

GEOL/GEOG 255 Syllabus, Spring 2009

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Office Hours: M 10-11, W 11-12; Th 11-12, or by appointment.

Lecture meets from 9:05 – 9:55 MWF in 417 McCardell BiHall.

Lab meets from 1:30 – 4:15 either W (section Z) or Th (section Y) in 419 McCardell BiHall. Most of the time we will be in the field or in a prep lab (e.g. MBH 422) or analytical lab (e.g. MBH 152).

TEXTBOOK (Required): *Applied Hydrogeology* (4th edition) by C.W. Fetter, 2001, Prentice-Hall. ISBN: 0-13-088239-9. A previous edition of the text is on reserve in Armstrong Library. Additional reserve/reference books are available in the back of the classroom (see list on opposite side).

OBJECTIVE Water is our most valuable resource, not only for humans, but for all life on this planet. If we run out of oil... well, no more plastics or gasoline-burning autos, but we could probably figure something out. Without clean, plentiful water, the result is disease, war, ground subsidence, habitat loss, and a long list of disastrous outcomes. In this course, we will address many of the important controls on the quantity, quality and distribution of water at the earth's surface, including atmospheric water, surface water, soil water and ground water. Some material will be presented as lectures, some as laboratory activities, and some as student-led presentations and discussions. We will approach these issues from a geological perspective with elements of geography, chemistry and a little bit of policy.

I fully anticipate active, creative, thoughtful and informed participation on your part.

COURSE OUTLINE, ASSIGNMENT DUE DATES.

	TOPICS	Readings, Assignments Due
Wk 1 (Feb 9-13)	M-W Introduction; unique physical & chemical properties of water; the hydrologic equation. F: hydrologic cycle, hydro data analysis.	Ch 1&2
Wk 2 (Feb 16-20)	Precipitation (condensation, geographic controls, measurement and analysis, climate). Infiltration, runoff, flooding, stream hydrographs.	Ch 2 Article #1 (Fri)
Wk 3 (Feb 23-27)	Flooding, flood-frequency analysis, land-use, storm intensity and climate. Effects of dams.	Handouts Articles #2,3 (Fri)
Wk 4 (Mar 2-6)	Soil moisture, ground water recharge. Aquifer properties	Ch 6, Ch 3. HW1 due 9:05 AM Mar 6
Wk 5 (Mar 9-13)	Aquifer properties, ground water flow	Ch 4, Ch 8. Articles #4,5 (Fri)
Wk 6 (Mar 16-20)	Aquifer tests. Quantifying sustainable use. EXAM 1 = Wed Mar 18 in class.	Ch 5; EXAM 1 Mar 18. Articles #6,7 (Fri)
Wk 7	Spring Break	
Wk 8 (Mar 30-Apr 3)	Regional ground water systems : Case studies, e.g., glacial outwash-till, High Plains Aquifer, SE USA carbonate aquifers.	Ch 7 Articles #7,8
Wk 9 (Apr 6-10)	Water composition—controls on natural variability.	Ch 9 Article #9
Wk 10 (Apr 13-17)	Water quality, contamination. Atmospheric, surface water.	Ch 10 Articles #10,11
Wk 11 (Apr 20-24)	Water quality, contamination. Soils and ground water.	Ch 10 HW2 due 9:05 AM Apr 17
Wk 12 (Apr 27-May 1)	Climate change and the hydrologic cycle.	Handouts. Articles #12,13
Wk 13 (May 4-8)	Hydrology & policy—Indian water rights, riparian vs. prior appropriation doctrines, Clean Water Act, global/trans-border issues, science and policy.	Ch 11 Handouts

**Assignments are due at 4 PM in my office (or as e-mail attachment, or posted to course folder).

LAB

Week, Date Topic, type of assignment due.

- 1-4: Feb 11/12 - Mar 4/5 Community-based ground water quality study, carbonate bedrock aquifer, northern Addison County. (field-lab). End-products are (1) individual reports to homeowners, and (2) report with tables, maps, correlation plots, etc.
5. Mar 11/12 Field trip/outdoor lecture & discussion section on elements of hydrologic cycle discussed thus far in class. 2:00 – 4:00.
6. Mar 18/19: Modeling hydrogeological systems and ground water flow using MODFLOW © (computer lab). Note that the CD in the back of the Fetter (2001) textbook contains a version of MODFLOW that we will use in lab
7. Mar 25/26: Spring Break.
8. Apr 1/2: Wetlands. In Field.
9. Apr 8/9: Stream morphology, Rosgen-style stream classification, Little Otter Creek or Middlebury River (depending on field conditions). In Field.
10. Apr 15/16: Soils, vadose zone hydrology. In Field.
11. Apr 22/23: Ground water monitoring well exercise in Stowe. Leave Midd at 12:15. In Field.
12. Apr 29/30: Stream gaging, quantifying infiltration from discharge analysis, New Haven River. In Field.
13. May 6/7: Meandering stream geomorphology from the river's point of view: Otter Creek by canoe. In Field.

You are responsible for dressing appropriately for field labs.

REQUIREMENTS - GRADING

Lecture participation (10%): insightful vocal participation in lecture and lab.

Labs (30%): lab reports/assignments = 15%, other 15% includes attendance/participation, analysis.

2 Homework assignments (15%): —7.5% each.

2 Exams (35%)

Exam #1: In class March (15%)

Exam #2: Take-home exam (any time during finals week) (20%)

- Both are based on class notes, text, any assigned readings (i.e. j. articles).
- Both are self-scheduled, timed (2h), open book, notes, etc.

Peer-reviewed journal article presentation (10%): ~ 10 min professional- style presentation w/ figures (using figures, table).

ADDITIONAL READINGS

Berner EK, Berner RA (1996) *Global Environment: Water, Air and Geochemical Cycles*. Prentice Hall.

* Good section on acid precipitation.

Brady NC, Weil RR (2002) *The Nature and Properties of Soils* (13e). Prentice Hall.

* Classic soil science text

Dingman SL. (1994) *Physical Hydrology*. Prentice Hall.

* Useful information on a range of topics.

Drever JI (1997) *The Geochemistry of Natural Waters: Surface and Groundwater Environments* (3e). Prentice Hall.

* Good reference for water chemistry, including organic compounds.

Dunne T, Leopold LB (1978) *Water in Environmental Planning*. WH Freeman and Co.

* Classic text, contains reference to global cooling!!

Easterbrook DJ (1999) *Surface Processes and Landforms* (2e). Prentice Hall.

* Useful information on fluvial processes, stream morphology.

Fetter CW (1993) *Contaminant Hydrogeology*. Macmillan Pub. Co.

* Mostly chemical hydrogeology with some physical hydrogeology and case studies.

Hewlett JD (1982) *Principles of Forest Hydrology*. Univ. Georgia Press.

* Some useful data on forests and their role in the hydrologic cycle.

Montgomery CW (2000) *Environmental Geology* (5e). McGraw-Hill.

* Refer to this text if you are lacking in basic geology background.

Schlesinger WH (1991) *Biogeochemistry: An Analysis of Global Change*. Academic Press.

* Useful information on elemental cycles (e.g. CHONPS).

Stanitski CL et al. (2000) *Chemistry in Context* (3e). Am Chem Society.

* Refer to this text if you are lacking in basic chemistry background.

Ward AD, Elliot WJ (1995) *Environmental Hydrology*. CRC-Lewis Press.

* Contains problem sets and a wide range of data.

Viessman WJ, Lewis GL () *Introduction to Hydrology* (5th Ed.). Prentice Hall.

* I used this text in 2003.

