



ABE 459: Drainage and Water Management

Fall Semester 2026

Course Information

- Full semester course
- Contact Hours: (e.g., Monday, Wednesday, Friday 10:00 – 10:50 AM; three 50-minute lecture periods each week)
 - 3 lecture periods per week, MWF 10:00-10:50; 1 lab per week, W 3:00-5:50
 - 3 hours lecture, 3 hours lab
- Course Format: in person
- Course Location: 242 AESB
- Weekly Hours of Expected Student Work, apart from instruction time: 8 hours per week outside of lecture and laboratory activity
- 4 Credit Hours

Instructor Information

- Richard Cooke
- Office: 332J AESB
- Phone: 217-333-0944
- Email: rcooke@illinois.edu
- WWW: http://abe.illinois.edu/faculty/R_Cooke
- Office hours: TBA

Course Description

Design, construction, performance, and maintenance of agricultural drainage systems to meet both production and water quality objectives. Modeling drainage systems. Principles of conservation drainage.

Learning Outcomes

A student who completes this course will be able to:

1. Determine conditions under which drainage is required, and evaluate quantities of water to be removed,
2. Design conveyance, distribution, and collection elements of surface and subsurface drainage systems, and subirrigation systems, to meet both production and water quality objectives,
3. Model flow and transport in subsurface drainage systems, and
4. Design and evaluate drainage-related best management practices.

Prerequisites

Credit or concurrent registration in TAM 335

Course Materials

Learning Management System

Class Canvas Site <https://canvas.illinois.edu/>

Required and Recommended Course Readings

Illinois Drainage Guide <https://publish.illinois.edu/illinoisdrainageguide/>

Uchtmann, D.L., and B. Gehris. 1997. [Illinois Drainage Law](https://publish.illinois.edu/illinoisdrainageguide/). Circular 1355, Cooperative Extension Service, University of Illinois.
<https://farmdoc.illinois.edu/publications/illinois-drainage-law>

[DRAINMOD Software Program](https://www.bae.ncsu.edu/agricultural-water-management/drainmod/)

<https://www.bae.ncsu.edu/agricultural-water-management/drainmod/>

[QGIS Open Source Software](http://www.qgis.org/) <http://www.qgis.org/>

[Google Earth Pro](https://www.google.com/earth/)

Required and Recommended Materials

Skaggs, R.W. and J. Van Schilfgaarde. 1999. Agricultural Drainage. Monogram No. 38, American Society of Agronomy

Course Requirements and Policies

Grading Breakdown

The final grade will be based on a combination of scores as follows:

Activity	Percentage
Laboratory/Tutorial Reports	20
Homework Exercises	20
Design Exercises	40
Formal Reports	20

Course Components

HOMEWORK POLICIES

There will be a total of 6 to 8 homework assignments during the semester. Homework assignments are due before **midnight** of the due date. Late work will not be accepted.

LABORATORY REPORT

There will be two laboratory exercises during the semester for which formal reports are required. Data collection for these exercises must be completed before the start of the Thanksgiving break. All reports should be formatted in accordance with the report template provided. Reports may be submitted at any time, any number of times, and in any order. Submitted reports will be returned with suggestions for improvement within seven days. Reports can be resubmitted at any time up until the last day of instructions. Grades will be based on the final submissions.

PROJECTS

As a replacement for the two formal laboratory exercises, students who sign up for Section 39805 can opt to do a project. They will be provided with a hypothesis, around which they will design and conduct an experiment, and prepare a report. The report will be in the form of a manuscript to be submitted to Applied Engineering in Agriculture, Agricultural Water Management, or the Journal of Irrigation and Drainage. All the students will serve as co-authors with the order of authorship being as they decide. If students cannot agree on the ordering of names, the instructor reserves the right to decide the order of authorship. A first draft of the manuscript is due on or before the last day of instruction before the Thanksgiving break. The manuscript will be returned with suggestions for improvement within seven days. It can be resubmitted any number of times up to the last day of exams. Grades will be based on the final submission. Students may opt out of the group research project and instead conduct a research project that is directly related to their thesis, if the project has significant **Drainage and Water Management** content. Instructor approval is required.

EXAMS

There will be no exams.

Late Assignment Policy

Outline policy on late assignments (e.g., a certain number of points or percentage from total grade deducted each day after due date, no points are deducted if instructor is contacted a certain amount of time in advance of due date, etc.).

Class Attendance

The [Student Code](#) states "Regular class attendance is expected of all students at the university." *Each instructor's class attendance policy must be included in the syllabus. If there are expectations and/or grading based on class attendance/participation, instructors should include this section so students are aware of the expectations and clear information on how this will be calculated for the grade.*

Absence Policy

Students who miss classes, for whatever reason, are responsible for getting notes from a classmate and/or watching videos of the missed classes. The videos are not intended to substitute for lecture/discussion classes as they often include interactive activities.

Final Letter Grades/ Grading Scale

Final grades are assigned based on a fixed percentage scale:

A+	>97.4	A	91.4-97.3	A-	89.4-91.3
B+	87.4-89.3	B	81.4-87.3	B-	79.4-81.3
C+	77.4-79.3	C	71.4-77.3	C-	69.4-71.3
D+	67.4-69.3	D	61.4-67.3	D-	59.4-61.3
		F	< 59.4		

Additional Course and Campus Policies

Artificial Intelligence Policy

Students should be aware of the University of Illinois' Generative AI Guidance for Students

https://www.vpaa.uillinois.edu/digital_risk_management/generative_ai/students

Most relevant for this course, if AI is used to revise text for editing, both the edited and unedited manuscripts should be submitted together. **"Be transparent in your use of generative AI and cite as appropriate."**

Academic Integrity

The University of Illinois Urbana-Champaign *Student Code* should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL:
<http://studentcode.illinois.edu/>.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy:
<https://studentcode.illinois.edu/article1/part4/1-401/> . Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Students with Disabilities

The University of Illinois Champaign-Urbana, is committed to ensuring that all students, including students with disabilities, do not experience barriers to learning and participating fully in class. Students who have a letter of accommodation from DRES are advised to share that with instructors as soon as possible to ensure accommodation needs can be discussed and met.

To obtain disability-related academic accommodations, disabled students must contact Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, please visit 1207 S. Oak Street, Champaign, call 217.333.1970, email disability@illinois.edu, or visit the DRES website.

Family Educational Rights and Privacy Act (FERPA)

See <http://registrar.illinois.edu/ferpa> for more information on Family Educational Rights and Privacy Act (FERPA).

Mental Health

Significant stress, mood changes, excessive worry, substance/alcohol misuse or interferences in eating or sleep can have an impact on academic performance, social development, and emotional wellbeing. The University of Illinois offers a variety of confidential services including individual and group counseling, crisis intervention, psychiatric services, and specialized screenings which are covered through the Health Service Fee. If you or someone you know experiences any of the above mental health concerns, it is strongly encouraged to contact or visit any of the University's resources

provided below. Getting help is a smart and courageous thing to do for yourself and for those who care about you.

- Counseling Center (217) 333-3704
- McKinley Health Center (217) 333-2700
- National Suicide Prevention Lifeline (800) 273-8255
- Rosecrance Crisis Line (217) 359-4141 (available 24/7, 365 days a year)

If you are in immediate danger, call 911.

*This statement is approved by the University of Illinois Counseling Center

Community of Care

As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regard to their well-being or yours, we encourage you to refer this behavior to the Connie Frank CARE Center (formerly the Student Assistance Center) in the Office of the Dean of Students. You may do so by calling 217-333-0050 or by submitting an [online referral](#). Based on your report, staff in the Connie Frank CARE Center will reach out to offer support and assistance.

Further, as a Community of Care, we want to support you in your overall wellness. We know that students sometimes face challenges that can impact academic performance (examples include mental health concerns, food insecurity, homelessness, personal emergencies). Should you find that you are managing such a challenge and that it is interfering with your coursework, you are encouraged to contact the [Connie Frank CARE Center](#) (formerly the Student Assistance Center) in the Office of the Dean of Students for support and referrals to campus and/or community resources.

Disruptive Behavior

Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office for Student Conflict Resolution (<https://go.illinois.edu/ReportMisconduct>; conflictresolution@illinois.edu; 333-3680) for disciplinary action.

Emergency Response Recommendations

Emergency response recommendations and campus building floor plans can be found at the following website: <https://police.illinois.edu/em/run-hide-fight/>. I encourage you to review this website within the first 10 days of class.

Religious Observances

It is the policy of the University of Illinois Urbana-Champaign to reasonably accommodate its students' religious beliefs, observances, and practices that conflict with a student's class attendance or participation in a scheduled examination or work requirement, consistent with state and federal law. Students must make requests for accommodation in advance of the conflict to allow time for both consideration of the request and alternate procedures to be prepared. Requests should be directed to the instructor. The Office of the Dean of Students provides an optional resource on its [website](#) to assist students in making such requests.

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including supportive measures, resources, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: wecare.illinois.edu.

Veterans and Military Students

As a military-friendly institution, and per federal regulations and Illinois statutes, the University of Illinois Urbana-Champaign has established policies and procedures to accommodate military-connected students. In addition to the support available at the Chez Veterans Center (<https://chezveteranscenter.ahs.illinois.edu/>), members of the National Guard or Reserves and active-duty military personnel with military obligations (e.g., deployments, training, drills) are encouraged to communicate these, in advance whenever possible, to the instructor. The policy for Excused Absences and Departure from the University for U.S. Military or other U.S. National Defense Services can be found at <https://studentcode.illinois.edu/article3/part3/3-313>.

Course Schedule/Outline

Week	Topics	Instructional Activities
Week 1 (8/24 - 8/28)	• Introduction to Latitude/Longitude • Introduction to Global Navigation Satellite Systems • Introduction to Google Earth	QGIS and QGIS Print Layout
Week 2 (8/31 - 9/4)	• Soil Properties and Behavior • Soil Water Tension	Creating a Soil Map
Week 3 (9/7 – 9/11)	• Determination of Drainage Volumes • Saturated Flow in Soils	Incorporating Soil Physical Properties in Soil Maps
Week 4 (9/14 – 9/18)	• Numerical Analysis of Saturated Flow. The Finite Difference Method • Saturated Flow, Potential Distribution - VBA/QGIS Finite Difference Solution	Finite Difference Method Model of Drainage Simulator
Week 5 (9/21 – 9/25)	• Dupuit–Forchheimer Assumptions. Steady-State Drainage Equations • Transient Drainage Equations • Subirrigation Equation	Drainage Simulator
Week 6 (9/28 – 10/2)	• Coefficients for Quantifying Subsurface Drainage Rates • Velocity Profiles in Open Channel Flow. Manning Equation	Rating Curve Field Exercise

Week	Topics	Instructional Activities
Week 7 (10/5 – 10/9)	• Drainage Outlets • Illinois Drainage Law	Determination of Drainage Benefits
Week 8 (10/12 – 10/16)	• Drainage Intensity - Depth and Spacing • Coefficients for Quantifying Subsurface Drainage Rates	Mapping Depressions and Delineating Run-on Areas
Week 9 (10/19 – 10/23)	• Layout Strategies. Pipe Depth, Slope and Sizing • Pipe Sizing Tool. Main Telescoping	Illini Drainage Tools: Preparing for Design
Week 10 (10/26 – 10/30)	• Drainage Design Template • Introduction to Conservation Drainage	Illini Drainage Tools: System Design
Week 11 (11/2 – 11/6)	• Drainage Water Management • Bioreactors	Drainage Water Management Plan
Week 12 (11/9 – 11/13)	• Introduction to Drainage Modeling • Model Calibration	DRAINMOD Calibration Example
Week 13 (11/16 – 11/20)	• Sensitivity Analysis • Reliability Analysis	Drainage Water Management Design
Week 14 (11/30 – 12/4)	• Subirrigation Design Tools	Subirrigation Design
Week 15 (12/7 – 12/9)	• Design Exercises	