

UAPP 411/611: Regional Watershed Management Syllabus for Spring Semester 2013

<u>Texts & Resources</u>	<u>Catalog Description</u>	<u>Course Objectives</u>
<u>Grading</u>	<u>Class Schedule</u>	<u>Class Format</u>
<u>Project Assignments</u>	<u>Advice for Success</u>	<u>Class Attendance</u>

Instructor: Gerald J. Kauffman
 University of Delaware
 School of Public Policy and Administration
 DGS Annex, Academy St.
 Newark, DE 19716
 ph: 302-831-4929 cell: 302-893-8605
jerryk@udel.edu

Spring 2013
 Wed 2:30-5:30 pm
 Memorial Hall Room 108

Texts & Resources

Cech, Thomas V., *Principles of Water Resources, History, Development, Management, and Policy*. John Wiley and Sons, Inc. 2005.

Catalog Description

This course is designed to review the practical applications of watershed planning and management as a tool to manage land, water, and ecosystem resources. Students will explore the public policies and practices of watershed management by examining case studies in water supply, water quality, drought, floodplain, and stormwater management in the Delaware River and Chesapeake Bay basins. The watershed curriculum will utilize a multi-disciplinary approach involving the fields of geography, environmental science, geology, public policy, environmental economics, urban and regional planning, geographic information systems (GIS), and civil/environmental engineering. 3 credits.

Course Objectives

This course will enable students to:

1. Define goals and objectives to address water resources problems.
2. Understand Federal, State, regional, and local policies as they apply to watershed management.
3. Delineate a watershed utilizing GIS mapping techniques.
4. Develop and implement a watershed management plan.
5. Examine the various engineering, institutional, governance, legal, and financial frameworks needed for successful implementation of a watershed management plan.

Grading

Final grades will be based on the following criteria:

Participation/quizzes, mid-term exam, final exam, mid-term project, final term paper

- Quizzes may be given.
- No make-up exams will be scheduled except due to hardship with the consent of the instructor.
- No project will be accepted for grading after its due date.

Class Schedule

Feb 6, 2013 - Introduction to Watershed Management. What is a watershed? Define watershed goals,

objectives, problems, and stakeholders

I. Introductions

- The Atlantic Sturgeon
- Hand out student information sheets
- Identify home on watershed maps

II. Review of Syllabus

- Texts/Resources
- Course Objectives
- Grading
- Class Schedule/Format
- Project Assignments

III. Introduction to Watershed Management

- What is a watershed?
- History of watershed management
- Watershed problems (water supply/quality/flooding, etc.)
- Goals/Objectives
- Stakeholders (governments/environmentalists/businesses)

Break

IV. The Delaware River

V. Homework

Reimold, R. J., 1998. Watershed Management Practices, Policies, and Coordination. Chapter 1. pp. 1 - 9 and Chapter 3 pp. 35 - 53.

Center for Watershed Protection, 2001. Rapid Watershed Planning Handbook. Chapter 1. Basic Concepts of Watershed Protection. pp. 1.1 - 1.33.

USEPA. Top 10 Watershed Lessons Learned. <http://www.epa.gov/owow/lessons>.

VI. Class Dismissed

Feb 13, 2012 - Compiling a GIS watershed inventory: geology, soils, topography, land use, zoning, political boundaries, point and nonpoint source pollutants

I. Class Business

Quiz No. 1

- Syllabus Feedback
- Watershed Team Selection
- Current Events Discussion

II. Discussion of Readings

III. GIS Watershed Inventory Laboratory/Technical Exercise/Discussion

- Delineate a watershed by hand using contour map
- Aerial photo interpretation of land use/soils mapping
- How to build a watershed using ARCVIEW (Christina Basin)
- State boundaries, municipalities
- Hydrology/watersheds

Break

IV. Watersheds: Connecting Weather to the Environment, University Corporation for Atmospheric Research <http://www.meted.ucar.edu/broadcastmet/watershed/>

V. USEPA Top 10 Watershed Lessons Learned

VI. Video – Storm on Tap Weather Channel

VII. Homework

National Academy of Sciences. New Strategies for America's Watersheds. 1999. Chapter 1. Why Watersheds. pp. 13 - 36. Chapter 2. Spatial and Temporal Scales for Watersheds. pp. 37 - 55. <http://bob.nap.edu/books/0309064171/html/>

Cech, T.V., 2005. Principles of Water Resources, History, Development, Management, and Policy. Ch. 2 and 3. pp. 23 - 81.

Meehan, G. T., 2010. A Symphonic Approach to Water Management: The Quest for New Models of Governance. Journal of Land Use. 26(1):1-33.

VIII. Class Dismissed

Feb 20 Watershed management using GIS

I. Class Business

- Finalize Field Recon. Schedule
- Discuss mid-term Class Project No. 1

II. GIS and Powerpoint Basics for Watershed Management

III. Introduction to Watershed Management, National Academy of Sciences

IV. Spatial and Temporal Scales of Watersheds

V. Homework

Smith, W. J., December 2002. The Clearinghouse Approach to Enhancing Informed Public Participation in Watershed Management Utilizing GIS and Internet Technology. Water International. Vol. 27, No. 4. pp. 558-567.

Ward, R., February 2003. Walking the Fine Line Between Water Science and Policy. Colorado Water. Newsletter of the Water Center at Colorado State University. pp. 3-4. .

Goldfarb, W., April 1997. Teaching Water Resources Policy to University Science and Engineering Students: Opportunities and Challenges. Journal of the American Water Resources Association. Vol. 33, No. 2. pp. 255 -259.

Cech, T.V. Principles of Water Resources, History, Development, Management, and Policy, 2005. Ch. 9. Federal Water Agencies. pp.247-284, and Ch. 10. Local, Regional, State, and Multistate Water Management Agencies. pp. 285-319.

VI. Class Dismissed

Feb 27 - Federal and state watershed policies, programs, and regulations. Local, municipal, and county watershed programs and ordinances

I. Class Business

* Review of Watershed Project No.1 Teams

* Field Recon of Christina Basin

II. Watershed GIS Laboratory

- GIS Delineation of Watershed – Upper Christina watershed
- GIS as a Watershed Tool
- GIS Watershed mapping using GOOGLE EARTH

III. The Federal, State, Local Political Structure and Watershed Civics

IV. Assigned Reading

Reimold, R.J., 1998. Watershed Management, Practices, Policies, Coordination. Ch. 4. Developing a

Watershed Management Plan.

Tenth Report to the Governor and General Assembly Regarding the Progress of the Delaware Water Supply Coordinating Council, 2008. www.wra.udel.edu.

Cech, T.V., 2005. Principles of Water Resources, History, Development, Management, and Policy. Ch. 5. Water Quality. pp. 112 – 145.

V. Class dismissed

Mar 6 Water supply, water quality, and drought management issues and problems. Floodplain, stormwater, habitat, land use, and riparian corridor issues and problems

I. Class Business

* Quiz

* Review of March 20, 2013 field reconnaissance 2:00 - 5:30 pm, Christina Basin by bus/van

II. Federal Watershed Regulations and Programs

- Safe Drinking Water Act
- Clean Water Act (Section 404/305b, TMDL)
- Delaware Estuary Program
- Wild and Scenic Program

III. State Watershed Regulations and Programs

- DE Whole Basin
- Section 319
- Inland Bays
- DE Stormwater and Sediment Control Regulations

IV. Design of Watershed Restoration BMPs

- Floodplain, Stormwater, Habitat, Land Use, Riparian Issues
- Point and Nonpoint Source BMP Solutions, Structural/Nonstructural
- Water Quality Models

VI. Water Supply Issues and Alternatives

- Water Supply, Water Quality, Drought Issues
- Storage, Groundwater, Pipeline, Technology Alternatives

V. Homework

Purdue University. Local Government Assistance Network. Land Use Impacts on Water Quality. www.ecn.purdue.edu/runoff/lthianew.

Kauffman, G. J., Wozniak, S. L., and Vonck, K. J. June 2003. A Watershed Restoration Action Strategy (WRAS) for the Delaware Portion of the Christina Basin. pp. 1 - 77.

Prepare One Page Watershed Plan (Title, Mission Statement, Problems Statement, Goals/Objectives)

VII. Class dismissed

Mar 13 - Development of a draft watershed management plan

I. Introduction

- Quiz
- Review of Christina Basin Field Trip
- Review for mid term exam
- Review of watershed (computer vs. student) digitizing exercise

II. Development of a Watershed Management Plan

- Title
- Mission Statement
- Problems/Issues
- Goals/Objectives
- Regulations/Ordinances
- GIS Watershed Inventory
- Alternatives Analysis
- Conclusions/Recommendations

Break

III. Watershed Planning Processes

IV. Homework Assignment

* Watershed teams continue Project No. 1 for presentation, due April 4, 2012

- Watershed team conduct stream habitat monitoring, due April 4, 2012
- Read for class April 21, 2012:

Center for Watershed Protection. Crafting Better Urban Watershed Protection Plans. Article 129.
Feature article from Watershed Protection Techniques. 2(2): 329-337

V. Class dismissed

Mar 20 - Field Reconnaissance to Watershed Projects in the Christina River Basin
Field Trip to Christina River Basin, An Urban and Rural Watershed Reconnaissance

I. Van leaves from front of UDWRA, DGS Annex 2:00

II. Wilmington Riverfront

III. Hoopes Reservoir

IV. Woodlawn Trustees/Brandywine Creek State Park

V. Wyeth Property Stream Restoration

VI. Pike Creek Stream Restoration Project

VII. Back to UDWRA 5:30 pm

Reminder to continue work on in class presentations.

Mar 27 - Spring Break

Apr 3 - Verbal presentation to class. Take home mid-term examination

I. Each watershed team delivers watershed management plan presentation to class (45 minutes each).

II. Take home mid-term exam due Week 10

III. Homework

Apr 10 - Watershed governance and institutional issues. Watershed funding strategies.

I. Class Business

- Quiz
- Self appraisal on watershed presentations
- Mid-term exam due

II. Watershed Governance and Institutional Options

- Government Agencies
- Councils/Committees
- Water Districts
- Nonprofit Watershed Organizations and Associations

III. Watershed Funding Strategies

- Federal/State Grants and Loans
- Polluter Pays
- Capital Programs
- Fees/Taxes/Utilities

IV. Think, Pair, and Share Activity Governance/Funding

- Break up into paired groups and select a watershed
- Devise a governance and funding strategy
- Share with class using one page of notes

V. Homework

Kauffman, G. J., 2002. What if... the United States of America were based on Watersheds? *Water Policy Journal*. 4:57 - 68.

Schueler, T. R., Holland, H. K. Center for Watershed Protection. *The Practices of Watershed Protection*. Article 128. Choosing the Right Watershed Management Structure. pp. 639 – 645 and Article 30. The Economics of Watershed Protection. pp. 171-181.

VI. Class dismissed

 Apr 17 - Water Law, Watershed Economic Analysis, Environmental indicators, Watershed Education.

I. Class Business

- Quiz
- Upcoming Field Trip

II. Water Law and Ethics

- Environmental Ethics
- Eastern Riparian Rights
- Western Prior Appropriation

III. Watershed Economic Analysis

- Supply and Demand
- Discounting
- Benefit/Cost Analysis

IV. Watershed and Environmental Indicators

- Impervious Cover
- Water Quality
- Report Cards
- Habitat

V. Watershed Education

VI. Homework

Develop one page environmental indicators for selected watershed

Dzurik, A. A. and D. A. Theriaque, 1996. *Water Resources Planning*. Chapter 7. Economic Analysis. pp. 121 - 151.

Cech, T.V., 2005. *Principles of Water Resources, History, Development, Management, and Policy*.

The Economics of Water. pp. 381 – 392.

VI. Class dismissed

Apr 24 - Case Studies in Interstate, State, and Local Watershed Management

1. Class Business

* Term paper requirements

* Review of Environmental Indicator Homework

II. Case Studies in Interstate Watershed Management

- Delaware River Basin

- Susquehanna River Basin

III Case Studies in State-wide Watershed Management

- Broadkill River Tributary Action Team

- Delaware Watershed Assessment Branch

IV. Nonprofit Local Watershed Management

- Brandywine Valley Association

- Chesapeake Bay Program

V. Local Watershed TMDLs

- Appoquinimink River Watershed

- Inland Bays Watershed

VI. Homework

Cech, T. V., 2005. Principles of Water Resources, History, Development, Management, and Policy. Ch. 8. Water Allocation Law. 211 – 241.

Foran, P.G., 1995. Survey of Eastern Water Law. 1-75.

University of Colorado Law School, 2000. Laws Influencing Community-Based Conservation in Colorado and the American West: A Primer. 1-57.

Kauffman, G. J., 2006. Perspectives on Ethics and Water Policy in Delaware. Journal of Philosophical Research. Special issue: Ethics and the Life Sciences. 93-126.

Harris, H. J., and D. Scheberle, Ode to the Miners' Canary: The Search for Environmental Indicators. 177 - 200.

Schueler, T. R. and H. K Holland, Center for Watershed Protection. The Practices of Watershed Protection. Article 126. Understanding Watershed Behavior. 671-679.

Schueler, T. R. and H. K Holland, Center for Watershed Protection. The Practices of Watershed Protection. Article 127. On Watershed Education. 629 -635.

May 1 – Watershed Funding

Water Law

Schueler, T. R., Holland, H. K. Center for Watershed Protection. The Practices of Watershed Protection. Article 27. The Tools of Watershed Protection. pp. 133 - 144.

EPA Funding Guidebook

GWP Handbook of River Basins

DRBC Compact

May 8 - Last day of class. Review of semester, final exam, and term paper requirements.

SEMESTER REVIEW

1. Concepts of Watershed Management
 2. Watershed Delineation
 - * By hand
 - * By ArcView GIS
 3. Watershed Plan Format
 - * Title
 - * Mission Statement
 - * Goals/Objectives
 - * Applicable Ordinances/Regulations
 - * Problem Statement
 - * GIS Watershed Inventory
 - * Alternatives/Analysis
 - * Watershed Governance
 - * Funding Strategies
 - * Conclusions/Recommendations
 4. Governance Entities
 - * Agencies
 - * Councils/Committees
 - * Water Districts
 - * Watershed Organizations/Associations
 5. Watershed Funding Strategies
 - * Federal/State Grants and Loans
 - * Polluter Pays
 - * Capital Programs
 - * Fees/Taxes/Utilities
 6. Water Law, Ethics, and Economics
 7. Watershed Case Studies
 - * Delaware River Basin Commission
 - * Susquehanna River Basin Commission
 - * Christina Basin TMDL Strategy
 - * Broadkill Tributary Action Team
 - * DE Source Water Protection
 - * Brandywine Valley Association
 - * Chesapeake Bay Program
 - * Appoquinimink Watershed TMDL
 - * Inland Bays watershed TMDL
 8. Christina Basin Watershed Tour
 9. Brandywine Creek Field Recon
- Homework

Delaware River Basin Commission, Cornell University, Pennsylvania State University, Rutgers University, University of Delaware, Partnership for the Delaware Estuary, July 4, 2008. Technical

Report - State of the Delaware River Basin.

Cech, T.V. 2005. Principles of Water Resources, History, Development, Management, and Policy. Chapter 15. Emerging Water Issues. pp. 414 – 430.

May 15 – Reading Day - Field Reconnaissance along Brandywine Creek via kayak

May 22 - Final Exam in classroom

Class Format

Learning about watersheds is an active process where students participate in class discussions and hands-on exercises. We will be meeting in a classroom with projection equipment. We will be utilizing this equipment for course presentations and demonstration of computer GIS methods. Some of the course involves field trips and discussions of case studies to explore actual applications of watershed management. You are highly encouraged to ask questions regarding any topic on watershed management. Class participation and attendance for the quizzes is strongly recommended as it counts for 20% of your grade. The course work will be rigorous but completion of the course will properly prepare you for a possible career in watershed management. The recommended class size is 30 students.

Project Assignments

Everyone will be assigned to watershed project teams of 4 – 5 students this semester. These groups will function independently during class and outside of class.

Mid Term Project - Development of a Watershed Plan

Each group will prepare a draft, preliminary watershed plan for a real or hypothetical watershed. For Project #1, each team will prepare a one-page summary sheet suitable for duplication as a class handout. All written work for the projects must be word-processed (typed, spell-checked, etc. Each team is responsible for a 30- 45- minute presentation of one project to the class. Students will delineate the watershed on maps using ArcView GIS. Each group will define the problem, i.e. water quality, flooding, etc., and the goals and objectives for addressing the problem. The group will characterize the watershed and provide recommended actions such as best management practices to address the defined problem. The report should be no longer than 10 pages single-spaced with tables and graphs and include at least 2 GIS watershed maps.

Final Term Paper - Watershed Management

Students will write a term paper or prepare a digital product researching a topic in watershed management. The paper should be in two parts. The first part should focus on the history and evolution of watershed management. The second part should present a specific watershed demonstrating an application of approaches that you have learned in class. The focus may be on tenets and trends in watershed management in the United States or internationally. The watershed that you choose may be sub-state, state, interstate, or regional.