



## ***Environmental Engineering (EVEN) Degree Guidelines***

**Academic Year 2006-2007**

**College of Engineering and Applied Science**

**University of Colorado at Boulder**

### **Environmental Engineering Program**

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# 1. Introduction to Environmental Engineering

The *Environmental Engineering (EVEN) Degree Guidelines* provide an outline of the curriculum and policies of the Environmental Engineering (EVEN) degrees offered by the College of Engineering and Applied Science of the University of Colorado at Boulder. These guidelines are written primarily for the Environmental Engineering students and faculty advisors. The current version of these *Guidelines* and versions dating back to the beginning of the Program in 1998 are kept on the Program's web site (<http://www.colorado.edu/engineering/even/evenbs.htm>).

General curriculum and policy information for students is also available from the Office of Student Services in the Dean's Office of the College of Engineering and Applied Science (<http://ecadw.colorado.edu/engineering/students/advising.htm>). Similar information on academic support programs, advising, and registration is available on the web at the College's Undergraduate Student Services web page (<http://ecadw.colorado.edu/engineering/students/undergraduate.htm>).

Information on courses offered each semester is available in the *Registration Handbook and Schedule of Courses* and the *University of Colorado at Boulder Catalog* published by the University of Colorado. Course scheduling information for the coming semester and the past two or three semesters is available on University's Schedule Planner web page (<http://plus.colorado.edu/planner/>). Course descriptions are available in the University's Course Catalog (<http://www.colorado.edu/catalog/catalog06-07/courses.html>).

## 1.1. Overview of Environmental Engineering

Environmental engineers play a vital role in maintaining the quality of both human environmental systems and the natural environment. Environmental engineering encompasses the scientific assessment and development of engineering solutions to environmental problems impacting the biosphere, land, water, and air quality. Environmental issues affect almost all commercial and industrial sectors, and are a central concern for the public, for all levels of government, and in international relations. These issues include safe drinking water, wastewater processing, solid and hazardous waste disposal, outdoor air pollution, indoor air pollution and transfer of infectious diseases, human health and ecological risk management, and prevention of pollution through product or process design.

To address these challenges, environmental engineers often encounter challenging problems that must be solved in data-poor situations as members of multidisciplinary teams. Environmental problems require creative solutions blended with contributions from scientists, lawyers, business people, and the public. Good communication skills, as well as technical proficiency, are essential for success in this arena. In addition, technology designed to address environmental problems is marketed globally, opening up increasing opportunities for international work in the environmental engineering field.



The Engineering Center at the University of Colorado at Boulder.

## 1.2. History of the Environmental Engineering Program

The Environmental Engineering Program at the University of Colorado at Boulder originated with a college-wide faculty committee that met during the 1993-1994 academic year to develop a multi-disciplinary curriculum for a Bachelor of Science degree in Environmental Engineering. The committee was headed by Prof. John Daily of Mechanical Engineering. The degree program was intended to supplement environmental engineering options that were offered through the Departments of Chemical and Biological Engineering and Civil, Environmental, and Architectural Engineering (the Department of Mechanical Engineering now offers an environmental engineering option as well).

The initiative to develop the EVEN BS degree and the Environmental Engineering Program to administer the degree was motivated by recognition that (1) environmental engineering had matured into a full-fledged discipline of its own and (2) environmental engineering intersected with the traditional disciplines of chemical, civil, and mechanical engineering, but was not adequately covered by any single discipline. The faculty committee decided that students intending to work in environmental engineering would benefit from a curriculum that focused on environmental engineering and related

courses regardless of which department offered those courses. At the same time, the existing environmental engineering options could be retained in the Departments for students who were interested in environmental engineering but wanted to pursue traditional Chemical, Civil, or Mechanical engineering degrees.

The proposed EVEN BS degree program was approved by the faculty of the College of Engineering and Applied Science in the spring of 1994. The faculty committee then prepared a full proposal for the new degree program for the Colorado Commission on Higher Education (CCHE), and the new EVEN BS degree program was approved in the spring of 1998. The first Director of the Environmental Engineering Program was Prof. Jana Milford of Mechanical Engineering. Students began entering the program in the fall of 1998. The first degree was awarded in December 1999 (to a student who transferred into the program as a third-year student).



EVEN students on a field trip for the CVEN 3434 Introduction to Applied Ecology course with Professor Diane McKnight.

In approving the new degree, CCHE relied on the College's intent to deliver the EVEN BS degree using existing courses and faculty. To this end, the program is administered by the College, and operates through the participation of affiliated faculty from Aerospace Engineering Sciences, Chemical and Biological Engineering, Civil, Environmental, and Architectural Engineering, and Mechanical Engineering. The College provides support for a faculty Director (currently Prof. Angela Bielefeldt of Civil, Environmental, and Architectural Engineering), a Program Coordinator, and teaching assistant support for field courses to supplement the EVEN curriculum. The four departments that participate in the program are committed to regularly offering the courses that comprise the EVEN curriculum, coordinating to avoid scheduling conflicts, and sharing academic advising and other faculty service requirements.

During the 2002-2003 academic year, the Environmental Engineering Program applied for accreditation of the EVEN BS degree with the Accreditation Board of Engineering and Technology (ABET). The application consisted of a detailed Self-Study Report and a visit by three ABET examiners. The ABET examiners were thoroughly satisfied with the EVEN BS degree and ABET granted accreditation to the degree in September 2003. The Environmental Engineering Program completed the first major revision of the EVEN curriculum for the 2004-2005 academic year. Another ABET accreditation review in 2005 resulted in a few curriculum revisions, including the addition of a laboratory course in a field related to earth science.

### 1.3. Mission and Educational Objectives

The EVEN faculty, its Professional Advisory Board (representing prospective employers of our graduates), and EVEN alumni and current students have contributed to the creation of the Program's mission and the educational objectives of the EVEN BS degree.

The **mission** of the Environmental Engineering Program is to provide a multidisciplinary undergraduate environmental engineering education that emphasizes mastery of principles and practices, inspires service for the global public good, endows a desire for life-long learning, and prepares students for broad and dynamic career paths in environmental engineering.

The **educational objectives** of the EVEN BS degree are to produce students who reach the following achievements three to five years after graduation:

1. EVEN graduates have become established in professional careers and earned advanced degrees;
2. EVEN graduates have applied multidisciplinary approaches to manage the unique challenges and balance the competing social, political, economic, and technical goals of environmental problems and solutions; and
3. EVEN graduates have served the needs of our society and protected the future of our planet in an ethical manner.

## 2. Environmental Engineering Degree Programs

### 2.1. Bachelor Science Degree in Environmental Engineering

#### 2.1.1. Overview of EVEN BS Degree

The Bachelors of Science degree in Environmental Engineering (EVEN) at the University of Colorado provides preparation for professional proficiency or graduate training in environmental engineering in a four-year curriculum.

The curriculum includes courses in engineering fundamentals and applications, advanced mathematics, chemistry, physics, biology, geology, and the arts and humanities. Courses specific to environmental engineering practice include water chemistry, microbiology, and air pollution control. In addition, environmental engineering requires hands-on laboratory experiences, up-to-date skills in the use of computers for modeling and data analysis, and experience in the design of environmental engineering systems. Many of the required engineering courses in the Bachelor of Science curriculum are culled from Aerospace Engineering Sciences, Chemical and Biological Engineering, Civil, Environmental, and Architectural Engineering, and Mechanical Engineering.

The curriculum also includes three Option courses and four technical elective courses. The three Option courses represent an area of specialization in environmental engineering selected by the student beginning in the third year. The curriculum includes six sets of prescribed Option courses:

- Air Quality
- Applied Ecology
- Chemical Processing
- Environmental Remediation
- Water Resources and Treatment

In addition to these prescribed Options, students may also formulate their own sequence of Option courses (referred to as a “special Option”) representing an area of specialization not included in the six sets of Option courses listed above. This selection must be done by petition to the Environmental Engineering Program.

Students in the program are also encouraged to participate in research through independent study projects, a senior thesis, the Undergraduate Research Opportunities Program (UROP), or as undergraduate research assistants in sponsored research programs.

#### 2.1.2. Curriculum for EVEN BS Degree

The following section contains the curriculum table for the EVEN BS degree. The curriculum represents a “contract” of sorts with incoming students – for students entering the program during the current academic year, completion of this curriculum with a satisfactory grade point average is the requirement for graduation. The curriculum also represents a guarantee that the courses listed (or acceptable substitutes) will be available in the semesters listed.

The curriculum is somewhat dynamic despite its contractual nature. Minor changes may be made by the Program during the academic year, and major changes may be made between academic years. To meet graduation requirements, students are expected to follow the curriculum in effect for the academic year they started the program; therefore, students should keep a copy of the *Environmental Engineering (EVEN) Degree Guidelines* for the academic year they start the program. An archive of the *Guidelines* is retained on the Program’s web site (<http://www.colorado.edu/engineering/even/evenbs.htm>). Students may elect to follow a later curriculum revision with Program approval; however, students may not elect to follow a curriculum in effect before they started the program.

The curriculum below shows the recommended sequence of courses. In each curricula, courses marked with an asterisk (\*) are offered only in the semester shown. Other courses are offered in both semesters. For example, the required course in Probability and Statistics (third-year fall in the EVEN BS curriculum) may be taken in another semester (provided that all prerequisite and co-requisite course requirements are met) because Probability and Statistics is not required by a course following it in the curriculum schedule.



EVEN students examine a soil sample collected by hollow-stem auger drilling during the EVEN 4830 Environmental Sampling and Analysis course in Spring 2003.

Many of the required courses in the EVEN BS curriculum may be satisfied by courses from different engineering departments (Solid Mechanics, Engineering Economics, Fluid Mechanics, Thermodynamics, Heat Transfer, Probability and Statistics). Students may choose any of the offerings from different departments for these required courses; however, students should evaluate these choices carefully depending on their major interest in environmental engineering. For example, a student interested in the Air Quality Option might want to take the Mechanical Engineering courses for Solid Mechanics, Fluid Mechanics, Thermodynamics, and Heat Transfer. A student interested in the Chemical Processing Option would do best to choose Chemical Engineering courses (in fact, CHEN 3320 Chemical Engineering Thermodynamics is required for some of the Chemical Processing Option courses).

For certain courses in the EVEN BS degree curricula, students may encounter problems and concerns about prerequisite and co-requisite course requirements not being met. There is no need for concern; the Environmental Engineering Program has consulted in detail with the departments and faculty offering these courses and has gained assurance that the sequence of courses in the EVEN curricula is appropriate for engineering students.

Guidance on selection of Option courses, Humanities and Social Science (H&SS) courses, and technical elective courses is offered in Section 4.



A settling pond for the treatment of acid mine drainage.

## EVEN BS Degree, 2006-2007 Academic Year

Fall, First Year		Spring, First Year	
APPM 1350 Calculus 1 for Engineers	4	APPM 1360 Calculus 2 for Engineers	4
CHEN 1211 General Chemistry for Engineers	3	GEEN 1400 Engineering Projects	3
CHEM 1221 General Chemistry Laboratory	2	H&SS Elective II ( <i>a</i> )	3
EVEN 1000 Introduction to Environmental Engineering (*)	1	PHYS 1110 General Physics 1	4
GEEN 1300 Introduction to Engineering Computing	3	Technical Elective I ( <i>b</i> )	3
H&SS Elective I ( <i>a</i> )	3		
	<b>16</b>		<b>17</b>
Fall, Second Year		Spring, Second Year	
APPM 2350 Calculus 3 for Engineers	4	APPM 2360 Intro Differential Eqns with Linear Algebra	4
CVEN 3414 Fundamentals of Environmental Engineering (*)	3	CHEM 4521 Physical Chemistry for Engineers (*)	3
H&SS Elective III ( <i>a</i> )	3	CHEM 2120 Material and Energy Balances	3
PHYS 1120 General Physics 2	4	H&SS Elective IV ( <i>a</i> )	3
PHYS 1140 Experimental Physics 2	1	Solid Mechanics ( <i>c</i> )	3
	<b>15</b>		<b>16</b>
Fall, Third Year		Spring, Third Year	
CVEN 3454 Water Chemistry (*)	4	CVEN 4424 Environmental Organic Chemistry (*)	3
EMEN 4100 Business Methods & Economics for Engineers (*)	3	Heat Transfer ( <i>h</i> )	3
Fluid Mechanics ( <i>d</i> )	3	CVEN 4484 Introduction to Environmental Microbiology (*)	3
Required Communication Course ( <i>f</i> )	3	MCEN 4131 Air Pollution Control (*)	3
Thermodynamics ( <i>g</i> )	3	Probability and Statistics ( <i>e</i> )	3
	<b>16</b>		<b>15</b>
Fall, Fourth Year		Spring, Fourth Year	
CVEN 4333 Engineering Hydrology	3	CVEN 4434 Environmental Engineering Design (*)	3
CVEN 4444 (5834) Environmental Engineering Processes (*)	3	Air or Earth Science Laboratory/Field Course ( <i>k</i> )	3
HS&S Elective V ( <i>a</i> )	3	Option Course II ( <i>i</i> )	3
Technical Elective II ( <i>b</i> )	3	Option Course III ( <i>i</i> )	3
Option Course I ( <i>j</i> )	3	Technical Elective IV ( <i>b</i> )/Senior Thesis ( <i>j</i> )	3
Technical Elective III ( <i>b</i> )/Senior Thesis ( <i>j</i> )	3		
	<b>18</b>		<b>15</b>
			<b>Total Credit Hours 128</b>

\* Only offered in the semester shown (not including summer offerings).

*a.* A total of 18 credit hours of humanities and social sciences (H&SS) electives is required. At least six hours must be at the upper division (3000 or 4000) level. Required Communication Course (*g*) must be taken at the 3000-level or above.

*b.* A total of 9 credit hours of technical electives is required. Three technical elective credits may be lower division (1000-, 2000-level). Three technical elective credits must be in the earth sciences, either lower or upper division. Remaining technical elective credits must be upper division in engineering, mathematics, or sciences. An independent study (EVEN 4840) may be completed as technical electives for up to 6 credits.

*c.* Solid Mechanics options: CVEN 2121 Analytical Mechanics (F,S), GEEN 3851 Statics for Engineers (Sum), or MCEN 2023 Statics and Structures (F).

*d.* Fluid Mechanics options: CHEN 3200 Chemical Engineering Fluid Mechanics (S), CVEN 3313 Theoretical Fluid Mechanics (S), GEEN 3853 Fluid Mechanics for Engineers (Sum), or MCEN 3021 Fluid Mechanics (F).

*e.* Probability and Statistics options: APPM 4570 Statistical Methods (F,S), CHEN 3010 Applied Data Analysis (F), CVEN 3227 Probability, Statistics, and Decisions (S).

*f.* Usually WRTG 3030 Writing on Science and Society (F,S), or HUEN 3100 Humanities for Engineers 1 (F) and HUEN 3200 Humanities for Engineers 2 (S; counts for H&SS Elective V (*a*)).

*g.* Thermodynamics options: CHEN 3320 Chemical Engineering Thermodynamics (F; *required for Chemical Processing Option*), GEEN 3852 Thermodynamics for Engineers (Sum), or MCEN 3012 Thermodynamics (F, *required for Air Quality Option*).

*h.* Heat Transfer options: CHEN 3210 Chemical Engineering Heat Transfer (F) or MCEN 3022 Heat Transfer (S).

*i.* Option courses are specified on the following page.

*j.* Senior Thesis: a senior thesis can be completed with faculty approval if Technical Electives II and IV are taken as independent studies on a single research topic.

*k.* Air or Earth Science Laboratory/Field Course: A 3(+) credit hour course with a significant laboratory or field component related to air quality or earth science.

Beginning in the spring of their third year, students must select an Option, an area of specialization in environmental engineering. For each option, a total of 9 credit hours of option courses are required. Students may choose from the lists of possible Option courses listed below.

### **Air Quality Option**

- ATOC 3500 Air Chemistry and Pollution (3 credit hours, F)
- MCEN 4042 Thermal Systems Design (3 credit hours, S)
- MCEN 4152 Introduction to Combustion (3 credit hours, F)
- MCEN 4162 Energy Conversion (3 credit hours, contact Mechanical Engineering Department)

### **Applied Ecology Option**

- CVEN 3434 Intro to Applied Ecology (*required for this option*, 3 credit hours, S)
- EBIO 3270 Ecosystem Ecology (3 credit hours, S)
- EBIO 4020 Stream Biology (3 credit hours, F)
- EBIO 4030 Limnology (3 credit hours, S)

### **Chemical Processing Option**

- CHEN 3220 Chemical Engineering Separations and Mass Transfer (*required for this option*, 3 credit hours, S)
- CHEN 4330 Chemical Engineering Reaction Kinetics (*required for this option*, 3 credit hours, S)
- CHEN 4670 Environmental Separations (3 credit hours, every other S)

### **Environmental Remediation Option**

- CVEN 4353 Groundwater Engineering (3 credit hours, F)
- CVEN 4474 Hazardous and Industrial Waste Management (3 credit hours, S)
- GEOL 3030 Introduction to Hydrogeology (3 credit hours, F)
- GEOL 4716 Environmental Field Geochemistry (2 credit hours, S)

### **Water Resources and Treatment Option**

- CVEN 3323 Hydraulic Engineering (3 credit hours, F)
- CVEN 3424 Water and Waste Water Treatment (3 credit hours, S)
- CVEN 4323 Water Resource Engineering Design (3 credit hours, )
- GEOG 4501 Water Resources and Water Management of Western United States (3 credit hours, S)

### **Special Option**

Students with unique educational goals may formulate a personalized sequence of three courses (9 credit hours) as the Option sequence. To do so, students must present their Option plan to their faculty advisor and submit a petition to the Environmental Engineering Program for approval. The "Special Option" petition may be found in the Forms Appendix.



## 2.2. Dual Degrees

Students in the College of Engineering and Applied Science may obtain Bachelor of Science degrees in two engineering disciplines or one degree in engineering and a second degree from a department in another college or school of the University. Students must satisfy the curricula for both programs and complete a minimum of 30 additional credit hours above and beyond the larger minimum credit hour requirement.

Of the 30 additional credit hours, dual degree students must complete 24 semester credit hours in courses offered by the secondary academic department or in courses approved in advance by the department as substitutes. Transfer students pursuing double degrees must complete a minimum of 75 semester credit hours as a degree student in the College of Engineering and Applied Science and must satisfy all other stipulations regarding total hours required and approval of all coursework by both departments concerned.

Resident students should be aware that the College Opportunity Fund (COF) will not cover all tuition costs associated with a double degree program (those beyond 145 semester credit hours).



Erik Jorgensen, an EVEN 2005 graduate, working on a solar pond evaporation control system for the U.S. Bureau of Reclamation.

### 2.3. Concurrent Bachelor of Science/Master of Science Degree

The Environmental Engineering Program is cooperating with the Civil, Environmental, and Architectural Engineering Department to offer concurrent EVEN BS/CVEN MS degrees in a five-year curriculum (currently, this is the only concurrent BS/MS degree that includes the EVEN BS degree). To fit the BS and MS degrees in only five years, students are allowed to count two technical elective courses (6 credit hours) taken at the graduate level for both the EVEN BS and CVEN MS degrees. Students must first complete the four-year Environmental Engineering Bachelor of Science curriculum (Section 2.1); they then complete the requirements of the CVEN MS degree in the graduate programs of either Environmental Engineering or Water Resources Engineering.

The purpose of the concurrent EVEN BS/CVEN MS degrees is to allow capable students to gain greater depth of knowledge in environmental engineering by jointly pursuing BS and MS degrees. The concurrent degree program offers students greater flexibility in scheduling technical electives and graduate courses and to enable them to obtain BS and MS degrees in five years.

Students seeking to pursue the concurrent EVEN BS/CVEN MS degrees must achieve a minimum grade point average of 3.25 when they submit an application for admission to the program. Students are expected to submit an application during the sixth or seventh semester of their undergraduate program in EVEN (75 to 110 credit hours). Applications are made to the Civil, Environmental, and Architectural Engineering Department. The following items are needed to complete an application:

- Concurrent EVEN BS/CVEN MS Degrees application form (no application fee)
- Four letters of recommendation
- University of Colorado Application for Graduate Admission form, Part II only
- Certification by the EVEN Program that the required number of coursework hours have been completed
- Copy of internal transcript

The application deadlines are April 30 for admission to the program for the following fall and October 30 for admission for the following spring semester.

To continue in the program, students must maintain full-time status with a cumulative GPA of 3.25 to remain in the program. In addition, to count the two graduate courses (6 credit hours) for both the EVEN BS and CVEN MS degrees, the student must achieve a grade point average of at least 3.5 in the 24 credit hours taken immediately after admission to the program. For the CVEN MS, students may complete the requirements for either the Plan I (thesis) or Plan II (course work only) Master of Science degrees.

Students admitted to the concurrent EVEN BS/CVEN MS degrees program who do not meet the requirements for completing the concurrent degrees or who elect not to complete the concurrent degrees may count appropriate graduate courses toward the technical elective (up to 9 credit hours) and option course (up to 9 credit hours) requirements for the EVEN BS.



Sabre Duren, an EVEN 2002 graduate, measuring stream flow with a pygmy meter for an independent study project.

## **3. Advising**

### **3.1. Advising Process**

Each Fall and Spring semester, just prior to the registration period for the following semester, students are required to meet with their faculty advisors for academic counseling. In the Environmental Engineering Program, members of the faculty engage in academic counseling to promote greater student-faculty interaction. Faculty advisors are also available for academic and career counseling beyond the required meetings each semester at the student's request.

A few weeks before each advising period, the Program Coordinator will announce to students and faculty advisors by email the advising period schedule. With this email, an updated version of these *Environmental Engineering (EVEN) Degree Guidelines* and other advising information will be sent.

Students must make an appointment with their faculty advisors during the advising period. Faculty advisors will give meetings with advisees high priority during this time. In preparation for the meeting, students should assemble a proposed course plan for the following semester using these *Environmental Engineering (EVEN) Degree Guidelines* and the course schedule for the following semester, which is available on the University of Colorado Personal Look-Up Service (PLUS) web page (<http://plus.colorado.edu/planner/>).

During the advising meeting, students must discuss their proposed course plan with their faculty advisor. Faculty advisors will record course selections on the Degree Requirements Worksheet (see Forms Appendix). Faculty advisors will also be available to counsel the students on academic performance, long-term course plans, graduation requirements, career planning, and any other personal issues that affect the student's education. At the conclusion of the meeting, the faculty advisor will sign the students' academic file certifying that advising has been done.

After the advising meeting, students are required to fill out an Advising Evaluation Form (see the Forms Appendix) to provide feedback on the advising process. These forms must be submitted to the Program Coordinator.

Once the Coordinator has received a student's academic file with the signature of the faculty advisor (from the faculty advisor) and the Advising Evaluation Form (from the student), the Coordinator will "raise the flag" to allow the student to register.

Many academic advising questions pertain to the "logistics" of course scheduling and registration. Most of these questions should be directed to the Program Coordinator (see the cover sheet for contact information) instead of the faculty advisors. The Coordinator will provide assistance on procedural questions involving registration, degree plans, graduation requirements, and the petition process. In addition, the Coordinator will help students determine whether a particular situation should be discussed with their faculty advisor.

### **3.2. Program Contact with Students (Email)**

Official notices to students concerning Environmental Engineering Program advising, curriculum, registration, graduation requirements, and policies will be made by e-mail. By default, official notices will be sent to your University e-mail address as listed on the student directory on the web (<http://www.colorado.edu/search/>). You may arrange to also receive official notices at a non-University e-mail address of your choice by notifying the Program Coordinator; however, the Coordinator will provide this service only as convenience to you. The Coordinator will not be responsible for information sent to abandoned e-mail addresses. To reiterate, the Program is required to notify you only at your University e-mail address.

### **3.3. Academic Records**

An official Environmental Engineering Program academic file will be maintained for each student by the Program Coordinator. This file will contain copies of official documentation related to academic history and progress.

The Environmental Engineering Program Coordinator and faculty advisors will strive to provide you with complete, timely, and accurate academic advising; but ultimately, the responsibility of meeting graduation requirements is yours. Consequently, you should ensure that all copies of relevant paperwork are present in your academic file and that you keep your own copies of critical information.

### **3.4. Additional Advising Resources**

Students may also be referred to various College of Engineering and Applied Science and University of Colorado counselors for certain issues. Many of the College's student support services are listed on the College web page (<http://ecadw.colorado.edu/engineering/students/undergraduate.htm>). At the University level, students may consult with the following groups:

- Career Services – provides services for resume and interview skills improvement, internship and job postings, and career fairs (<http://www.colorado.edu/careerservices/>, 34 Willard Hall, 303 492 6541)
- Counseling and Psychological Services: A Multicultural Center -- provides a variety of programs and assistance to address general academic or personal issues. (<http://www.colorado.edu/sacs/counseling/>, 134 Willard Hall, 303 492 6766)

### 3.5. Faculty Advisor Assignments

First-year, change-of-major, and transfer students entering the Environmental Engineering Program will be assigned a faculty advisor (Table 3). Incoming change-of-major and transfer students will initially be advised by the Program Director. At the first advising meeting for change-of-major and transfer students, transfer credits will be evaluated and a complete course plan to meet graduation requirements will be formulated. After the initial advising, change-of-major and transfer students will be directed to a faculty advisor handling the class to which the incoming student is assigned.

**Table 3. Faculty advisor assignments by class for the 2006-2007 academic year.**

class	faculty advisor	office	phone	email
first-year ( $\leq 32$ hours)	Angela Bielefeldt	ECOT 516	492 8433	angela.bielefeldt@colorado.edu
second-year ( $32 < \text{hours} \leq 64$ )	Shelly Miller	ECME 222	492 0587	shelly.miller@colorado.edu
third-year ( $64 < \text{hours} \leq 96$ )	Jana Milford	ECME 214	492 5542	jana.milford@colorado.edu
fourth-year ( $> 96$ hours)	Joseph Ryan	ECOT 517	492 0772	joseph.ryan@colorado.edu
transfers (initial advising)	Angela Bielefeldt	ECOT 516	492 8433	angela.bielefeldt@colorado.edu

## 4. Academic Policies

### 4.1. Prerequisite and Co-Requisite Courses

Most of the courses in the Environmental Engineering curricula have prerequisite and co-requisite requirements (see the last two tables in the Forms and Appendix). The purpose of these requirements is to ascertain that you are adequately prepared for subsequent courses.

Students must successfully complete all prerequisite courses before enrolling for a required course in the Environmental Engineering curricula. Students must also simultaneously enroll in and complete satisfactorily (grade of C- or better) all co-requisite courses. Successful completion means receiving a grade of C- or better. Grades of D+, D, D-, F, IF, or IW do not satisfy this requirement.

Successful completion of prerequisite and co-requisite courses will be monitored for all required courses in the Environmental Engineering curricula by the Program Coordinator. Students who do not successfully complete (grade below C-) prerequisite and co-requisite courses must retake those courses before advancing in the curricula. If a student registers for a course without satisfactorily completing prerequisite courses, the Program Coordinator will notify the student that course must be dropped and, if necessary, will drop the student from the course. Students required to retake courses are strongly urged to consult their faculty advisor before re-taking courses to evaluate areas in which academic performance can be achieved.

The prerequisite and co-requisite policy applies only to required and option courses in the curricula. If a student has not satisfied all of the prerequisite and co-requisite requirements for an elective course (technical, humanities & social sciences, chemistry), that elective course may be taken with the approval of the instructor.

Courses not listed in the curricula may be used to satisfy prerequisite and co-requisite requirements if transfer credit has been approved or a petition to the Environmental Engineering Program has been approved. Generic College of Engineering and Applied Science petition forms for this purpose may be obtained from the Program Coordinator.

### 4.2. Transfer Credit

Five different kinds of students transfer into the Environmental Engineering program:

- students changing majors from the College's Open Option major to EVEN
- students changing majors from another of the College's engineering degrees to EVEN
- students changing majors from another College or School in the University of Colorado to EVEN
- students changing majors from another campus of the University of Colorado to EVEN
- students transferring from another institution

For all transfer students, the College of Engineering and Applied Science requires that the last 45 credit hours used to fulfill degree requirements must be taken as a regular degree student in the College of Engineering and Applied Science in the University of Colorado at Boulder. More details about the College of Engineering Applied Science transfer credit policies are available in the Dean's office or online at the following URL on the College of Engineering and Applied Science web page ([http://ecadw.colorado.edu/engineering/prospective/transfer\\_students.htm](http://ecadw.colorado.edu/engineering/prospective/transfer_students.htm)).

#### 4.2.1. Change of Major: From the College's Open Option to EVEN

The EVEN program accepts the College of Engineering and Applied Science Open Option curriculum as a substitute for its own first-year curriculum. Grades of C- or better must have been achieved for all courses counting for required courses in the EVEN curriculum. Students changing from Open Option to EVEN must complete a change-of-major form for the College. A description of the College's Open Option is available online on the College web page ([http://engineering.colorado.edu/students/open\\_option.htm](http://engineering.colorado.edu/students/open_option.htm)).

#### 4.2.2. Change of Major: From a College Engineering Degree to EVEN

Evaluation of the credit hours earned in another engineering degree curriculum in the College of Engineering and Applied Science for credit in EVEN will be done at the first advising meeting with the EVEN Program's Director. Grades of C- or



Susan Bautts, a 2003 EVEN graduate, collects samples of the benthic macroinvertebrate population in an acid mine drainage-affected stream.

better must have been achieved for all courses counting for required courses in the EVEN curriculum. Because EVEN is a multi-department program, most students coming into EVEN from other engineering degree programs in the College are able to transfer most of their basic courses for credit toward the EVEN BS degree. Students changing from another engineering degree to EVEN must complete a change-of-major form for the College.

#### **4.2.3. Change of Major: From Another College or School to EVEN**

Students transferring into EVEN from another of the University of Colorado's Colleges and Schools (e.g., College of Arts and Sciences, School of Business) must first complete an Intra-University Transfer (IUT) application to the College of Engineering and Applied Sciences (details are available in the Dean's Office or at [http://ecadw.colorado.edu/engineering/prospective/transfer\\_cu-boulder.htm](http://ecadw.colorado.edu/engineering/prospective/transfer_cu-boulder.htm)). Once the application is approved, credit hours from the non-engineering degree will be evaluated for EVEN credit at the first advising meeting with the EVEN Program's Director. Students changing majors to EVEN from non-engineering degrees must complete the mathematics, chemistry, and physics requirements of the first year of the College's Open Option curriculum to apply for IUT; therefore, they will typically start EVEN with credit for most of the first year of the EVEN curriculum.

#### **4.2.4. Change of Major: From Another Campus of the University of Colorado System**

Students transferring into EVEN from another campus of the University of Colorado system will, in almost all cases, have the same status as transfers from the University of Colorado at Boulder. Students from other campuses should refer to the three change-of-major sections above. More details on Intercampus Transfer to the College of Engineering and Applied Sciences are available in the Dean's Office or online ([http://ecadw.colorado.edu/engineering/prospective/transfer\\_other\\_cu.htm](http://ecadw.colorado.edu/engineering/prospective/transfer_other_cu.htm)).

#### **4.2.5. Transfer from Another Institution**

Students transferring from another university or community college can find information on the College of Engineering and Applied Science website ([http://ecadw.colorado.edu/engineering/prospective/transfer\\_students.htm](http://ecadw.colorado.edu/engineering/prospective/transfer_students.htm)). An initial and official transfer credit evaluation is performed by the University Admissions Office using the transcript from the previous institution. Courses in which the student received a grade lower than a C- will not be accepted by the Admissions Office.

Once the Admissions Office has completed its evaluation, the student will meet with the EVEN Director for evaluation of transfer credits for the EVEN curriculum. Note that acceptance of transfer credits by the Admissions Office does not mean that the transfer credits will count toward the EVEN BS degree; courses taken at another institution must match the course requirements for the EVEN curricula. In most cases, identification of courses is straightforward; however, for some courses, the EVEN Director may request documentation of course content (catalog descriptions, course syllabi).

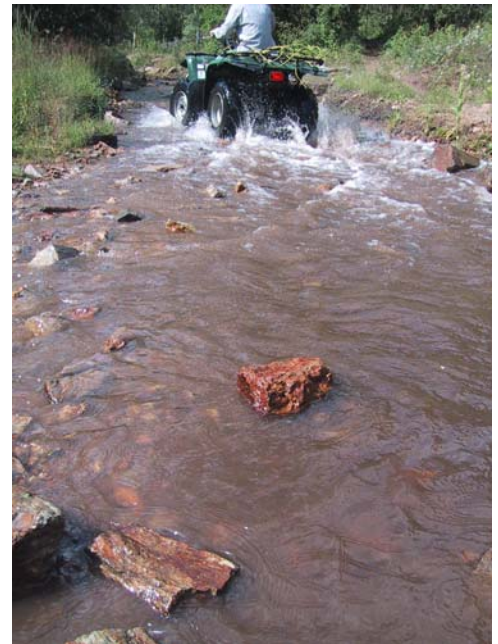
#### **4.2.6. Advanced Placement Credit**

Advanced Placement (AP) credit may be approved on the basis of College Entrance Examination Board's Advanced Placement tests. For students who have taken advanced placement courses in high school and who achieve the required score in the CEEB's AP examination, advanced placement credit will be granted by the College of Engineering and Applied Sciences as part of the admission process. Advanced placement credits must also be evaluated for credit toward the EVEN curricula by the student's faculty advisor or the EVEN Director. If a student later takes a course for which advanced placement credit was granted, the credit for the course taken at the University of Colorado will replace the AP credit.

For a listing of CU course equivalents for typical advanced placement credit, see the College of Engineering and Applied Science Advanced Placement and MAPs guidelines (available in the Dean's office or online at [http://engineering.colorado.edu/prospective/transfer\\_credits.htm](http://engineering.colorado.edu/prospective/transfer_credits.htm)).

#### **4.2.7. Continuing Education Courses**

Courses may be taken for EVEN degree credit through programs offered by the University of Colorado's Division of Continuing Education (see a full description at <http://www.colorado.edu/ContEd/>):



EVEN 2001 graduate Durrelle Scott (the headless rider) drives an ATV in a flooded road near a creek to simulate the generation of suspended sediment by off-highway vehicle recreation.

- Maymester
- Summer Session
- Available Credit for Eligible Special Students (ACCESS)
- Center for Advanced Training in Engineering and Computer Science (CATECS)
- Boulder Evening Credit
- Independent Learning
- Concurrent High School

A maximum of 16 credit hours taken through Continuing Education programs other than Maymester and Summer Session can be applied to the EVEN BS degree (Maymester and Summer Session courses are equivalent to courses offered during the regular academic year). A maximum of 8 of the 16 credit hours can be taken as Humanities and Social Sciences courses. According to the College of Engineering and Applied Science, students must secure advance approval of the Environmental Engineering Program and the Dean's Office prior to registering for Continuing Education courses.

### 4.3. Humanities and Social Sciences Electives

#### 4.3.1. Importance of Humanities and Social Sciences to Environmental Engineers

The purpose of humanities and social sciences (H&SS) electives is to broaden the engineering education. In environmental engineering, appreciation and knowledge of the social, historical, political, and economic context of environmental problems is critically important. The EVEN BS degree requires 18 credit hours of H&SS courses. One H&SS course is required – a required communications course (see section 4.3.2) – to improve writing and oral presentation skills. For the remaining 15 credit hours of the H&SS requirements, the EVEN faculty recommended that you select a *sequence of courses that complement and broaden your education in environmental engineering* and that you avoid random selection of unrelated introductory courses.



Prof. Joe Ryan (third from left) examines waste rock from a mine in St. Kevin Gulch near Leadville with students from the EVEN 4830 Multidisciplinary Approaches to Abandoned Mine Remediation course in Spring 2003.

Some H&SS courses that might be of interest to environmental engineers includes

- ECON 3545 Environmental Economics
- ENVS 3003 Race, Class, and Pollution Politics
- ENVS 3020 Advanced Writing in Environmental Studies
- ENVS 4100 Topics in Environmental Policy
- ENVS 4800 Critical Thinking in Environmental Studies
- GEOG 2412 Environment and Culture
- HIST 4267 Mining in the Western United States
- HIST 4417 Environmental History of North America
- INVS 1000 Responding to Social and Environmental Problems Through Service Learning
- MCDB 1030 Plagues, People, and Microorganisms
- PACS 3520 Environmental Dimensions of International Security
- PHIL 2140 Environmental Justice
- PHIL 3140 Environmental Ethics
- PSCI 3201 Environment and Public Policy
- SOCY 3091 Environment and Society

Additional courses of interest to environmental engineers may be found in the required and recommended curricula for the Environmental Studies program in the College of Arts and Sciences (<http://www.colorado.edu/envirostudies/>).

### 4.3.2. Humanities and Social Sciences Requirements

The Environmental Engineering Program follows the College of Engineering and Applied Science H&SS requirements ([http://ecadw.colorado.edu/engineering/Advising\\_Guides/HSS.pdf](http://ecadw.colorado.edu/engineering/Advising_Guides/HSS.pdf)). A total of 18 credit hours of H&SS electives is required for graduation. At least six of the required credit hours must be at the upper division level (3000- or 4000-level courses). In accordance with the rules of the College of Engineering and Applied Science, a course on writing and oral presentations is required (typically, WRTG 3030 Writing on Science and Society, but other options are listed below). This course provides three credit hours of upper division H&SS credit. The remaining courses must be selected from the College's approved H&SS course list (<http://ecadw.colorado.edu/homer/>). Petitioning for the approval of courses not on the approved list is allowed (see below).

Some substitutes for WRTG 3030 are accepted by the College of Engineering and Applied Sciences and the EVEN Program. The Herbst Humanities Program (<http://ecadw.colorado.edu/herbst/>) offers a two-semester (6 credit) sequence of seminar courses (HUEN 3100 Humanities for Engineers 1, HUEN 3200 Humanities for Engineers 2) that can be substituted for WRTG 3030 and the upper division H&SS course. If students take only HUEN 3100, credit is given only for the upper division H&SS course. Occasionally, other writing courses have been offered in the College of Engineering and Applied Science (e.g., GEEN 3000 Professional Communications for Engineers, GEEN 3860 Writing and Communication in Engineering) that may be substituted for WRTG 3030.

Students may petition the College of Engineering and Applied Sciences for approval of a H&SS course not on the *HOMER* list. It is strongly suggested that the petition be approved before enrolling in the course.

### 4.3.3. Some Specific Inclusions and Exclusions for the H&SS List

Foreign language courses generally satisfy the humanities and social science requirements.

The first seminar in the Minority Engineering Program (GEEN 1510) provides one hour of lower division H&SS credit; the second course (GEEN 1520) provides no credit.

Generally, courses in performance and the fine arts, mathematics, and natural sciences are not acceptable as H&SS electives. The following courses are specifically excluded as satisfying H&SS requirements:

- courses in painting, sculpture, photography, and other fine arts
- courses in musical instruments, band, choir, and other performance courses
- courses in accounting, finance, personnel administration, and other business practices



EVEN 2004 graduates Richard Comstock, Ian Crocker, and Robbie Rebel in the CVEN 3454 Water Chemistry laboratory.

### 4.3.4. Advice on Humanities and Social Sciences Course Selection

Guidance in the H&SS course selection process is available through the College of Engineering and Applied Sciences (see the online guide *HOMER*, <http://ecadw.colorado.edu/homer/>).

## 4.4. Technical Electives

### 4.4.1. Overview of Technical Electives

Technical electives provide an opportunity for students to explore a range of engineering, mathematical, and natural sciences topics to provide increased breadth or to focus on a specific technical area to develop in-depth understanding. In addition, one technical elective must be used to meet a requirement for a course in earth sciences prescribed by the American Academy of Environmental Engineers (AAEE; <http://www.aaee.net/>) for environmental engineering curricula. Students should consult their faculty advisors to plan their technical elective program.

### 4.4.2. Technical Elective Requirements

The EVEN BS curriculum requires nine credit hours of technical electives. Technical elective credit may be met by courses in the following categories:



- most engineering, physics, biology (both EBIO and MCDB), chemistry, geology, physical geography, and mathematics (both APPM and MATH) courses that are substantially different than required EVEN courses;
- many courses taught by Computer Science and Engineering Management;
- quantitatively rigorous in social sciences (economics, psychology, human geography); and
- independent study courses with appropriate quantitative analysis.

All technical elective course selections should be approved by your advisor.

One of the technical elective courses (3 credit hours) must be an earth science course at either the lower division or upper division level. See the list of recommended earth science courses in Section 4.4.4.

One of the technical elective courses (3 credit hours) may be a lower division (1000-, 2000-level) course. The remaining technical elective courses must be taken at the 3000-level and above. Both undergraduate and graduate courses (5000-level and above) may be taken as technical electives; admission to graduate courses requires the consent of the instructor.

Technical electives counted toward the graduation requirements for the EVEN BS degree may not be taken pass/fail. Exceptions to these rules will be considered by petition to the Environmental Engineering faculty.

#### 4.4.3. Specific Inclusions and Exclusions for Technical Electives

Independent study (see Section 4.7) is accepted as technical elective credit up to a maximum of 6 credit hours.

A maximum of 3 credit hours of Reserve Office Training Corps (ROTC) courses may be used as technical electives upon commissioning.

Courses in communications and foreign languages do not count as technical electives.

#### 4.4.4. Advice on Technical Electives

Here are just a few recommended courses for the technical elective that satisfy the earth science requirement:

- ATOC 1050 Weather and the Atmosphere
- CVEN 3698 Engineering Geology
- GEOL 1010 Introduction to Geology 1
- GEOL 1060 Global Change 1 – An Earth Science Perspective
- GEOL 2100 Environmental Geology
- GEOL 3030 Introduction to Hydrogeology
- GEOL 3520 Environmental Issues in Geosciences



EVEN/CHEN 2004 graduate Lily Isenhardt perches precariously for a precious water sample from the Snake River in Summit County.

Just about any course from the Department of Geological Sciences will satisfy the earth science requirement.

Many students have found that a course devoted to the use of computer software for engineering drawing (e.g., AutoCAD®) or geographic information science (GIS) and mapping (e.g. ARCview®) can open up job opportunities. The following courses are available on the Boulder campus:

- AREN 1017 Engineering Drawing
- GEOG 3053 Cartography: Visualization and Information Design
- GEOG 3093 Geographic Interpretation of Aerial Photographs
- GEOG 4043 Cartography 2: Interactive and Multimedia Mapping (prerequisite, GEOG 3053)
- GEOG 4103 Introduction to Geographic Information Science

## 4.5. Independent Study

### 4.5.1. Introduction to Independent Study

An independent study is a collaboration between a student and a faculty on a special project that provides the student with a learning experience. An independent study may also fill an academic need of importance to the student that

cannot be filled by the regular course offerings. Independent studies are opportunities for students to earn credit for learning outside the normal lecture and laboratory class structure.

In the EVEN BS curriculum, independent studies may be counted as technical electives (up to a maximum of six credit hours). Independent studies may be conducted in any increment of credit hours up to a maximum of 3 credit hours per semester, with one credit hour representing 25 hours of actual work on the task or project. The Environmental Engineering Program encourages students to consider independent study to engage in a long-term research project with a faculty member.

#### 4.5.2. Independent Study Requirements

The following rules apply to independent studies:

- a maximum of 6 credit hours of independent study may be applied to EVEN BS degree requirements as technical electives.
- independent studies may not be applied as Option courses.
- a maximum of 3 credit hours of independent study may be taken per semester.
- independent studies may be supervised by any appropriate University of Colorado faculty member.
- a proposal for an independent study must be made by filling out the Independent Study Agreement Form and submitting the form to the EVEN Program Coordinator.
- the EVEN director must approve the proposed independent study.
- a final product of the independent study must be submitted to the Environmental Engineering Program before a grade will be sent to the registrar's office for posting.
- approval of a second independent study is contingent on successful completion of the requirements for the first independent study. A copy of the Independent Study Agreement Form for the previous independent study must accompany the second application.
- Independent studies may not be arranged retroactively.
- independent study credit is not allowed for internship experiences, work-study, or work done for pay, following University rules.

#### 4.5.3. Independent Study Procedures

To propose an independent study, students must first determine with a collaborating faculty member the topic, goals, number of credit hours (up to 3 per semester), work plan, and required product for the independent study. This information must be recorded on an Independent Study Agreement Form (see the Forms Appendix) and submitted to the EVEN Program Coordinator before the drop/add deadline of the current semester.

The independent study proposal will be reviewed by the EVEN Director and approved, returned for amendment, or disapproved owing to some deficiency in the proposal. The student will conduct the independent study under the guidance of the faculty advisor. At the end of the independent study, the student must submit to the Environmental Engineering program a copy of the final product (a report, a computer code, etc.) in addition to any required products due to the collaborating faculty.



EVEN 2004 graduates Venessa Sanchez and Adam Musulin sample water at the Coors plant in Golden, Colorado.

#### 4.5.4. Senior Thesis

Students completing two independent studies for a total of six credit hours during the fall and spring semesters of their fourth year may write a senior thesis. A senior thesis shows that a student can complete scientific and engineering research independently and can communicate results.

A senior thesis must be supervised and graded by a member of the Environmental Engineering faculty and defended before a committee of three faculty, two of whom must be affiliated with the Environmental Engineering program. The completed thesis must be submitted to the Environmental Engineering Program coordinator by the final day of the semester during which the second independent study is completed.

## 4.6. Petitions

### 4.6.1. Petition Rules and Guidelines

Any exceptions or waivers of the rules and regulations of the Environmental Engineering Program or the College of Engineering and Applied Science must have prior approval by petition. The petition must be completed and submitted to the Environmental Engineering Program for approval; the petition will then be forwarded to the Dean's Office. It is the student's responsibility to follow up on the petition's progress. Petition forms may be obtained from the Program Coordinator.

The following list provides some examples of situations for which a petition is required:

- enrolling in a course when prerequisites have not been satisfied
- substituting for a required course
- dropping or adding a course after deadlines
- requesting the pass/fail grade option for a course

Follow these guidelines when completing the petition:

- review the rules and policies of the College of Engineering and Applied Science as published in the *University of Colorado Course Catalog* published during the year of your admission to the College and the current edition(s) of the appropriate Advising Guide to establish your need to petition and the specific rule or policy you wish to waive.
- consult with the Program Coordinator and faculty advisor for clarification of Program rules and policies.
- write the petition clearly (and neatly!).
- provide complete information in the petition, including the number and title of all courses and pertinent data such as course syllabi.

If properly completed, the petition process will normally take one to two weeks.

### 4.6.2. One-Time Forgiveness Policy

The College of Engineering offers a one-time forgiveness policy to allow correction of a significant registration error resulting in an unanticipated grade. As indicated by the title, the forgiveness policy can be used only once. Forgiveness may be requested in a petition describing the registration error. Students on academic probation or suspension may not use this policy.

## 4.7. Academic Honesty

The Environmental Engineering Program adheres to the policies of the College of Engineering and Applied Science and the University of Colorado at Boulder on academic honesty, which states:

"As members of the academic community, students have a responsibility to conduct themselves with the highest standards of honesty and integrity. These qualities are also vital to the profession of engineering. Violations of academic ethics tarnish the reputation of all students and will be treated with the utmost seriousness."

Be forewarned and discourage your fellow students from participating in any unethical activities. The following are examples of some, but certainly not all, acts that violate academic ethics:

- plagiarizing
- cheating on assignments and exams
- possessing or observing of exams or solutions to examinations prior to the exam
- altering, forging, or falsifying official records
- performing work or taking an exam for another student
- providing material of your own or of others to a fellow student

The College of Engineering and Applied Science procedures for handling academic ethics violations are available in the Dean's Office and on the College of Engineering and Applied Science web site ([http://engineering.colorado.edu/students/honor\\_code.htm](http://engineering.colorado.edu/students/honor_code.htm)). University academic honesty policies are available at the Honor Code web site (<http://www.colorado.edu/academics/honorcode/>).

## 5. Graduation Requirements

### 5.1. Requirements for EVEN BS Degree

#### 5.1.1. General Requirements

To graduate with a Bachelor of Science degree in Environmental Engineering from the College of Engineering and Applied Science at the Boulder campus, students must meet the following minimum requirements:

1. Satisfactory completion of the required and elective courses in the Environmental Engineering Bachelor of Science curriculum (see Section 2.1). Students must satisfactorily complete 128 credit hours, of which the last 45 credit hours shall be earned after admission to the College of Engineering and Applied Science as a degree student.
2. A minimum cumulative grade point average of 2.000 for all courses attempted and for all courses that count toward graduation requirements, excluding "P" grades for courses taken Pass/Fail.
3. A minimum cumulative major grade point average of 2.000. This major grade point average includes only course work in engineering courses.
4. Successful completion of the Minimum Academic Preparation Standards (MAPS) requirement of the College of Engineering and Applied Science.
5. Completion of the Fundamentals of Engineering (FE) examination during the final academic year.
6. Submission of a completed Diploma Card (available in the Dean's Office) to the Program Coordinator.

Graduation will be postponed by failure to complete these requirements. Any exceptions to these requirements will require approval of the Environmental Engineering Program Director and the Dean's office by petition.

To be sure that all requirements are met, students can consult with the Environmental Engineering Program Coordinator, Director, and their faculty advisors. Students must be aware that meeting graduation requirements is ultimately their own responsibility.

#### 5.1.2. Grading Policy

Students are evaluated by their performances in the courses that make up the Environmental Engineering curriculum following the standard procedures implemented by the College of Engineering and Applied Science ([http://ecadw.colorado.edu/engineering/Advising\\_Guides/grading.pdf](http://ecadw.colorado.edu/engineering/Advising_Guides/grading.pdf)). Student performance is determined by course instructors. Instructors award grades following the University of Colorado standardized grading system (Table 1).

Grade point averages of students are determined only for "quality credit hours." Quality credit hours are those earned in courses taken for standard grades at the University of Colorado. "Earned credit hours" include quality credit hours plus credit hours earned in courses taken pass/fail and credit hours transferred from other institutions; thus, grades in pass/fail courses and courses from other institutions do not count in the University of Colorado grade point average.

Other grades appearing on student transcripts include Incomplete (IF), No Credit (NC), and Pass (P). A grade of IF indicates that course requirements were not completed owing to documented reasons beyond the control of students. Grades of IF require completion of an "IF Grade Record" by the instructor and student stating the work that must be completed to award a final grade. All work required for the final grade must be completed within one year or the IF grade is changed to F. A grade of NC indicates that the course taken cannot be used to fulfill graduation requirements. These courses cannot be repeated for standard grades. A grade of P in a course taken pass/fail indicates that the student achieved the minimum passing grade of D- or better.

**Table 1.** Standardized grading system of the University of Colorado at Boulder.

letter grade	credit points	quality of performance
A	4.0	superior/excellent
A-	3.7	
B+	3.3	
B	3.0	good/better than average
B-	2.7	
C+	2.3	
C	2.0	competent/average
C-	1.7	(minimum passing grade in prerequisite course)
D+	1.3	
D	1.0	
D-	0.7	(minimum passing grade in non-prerequisite course)
F	0.0	failure
IF		incomplete
NC		no credit
P		pass in a pass/fail course

### **5.1.3. Pass/Fail Grading**

Pass/Fail grading is permitted only for courses used as technical or H&SS electives or for courses above and beyond degree requirements. The primary purpose for offering the opportunity for students to enroll in a course for a grade of P or F instead of a standard letter grade is to encourage students to broaden their educational experience by selecting challenging courses without serious risk to the cumulative grade point average. Students on academic probation may not elect the P/F grade option.

The College allows a maximum of six pass/fail credit hours per semester. Pass/fail hours counting toward graduation shall not exceed a cumulative total of 16. Transfer students are allowed one credit hour Pass/Fail for every nine credit hours completed under the Standard Grading System.

### **5.2. Fundamentals of Engineering Exam**

One of the requirements for graduation with the EVEN BS degree is that students must take the Fundamentals of Engineering (FE) Exam. This test serves two purposes: (1) it provides students with the opportunity to complete the first step toward Professional Engineer (PE) status and (2) it provides the Environmental Engineering Program with a useful assessment of engineering proficiency attained by EVEN graduates. Students usually take the FE Exam during their final semester.

The Fundamentals of Engineering Examination is the first step toward achieving licensure as a Professional Engineer (PE), a particularly important credential for engineers working as consultants. The FE Exam is administered by the National Council of Examiners for Engineering and Surveying (NCEES; <http://www.ncees.org>). The FE Exam is offered semi-annually, in April and October. Students can register to take the FE Exam in the Dean's office. Registration notices will be distributed by the EVEN Program Coordinator.

The exam consists of two parts, the morning and afternoon "specifications." The morning specification covers engineering, science, and mathematics fundamentals. The afternoon specification is discipline-specific. Beginning with the April 2002 exam, Environmental Engineering will be offered as the afternoon specification. The NCEES offers general information, study materials, and sample questions for the FE Exam. Numerous review books for the FE Exam are also readily available at web booksellers.

### **5.3. Requirements for Dual Degrees**

Students may choose to pursue a second Bachelor of Science degree simultaneously with the EVEN BS degree. The second BS degree may be pursued in a College or School at the University of Colorado at Boulder. To do this, they must (1) satisfy the requirements of both BS degree curricula and (2) take a minimum of 30 credit hours beyond the credit hour requirement for the degree with the higher credit hour requirement. If the requirements of both curricula can be satisfied with fewer than 30 credit hours, the difference can be made up with elective courses.

## 6. Faculty Directory

More than twenty College of Engineering and Applied Science faculty are affiliated with the Environmental Engineering Program. These faculty are rostered in the Aerospace Engineering Sciences, Chemical and Biological Engineering, Civil, Environmental, and Architectural Engineering, and Mechanical Engineering departments.

**Angela Bielefeldt**, Associate Professor, Civil, Environmental, and Architectural Engineering  
Education: B.S., Iowa State University (1992), M.S., Ph.D., University of Washington (1994, 1996)  
Teaching: CVEN 4434 Environmental Engineering Design, CVEN 4474 Hazardous Waste Management  
Research: Biological Treatment of Hazardous Organic Compounds, Subsurface Bioremediation  
Email: [angela.bielefeldt@colorado.edu](mailto:angela.bielefeldt@colorado.edu), phone: 303 492 8433, office: ECOT 516

**Melvyn Branch**, Professor, Mechanical Engineering  
Education: B.S.E., Princeton U. (1966), M.S., Ph.D., University of California at Berkeley (1968, 1971)  
Teaching: MCEN 4152 Introduction to Combustion, MCEN 4162 Energy Conversion  
Research: Combustion-Generated Air Pollution, Hazardous Waste Destruction, Combustion Chemistry  
Email: [melvyn.branch@colorado.edu](mailto:melvyn.branch@colorado.edu), phone: 303 492 7427; office: ECME 210

**David Clough**, Professor, Chemical and Biological Engineering  
Education: B.S., Case Institute of Technology (1968), M.S., Ph.D., University of Colorado at Boulder (1969, 1975)  
Teaching: GEEN 1300 Introduction to Engineering Computing, CHEN 3010 Applied Data Analysis  
Research: Improved Control of Industrial Processes, Optimization and Control of Natural Resources Distribution  
Email: [david.clough@colorado.edu](mailto:david.clough@colorado.edu), phone: 303 492 6638, office: ECCH 126

**John Daily**, Professor, Mechanical Engineering  
Education: B.S., M.S., U. Michigan (1969, 1970), Ph.D., Mechanical Engineering, Stanford University (1975)  
Research: Hazardous Waste Destruction, Combustion, Propulsion  
Email: [john.daily@colorado.edu](mailto:john.daily@colorado.edu), phone: 303 492 7110, office: ECME 224

**Robert Davis**, Professor, Chemical and Biological Engineering, and Dean, College of Engineering and Applied Science  
Education: B.S., University of California at Davis (1978), M.S., Ph.D., Stanford (1979, 1983)  
Research: Fluid Mechanics, Environmental Membrane Separations, Membrane Filtration and Microflotation  
Email: [robert.davis@colorado.edu](mailto:robert.davis@colorado.edu), phone: 303 492 7314, office: ECCH 108

**William Emery**, Professor, Aerospace Engineering Science  
Education: B.S., Brigham Young U. (1971), Ph.D., U. Hawaii (1975)  
Teaching: EVEN 4830 Environmental Satellite Remote Sensing  
Research: Satellite Remote Sensing of Oceans, Vegetation and Atmosphere  
Email: [william.emery@colorado.edu](mailto:william.emery@colorado.edu), phone: 303 492 8591, office: ECME 275

**John Falconer**, Professor, Chemical and Biological Engineering  
Education: B.E.S., Johns Hopkins University (1967), M.S., Ph.D., Stanford University (1968, 1974)  
Teaching: CHEN 1211 General Chemistry for Engineers, CHEN 3320 Thermodynamics  
Research: Heterogeneous Catalysis, Environmental Catalysis, Zeolite Membrane Separations  
Email: [john.falconer@colorado.edu](mailto:john.falconer@colorado.edu), phone: 303 492 8005, office: ECCH 132

**Michael Hannigan**, Professional Research Associate, Mechanical Engineering  
Education: B.S., Southern Methodist University (1990), M.S., Ph.D., California Institute of Technology (1991, 1997)  
Teaching: EVEN 4830 Special Topics – Environmental Toxicology  
Research: Characterization and Abatement of Air Pollution  
Email: [michael.hannigan@colorado.edu](mailto:michael.hannigan@colorado.edu), phone: 303 735 5045, office: ECME 215A

**Mark Hernandez**, Associate Professor, Civil, Environmental, and Architectural Engineering  
Education: B.S., M.S., Ph.D., University of California at Berkeley (1986, 1988, 1994)  
Teaching: CVEN 3414 Fundamentals of Environmental Engineering, CVEN 4484 Introduction to Environmental Microbiology  
Research: Biological Waste Treatment Processes, Subsurface Bioremediation, Microbiology of Aerosols  
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**Jean Hertzberg**, Associate Professor, Mechanical Engineering  
Education: B.S., U. Michigan (1981), M.S., Ph.D., University of California at Berkeley (1983, 1986)  
Teaching: MCEN 3012 Thermodynamics, MCEN 4030 Computational Methods  
Research: Combustion Fluid Mechanics, Hazardous Waste Destruction  
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**Lakshmi Kantha**, Professor, Aerospace Engineering Science  
Education: B.E., M.E., Bangalore Univ. (1967, 1969), Ph.D., Massachusetts Institute of Technology (1973)  
Research: Numerical Modeling of Oceans and Related Physical Processes  
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**Diane McKnight**, Professor, Civil, Environmental, and Architectural Engineering  
Education: B.S., M.S., Ph.D., Massachusetts Institute of Technology (1975, 1978, 1979)  
Teaching: CVEN 3434 Applied Ecology  
Research: Aquatic Ecology, Aquatic Chemistry  
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**Jana Milford**, Associate Professor, Mechanical Engineering  
Education: B.S., Iowa State University (1983), M.S., Ph.D., Carnegie Mellon University (1985, 1988)  
Teaching: MCEN 4131 Air Pollution Control  
Research: Air Quality Modeling, Atmospheric Chemistry  
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**Shelly Miller**, Assistant Professor, Mechanical Engineering  
Education: B.S., Harvey Mudd College (1986), M.S., Ph.D., University of California at Berkeley (1991, 1996)  
Teaching: MCEN 4131 Air Pollution Control, MCEN 4141 Indoor Air Pollution  
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**Hari Rajaram**, Associate Professor, Civil, Environmental, and Architectural Engineering  
Education: B.Tech., IIT, Madras (1985), M.S., U. Iowa (1987), Sc.D., M.I.T. (1991)  
Teaching: CVEN 4353 Groundwater Engineering  
Research: Groundwater and Contaminant Hydrology, Stochastic Modeling of Transport Processes  
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**Joseph Ryan**, Professor, Civil, Environmental, and Architectural Engineering; EVEN Director  
Education: B.S., Princeton U. (1983), M.S., Ph.D., Massachusetts Institute of Technology (1988, 1992)  
Teaching: EVEN 1000 Intro to Environmental. Engineering, CVEN 3454 Water Quality, CVEN 4424 Environmental Organic Chemistry  
Research: Contaminant Fate and Transport in Natural Waters, Surface and Colloid Chemistry  
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**JoAnn Silverstein**, Professor and Chair, Civil, Environmental, and Architectural Engineering  
Education: B.S., M.S., Ph.D., University of California at Davis (1978, 1980, 1982)  
Research: Biological Treatment of Contaminants in Water and Wastes, Water Recycling  
Email: joann.silverstein@colorado.edu, phone: 303 492 7211, office: ECOT 515

**Scott Summers**, Professor, Civil, Environmental, and Architectural Engineering  
Education: B.S., M.S., University of Cincinnati (1980, 1982), Ph.D., Stanford University (1986)  
Teaching: CVEN 3424 Water and Wastewater Treatment  
Research: Drinking Water Quality and Treatment, Disinfection By-Products, Natural Organic Matter  
Email: r.summers@colorado.edu, phone: 303 492 6644, office: ECOT 540

## Forms and Appendices

The forms listed below are available on the following pages:

- Special Option Course Selection Proposal
- Advising Evaluation Form
- Degree Requirements Worksheet
- Independent Study Agreement Form
- Table of Prerequisite and Co-requisite Courses for Required Courses in the EVEN BS Curriculum
- Table of Prerequisite and Co-requisite Courses for Option Courses in the EVEN BS Curriculum





### Special Option Selection Proposal

Student Name: \_\_\_\_\_ Student number: \_\_\_\_\_

Class standing (circle): First-year Second-year Third-year Fourth-year Fifth-year  
Degree Program (circle): EVEN BS EVEN BS/CVEN MS

Faculty Advisor Name: \_\_\_\_\_

Title for Area of Specialization for Special Option:  
\_\_\_\_\_  
\_\_\_\_\_

Proposed Courses for Special Option (total of 12 credit hours):

1.	_____	_____
	Course Number and Name	Credits
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

Explanation of Need for Special Courses (i.e., difference from regular Options; importance for an Environmental Engineering education):

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Student Signature \_\_\_\_\_ Date \_\_\_\_\_ Faculty Advisor Signature \_\_\_\_\_ Date \_\_\_\_\_

Received by Program Coordinator \_\_\_\_\_  
Date \_\_\_\_\_

Director Approval:    Approved    Returned for Amendment    Disapproved

Comments:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Director Signature \_\_\_\_\_ Date \_\_\_\_\_





# Degree Requirements Worksheet – EVEN BS Degree

Student Name: \_\_\_\_\_

Student#: \_\_\_\_\_

Faculty Advisor: \_\_\_\_\_

## Required Courses

course no.	course name	credits	course taken (if different)	grade	term
<u>Engineering (53 hours)</u>					
EVEN 1000	Intro to Environmental Engineering	1	_____	_____	_____
GEEN 1300	Intro to Engineering Computing	3	_____	_____	_____
GEEN 1400	Engineering Projects	3	_____	_____	_____
CVEN 3414	Fundamentals of Environmental Engr	3	_____	_____	_____
CHEN 2120	Chem Engr Matl Energy Balances	3	_____	_____	_____
a	Solid Mechanics	3	_____	_____	_____
CVEN 3454	Water Chemistry	4	_____	_____	_____
EMEN 4100	Business Methods & Economics Engr	3	_____	_____	_____
b	Fluid Mechanics	3	_____	_____	_____
c	Thermodynamics	3	_____	_____	_____
CVEN 4424	Environmental Organic Chemistry	3	_____	_____	_____
d	Heat Transfer	3	_____	_____	_____
CVEN 4484	Intro to Environmental Microbiology	3	_____	_____	_____
MCEN 4131	Air Pollution Control	3	_____	_____	_____
e	Probability and Statistics	3	_____	_____	_____
CVEN 4333	Engineering Hydrology	3	_____	_____	_____
CVEN 4444	Environmental Engineering Processes	3	_____	_____	_____
CVEN 4434	Environmental Engineering Design	3	_____	_____	_____
f	Air/Earth Laboratory/Field	3	_____	_____	_____

Engineering Total (56)

## Mathematics (16 hours)

APPM 1350	Calculus 1 for Engineers	4	_____	_____	_____
APPM 1360	Calculus 2 for Engineers	4	_____	_____	_____
APPM 2350	Calculus 3 for Engineers	4	_____	_____	_____
APPM 2360	Intro Diff Eqns with Linear Algebra	4	_____	_____	_____

Mathematics Total (16)

## Sciences (17 hours)

CHEN 1211	General Chemistry	3	_____	_____	_____
CHEM 1221	General Chemistry Laboratory	2	_____	_____	_____
PHYS 1110	General Physics 1	4	_____	_____	_____
PHYS 1120	General Physics 2	4	_____	_____	_____
PHYS 1140	Experimental Physics 2	1	_____	_____	_____
CHEM 4521	Physical Chemistry for Engineers	3	_____	_____	_____

Sciences Total (17)

- a Solid Mechanics options: CVEN 2121 Analytical Mechanics, GEEN 3851 Statics for Engrs, MCEN 2023 Statics and Structures.
- b Fluid Mechanics options: CHEN 3200 Chemical Engineering Fluid Mechanics, CVEN 3313 Fluid Mechanics, GEEN 3853 Fluid Mechanics for Engineers, MCEN 3021 Fluid Mechanics.
- c Thermodynamics options: CHEN 3320 Chemical Engineering Thermodynamics, GEEN 3852 Thermodynamics for Engineers, MCEN 3012 Thermodynamics.
- d Heat Transfer options: CHEN 3210 Chemical Engineering Heat Transfer, MCEN 3022 Heat Transfer.
- e Probability & Statistics options: APPM 4570 Statistical Methods, CHEN 3010 Applied Data Analysis, CVEN 3227 Probability, Statistics, & Decisions.
- f Air/Earth Laboratory/Field course: a 3(+) credit course with a significant laboratory or field component focusing on air quality or earth science.

## Elective Courses

course no.	course name	credits	course taken	grade	term
<u>Humanities &amp; Social Sciences Electives (18 hours, 6 hours upper division)</u>					
	H&SS (lower or upper division)	_____	_____	_____	_____
	H&SS (lower or upper division)	_____	_____	_____	_____
	H&SS (lower or upper division)	_____	_____	_____	_____
	H&SS (lower or upper division)	_____	_____	_____	_____
g	Required Communication Course	_____	_____	_____	_____
	H&SS (upper division)	_____	_____	_____	_____
		<input type="text"/>	H&SS Total (18)		
<u>Option Courses (9 hours)</u>					
h	Option 1	_____	_____	_____	_____
	Option 2	_____	_____	_____	_____
	Option 3	_____	_____	_____	_____
		<input type="text"/>	Option Total (9)		
<u>Technical Electives (12 hours, 9 hours upper division, 3 Earth Science)</u>					
i	Tech (lower or upper division)	_____	_____	_____	_____
	Tech (upper division)	_____	_____	_____	_____
	Tech (upper division)	_____	_____	_____	_____
	Tech (upper division)	_____	_____	_____	_____
		<input type="text"/>	Technical Elective Total (12)		
<hr/>					
<b>Credit hour Total:</b>		<input type="text"/>	<b>Grade Point Average:</b>		<input type="text"/>
		(128)			
<b>Preliminary Check:</b>		<input type="text"/>	<b>Date:</b>		<input type="text"/>
<b>Final Check:</b>		<input type="text"/>	<b>Date:</b>		<input type="text"/>
<b>FE Exam:</b>		<input type="text"/>	<b>Date:</b>		<input type="text"/>

- g WRTG 3030 Writing on Science and Society, HUEN 3100/3200, or another approved course.
- h Consult *Environmental Engineering (EVEN) Degree Guidelines* for lists of Option courses.
- i Technical Electives: Three technical elective credits may be lower division (1000-, 2000-level). Three technical elective credits must be in the earth sciences, either lower or upper division (eligible departments and programs include APAS, ATOC, CVEN, GEOL, and GEOG). Independent studies (EVEN 4840) may be completed as technical electives for up to 6 credits total, 3 credits per semester.

**Table of Prerequisites and co-requisites for required courses in the EVEN BS curriculum.**

course no.	course name	prerequisites	co-requisites
APPM 1350	Calculus 1 for Engineers	none	none
APPM 1360	Calculus 2 for Engineers	APPM 1350	none
APPM 2350	Calculus 3 for Engineers	APPM 1360	none
APPM 2360	Intro Diff Eqns with Linear Algebra	APPM 1360	none
APPM 3050	Scientific Computing in MATLAB	APPM 1360, APPM 2360	
APPM 4570	Statistical Methods	APPM 1360	none
CHEM 1221	General Chemistry Laboratory	none	none
CHEM 4521	Physical Chemistry for Engineers	*CHEM 1211 or CHEM 1111/CHEM 1131	none
CHEN 1211	General Chemistry for Engineers	none	none
CHEN 2120	Chem Engr Matl Energy Balances	CHEM 1211	GEEN 1300
CHEN 3010	Applied Data Analysis	GEEN 1300, APPM 2360	none
CHEN 3200	Chem Engr Fluid Mechanics	APPM 2360, CHEN 2120, GEEN 1300	none
CHEN 3210	Chem Engr Heat Transfer	Fluid Mechanics	none
CHEN 3320	Chem Engr Thermodynamics	CHEN 2120, CHEM 4521	none
CVEN 2121	Analytical Mechanics 1	PHYS 1110	APPM 2350
CVEN 3227	Probability, Statistics & Decisions	APPM 2360	none
CVEN 3313	Theoretical Fluid Mechanics	CVEN 2121, MCEN 2023	none
CVEN 3414	Fundamentals of Environmental Engr	CHEM 1211, CHEN 1221, APPM 2350	none
CVEN 3454	Water Chemistry	CVEN 3414	none
CVEN 4147	Engineering Economy and System Design	none	none
CVEN 4424	Environmental Organic Chemistry	CVEN 3414	none
CVEN 4434	Environmental Engineering Design	CVEN 3454	none
CVEN 4444	Environmental Engineering Processes	CVEN 3414	none
CVEN 4484	Intro to Environmental Microbiology	CHEM 1211, CHEN 1221, APPM 2350	none
EMEN 4100	Business Methods and Economics for Engr	none	none
EVEN 1000	Intro to Environmental Engineering	none	none
GEEN 1300	Intro to Engineering Computing	none	none
GEEN 1400	Engineering Projects	none	none
GEEN 3851	Statics for Engineers	PHYS 1110, APPM 2350	none
GEEN 3852	Thermodynamics for Engineers	APPM 2350	none
GEEN 3853	Fluid Mechanics for Engineers	APPM 2350 or 2360, GEEN 1300	none
MCEN 2023	Statics and Structures	APPM 1360	none
MCEN 3012	Thermodynamics	APPM 2350	none
MCEN 3021	Fluid Mechanics	APPM 2360, Solid Mechanics	none
MCEN 3022	Heat Transfer	MCEN 3012, Fluid Mechanics	none
MCEN 4030	Computational Methods	GEEN 1300, APPM 2360	none
MCEN 4131	Air Pollution Control	Fluid Mechanics	none
PHYS 1110	General Physics 1	none	APPM 1350
PHYS 1120	General Physics 2	PHYS 1110	APPM 1350
PHYS 1140	Experimental Physics 1	PHYS 1110	PHYS 1120

\*or by instructor's consent as arranged by the Environmental Engineering Program

**Table of Prerequisites and co-requisites for Option courses in the EVEN BS curriculum.**

course no.	course name	prerequisites	co-requisites
<i>Air Quality Option</i>			
ATOC 3500	Air Chemistry and Pollution	none	none
MCEN 4042	Thermal Systems Design	Thermodynamics, Heat Transfer	none
MCEN 4152	Introduction to Combustion	Thermodynamics, Fluid Mechanics, Heat Transfer	none
MCEN 4162	Energy Conversion	Thermodynamics	none
<i>Applied Ecology Option</i>			
CVEN 3434	Introduction to Applied Ecology	CHEN 1221, PHYS 1110, PHYS 1140	none
EBIO 3270	Ecosystem Ecology	EBIO 1240 *	none
EBIO 4020	Stream Biology	EBIO 1240 *	none
EBIO 4030	Limnology	EBIO 1240 *	none
<i>Chemical Processing Option</i>			
CHEN 3220	Chem Eng Separations and Mass Transfer	Fluid Mechanics, Heat Transfer	none
CHEN 4330	Chem Engr Reaction Kinetics	CHEN 2120, CHEN 3320	CHEN 3210
CHEN 4670	Environmental Separations	CHEN 2120	none
<i>Environmental Remediation</i>			
CVEN 4353	Groundwater Engineering	Fluid Mechanics	none
CVEN 4474	Hazardous and Industrial Waste Mgmt	CVEN 3414, CVEN 3424 *	none
GEOG 3030	Introduction to Hydrogeology	APPM 1350	none
GEOG 4716	Environmental Field Geochemistry	GEOG 2700, CHEM 1211 *	none
<i>Water and Wastewater Option</i>			
CVEN 3323	Hydraulic Engineering	CVEN 3313	none
CVEN 3424	Water and Wastewater Treatment	CVEN 3414	none
CVEN 4323	Water Resources Engr Design	Statistics, Engineering Economics	none
GEOG 4501	Water Resources Mgmt Western US	none	none

\*or by instructor's consent as arranged by the Environmental Engineering Program