# CIEG 443-010/643-010

## Watershed Engineering, Planning, and Design

**Syllabus for Spring Semester 2009**

<table>
<thead>
<tr>
<th>Texts &amp; Resources</th>
<th>Catalog Description</th>
<th>Course Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grading</td>
<td>Class Schedule</td>
<td>Class Format</td>
</tr>
<tr>
<td>Project Assignments</td>
<td>Advice for Success</td>
<td>Class Attendance</td>
</tr>
</tbody>
</table>

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### Texts & Resources

To be provided by instructor:


**Important related web sites:**

- [www.ce.udel.edu](http://www.ce.udel.edu) University of Delaware Department of Civil and Environmental Engineering
- [www.wr.udel.edu](http://www.wr.udel.edu) University of Delaware, Water Resources Agency
- [www.udel.edu/dgs/](http://www.udel.edu/dgs/) Delaware Geological Survey
- [www.ipa.udel.edu](http://www.ipa.udel.edu) Institute for Public Administration
- [www.dnrec.state.de.us](http://www.dnrec.state.de.us) DE Dept. of Natural Resources and Environmental Control
- [www.drbc.net](http://www.drbc.net) Delaware River Basin Commission
- [www.epa.gov](http://www.epa.gov) U.S. Environmental Protection Agency
Catalog Description

This course reviews the planning, design and engineering of watershed best management practices necessary to protect and restore the quality and quantity of surface and ground waters. Students will design various stormwater and watershed best management practices such as wet detention basins, bioretention wetlands, stream restoration and bioengineering, and soil erosion and sediment control plans. This independent study course is designed to prepare interested students for future careers in water resources engineering and watershed management.

Course Objectives

This course will enable students to:
1. Understand the delineation of watersheds and rainfall-runoff characteristics.
2. Review various Federal, state, and local laws and regulations (such as the TMDL provisions of the Clean Water Act) that require design of stormwater best management practices.
3. Design stormwater BMPs such as detention ponds and bioswales using open channel flow and hydrologic computer models.
4. Design groundwater recharge facilities based on water balance, soil moisture, and soil permeability methods.
5. Design stream restoration and bioengineering projects using stream geomorphology and open channel flow techniques.

Grading

Final grades will be based on the following calculations:

Project No. 1, Watershed Planning/Ordinances 25%
Project No. 2, Upper Christina River Floodplain Delineation, City of Newark 25%
Project No. 3, White Clay Creek Dam Removal/Shad Restoration Project 25%
Project No. 4, Design of Design of Green Roof/Stormwater BMP for UD campus 25%

Class Schedule

Module 1 – Watershed Planning
Wed Feb 11, 2009
- Introductions, syllabus review, review of text books
- Watershed delineation, land use, and soil characteristics
- Preparation of watershed plan – Christina Basin Watershed Restoration Action Strategy
- Federal regulations - Clean Water Act (TMDL provisions)
- State - Delaware stormwater and sediment regulations
- Local - New Castle County Unified Development Code - WRPA ordinance
- Stormwater BMP removal efficiencies

Module 3 – Upper Christina River Floodplain Delineation
Wed Feb 25 – Field survey stream cross sections and hydraulic structures along Upper Christina River.

Wed Mar 4 – Compute flood flows using TR55 model.

Wed Mar 11 – Compute flood elevations using HECRAS model.

Wed Mar 18 – Delineate floodplains using LIDAR topographic mapping.

Wed Mar 25 – Prepare floodplain delineation report

**Module 32 – White Clay Creek Dam Removal/Shad Restoration**

Wed Mar 25 – Impacts of dams on stream environment.

Wed Apr 1 – Spring Break

Wed Apr 8 - Stream field survey at dam removal sites.


Wed Apr 22 – Prepare design drawings, plan, profile, cross sections, specifications for dam removal/hydroelectric conversion.

**Module 4 - Design of Green Roof Stormwater BMP for UD campus**

Wed Apr 29 – Review green roof design criteria. Compute 2 – yr design flow. Select building for retrofit.

Wed May 6 – Field survey of candidate green roof retrofit on campus.

Wed May 14 – Produce plans, specification for green roof retrofit project. Plant pilot scale demonstration green roof at UDWRA building

Wed May 21 - Last Day of Class - Field reconnaissance (via kayak) along the White Clay Creek to monitor watershed BMPs.

**Project Assignments**

Grades are based on four projects, each pertaining to a different design module. Students may be asked to present their findings before the class. Each student will submit a 4 to 5 page report summarizing the design of each water resources engineering project according to the following schedule.

<table>
<thead>
<tr>
<th>Project</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1 - Watershed Planning/Ordinances</td>
<td>Feb 25</td>
</tr>
<tr>
<td>Module 2 – Upper Christina Floodplain Delineation</td>
<td>Mar 25</td>
</tr>
<tr>
<td>Module 3 – White Clay Creek Dam Removal</td>
<td>Apr 22</td>
</tr>
<tr>
<td>Module 4 - Design of Green Roof/Stormwater BMP for UD campus</td>
<td>May 21</td>
</tr>
</tbody>
</table>