

## **Stormwater Control Systems (CANVAS titles this course: Adv. Stormwater Control for ENV4411)**

ENV 4411 Sections: 12780, 12781, CAMP CANVAS site: <https://ufl.instructure.com/courses/467461>

**Class Periods:** Tuesday and Thursday 10:40 to 12:00 (recording will be uploaded in afternoon after a class period)

**Location:** Lectures are in-class (CSE E118) **and** on-line; UF-EDGE will update the CANVAS site with lectures

**Academic Term:** Autumn (Fall) 2022

### ***Instructor:***

John J. Sansalone, PhD, PE, Professor

jsansal@ufl.edu

352.846.0176

Office Hours: Tuesday/Thursday from 1530 to 1700 through on-line meetings, email communication

### ***Teaching Assistant/Peer Mentor/Supervised Teaching Student:***

- There is no Teaching Assistant/Peer Mentor/Supervised Teaching Student for this class

### ***Course Description***

Chemical, physical, biological and hydrologic aspects of rainfall runoff and control through unit operations and processes (UOPs). Stormwater physical and chemical loads. Interactions between hydrologic processes, water chemistry, sediment transport, infrastructure materials, quantitative maintenance practices and UOPs for treatment and water reuse. 3 credits

### ***Course Pre-Requisites / Co-Requisites***

EES 4201 (Water Chemistry) or instructor permission, Hydraulics, Fluid Mechanics, Spreadsheet and Writing proficiency

### ***Course Objectives***

This course will develop the chemical, physical, biological and hydrologic aspects of rainfall-runoff; and control through unit operations and processes (UOP); commonly called BMPs. This course introduces knowledge of interactions between hydrologic processes; water chemistry, sediment transport, infrastructure materials and UOPs for treatment/reuse. A primary objective of the course is to provide an understanding of constituent physical properties, chemistry and loads; as such understanding can be used to design UOPs for control, treatment and/or reuse. UOP concepts will be evaluated for a spectrum of control conditions ranging from regional, in-situ, source control to low impact development (LID) and infrastructure material modification concepts. Ecological and economic issues for rainfall-runoff control will be presented. Rainfall-runoff, as unique water compared to wastewater or drinking water, will be examined. This course has a design facet and the major component of the course is a student design treatment/reuse project, unless the students want tests as a component.

1. The student will develop an understanding of basic hydrologic processes since hydrology drives load and chemistry, including basic hydrograph concepts and empirical techniques, the rainfall-runoff process and the use of a design storm concept from differing water chemistry and water quantity perspectives. The student will develop an understanding of hydrologic measurements, the quantitative design components of storm sewers and combined storm sewers. The student will be exposed to controls for peak flow, volume and timing attenuation.
2. The student will develop an understanding of physical and chemical aspects of rainfall-runoff including disturbed area runoff. Such understanding will include sources of constituents, temporal distribution, mass loading, dissolved vs. particulate-bound phases and speciation and the importance of Eh-pH diagrams. The student will evaluate the concept of a “water quality volume” in terms of concentration, toxicity and mass.
3. The student will develop an understanding of basic unit operation and process that may be feasible for centralized and in-situ rainfall-runoff treatment. This objective includes introduction (or review) of sedimentation, coagulation/flocculation, adsorption/precipitation, filtration, disinfection, combined processes, and how these UOPs are combined in treatment trains. Issues of operation and maintenance have important implications for treatment and control; therefore, such topics will be discussed in the context of physical, biological, chemical and hydrologic phenomena.

4. The student will develop an understanding of issues related to centralized rainfall-runoff treatment/control in contrast to in-situ treatment, LID, or source control, for treatment and reuse. Actual project and research experience will be brought into the lectures. There will be ongoing discussion of regulation and the use of “presumptive guidance”.

**Materials and Supply Fees**

This class has no materials or supply fees other than submission of a spiral-bound final design report (to accompany the companion digital submission of the final design report) by the student.

**Relation to Program Outcomes (ABET):**

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	High
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

\*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

**Required Textbooks and Software**

- There is no required textbook
- Course notes are developed by the instructor and provided on CANVAS
- In lieu of a textbook, publications, generally as peer-reviewed manuscripts are provided on CANVAS
- The class is designed to utilize software available to students through the University of Florida

**Recommended Materials**

No one book covers this topic adequately; the physical, chemical and UOP topics are still young and knowledge is changing too rapidly; although hydrologic understanding is a good foundation. I will provide selected documents and papers electronically. We will place files on the class CANVAS website and try to organize these as pdf documents to maximize portability and minimize file size. We will review and utilize many journal and reference papers; provided on the course CANVAS site; <https://ufl.instructure.com/courses/467461>.

If you have a technical question that is not overly involved (email is not a good forum and a bit imprecise to address complex questions, but is good for simple questions and clarifications) let us coordinate (through email) an on-line meeting during office hours. I respond to email, but the discussion/chat log that is on CANVAS is for you as students to interact. **I do not debug spreadsheets or unit conversions in spreadsheets**, I give advice on format and organization only. We are in an EDGE classroom, so lectures will be recorded. When I have scheduling conflicts, lectures will be completed and posted through Zoom onto CANVAS.

**Course Schedule** (each topic can cover a lecture week; we will have to return to, or move to, a number of topics as the design projects develop since the design will have iterative and coupled considerations)

1. Introduction to rainfall-runoff quantity and chemistry issues as influenced by anthropogenic activities, the constructed environment and infrastructure materials
2. Unit operations/processes: sedimentation, filtration, adsorption, unsteady water treatment
3. Rainfall-runoff processes, hydrograph models, design storms, hydrologic measurements
4. Design components of, and processes in, storm sewer and combined sewer systems
5. History of urban water pollution, toxicity and treatment; Urban water of Rome: SPQR
6. Engineered controls for rainfall-runoff peak flow, volume and timing attenuation
7. Regulatory developments that influence control, treatment and water chemistry standards, TMDLs (Important current regulatory topic!!), presumptive guidance
8. The quantification of urban rainfall-runoff chemistry parameters and loadings (concentration vs. mass), introduction to the misconception of a first-flush
9. Water chemistry measurements for rainfall-runoff, basic rainfall-runoff and sheet flow transport processes including concepts such as a “water quality volume”
10. Metals, nutrients, speciation (Eh-pH space), pathogens, particle size distributions (PSDs)
11. Treatment unit operations and processes for LID, in-situ treatment, combined sewer treatment, source control vs. centralized treatment, vs. the sustainability of maintenance
12. Passive infiltration treatment of rainfall-runoff (introduction to variably-saturated flow/transport) and the role of urban maintenance for TMDL load credits
13. Concepts of runoff reuse, recycling/banking, urban heat islands, current treatment models, climate change (there is no possible way to cover all of these topics in depth, but we will try and introduce as many of these topics as possible; the reference materials provided will go into much further depth and are useful references for your professional careers as well as needed for your project designs in this class)

***Attendance Policy, Class Expectations, and Make-Up Policy***

This class has on-campus and on-line enrollment for Autumn 2022. This class is held at the scheduled time in the scheduled classroom. For both on-campus and on-line students a final spiral bound design report is to be delivered to the instructor by the close of business on the final day of this class for the Autumn semester 2022. More details will be provided with the Design Project description handout in the next few weeks.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

**Assessment Methods to Demonstrate Understanding and Application of Objectives:**

1. Homework may be assigned as design/analysis modules that become part of the final design submission; if needed by students. This is a graduate class so the intent of the homework is to have the student organize components of their design report. Homework will also assist students to work through technical and conceptual problems involving course topics, objectives and design. If homework is assigned as an interim task in preparing the design, the homework will be directed towards and developed to support the design report but will not be graded until integrated as part of the final design report which is graded.
2. A test or tests, if needed, can be used to determine the level of understanding of the basic definitions, concepts and quantitative methodology and calculations presented in the notes, publications and lectures.
3. For this semester and the circulation of the Omicron variants of covid-19, interactions between students and instructor will be on-line during office hours or by on-line appointment in lieu of during class or in

person. In addition to the undergraduate sections, for the last 17 years there has been a significant on-line cohort at the graduate level in this class and most on-line students who have had to juggle work, classes and family have been very successful. These on-line meetings and office hours as well as emails will help the instructor assess individual and class understanding of the material presented and provided and give feedback to the instructor as to progress in the class and any review needed.

4. The design report will allow assessment of student's efforts to develop design concepts and creative problem solving dealing with real, practical and complex rainfall-runoff issues that combine aspects of chemistry, hydraulics, mechanics, unit operations, infrastructure, transportation, water resources and environmental science/engineering as well as societal, ethical and economic impacts.
5. A student design project is the primary class goal and will give the student the opportunity to prepare design concepts with graphical, quantitative, tabular analyses to promote and defend their design in a professionally written manner using the style/presentation of the publications provided to the class. Students in the ENV 6416 section of this class are required, in addition to the design project, to include an organized written synthesis of a rainfall-runoff contaminant or treatment topic with 10 to 15 peer-reviewed (peer-reviewed reports or peer-reviewed manuscript publications, no internet citations); a topic that is contemporary to impacts to the Florida environment and restoration thereof. The historical development from the literature is important. You will need VPN to do this work. Examples include the historical development of residence time presumptive guidance or the role of glyphosate on proliferation of *Karenia brevis*, a single-celled, photosynthetic dinoflagellate implicated in Red Tide in Florida, evolution and current status of numeric nutrient criteria (NNC) in Florida; and the implementation of GIS, hydrology and stormwater chemistry (albeit as event mean concentrations) to compare stormwater loads (kg) discharged to wastewater loads (kg) discharged ....

#### ***Evaluation of Grades***

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Homework Sets	0	0%
Quizzes (0)	0	0% (unless requested)
Midterm Exam	0	0% (unless requested)
Final Exam	0	0% (unless requested)
Design Report	100	100%
		<b>100%</b>

#### ***Grading Policy***

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 - 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 - 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:  
<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

### ***Students Requiring Accommodations***

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### ***In-Class Recording***

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, [jpennacc@ufl.edu](mailto:jpennacc@ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

#### ***Health and Wellness***

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **[Office of Title IX Compliance](#)**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.



University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

### Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.  
<https://lss.at.ufl.edu/help.shtml>.

**Career Connections Center**, Reitz Union, 392-1601. Career assistance and counseling;  
<https://career.ufl.edu>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

**On-Line Students Complaints**: <https://distance.ufl.edu/state-authorization-status/#student-complaint>.

Location of our classroom: CSE (Room E118) on the UF main campus (NTS), North ↑

