CEE 5984 Urban Water Sustainability

The Charles E. Via, Jr. Department of Civil and Environmental Engineering
Virginia Polytechnic Institute and State University
Spring Semester, 2019

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Office Hours: Tuesday/Thursday from 1-2 for students at OWML (otherwise please call or send questions by e-mail)

Course Description

Catalog Description: Topics in urban water sustainability, including climate change and the supply of freshwater, benefits and co-benefits of stormwater capture and reuse, decentralized water and wastewater treatment systems, fit-for-purpose water, wastewater recycling, and environmental water needs. All topics in urban water sustainability will be addressed through a coupled social-ecological-engineering lens.

Prerequisites: Background in any of the following - environmental engineering, hydrology, socio-hydrology, ecology, social ecology, or consent of instructor


Other reading: Additional reading material (peer reviewed journal articles) will be available for download through Canvas.

Course notes: Lecture notes will be available periodically through Canvas.

Educational Objectives

The objective of this course is to enable students to think critically about urban water systems, and how they can be made more resilient to current and future challenges such as climate change, environmental degradation, and population growth. After completing this course, a student will be familiar with issues of urban water scarcity, resilience, reliability, vulnerability, and sustainability as well as hard and soft path approaches for urban water infrastructure.

Topics and Reading Assignments (subject to modification)
Module 1 - Lectures 1-3: Urban water systems from Ancient Rome to modern-day Los Angeles and Melbourne.

Reading for Lectures 1-3:
Textbook: Water 4.0, pp. 1-89;
Peer Reviewed Article:

Module 2 - Lectures 4-8: Feedback loops, drought, and examples of ancient and modern societies that have thrived or collapsed in the face of water scarcity.

Reading for Lectures 4-8:
Textbook: None
Peer Reviewed Articles:

Module 3 - Lectures 9-11: Frameworks for understanding coupled human and natural water systems (from feedback loops to quantitative models).

Reading for Lectures 9-11:
Textbook: Water 4.0, pp. 90-138;
Peer Reviewed Literature:

Module 4 - Lectures 12-15: Minimizing the human and ecological impacts of urban water systems.

Reading for Lectures 12-15:
Textbook: Water 4.0, pp. 139-186;
Peer Reviewed Articles:
4) Price vs non-price incentives (reading to be determined)
Module 5 - Lectures 16-19: Hard Path and Soft Path solutions for satisfying urban water demand. *(Key Concepts: Water productivity; Green vs Grey; Hard vs Soft path; Multi-objective design/modeling)*

Reading for Lectures 16-19:
*Textbook:* Water 4.0, pp. 187-216;
*Peer Reviewed Articles:*
5) Daly et al. (2012) “Modelling of stormwater biofilters under random hydrologic variability: a case study of a car park at Monash University, Victoria (Australia)

Module 6 - Lectures 20-23: Ecosystem services (co-benefits) and disservices of natural and engineered ecosystems

Reading for Lectures 20-23:
*Textbook:* Water 4.0, pp. 217-237;
*Peer Reviewed Literature:*

Module 7 - Lectures 24-29: Global assessment of water scarcity, resilience, reliability, vulnerability, and sustainability

Reading for Lectures 24-29:
*Textbook:* Water 4.0, pp. 238-272;
*Peer Reviewed Literature:*

**GRADING POLICIES**

**Course Grade:**
- Take-Home Projects – Module-based (2) .......................................................... 15%
- Take-Home Project – Comprehensive (1) ......................................................... 15%
- Short Quizzes (daily) ..................................................................................... 50%
- Final Exam ..................................................................................................... 20%
- Classroom Participation .................................................................................. up to 5% extra credit

**Take-Home Projects (Module-based and Comprehensive)**

At the graduate level, three take-home projects will be assigned for the course (e.g., for Modules 2 and 6, as well as a comprehensive project due at the end of Module 7). Project prompts (and due dates) will be made available on Canvas. Completed projects should be submitted online (through Canvas), and must be turned in by midnight on the due date. Late projects will be penalized by 1 letter grade for each day they are late.

You may work with other students on your take-home projects. However, each student must prepare their own diagrams, writing, assessment, and other work for each assignment. You may not copy another student's work. Duplicate assignments will result in an F on the project for both parties.

**Quizzes (daily – final scores will be calculated from the top 20 quizzes for graduate students)**

Short quizzes on the required reading (≤ 10 multiple choice questions) will be given at the start of each lecture. These quizzes will be closed book and implemented online in Canvas. You will need to bring a laptop, smartphone or other device through which you can access Canvas in order to take the quizzes. Quizzes will open automatically at the start of class and time out automatically after 10 minutes. The password to access each quiz will be given at the start of class. If you miss a quiz or are late to class and do not finish a quiz in time you will not have the opportunity to make up that quiz. The missed quiz will count towards the 8 quiz scores that are not included in your final quiz total.

**Final Exam**

The final exam will be closed book and comprehensive. It will focus on material covered in lecture, which closely follows the assigned reading. 50% of questions will be pulled from quizzes and the remainder will be new. The final will be implemented in Canvas, and therefore you will need to bring a laptop, smartphone, or other device through which you can access Canvas in order to take the Final.

**COURSE POLICIES**

**Principles of Community:** The Virginia Tech Principles of Community are intended to increase access and inclusion and to create a community that nurtures learning and growth for all of its members. They are defined at: inclusive.vt.edu
**Honor Code:** All students must adhere to the Honor Code Policies of Virginia Tech. For information about the Graduate Honor System of Virginia tech, please visit [graduateschool.vt.edu/academics/expectations/graduate-honor-system.html](http://graduateschool.vt.edu/academics/expectations/graduate-honor-system.html). Any suspected violations of the Honor Code (plagiarizing published work, copying another student's work, cheating on exams, etc) will be promptly reported to the honor system. Honesty in your academic work will develop into professional integrity. The faculty and students of Virginia Tech will not tolerate any form of academic dishonesty.

**Attendance Policy:** Daily attendance is expected and required to receive credit for in-class quizzes. Participation during lecture is encouraged, and worth up to 5% extra course credit.

**Accommodations:** Students are encouraged to address any special needs or accommodations with me during the first two weeks of the semester, or as soon as you become aware of your needs. Those seeking accommodations based on disabilities are required to obtain a Faculty Letter from the Services for Students with Disabilities office in Lavery Hall ([www.ssd.vt.edu/](http://www.ssd.vt.edu/)).

If you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please make an appointment with me during the first two weeks of the semester or as soon thereafter as you become aware of the need.