Course Syllabus

ISEN 470 – Sustainability in Water and Wastewater
Fall 2021

Northwestern University

Instructors:
Professor: Patrick J. Boyle
Faculty Sponsor: George Wells
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https://www.mccormick.northwestern.edu/research-faculty/directory/profiles/wells-george.html

Office Hours: By appointment

Site Visits: The class will aim to visit at least 1-2 water related facilities including the City of Evanston Water Treatment plant on Lincoln Avenue. Additional field visits will be confirmed with / arranged by the instructor.

Class Room: Tech L168

Class Timing: Thursday evenings from 6 to 8:50 pm, October 28 – December 2, 2020

Recording of Synchronous Remote Class Sessions
This class or portions of this class will be recorded by the instructor for educational purposes. These recordings will be shared only with students enrolled in the course and will be deleted at the end of the Spring Quarter. Your instructor will communicate how you can access the recordings. Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact AccessibleNU. Unauthorized use of classroom recordings — including distributing or posting them — is also prohibited. Under the University’s Copyright Policy, faculty own the copyright to instructional materials — including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

Course Synopsis: This class will provide an introduction to the economics, technology and regulation that drive water and wastewater markets. As a 5-week class, this is a survey of the major issues that exist and a discussion of opportunities to drive to more sustainable water systems.

Course Goals: Students will build a foundation in:
• Key Concepts & Terminology in the water and wastewater industry
• The basic science of water systems (high level) and critical components of the water “supply chain”
• Primary stakeholders in water systems at the global and US market levels – including providers of water / wastewater services, regulators and end users
• Major trends and issues in water systems (globally, but deeper dive in N. America)
• Emerging sustainable technology / policy / business model innovation in water
• Key questions, measurements, tools & resources to be used when considering water sustainability

Students interested in any sort of sustainability, manufacturing, food or water disciplines should strongly consider this course. It will offer basic literacy in the water issues of our day and will help students identify areas for further study given their interests or career path.

This course will require an ability to understand basic scientific concepts (hydrologic cycle and its connection to climate), technical solutions to drive water efficiency / sustainability and a basic understanding of government to internalize the regulatory environment but in general there are no prerequisites. As many students will not have deep knowledge of water systems and sustainability topics, the reading list is significant. Students are expected to complete readings prior to class. Please refer to the reading list for primary texts that will be used for the class. There will also be supplemental readings, including articles and essays, that will be provided by the instructor.

As part of the class, we will have a series of guest panels and lectures by business professionals from a variety of stakeholders that work in the sustainability field. Particular focus will be placed on the practical reality of how to assess and implement solutions in water.

**Grading/Assessment:**

Grading will be based on the following rubric:

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<tr>
<th>Component</th>
<th>Weight</th>
<th>Details</th>
<th>Due</th>
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<tbody>
<tr>
<td>Case Write Ups</td>
<td>40%</td>
<td>Two write ups on key questions from case studies to answer key questions.</td>
<td>Week #2, 4</td>
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<td>*Write ups should be turned in before class discussion on the case</td>
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<tr>
<td>Final Paper</td>
<td>40%</td>
<td>Final paper (~8-10 pages) that covers the assessment of a future challenge/opportunity in water or wastewater. The paper should assess the topic from the point of view of: end users, businesses / utilities, government/regulators and technologists</td>
<td>End of course</td>
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<tr>
<td>Preparation &amp; Participation</td>
<td>20%</td>
<td>Based on attendance and instructor assessment of preparation and participation in class on a weekly basis</td>
<td>Ongoing</td>
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**Grading Policy:**
- Grades will be assigned based on all the work you have completed during the semester following the traditional practice of A=90-100, B=80-89, C=70-79, D=60-69, F<60.

**Course Readings:**
The following texts are required for the class. Instructor will specify if only portions of the books are to be read. Other articles and essays will be distributed in class.


**Supplemental Reading List**

- Euler, J. Water reduction and resue in a P&G Beauty Care manufacturing facility, wbcsd, 2017.
- Mianzan, A; Environment Manager Water and Green Infrastructure; Shell Global Solutions Reusing and recycling water in Australia, wbcsd, 2017.
- WaterSense Hospital Installs Water-Efficient Laboratory and Medical Equipment, EPA, July 2014.
- WaterSense Texas Hotel Upgrades to Four-Star Water Efficiency, EPA, July 2014.

**Video Viewings**
Throughout the quarter, students will be required to view videos outside of class time. Videos are available online.

- Al-Attiya, F. *A country with no water*, TED talk, 2012

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1 [https://www.ted.com/talks/fahad_al_attiya_a_country_with_no_water/transcript](https://www.ted.com/talks/fahad_al_attiya_a_country_with_no_water/transcript)
The L’Oréal factory in Settimo Torinese, Italy:  [https://www.youtube.com/watch?v=Zcfp0L0EWeM](https://www.youtube.com/watch?v=Zcfp0L0EWeM)

### CLASS OUTLINE

<table>
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<tr>
<th>Weekly Topic</th>
<th>Description</th>
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| **1**: History & fundamentals of water management | • Water and wastewater: A system overview  
• Economic, technological and policy basics of water  
• Water use trends  
• Environmental regulations and policies  
• Water Energy Nexus  
• Global view of water & translation into N. American systems |
| **2**: Sustainability as applied to Water and Wastewater | • Water risk in business  
• Key measures, risks and opportunities in water / wastewater sustainability  
• Global impacts of water and wastewater  
• Overview of decisions that shape and influence the accessibility, affordability, adequacy of water and sanitation services  
• Outline of specific N. American and global risks in WWW  
**Guest Lecturer: Nestle Waters NA**  **Case Study #1 Assigned** |
| **3**: Impacts of Water and Wastewater | • Environmental Impacts  
• Cost to improve WWW sustainability  
• Gray vs green infrastructure  
• Role of water resource planning  
**Guest Lecturer: SF Public Utilities Division** |
| **4**: Stakeholders & their role | • Government, non-profit, corporates, consumers  
• Engagement principles & challenges  
• Water and wastewater infrastructure  
• PFAS, Crypto, Flint  
• Alliance for Water Efficiency  
**Guest Lecturer: Milwaukee Water Council**  **Case Study #2 Assigned** |
| **5**: Driving to Sustainable WWW | • WASH  
• Sustainable Development Goals  
• Measurements  
• Incentives  
• Politics  
**Final Paper Due** |

There will be no final exam for this class but final papers will be due on scheduled final exam date.