

Syllabus
CEE 694-50-4245 Wetland Design
University of Louisville, Department of Civil and Environmental Engineering
Speed School Summer Session 2024

Course Description

Wetland Design is a graduate-level, online class that shows how to design and build naturally appearing and functioning wetlands. There are no classroom sessions. The detailed modules explain the values of wetlands, how wetlands were drained, factors affecting site selection for restoration, techniques for construction, and how nonfunctioning wetlands may be repaired. The class focuses on teaching practical, low cost, and highly effective practices for restoring wetlands that will require little, if any maintenance. Specific examples from across North America show how wetlands may be built to improve habitat for rare animals and plants, provide water for livestock, manage stormwater, recharge groundwater, and control flooding. Assignments are completed independently, and generally require working outdoors. Engineering, biology, hydrology, and landscape architecture students are welcome to register. The instructors are actively involved with the restoration of wetlands and streams across North America.

Registration

Wetland Design is open to U of L students who are enrolled in a degree program and non-U of L students who would like to take the class. Non-U of L students interested in taking this course must apply for acceptance into Graduate School at U of L <http://louisville.edu/graduate/>

Those holding a bachelor's degree in a related field from a regionally accredited institution may apply for Graduate School at U of L. You would need to request that your college transcripts be sent to U of L. You are responsible for contacting your school(s) and requesting that official transcripts be sent. You are also responsible for any fees associated with these requests.

The cost to take the course for non-resident Graduate students who are enrolled in a degree program at U of L is \$1,606.00 per credit hour x 3-credit-hours = \$4,818.00. For resident Graduate students enrolled in a degree program at U of L the cost is \$791.00/credit hour x 3-credit hours = \$2,373.00. The cost per credit hour is the same for an individual interested in taking the class as a Non-Degree-Student. Individuals not currently enrolled at U of L must also pay (Graduate School Application Fee = \$65.00) + (Student Recreation Fee = \$11.00/credit hour x 3-credits = \$33.00).

Individuals who are enrolling only to take this course are not considered enrolling in an online program at U of L. Therefore, they do not qualify for online program tuition rates, which are the same as Resident rates.

The following information will help you complete the Graduate School Application:

- Under Educational Plans, Select
- No, do not intend to pursue a degree.
- Classification Level: Graduate – non-Degree.

- Part-time
- No, you are not applying to an online program.
- Under Program Selection – Non-Degree, Select
- Summer 2024
- No, not enrolled in a graduate degree program at UofL.
- Speed School of Engineering – Non-Degree
- Select Civil Engineering (NON)

You may take this course as a non-degree student, however, the cost per credit hour is the same, and you would need to pay a \$40.00 application fee. You would also need to show a degree bearing transcript (at least at the bachelor's level) with the application you complete.

The only way to register for this course and not receive credit is to Audit the course. Those Auditing the course pay the same rate, as if they were taking the course for credit. Students need to obtain permission from the instructor to Audit the course. The cost is the same to audit a course, as it is to take the course for credit. Audit students can only register during regular registration, not during early registration time periods. Here are the steps to take if you want to Audit the course and are not currently enrolled at U of L:

1. Apply as a Graduate/Speed School Non-Degree student.
2. Register in ULink for CEE-694.
3. Complete the Drop/Add form, checking AUDIT.
4. The instructor will need to sign the Drop/Add form indicating student wished to AUDIT.
5. The Advisor/Dean's signature is not required for this course.
6. Student sends the completed Drop/Add form to the Registrar (regoff@louisville.edu) to have the course changed from Graded/Credit to Audit

Course Instructors

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Please send all emails to tombiebighauser@gmail.com as he does not use the UofL email system. Tom Biebighauser will not receive your questions or assignments if you email them to the UofL email address listed for him.

Completed assignments and questions about the course should be emailed to tombiebighauser@gmail.com

Please do not upload assignments to Blackboard for this course.

Credits = 3

Course Dates: May 13 to July 23, 2024. The Final Exam must be completed by 6:00pm (EDT) on July 27, 2024.

This is an online class where lessons and assignments may be completed at any time during the day or night. Reading assignments, PowerPoint presentations, quizzes, and assignments must be completed by the dates listed in this syllabus, or in advance. The current week's lessons and assignments should be completed prior to the next week's scheduled lessons. Students are expected to work independently in this class. There are no group assignments or required field trips.

Student Learning Outcomes

Through online PowerPoint presentations, readings, and independent assignments requiring trips outdoors, students are expected to:

1. Learn how to name different types of wetlands.
2. Know the primary values of wetlands of different types.
3. Recognize the signs of wetland drainage and understand the principles of drainage.
4. Know how to select and evaluate sites for wetland restoration and construction.
5. Understand the primary techniques available for building wetlands.
6. Recognize threats to natural and constructed wetlands.
7. Find how to repair failed wetlands.
8. Explain the concepts of wetland spillway construction and maintenance.
9. Understand how to design wetlands for various purposes.
10. Recognize the basics of supervising the construction and planting of wetlands.
11. Outline strategies for developing partnerships and obtaining funding for wetland projects.
12. Understand the process for obtaining required permits from the government prior to implementation of a wetland project.

Textbooks Required:

Thomas R. Biebighauser, *Wetland Drainage, Restoration, and Repair*, Lexington, KY, University Press of Kentucky, 2007.

May be ordered from:

<https://www.kentuckypress.com/9780813124476/wetland-drainage-restoration-and-repair/>

http://www.amazon.com/Wetland-Drainage-Restoration-Repair-Biebighauser/dp/0813124476/ref=sr_1_1?ie=UTF8&qid=1420145665&sr=8-1&keywords=wetland+drainage+restoration+and+repair

Thomas R. Biebighauser. *Wetland Restoration and Construction - A Technical Guide*. Upper Susquehanna Coalition, 186 pages, 2023 3rd-edition (earlier editions are acceptable)

May be ordered from:

https://www.forestry-suppliers.com/product_pages/products.php?mi=48410&itemnum=59963

https://www.amazon.com/Wetland-Restoration-Construction-Technical-Guide-dp-0983455821/dp/0983455821/ref=dp_ob_title_bk

Both books should be ordered well in advance of taking the class. Please do not wait until the last minute to place your order. It would be very difficult to pass this course without having and reading these books.

Course Outline

Week 1

Wetland restoration and values

- a) How wetlands appear and function
- b) The various types of wetlands
- c) Animals and plants found in wetlands.

Required reading:

Wetland Drainage, Restoration, and Repair; Introduction

Wetland Restoration and Construction - A Technical Guide; Introduction, Chapter 1

Publications that are listed on Blackboard.

PowerPoints to view:

Lesson 1.1 Wetland Restoration and Values

Lesson 1.2 Wetland Definitions and Types

Lesson 1.1 Quiz due by 6:00 PM (EDT) on Saturday, May 18, 2024

Lesson 1.2 Quiz due by 6:00 PM on Saturday, May 18, 2024

Assignment 1.0: Wetland and mosquito inventory (due by 6:00 PM on Saturday, May 18, 2024)

Week 2

Wetland Drainage

- a) Moving and channeling streams
- b) Ditch digging.
- c) Burying wood, rock, clay tile, and plastic drainage structures
- d) Filling wetlands with soil
- e) Sloping the surface of wetlands so they will drain.
- f) Recognizing historically drained wetlands

Required reading:

Wetland Drainage, Restoration, and Repair; Chapters 1-9

Wetland Restoration and Construction - A Technical Guide; Chapter 2

Publications that are listed on Blackboard.

PowerPoints to view:

Lesson 2.1 Ditching and Filling of Wetlands

Lesson 2.2 Buried Drainage Structures

Lesson 2.3 Identification of Drained Wetlands

Lesson 2.1 Quiz due by 6:00 PM on Saturday, May 25, 2024

Lesson 2.2 Quiz due by 6:00 PM on Saturday, May 25, 2024

Lesson 2.3 Quiz due by 6:00 PM on Saturday, May 25, 2024

Assignment 2.0: Identification of Drained Wetlands (due by 6:00 PM on Saturday, May 25, 2024)

Week 3

Wetland Design and Construction

- a) Identification of drained and filled wetlands.
- b) Slope considerations.
- c) Soil texture
- d) Surface water and groundwater
- e) Groundwater dams

Assigned reading:

Wetland Drainage, Restoration, and Repair; Chapters 11, 12, 14

Wetland Restoration and Construction - A Technical Guide; Chapter 3, 4

Publications that are listed on Blackboard.

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PowerPoints to view:

Lesson 3.1 Wetland Design

Lesson 3.2 Construction of Wetlands Surface Water Technique-Ridge-top Areas

Lesson 3.3 Construction of Wetlands-Surface Water Technique- Riparian Areas

Lesson 3.4 Construction of Wetlands- Compacted Clay Liners

Lesson 3.5 Blue Lake Wetland Restoration Project (Compacted Clay Liners)

Lesson 3.1 Quiz due by 6:00 PM on Saturday, June 1, 2024

Lesson 3.2 Quiz due by 6:00 PM on Saturday, June 1, 2024

Lesson 3.3 Quiz due by 6:00 PM on Saturday, June 1, 2024

Lesson 3.4 Quiz due by 6:00 PM on Saturday, June 1, 2024

Lesson 3.5 Quiz due by 6:00 PM on Saturday, June 1, 2024

Week 4

Wetland Construction, heavy equipment, and budgets

- a) Building wetlands on saturated soils
- b) Using aquatic-safe liners
- c) Heavy equipment and wetland construction
- d) Estimating budgets for wetland construction

Assigned reading:

Wetland Drainage, Restoration, and Repair; Chapter 13, 15

Wetland Restoration and Construction - A Technical Guide; Chapter 5, 7

Publications that are listed on Blackboard.

PowerPoints to view:

Lesson 4.1 Construction of wetlands using the groundwater technique.

Lesson 4.2 Construction of wetlands using the aquatic-safe liner technique.

Lesson 4.3 Heavy Equipment and Wetland Construction.

Lesson 4.1 Quiz due by 6:00 PM on Saturday, June 8, 2024

Lesson 4.2 Quiz due by 6:00 PM on Saturday, June 8, 2024

Lesson 4.3 Quiz due by 6:00 PM on Saturday, June 8, 2024

Assignment 4.0: Design a Wetland outdoors (due by 6:00 PM on Saturday, June 8, 2024)

Week 5

Wetland spillways and water control structures

- a) Spillway design & construction
- b) Preventing and controlling erosion and head-cuts in spillways
- c) Stream restoration and spillway design
- d) Water control structures-values and problems

- e) Installation of water control structures

Assigned reading:

Wetland Restoration and Construction - A Technical Guide; Chapter 12
Publications that are listed on Blackboard.

PowerPoints to view

Lesson 5.1 Wetland Spillway Design

Lesson 5.2 Sumter National Forest Wetland Restoration Program

Lesson 5.3 Water Control Structures

Lesson 5.4 Estimating budgets and contracting wetland projects.

Lesson 5.5 Controlling Head-cuts that threaten wetlands using rock.

Lesson 5.6 Controlling Head-cuts that threaten wetlands using logs.

Quiz 5.1 due by 6:00 PM on Saturday, June 15, 2024

Quiz 5.2 due by 6:00 PM on Saturday, June 15, 2024

Quiz 5.3 due by 6:00 PM on Saturday, June 15, 2024

Quiz 5.4 due by 6:00 PM on Saturday, June 15, 2024

Quiz 5.5 due by 6:00 PM on Saturday, June 15, 2024

Quiz 5.6 due by 6:00 PM on Saturday, June 15, 2024

Assignment 5.0: Wetland Spillway Design (due by 6:00 PM on Saturday, June 15, 2024)

Week 6

Restoring wetlands of different types

- a) Spring Restoration
- b) Ephemeral wetlands
- c) Wet-meadow wetlands

Assigned reading:

Wetland Restoration and Construction - A Technical Guide; Chapter 6
Publications that are listed on Blackboard.

PowerPoints to view:

Lesson 6.1 Spring Restoration

Lesson 6.2 Restoration of Ephemeral Wetlands

Lesson 6.3 Restoration of Wet-Meadow Wetlands

Quiz 6.1 due by 6:00 PM on Saturday, June 22, 2024

Quiz 6.2 due by 6:00 PM on Saturday, June 22, 2024

Quiz 6.3 due by 6:00 PM on Saturday, June 22, 2024

Midterm Exam

The Midterm Exam must be completed by 6:00 PM on Saturday, June 22, 2024. The Midterm Exam covers PowerPoint Lesson 1.1 – Lesson 5.5, related Homework Assignments, and required readings in *Wetland Drainage, Restoration and Repair*, and *Wetland Restoration and Construction - A Technical Guide*. The best way to prepare for the Midterm Exam is to stay current with the required readings, PowerPoint Lessons, and Quizzes.

The Midterm Exam includes multiple choice, multiple answers, and essay questions that must be completed. The essay questions are worth 100-points each. Responding to the essay questions will require an understanding of the materials provided. Your answers to the essay questions should be 150 or more words in length and should contain specific points learned from the course. You will be given a maximum of 3 hours to take the exam, which is open book. The midterm exam must be completed in one session, it cannot be stopped and resumed at a later time and date as what Blackboard may say. You will be able to review the correct answers to the Midterm, your answers, your score, and feedback after everyone in the class has taken the Midterm, and the essay questions have been graded.

Week 7

Establishing Native Vegetation

- a) Forested Wetland Restoration
- b) Establishing trees, shrubs, and wildflowers
- c) Controlling nonnative plants
- d) Managing for specific plants

Assigned reading:

Wetland Drainage, Restoration, and Repair; Chapter 16
Wetland Restoration and Construction - A Technical Guide; Chapter 8
Publications that are listed on Blackboard.

PowerPoints to view

Lesson 7.1 Restoration of Forested and Shrub Wetlands
Lesson 7.2 Establishing Native Plants
Lesson 7.3 Planting Wetlands
Lesson 7.4 Reed Canary Grass and Wetland Restoration

Quiz 7.1 due by 6:00 PM on Saturday, June 29, 2024

Quiz 7.2 due by 6:00 PM on Saturday, June 29, 2024

Quiz 7.3 due by 6:00 PM on Saturday, June 29, 2024

Quiz 7.4 due by 6:00 PM on Saturday, June 29, 2024

Assignment 7.0: Wetland plant identification and plant sources (due by 6:00 PM on Saturday, June 29, 2024)

Week 8

Designing and building wetlands for specific purposes

- a) Wildlife and Fish habitat
- b) Storm water management and flood Control
- c) Groundwater recharge
- d) Livestock watering

Assigned reading:

Wetland Restoration and Construction - A Technical Guide; Chapter 9
Publications that are listed on Blackboard.

PowerPoints to view

Lesson 8.1 Wetlands for Treating Storm water and Reducing Flooding

Lesson 8.2 Devin's Ditch Storm-water Wetland Project

Lesson 8.3 Wildlife Habitat Improvement

Lesson 8.4 Wetlands that Help Livestock

Lesson 8.5 Building Wetlands for Rare Amphibians

Quiz 8.1 due by 6:00 PM on Saturday, July 6, 2024

Quiz 8.2 due by 6:00 PM on Saturday, July 6, 2024

Quiz 8.3 due by 6:00 PM on Saturday, July 6, 2024

Quiz 8.4 due by 6:00 PM on Saturday, July 6, 2024

Quiz 8.5 due by 6:00 PM on Saturday, July 6, 2024

Week 9

Government permits

- a) Section 404
- b) Section 401
- c) Floodplain
- d) Storm water
- e) Archeology
- f) Endangered Species

Assigned reading:

Wetland Restoration and Construction - A Technical Guide; Chapter 10
Publications that are listed on Blackboard.

PowerPoints to view:

Lesson 9.1 Government Permits and Approvals for wetland projects.

Lesson 9.2 Architects of the Swamp by John Carey, Scientific American, December 2013, pages 75-79

Quiz 9.1 due by 6:00 PM on Saturday, July 13, 2024

Quiz 9.2 due by 6:00 PM on Saturday, July 13, 2024

Assignment 9.0: Build a wetland in a box (due by 6:00 PM on Saturday, July 13, 2024)

Week 10

Wetland maintenance, repair, and renovation and funding wetland projects

- a) Strategy for inspection
- b) Threats to natural wetlands
- c) Repairing failed wetlands
- d) Controlling erosion
- e) Reducing the need for maintenance
- f) Improving fish and wildlife habitat
- g) Preparing a project proposal
- h) Identifying and working with partners
- i) Nonprofit organizations
- j) How to find funding
- k) Strategies for success

Assigned reading:

Wetland Drainage, Restoration, and Repair; Chapter 17, 18

Wetland Restoration and Construction - A Technical Guide; Chapter 11, 13

Publications that are listed on Blackboard.

PowerPoints to view:

Lesson 10.1 Wetland Inspection and Maintenance

Lesson 10.2 Wetland Renovation and Repair

Lesson 10.3 Restoration of Wetlands, Streams, and Rivers from Constructed Impoundments

Lesson 10.4: Partnerships and Funding for Wetland Projects

Lesson 10.5: Dam Removal and Valley Restoration

Quiz 10.1 due by 6:00 PM on Saturday, July 20, 2024

Quiz 10.2 due by 6:00 PM on Saturday, July 20, 2024

Quiz 10.3 due by 6:00 PM on Saturday, July 20, 2024

Quiz 10.4 due by 6:00 PM on Saturday, July 20, 2024

Quiz 10.5 due by 6:00 PM on Saturday, July 20, 2024

Assignment 10.0: Wetland Inspection (due by 6:00 PM on Saturday, July 20, 2024)

Week 11

Final Examination:

The final exam is available online, and must be completed by **6:00 PM on Saturday, July 27, 2024**. You may take the final exam any time or date prior to 6:00 PM on Saturday, July 27, 2024. The final exam is cumulative and includes multiple choice, multiple answers, and true and false questions. The Final Exam does not include essay questions. You will be given a maximum of 3 hours to take the exam, which is an open book. The final exam must be completed in one session, it cannot be stopped and resumed at a later time and date as what Blackboard says). You will be able to review the correct answers to the final exam, your answers, and your score after everyone in the class has taken the final exam.

Grading

The final letter grade (includes + or -) for the course is based primarily on the total number of points earned for the course. Added points may be earned by completing extra-credit assignments, and by attending optional field trips that may be offered during the course. Extra credit points will be added to the total number of points you have earned for the course to improve your letter grade. It is highly recommended that you complete one or more extra credit assignments to increase the number of points you have earned and to improve your letter grade. Extra-credit assignments may be emailed to tombiebighauser@gmail.com any time prior to July 20, 2024, at 6:00pm.

Percent	Letter Grade
97-100	A+
93-96	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-

Assigned Reading should be completed prior to reviewing the PowerPoint Lessons and Quizzes for the week. One can expect the information contained in the assigned readings to be included in the Quizzes, Midterm Exam, and the Final Exam. Blackboard would note if the information contained in certain readings will not be tested on in quizzes and exams.

Quizzes are posted on Blackboard for each PowerPoint lesson. The quiz should be taken following the completion of the required readings for each week, and after reviewing the respective PowerPoint lesson. You will not do well in this course if you only view the PowerPoint Lessons, and do not read the required books and publications. Taking quizzes is an excellent way to earn

points for your letter grade. To receive credit for taking a quiz, the quiz must be completed by the due date and time listed in the syllabus and on Blackboard for that quiz. You are allowed 20 minutes to take each quiz. The quizzes are open book. The quizzes will “disappear” from your view and not be available for taking or reviewing after the due date and time. Extensions will not be given for taking quizzes. The purpose of the quizzes is to provide an incentive for staying on schedule with the lessons and assignments. Each quiz must be completed in one session, it cannot be stopped and resumed at a later time and date.

This information will help you avoid confusion when trying to tell the difference between Multiple Choice and Multiple Answer Questions when taking quizzes and exams on Blackboard:

- Multiple Choice questions have a small circle next to each answer. You can only select one answer at a time. If you click on a second answer, the first one you clicked on will not stay selected.
- Multiple Answer questions have a small square next to each answer. When you click on more than one answer, each one you mark will stay selected.

Assignments must be completed and received by tombiebighauser@gmail.com by the due date and time listed in the syllabus and on Blackboard to receive credit. Assignments will be graded with full credit being given to work that is complete and responds fully to the guidelines and questions posted on Blackboard. Assignments will be accepted up to 3-days after the due date; however, the score received will be reduced by 30-percent for each day the assignment is late.

You are asked not to upload your completed assignments to Blackboard. The due dates for assignments are listed on the syllabus, and on Blackboard. Each assignment must be in Word format. Your name must be listed on each assignment. The actual computer file name for each assignment must contain your name and assignment number. Include your last name and assignment number in the subject line of each message. The photos included in each assignment must be reduced in size. The maximum file size for each assignment should be 4MB or less.

Instructor Modifications

PowerPoint Lessons, Reading Assignments, Quizzes, and Assignments will be posted by the instructor two or more weeks in advance of the scheduled lesson date. Material may be added or modified by the instructors up to two weeks prior to the date of the next scheduled class. However, errors will be corrected when found.

Questions

E-mail is the preferred way of asking questions of the primary instructor. Students should e-mail Tom Biebighauser tombiebighauser@gmail.com with their questions and can expect a reply to their e-mail within 24-hours. Tom Biebighauser designs and restores wetlands and streams full-time across the United States and Canada, and grades assignments and responds to emails in the evening.

Approval Needed for Duplication

All the PowerPoint Lessons, Resources, and Assignments relating to this class are copyrighted by Thomas R. Biebighauser. Students are not allowed to duplicate or share these materials electronically or in printed form without advance approval in writing from Thomas R. Biebighauser.

Title IX/Clery Act Notification

Sexual misconduct (including sexual harassment, sexual assault, and any other nonconsensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain confidential support from the PEACC Program (852-2663), Counseling Center (852-6585), and Campus Health Services (852-6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (852-5787) or University of Louisville Police (852-6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is not confidential under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer.

For more information, see the Sexual Misconduct Resource Guide.

<http://louisville.edu/hr/employeerelations/sexual-misconduct-brochure>

About the Instructor

Tom Biebighauser has restored over 3,000 wetlands and streams across Canada, in 26-States, Mexico, New Zealand, Puerto Rico, and Taiwan since 1979. He has developed highly effective and low-cost techniques for building wetlands and streams for endangered and threatened species of plants and animals. Tom retired from the US Forest Service in 2013, after working 34-years as a Wildlife Biologist where he started wetland and stream restoration programs across the United States. Having built over 1,400 dams, he has since decommissioned over 300 dams. Tom instructs a Graduate-level class on Wetland Design at the University of Louisville Speed School of Engineering, along with classes for the University of Alberta and the British Columbia Institute Technology. He has written 4 books about wetland restoration and has received 45 awards for his outstanding contributions.