WATERSHED MANAGEMENT

Geo 426/526, Fall, 20065 **TR 9:30-10:45, Shideler 229**

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This outline and other course materials are available on Blackboard (http://blackboard.muohio.edu).
Office hours: by appointment.

OBJECTIVES: The objectives of this course are to:
1. Understand the water-resource impacts associated with urban and agricultural land-use.
2. Explore the common management tools available for water quality and quantity management in the United States.

This course seeks to further the goals of the Miami Plan. Students develop skills in critical thinking by analyzing existing watershed management plans and assessing the degree to which such plans are likely so succeed. We focus on understanding contexts because watershed management is, by its very nature, holistic. Effective watershed management requires integration of social, political, as well as natural science dimensions of water and water-related concerns. A key component of the course is a group project in which students engage with other learners as they analyze, and evaluate an existing watershed management plan. Finally, we reflect and act on our understanding of watersheds through observing watershed management contexts in the local landscape and incorporating them in their own lives as appropriate.

One of the key components of watershed management is that everyone who lives, works, or visits in a watershed or who uses things produced in a watershed is a watershed manager in some degree. Thus while many students in this class will go on to become environmental or land-management professionals in some capacity, all of us are now and will continue to be watershed managers. This course reinforces that role by focusing on those parts of our daily lives that are significant to water resources, and the role of socioeconomic diversity and political processes in watershed management in southwest Ohio. A central outcome of the course is thus that all of us will know (*and recognize that we know*) a little more about watershed management in our lives.

APPROXIMATE SCHEDULE OF CLASSES:
(Note: two dates near the end of the semester are "open" to allow some flexibility.)

Date	**Topic**	**Reading (Available on course Blackboard site)**
8/22	Introduction; Course objectives	Brady, 1996
8/24	Discussion of group projects; The watershed framework	Petersen, 1999
8/29	Water quality in the U.S.	Dodds, and Whiles, 2004 Smith, and others, 1994 Zipper, and others, 2002
8/31	Ecological values	Gregory and others, 1991 Naiman and others, 2002
9/7	Spatial relations	Allan, Erickson, and Fay, 1997 D.S. Fisher and others, 2000.
9/8	Scale issues	Brezonik and others, 1999 Buck, and others, 2004. Crooks and Davies, 2001

9/12	Pollutants and pollutant transport	Leeds and others Vanni and others, 2001
9/14	Nutrient budgets	Bouraoui and others, 1999 Slaton and others, 2004
9/19	Water sampling and water data	Salvia and others, 1999
9/21	**Midterm: watershed management basics**	
9/26	Urban runoff	Lawler and others, 2006 Hatt and others, 2004
9/28	Urban water quality	Booth and others, 2004 Roy and others, 2006
10/3	Case study: Butler Stormwater Management District	Butler County Stormwater Management District documents
10/5	Cropland and water quality	Binkley and others, 2004 Lee and Jones-Lee, 2004
10/10	Cropland BMPs	Fawcett, and others, 1994 Fiener and others, 2005
10/12	Animals and nutrients	Cook and others,1996 Freifelder and others, 1998
10/17	Case study: Chesapeake Bay Program	Chesapeake Bay Program, 2002.
10/19	Group project presentations	
10/24	Group project presentations	
10/26	Soil and groundwater influences	Norton and Fisher, 2000
10/31	Wetlands	Helfield and Diamond, 1997 Mitsch and Gosselink, 2000
11/2	Streams and riparian corridors	S.G. Fisher and others, 1998 Vought and others, 1995
11/7	Buffers	Burt, and others, 1999 Lovell and Sullivan, 2006
11/9	Lakes	Ramstack and others, 2004 Reed-Andersen and others, 2000
11/14	GIS & Modeling	Potter and others, 2004 Tsihrintzis and Hamid, 1997
11/16	Public participation	Brenner and others, 1999 Birkeland, 2001
11/21	Socio-political issues	Habron, 2003 Johnson and others, 2001. McGinnis, 2001
11/28	OPEN	
11/30	OPEN	
12/5	Graduate paper presentations	
12/7	Graduate paper presentations	
12/11	**Final Exam, 2:45 pm**	

ASSIGNMENTS AND EVALUATION: Evaluation will be based one midterm, one final exam, a group project, and class participation.
The **exams** will be largely objective in nature and will cover material discussed in class, especially readings. The midterm will be in-class; the final will be take-home.

The **group project** will involve a critique of a Total Maximum Daily Load (TMDL) plan. TMDLs are a process for managing water quality in a mixed point- and non-point environment. Some are developed by state agencies, some by federal agencies, and some by local/regional agencies. All are developed on a watershed basis. A listing of those that have been developed for watersheds in Ohio can be found at http://www.epa.state.oh.us/dsw/tmdl/#Ohio's%20303(d)%20List%20and%20Schedule.

Groups will be assigned the task of describing and critiquing a specific TMDL plan, and presenting summaries of these plans to the class. The presentation should address: 1) characteristics of the watershed and its major pollution problems; 2) the sources and adequacy of water quality and pollutant-source information used in compiling the TMDL; 3) the methods chosen to reduce pollution loadings and the relative allocation of loads among the various sources; 4) The nature of stakeholder participation, both in the development of the TMDL and its implementation; and 5) an overall critique of the result. This critique should be informed not only by a review of the TMDL plan itself, but also by reviews of other TMDLs and of the broader literature on the TMDL process.

Oral presentations should be about 15 minutes in length, with Powerpoint slides. There will be no written report; the Powerpoint file should summarize the main points of the presentation.

Participation includes leading class discussion of two readings during the semester. Such leadership means coming to class having prepared a brief summary of the assigned article and a series of thought-provoking questions that will help to critically evaluate the article. Students not assigned to lead discussion on any particular day are still responsible for reading the article before class and participating substantively in the discussion.

Graduate students will, in addition, be expected to write a paper applying concepts of watershed management to some particular environmental problem of current significance. The paper should focus either on a particular watershed or a particular type of problem found in many watersheds. It should be a summary of the current state of knowledge, based on materials published within the last 15 years. It should be about 2500-4000 words in length, plus illustrations and references.

Students should be aware that **plagiarism** will not be tolerated. If you use someone else's work without giving proper credit you are committing plagiarism, which is not only unethical and dishonest but a violation of Miami's Code of Student Conduct. Examples of plagiarism include: copying a long phrase verbatim; paraphrasing multiple sentences; or closely mimicking the structure or ideas in a document written by another, without acknowledging the source. For most student papers there is nothing bad about using others' work to support your ideas—in fact it strengthens your work by validating it—if you properly cite the source. When in doubt, cite.

Evaluation summary:

Assignment	**426**	**526**
Midterm Exam	50 points	50 points
Final Exam	70 points	70 points
Group Project	50 points	50 points
Participation	30 points	30 points
Paper		50 points
Total	200 points	250 points

READINGS. Readings are listed below. Students are expected to read these items **in advance** of the class in which they are discussed. Readings are identified by author in the course schedule; complete citations are below.

Allan, J.D., Erickson, and D.L., Fay, J. 1997. The influence of catchment land use on stream integrity across multiple spatial scales. *Freshwat. Biol*.37: 149-161

Binkley D, Ice GG, Kaye J, et al., 2004. Nitrogen and phosphorus concentrations in forest streams of the United States *J Am Water Resour Assn* 40: 1277-1291

Birkeland, S., 2001. EPA's TMDL program. *Ecology Law Quarterly* 28: 297-325.

Booth, DB, Buck, O, Burkart, MR, Cahoon, LB, Chang, HJ, and Dodds, WK, 2004. Reviving urban streams: Land use, hydrology, biology, and human behavior. *Journal of the Water Resurces Assn*. 40: 1351-1364.

Bouraoui F, Turpin N, and Boerlen P, 1999. Trend analysis of nutrient concentrations and loads in surface water in an intensively fertilized watershed *Journal of Environmental Quality* 28: 1878-1885

Brady, Donald J, 1996 The watershed protection approach. *Water Science and Technology* 33, Issue 5: 17-21.

Brenner, A. J., Brush, L. A., Martin, J. S., Olsson, K. Y., Rentschler, P. L., and Wolf, J. K, 1999. The Huron river watershed council: grassroots organization for holistic watershed management. *Water Science and Technology* 39:331-337

Brezonik, Patrick L., Easter, K. W., Hatch, L, Mulla, D, and Perry, J., 1999. Management of diffuse pollution in agricultural watersheds: lessons from the Minnesota river basin. *Water Science and Technology Volume*: 39: 323-330

Buck, O, Burkart, MR, and Cahoon, LB, 2004. Scale-dependence of land use effects on water quality of streams in agricultural catchments. *Environmental Pollution* 130: 287-299.

Burt, T. P., Matchett, L. S., Goulding, K. W. T., Webster, C. P., and Haycock, N. E., 1999. Denitrification in riparian buffer zones: the role of floodplain hydrology. *Hydrological Processes* 13: 1451-1463

Butler County Stormwater Management Documents—online at the Blackboard site.

Chesapeake Bay Program, 2002. The State of the Chesapeake Bay. Chesapeake Bay Program: http://www.chesapeakebay.net/pubs/sob/sob02/sotb_2002_final.pdf

Cook, M. G., Hunt, P. G., Stone, K. C., and Canterberry, J. H., 1996 Reducing diffuse pollution through implementation of agricultural best management practices: a case study. *Water Science and Technology* 33:191-196

Crooks, S., and Davies, H., 2001. Assessment of land use change in the Thames catchment and its effect on the flood regime of the river. Physics and Chemistry of the Earth, Part B: Hydrology, *Oceans and Atmosphere* 26: 583-591

Dodds, WK, and Whiles, MR, 2004. Quality and quantity of suspended particles in rivers: Continent-scale patterns in the United States. *Environmental Management* 33: 355-367.

Fawcett, R.S., Christensen, B.R., and Tierney, D.P. 1994, Impact of conservation tillage on pesticide runoff into surface water: A review and analysis. *J. Soil & Water Conserv*. 49:126-135

Fiener, P.; Weigand, S.; Auerswald, K., 2005. Managing erosion and water quality in agricultural watersheds by small detention ponds. *Agriculture, ecosystems & environment*, 2005 Nov. 1, v. 110, no. 3-4, p. 132-142.

Fisher, D.S., Steiner, J.L., Endale, D.M., Stuedemann, J.A., Schomberg, H.H., Franzluebbers, A.J., and S.R. Wilkinson, 2000. The relationship of land use practices to surface water quality in the Upper Oconee Watershed of Georgia. *Forest Ecology and Management* Volume: 128: 39-48

Fisher, S G., Grimm, N B., Martí, E, Holmes, R M., Jones, J., and Jeremy B, 1998. Material Spiraling in Stream Corridors: A Telescoping Ecosystem Model. *Ecosystems* 1: 19-34.

Freifelder, R R., Smith, S V., and Bennett, R H.. Cows, humans and hydrology in the nitrogen dynamics of a grazed rural watershed. *Journal of Environmental Management* 52: 99-111

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins, 1991. An ecosystem perspective of riparian zones. *Bioscience* 41: 540-551.

Habron, G., 2003. Role of adaptive management in watershed councils. *Environmental Management* 31: 29-41.

Hatt, BE, Holman, IP, Houlahan, JE, and Lee, GF, 2004. The influence of urban density and drainage infrastructure on the concentrations and loads of pollutants in small streams. *Environmental Management* 34: 112-124.

Helfield, J M, and Diamond, M L., 1997. Use of Constructed Wetlands for Urban Stream Restoration: A Critical Analysis. *Environmental Management* 21: 329-341.

Johnson, J., H.M. Ravnborg, O. Westermann, and K. Probst, 2001. User participation in watershed management and research. *Water Policy* 3: 507-520.

Lawler, D.M., G.E. Petts, I.D.L. Foster, S. Harper, 2006. Turbidity dynamics during spring storm events in an urban headwater river system: The Upper Tame, West Midlands, UK Science of the Total Environment 360 109– 126

Lee, G.F., and Jones-Lee, A., 2004. Assessing the water quality impacts of phosphorus in runoff from agricultural lands. In Hall, WL and Robarge, WP, *Environmental Impact of Fertilizer on Soil and Water*. American Chemical Society, ACS Symposium Series 872: 207-235

Leeds, R., Brown, L.C., and Watermeier, N.L., no date. Nonpoint Source Pollution: Water Primer. Ohio State Unive. Extension Fact Sheet AEX-465-93. http://ohioline.osu.edu/aex-fact/0465.html

Lovell, S. T., and W.C. Sullivan, 2006. Environmental benefits of conservation buffers in the United States: Evidence, promise, and open questions *Agriculture, Ecosystems and Environment* 112 (2006) 249–260

McGinnis, S. L.., 2001. Watershed-based pollution trading development and current trading programs. *Environmental Engineering and Policy* 2: 161-170.

Mitsch, W J., and Gosselink, J G., 2000. The value of wetlands: importance of scale and landscape setting. *Ecological Economics* 35: 25-33.

Naiman, R.J., S.E. Bunn, C. Nilsson, G. E Petts, G. Pinay, and L.C. Thompson, 2002. Legitimizing fluvial ecosystems as users of water: an overview. *Environmental Management* 30: 455-467.

Norton, M.M., and Fisher, T.R., 2000. The effects of forest on stream water quality in two coastal plain watersheds of the Chesapeake Bay. *Ecological Engineering* 14:337-361.

Petersen, Mark M., 1999, A natural approach to watershed planning, restoration and management. *Water Science and Technology* 39: 347-352

Potter, KM, Ramstack, JM, Schultz, RC, and Sharpley, AN, 2004. A watershed-scale model for predicting nonpoint pollution risk in North Carolina. *Environmental Management* 34: 62-74.

Ramstack, JM, Schultz, RC, and Sharpley, AN, 2004. Twentieth century water quality trends in Minnesota lakes compared with presettlement variability. *Canadian Journal of Fisheries and Aquatic Sciences* 61: 561-576.

Reed-Andersen, T, Carpenter, S R., and Lathrop, R C., 2000. Phosphorus Flow in a Watershed-Lake Ecosystem.*Ecosystems* 3: 561-573.

Roy, A.., M. C. Freeman, B. J. Freeman, S.J. Wenger, J.L. Meyer, W.E. Ensign, 2006. Importance of Riparian Forests in Urban Catchments Contingent on Sediment and Hydrologic Regimes. *Environmental Management* Vol. 37, No. 4, pp. 523–539

Salvia, M., Iffly, J.F., Vander Borght, P., Sary, M., and Hoffmann, L., 1999. Application of the `snapshot' methodology to a basin-wide analysis of phosphorus and nitrogen at stable low flow. *Hydrobiologia* 410: 97-102

Slaton, NA, Stalnacke, P, Stalnacke, P, Stalnacke, P, Sullivan, A, and Tiscareno-Lopez, M, 2004. Nutrient input and removal trends for agricultural soils in nine geographic regions in Arkansas. *Journal of Environmental Quality* 33: 1606-1615.

Smith, R.A., R. B. Alexander and K. J. Lanfear, 1994, Stream Water Quality in the Conterminous United States -- Status and Trends of Selected Indicators During the 1980's, U.S. Geological Survey Water-Supply Paper 2400. http://water.usgs.gov/public/nwsum/sal/index.html

Tsihrintzis, V.A., and Hamid, R. 1997. Modeling and management of urban stormwater runoff quality: A review. *Water Resour. Manage*., 1997, vol. 11, no. 2, pp. 137-164

Vanni, M.J., W.H. Renwick, J.L. Headworth, J. Auch, and M. Schaus, 2001. Dissolved and particulate nutrient flux from three adjacent agricultural watersheds: a five-year study. *Biogeochemistry* 54:85-114.

Vought, L B.-M., Pinay, G, Fuglsang, A, and Ruffinoni, C., 1995. Structure and function of buffer strips from a water quality perspective in agricultural landscapes. *Landscape and Urban Planning* 31: 323-331

Zipper C.E., Stewart R.E., Holtzman G.I., Darken P.F., and Gildea J.J., 2002, Virginia USA water quality, 1978 to 1995: Regional interpretation. *Journal of the American Water Resources Association* 38:789-802.