Psychological Services (CAPS, <https://uhs.berkeley.edu/caps>) is available as part of University Health Services (the Tang Center). Services are offered at many locations, including on-site in the College of Engineering (<https://engineering.berkeley.edu/students/advising-counseling/counseling/>). CAPS services are available to all students, regardless of insurance, and initial visits do not cost anything. CAPS has expanded allowing students to receive help immediately with same-day counseling (510-642-9494), online resources, and a 24/7 counseling line at (855) 817-5667. Short-term help is also available from the Alameda County Crisis hotline: 800-309-2131. If you, or someone you know, is experiencing an emergency that puts their health at risk, please call 911.

For basic needs (food, shelter, etc):

The Basic Needs Center provides housing, food, transportation support, among other support needed to thrive at UC Berkeley. <https://basicneeds.berkeley.edu/> Specifically, the UC Berkeley Food Pantry (#68 Martin Luther King Student Union; <https://pantry.berkeley.edu>) aims to reduce food insecurity among students, especially the lack of nutritious food. Students can visit the pantry as many times as they need and take as much as they need while being mindful that it is a shared resource. The pantry operates on a self-assessed need basis; there are no eligibility requirements. The pantry is not for students and staff who need supplemental snacking food, but rather, core food support.

For solving a dispute:

The Ombudsperson for Students (102 Sproul Hall; 642-5754; <http://students.berkeley.edu/Ombuds>) provides a confidential service for students in need of a neutral party to resolve University-related disputes (academic or administrative). The Ombudsman can provide information on policies and procedures affecting students, facilitate

students' contact with services able to assist in resolving the problem, and assist students in complaints concerning improper application of University policies or procedures. All matters referred to this office are held in strict confidence.

For recovery from sexual harassment or sexual assault:

The Care Line or the PATH to Care Center (510-643-2005; <https://care.berkeley.edu/care-line/>) is a 24/7, confidential, free, campus-based resource for urgent support around sexual assault, sexual harassment, interpersonal violence, stalking, and invasion of sexual privacy. The Care Line will connect you with a confidential advocate for trauma-informed crisis support including time-sensitive information, securing urgent safety resources, and accompaniment to medical care or reporting.