Virginia Tech Degree Proposal
Bachelor of Science in Water: Resources, Policy, and Management
(CIP: 03.0205)

Type of degree action (circle one): ☑️ New Spinoff Revision Discontinuance

Program description
Virginia Polytechnic Institute and State University (Virginia Tech) requests approval for a new Bachelor of Science (B.S.) degree in Water: Resources, Policy, and Management, with an anticipated initiation in Spring 2015. Water connects society and environment through energy, food, climate, ecological, health, and economic systems and is therefore of vital importance to sustaining human life. Water issues such as drought, flooding, sanitation, and contamination exist on every continent and touch every citizen on the planet. As a resource, freshwater abundance is finite, with ever-increasing demands for its use as human population growth expands through urbanization and industrialization, which put additional pressures on aquatic ecosystems and the supply of safe drinking water. Sustainably managing water resources is a complex challenge that requires knowledge in a wide range of academic disciplines.

Few undergraduate degree programs provide integrated training in water science, policy, and management, although professionals are required to have interdisciplinary expertise in these areas to solve critical problems facing society today and in the future. Although the B.S. Water: Resources, Policy, and Management degree will be administered by the Department of Forest Resources and Environmental Conservation within the College of Natural Resources and Environment, it is nonetheless an interdisciplinary program and would be the first of its kind in Virginia as well as unique to any other undergraduate program anywhere in the U.S. The proposed new degree program will offer a strong interdisciplinary approach to water science, policy and management, while complementing existing undergraduate degree programs on our campus. Virginia Tech, with more than 80 faculty across all colleges involved in water research, teaching, and engagement, is well-situated to offer this degree with minimal need for new resources.

Universities and colleges have a major responsibility to prepare future water and land managers to meet the many complex challenges to sustainably manage water resources in the face of a rapidly expanding global population. Future water managers and decision makers need knowledge and training in natural science, technical assessment, economics, planning, and policy. A new B.S. degree program at Virginia Tech that integrates existing programs and courses from at least five colleges and numerous departments can provide an interdisciplinary and substantive understanding of water science, policy, and management. The proposed program will prepare Virginia Tech graduates for critical future responsibilities and will be a strong incentive for others who consider enrollment at Virginia Tech. There are currently no other undergraduate water degrees of this kind offered at any universities or colleges in the Commonwealth. Upon completing requirements for the new water degree, students will be qualified as professionals for employment with government agencies, the private sector, non-government
organizations, municipalities, and utilities seeking employees with university-level training in aspects of water science, policy, and/or management.

**Curriculum summary**
The B.S. degree in Water: Resources, Policy, and Management comprises 120 credits, distributed among the following categories of courses: i) Curriculum for a Liberal Education (general education; 36 credits); ii) Water Core (18 credits; listed below); iii) Communication (3 credits; listed below); iv) Water Law, Planning, and Economics (9 credits; listed below); v) Geospatial Technology (3 credits; listed below); vi) Water Science (12 credits); vii) Water Policy (12 credits); viii) Restricted Electives (18 credits), and ix) Free Electives (9 credits). All courses in the proposed curriculum are currently being taught by faculty at Virginia Tech.

**Core Degree Requirements (57 credits)**

**Water Core (all 18 credits required)**
- GEOG/NR 2004: Introduction to Water Resources and Environmental Issues (3)
- PHYS 2205: General Physics (3)
- PHYS 2215: General Physics Lab (1)
- FOR 3104: Principles of Watershed Hydrology (3)
- ENSC 3604: Fundamentals of Environmental Science (3)
- ENSC 4314: Water Quality (3)
- ALS/NR 4614: Watershed Assessment, Management, and Policy (2)

**Writing (3 credits – choose one course)**
- ENGL 3754 Advanced Composition (3) or
- ENGL 3764 Technical Writing (3)

**Water Law, Planning, and Economics (9 credits – choose one course from each area below)**
- AAEC 3314 Environmental Law (3), or UAP 4344 Law of Critical Environmental Areas (3)
- UAP 3354 Introduction to Environmental Policy and Planning (3), or UAP 4374 Land Use and Environment: Planning and Policy (3)
- AAEC 3324 Environmental and Sustainable Development Economics (3) or CEE 4344 Water Resources Planning (3)

**Geospatial Technology (3 credits – choose one course)**
- GEOG 4084 Introduction to GIS (3)
- GEOG 4354 Introduction to Remote Sensing (3)
- FOR 4114 Information Technology for Natural Resource Management (3)
- FOR 4214 Forest Photogrammetry and Spatial Data Processing (3)
- BSE 4344 GIS for Engineers (3)
Specialization Areas in Water Science and Water Policy (24 credits)
All students in the proposed curriculum will be required to take a minimum of 12 credits in Water Science Specialization Areas and a minimum of 12 credits in Water Policy Specialization Areas. Nine of the 12 credits must be completed in one Water Science Specialization Area and nine of the 12 credits must be completed in one Water Policy Specialization Area. Course listings by specialization area in Water Science and Water Policy are provided in Appendices A and B, respectively.

Restricted Electives (Minimum 18 credits)
Choose from courses listed under the Water Science or Water Policy Specializations or from those listed as Restricted Electives.

Free Electives (9 credits)

Curriculum for Liberal Education (36 credits)
Area 1: Writing and Discourse (0-6 credits – depending on placement)
Area 2: Ideas, Cultural Traditions, and Values (6 credits)
Area 3: Society and Human Behavior (6 credits)
Area 4: Scientific Reasoning and Discovery (8 credits, including 2 labs)
Area 5: Quantitative and Symbolic Reasoning (6 credits)
Area 6: Creativity and Aesthetic Experience (1 credit)
Area 7: Critical Issues in a Global Context (3 credits)

Relevance to university mission and strategic planning
The proposed degree fully supports Virginia Tech’s mission. Students in this program will have opportunities to serve the Commonwealth of Virginia, the nation, and the global community by utilizing their training in water science, policy, and management. They will be prepared to create, convey, and apply their knowledge of water to expand personal growth and opportunity, advance social and community development, foster economic competitiveness, and improve quality of life as presented in Virginia Tech’s Mission Statement. Additionally, the proposed degree supports stated goals in Virginia Tech’s Plan for a New Horizon: Envisioning Virginia Tech 2012-2018 (http://www.president.vt.edu/strategic-plan/strategic-plan.html) and the College of Natural Resources and Environment’s 2012-2018 Strategic Plan (http://cnre.vt.edu/college/about/2012-2018-CNRE-Strategic-Plan.pdf).
Specifically, the proposed degree is based on a team-driven initiative to leverage existing and emerging strengths in water science, policy, and management to grow a component of the undergraduate program at Virginia Tech, as specifically recommended in the Plan for a New Horizon. Furthermore, this degree is STEM-H-oriented in that it provides all students in the curriculum with specific course-based core curriculum training in water science, water technology, mathematics, and water-related health topics. Students have opportunities to expand their STEM-H training through selection of specialization areas in water science and water policy and through selection of an additional 18 credit hours in restricted electives that are STEM-H-oriented. Students graduating from this degree program will be STEM-H graduates and will be poised to join the STEM-H workforce.
Justification for the proposed program
The need for sustainable management of water resources at local, regional, and global scales is unprecedented and has been identified as one of the key environmental, economic, engineering, and social challenges for the 21st century. On a global scale, one out of eight people lacks access to clean water and adequate sanitation; and more than three million (6,000 children under the age of five/day) die from water-related health problems each year, mostly in developing countries. Water quality and availability are growing concerns in this country and Virginia as well. Virginia’s current and future economic growth depends on the availability of quality water resources. Maintaining water quality for an economically and ecologically sustainable Chesapeake Bay is a prime regional and Commonwealth example. In addition, the increasing population in eastern Virginia has put a strain on the Coastal Plain aquifers, resulting in lowered water levels in wells, and in some areas, land subsidence.

Adequate availability and quality of freshwater is fundamental to the sustainability of all life and requires an interdisciplinary approach to tackle the complex issues involved on a planet with expanding demands and limitations for this resource. Food production accounts for more than 70% of global water use and creates challenges for maintaining environmental water quality, while providing adequate crop production to sustain growing populations. Concurrently, climate change and rapid population growth are converging to create water challenges affecting both people and the environment. Societies now recognize the complexity of managing water sustainably and the need for innovative, transformative, interdisciplinary approaches to meet these complex challenges.

Despite calls for undergraduate education reform in water science and policy, few programs in the U.S. have embraced the integrative, interdisciplinary approach to train water professionals. Water touches on so many aspects of the environment and society that most universities, including Virginia Tech, offer courses spread across multiple colleges and departments, often with little coordination among faculty and students in instructional program delivery. Across universities, all relevant aspects of water science, policy, and management are provided through, for example, programs in civil and environmental engineering, geography, natural resources, geosciences, urban planning, and economics. However, there is a lack of holistic integration that provides students with training to address complex water issues.

Employment Demand
This new interdisciplinary degree program addresses the increasing need for professionals who are trained across an integrated curriculum in water science, policy, and management. The B.S. degree in Water: Resources, Policy, and Management will be attractive to students with an interest in developing skills essential for a diversity of careers involving water, including employment with government agencies, environmental consulting firms, educational facilities, university and government research laboratories, private industries, and non-governmental water organizations. Students in this degree
program will also be able to prepare for graduate schools by selecting appropriate elective courses.

As the number and complexity of water problems increase, so does the wave of water-related opportunities for scientific expertise, knowledge, and innovative solutions. A recent article in the New York Times documents that jobs in water are on the rise. The Bureau of Labor Statistics has predicted 18 percent growth from 2010 to 2020 in water-related employment, which is much faster than the average for all other occupations. Many of these jobs are with the federal government and state agencies and state departments of conservation. Others work in architecture, nongovernmental organizations, engineering, and for management, scientific and technical consulting firms.

**Student Demand**
Survey results from 66 students in NR 2984 (First Year Experience), 108 students in FIW 2114 (Principles of Fisheries and Wildlife), and 27 students in ENSC 3604 (Fundamentals of Environmental Science) taken in fall 2012 indicate that there is strong student demand for the proposed interdisciplinary degree program. When asked “if you are an undeclared major and Virginia Tech offered a WRPM major, how likely would you be to declare WRPM as your major?” 106 of 185 (57%) students expressed at least “somewhat likely to” interest in declaring WRPM as their major. Of these, nine said they “definitely would.” When asked “if Virginia Tech offered a WRPM major and adding it to your current major would not extend your undergraduate program past four years, how likely would you be to add WRPM as a second major?” 150 of 201 (75%) students expressed at least “somewhat likely to” interest in adding WRPM as a second major. Of these, 34 said they “definitely would.” When asked “if Virginia Tech offered a WRPM major and transferring to it did not extend your undergraduate program past four years, how likely would you be to change your current major to WRPM?” 91 of 200 (46%) students expressed at least “somewhat likely to” interest in transferring to the WRPM major. Of these, 12 said they “definitely would.” See Appendix C for student comments.

**Duplication**
This is the first interdisciplinary undergraduate water degree of its kind in Virginia and throughout the U.S. There is no duplication of this degree at any other institutions of higher learning in the Commonwealth of Virginia. There are some water-related options in various degree programs at Virginia Tech and in the Commonwealth (see table below). However, competition for students enrolled in the options below is not anticipated, given the substantive differences between the proposed B.S. degree in Water: Resources, Policy, and Management and these degree programs. Furthermore, there is strong support for this degree among departments offering water-related options at Virginia Tech (See Appendix D).
Degrees currently offered at Virginia Tech and other Commonwealth of Virginia universities with water-related options.

<table>
<thead>
<tr>
<th>Department</th>
<th>B.S. Degree</th>
<th>Option</th>
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<tbody>
<tr>
<td>CSES</td>
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<td>Water Resources</td>
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<tr>
<td>BSE</td>
<td>BSE</td>
<td>Land and Water Resources</td>
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<td></td>
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<td>Engineering</td>
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<td></td>
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<td>Resources Engineering</td>
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<td>FREC</td>
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<td>Watershed Management</td>
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<tr>
<td>UAP</td>
<td>Environmental Policy and Planning</td>
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<tr>
<td>AAEC</td>
<td>Environmental Economics, Management and Policy</td>
<td></td>
</tr>
<tr>
<td>Cross-College</td>
<td>Minor</td>
<td>Watershed Management</td>
</tr>
</tbody>
</table>

**Virginia Tech**

**University of Virginia**

| CEE        | Environmental and Water Resources Engineering |
| Env. Sciences | Environmental Sciences | Hydrology |

**Resource Needs/Savings**
The proposed undergraduate B.S. degree program in Water: Resources, Policy, and Management will rely on existing faculty for delivery of the proposed degree. Currently, 13 faculty from ten different departments and across five different colleges have all committed their instructional expertise to this degree program. All courses in the curriculum are currently being offered at Virginia Tech and permission from academic units responsible for every course listed in the curriculum has been obtained to accommodate students in courses listed in the new degree program. The new degree program is requesting additional resources (one full-time administrative assistant) to help support an academic advisor who will coordinate student advising and oversee student record keeping. Financial support for this position will be forthcoming from the College of Natural Resources and Environment (See Appendix E). No other new resources are requested at this time.
<table>
<thead>
<tr>
<th>RESOURCE</th>
<th>ESTIMATED COSTS (use NA if not applicable)</th>
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<tr>
<td>Graduate Teaching/</td>
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<td>Library</td>
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<tr>
<td>Equipment</td>
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<td>Other</td>
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</table>
Appendix A
Water Science Specialization

(Students complete 9 credits in one Water Science Specialization & select 3 elective credits from this list of Water Science approved courses)

I. Aquatic Ecosystems
BIOL 4004 (Freshwater Ecology), BIOL 4454 (Invertebrate Zoology), BIOL/CSES 4164 (Environmental Microbiology), BIOL/ENT 4354 (Aquatic Entomology), BIOL/FiW/ENT 4484 (Freshwater Biomonitoring), FiW 4514 (Principles of Aquaculture), FiW 4534 (Ecology & Management of Wetland Systems), FiW 4614 (Fish Ecology), FiW 4624 (Marine Ecology), FiW 4714 (Fisheries Management), FOR 4374 (Forested Wetlands), GEOS 3034 (Oceanography)

II. Hydrology
BIOL 4114 (Global Change Biology), BSE 3324 (Small Watershed Hydrology), BSE 4224 (Field Methods in Hydrology), CEE 4314 (Groundwater Resources), CEE 3304 (Fluid Mechanics), CEE 3314 (Water Resources Engineering), , CEE 4304 (Hydrology), CEE 4324 (Open Channel Flow), CEE 4354 (Environmental Hydrology), , CSES 3614 (Soil Physical & Hydrological Properties), CSES/GEOG/GEOS 3304 (Geomorphology), FOR 4354 (Forest Soils & Hydrology),GEOS 3014 (Environmental Geosciences), GEOS 4804 (Groundwater Hydrology)

III. Water Quality
BSE 3334 (Nonpoint Source Assessment & Control), BSE 4304 (Nonpoint Source Pollution Modeling & Management), BSE 4324 (Nonpoint Source Pollution), BSE 4394 (Water Supply & Sanitation in Developing Countries), CEE 3104 (Introduction to Environmental Engineering), CEE/CSES 4594 (Soil & Groundwater Pollution), CSES 3634 (Physics of Pollution), CSES 4734 (Environmental Soil Chemistry), FOR 4354 (Forest Soils & Hydrology), FOR 4374 (Forested Wetlands), GEOS 4804 (Groundwater Hydrology)

IV. Water Treatment & Public Health
BSE 4394 (Water Supply & Sanitation in Developing Countries), CEE 3104 (Introduction to Environmental Engineering), CEE 4114 (Fundamentals of Public Health Engineering), CEE 4104 (Water & Wastewater Treatment Design), CEE 4174 (Solid & Hazardous Waste Management), CSES 4164 (Environmental Microbiology), CSES/ENSC 4644 (Land Based Systems for Waste Treatment), FOR 4374 (Forested Wetlands)
Appendix B
Water Policy Specialization

(Students complete 9 credits in one Water Policy Specialization & select 3 elective credits from this list of Water Policy approved courses)

I. Watershed Management
ALS 3134 (Livestock & the Environment), ALS 3404 (Ecological Agriculture Theory & Practice), BSE 3324 (Small Watershed Hydrology), BSE 3334 (Nonpoint Source Assessment & Control), BSE 4304 (Nonpoint Source Pollution Modeling & Management), BSE 4324 (Nonpoint Source Pollution), CEE 3274 (Intro Land Development), CEE 4264 (Sustainable Land Development), FOR 4374 (Forest Wetlands), LAR 3154 (Watershed Sensitive Design & Construction), UAP 3354 (Introduction to Environmental Policy & Planning), UAP 4374 (Land Use & Environment: Planning & Policy)

II. Water Planning, Policy, & Economics
AAEC 3004 (Agricultural Production & Consumption Economics), AAEC 3014 (Analytical Methods of Applied Economics), AAEC 3324 (Environmentally Sustainable Development Economics), AAEC 3314 (Environmental Law), AAEC 3604 (Agricultural Law), AAEC 4314 (Environmental Economic Analysis & Management), AAEC 4344 (Sustainable Development Economics), CEE 4134 (Engineering Solutions for Environmental Sustainability), CEE 4344 (Water Resources Planning), FOR 4014 (Natural Resources Economics), GEOG 4204 (Geography of Resources), LAR 3154 (Watershed Sensitive Design & Construction), UAP 3224 (Policy Implementation), UAP 4344 (Law of Critical Environmental Areas), UAP 4374 (Land Use & Environment: Planning & Policy), UAP 4384 (Pollution Control Planning & Policy), UAP 4184 (Community Involvement)

III. International Water Management
ALS 4714 (Global Seminar), BSE 4394 (Water Supply & Sanitation in Developing Countries), IS 4014 (Seminar in Grassroots Development), UAP 4764 (International Development Policy & Planning), ALS/GEOG/NR/UAP 4404 (Approaches to International Development)

IV. Water, Climate, Energy, & Global Issues
BIOL 4114 (Global Climate Change), CEE 4134 (Engineering Solutions for Environmental Sustainability), CEE 4264 (Sustainable Land Development), GEOG 3104 (Environmental Problems & Population Development), GEOG 3114 (Introduction to Meteorology), ME 4194 (Sustainable Energy Solutions for a Global Society), NR 4444 (Practicing Sustainability), PSCI/UAP 3344 (Global Environmental Issues: Interdisciplinary Perspectives)
Appendix C
Selection of Student Comments from Surveys

I would love it and change to it immediately as I am already about to change to the watershed management option or ERM.

I definitely would look into having this my declared major.

This sound like a really interesting degree and if it became available I would definitely major in it. So, I hope it does.

If this major had been listed before I declared my major, it would have been very likely of me choosing it. I would definitely still consider choosing it now.

I would love to make this a second major or a minor – or possibly a concentration? I just transferred into Marine Fisheries, but my final goal was to work with international water relations. Marine Fisheries was the best fit for what I wanted, but Water, Resources, Policy, and Management sounds like exactly what I want to focus on. This should definitely become a major.

This program would add to the offerings of Virginia Tech by implementing an interdisciplinary degree the likes of which has not been fully established in the Natural Resources side of the campus. This allows for growth in student base, and in the type of experience offered to students.

I believe that offering WRPM as a major would be a great idea! It would encourage further options and diversity for students at Virginia Tech.

Sounds extremely interesting. Makes me actually want to look into the idea of it. I am sure if you offered this as a major many people would take part in it.

I would not transfer from my current major because I am very interested in it. However, I feel that it would be a great addition to my fisheries science major and there is a very good probability that I would double major with the two.

I feel like the degree is a great opportunity for students in CNRE.

I think it is an important major to add to the college. Water is and up and coming problem in the world, so teaching people how to go about the shortages, cleanliness, and maintenance of water is very crucial.

I would be very interested in adding it as a minor if it did not extend my undergraduate program past four years.

I feel like offering a WRPM major would be very beneficial to the environment in the long run and very informational for students at Virginia Tech.
I feel that this major would have huge potential, an engaging curriculum, and a strong job outlook. Overall, it would be highly beneficial to the university.

I am currently a water resources minor and would like the opportunity to further that line of education. Thanks.

I think this is a great idea. Water is becoming a very important issue in today’s time. There is much conflict over it, and the economic and ethical distribution of it. Not to mention, water’s role in Global Climate Change. The major is very timely, and I think it would be a great addition to Virginia Tech.

I think it is a wonderful idea.

I think water resources are becoming more and more important and this would be a great major to go into.

Too bad this wasn’t here when I was a freshman.
Appendix D - Letter of Support from Departments Offering Water-related Options at Virginia Tech

Dear Dr. Alavalapati:

We write to express our support for the proposed undergraduate B.S. degree in Water Resources, Policy, and Management, which, upon approval, will be offered through the Department of Forest Resources and Environmental Conservation. Members of our faculty have been part of the multidisciplinary team that helped develop the curriculum for this new degree and we see it as an opportunity for Virginia Tech to expand training opportunities for students in an area of rapidly growing need. As noted in the degree proposal, students seek opportunities to be broadly trained in technical and societal issues concerning water. The proposed curriculum will provide students with a multidisciplinary educational program integrating environmental, social, and economic courses, which will be of great value to meet the many challenges to manage our water resources sustainably. We anticipate that the new water degree will benefit many students, all of our departments, and the entire Virginia Tech community.

Sincerely,

[Signatures]

Steven Blank
Department Head
Agricultural and Applied Economics

W. Samuel Easterling
Department Head
Civil and Environmental Engineering

Nancy Ross
Department Head
Geosciences

Mary Leigh Wolfe
Department Head
Biological Systems Engineering

Diane Zahm
Co-Chair
Urban Affairs and Planning

Laurence W. Carstensen Jr.
Department Head
Geography

Steve McMullin
Interim Department Head
Fish and Wildlife Conservation

Thomas Thompson
Department Head
Crop and Soil Environmental Sciences

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution
November 8, 2013

TO: Dr. Janaki Alavalapati, Head Department of Forest Resources and Environmental Conservation

                    Paul M. Winistorfer

FROM: Paul M. Winistorfer, Dean

RE: Support for B.S. degree in Water: Resources, Policy and Management

Dear Janaki:

I am pleased with the progress being made with the newly proposed undergraduate B.S. degree in Water: Resources, Policy, and Management to be offered through the Department of Forest Resources and Environmental Conservation.

I am aware that the proposed degree program is in need of additional resources to support a new full-time academic advisor who will coordinate student advising and oversee student record keeping. With this letter, I am informing you that financial commitment for this position will be provided by the College of Natural Resources and Environment at this time. I do intend to seek a partnership with the Provost and other participating colleges to invite them to share in our resource needs. However, you can count on my financial commitment to this innovative new degree program.
Letters of Support for Inclusion of Courses in Proposed Curriculum for B.S. Degree in Water: Resources, Policy, and Management

AAEC
From: Blank, Steve [mailto:scblank@vt.edu]
Sent: Monday, March 11, 2013 2:31 PM
To: Schoenholz, Stephen
Subject: RE: request to include AAEC courses in the new water degree curriculum

Stephen,

On behalf of the Department of Agricultural and Applied Economics, I support the inclusion of the following AAEC courses in the curriculum of the proposed new undergraduate degree in water: AAEC 1005, 1006, 3004, 3014, 3314, 3324, 3604, 4314, 4344. Our department is happy to contribute to this new degree.

Best wishes,

Steve

Steven C. Blank, Ph.D.
Department Head and Professor
Agricultural and Applied Economics
208 Hutcheson Hall (0401)
Virginia Tech
Blacksburg, VA 24061

Telephone: 540-231-2609
FAX: 540-231-7417
Email: scblank@vt.edu

ALS
From: Taylor, Anna
Sent: Tuesday, March 26, 2013 5:12 PM
To: Schoenholz, Stephen
Subject: Request to include ALS courses in the new water degree curriculum

Dear Stephen,

The College of Agriculture and Life Sciences supports the inclusion of the ALS courses listed below in the curriculum of the new B.S. degree: Water: Resources, Policy, and Management.

Please contact me if you have more questions.

Sincerely,

Susan

Susan Sumner
Dear Susan,

I am seeking a letter of support from you as Associate Dean that permits inclusion of the following ALS courses in the curriculum of the proposed new undergraduate degree in Water: Resources, Policy, and Management:

**Required Courses:**
- ALS/NR 4614 Water Assess Mgt Policy

**Restricted Elective Courses (not required):**
- 2204 Intro Civic Agriculture

**Elective Courses Within Areas of Specialization Offered in the Water Curriculum (not required):**
- 3134 Livestock & Env
- 3404 Ecol Ag Theory & Practice
- 4714 Global Seminar
- ALS/GEOG/NR/UAP 4404 Approaches Int'l Devp

I have attached a copy of the curriculum for the new degree, which includes required courses, restricted electives, and electives within Areas of Specialization. The ALS courses are highlighted. The only required course from ALS is cross-listed 4614 that I teach with Darrell Bosch. Not all students in the new program will enroll in the above-listed elective courses. As such, demand for the elective courses is likely to be relatively low.

We are proposing a class of 20 per year to SCHEV. I will be submitting the proposal for this new degree into the university governance process within the next couple of weeks. As such, I would greatly appreciate a short email from you allowing us to use these courses in the new water major.

Please let me know if you have any questions.

Best regards,

Stephen

---

**Stephen H. Schoenholtz, Ph.D.**  
**Professor and Director**  
Virginia Water Resources Research Center  
College of Natural Resources and Environment  
210 Cheatham Hall (MC 0444)  
Virginia Tech  
Blacksburg, VA 24061-0001  
Phone: 540-231-0711  
Fax: 540-231-6673
CEE
From: Easterling, W. Samuel
Sent: Thursday, April 04, 2013 4:04 PM
To: Schoenholtz, Stephen
Cc: Widdowson, Mark; Lattimer, Kara
Subject: CEE Courses on Water:Resources, Policy and Management degree checklist

Dear Stephen:

I am writing to confirm that the Department of Civil and Environmental Engineering supports inclusion of the CEE courses you requested in the curriculum for the new undergraduate degree in Water: Resources, Policy, and Management. Specifically, it is agreed that CEE 4344 (Water Resources Planning) be included as a required course, and that CEE 2814, 3104, 3274, 3304, 3314, 3514, 4104, 4114, 4134, 4174, 4264, 4304, 4314, 4324, 4344, and CEE/CSES 4594 be included as elective courses. Please be aware that CEE 4344 is not always taught on a regular schedule. As such, students may need to opt for the other choice (AAEC 3324 Environmental and Sustainable Development Economics) to meet this requirement. Also please be aware that many of these courses have prerequisites.

Good luck going forward!

Regards,

Sam

W. Samuel Easterling, PhD, PE, F.ASCE
Montague-Betts Professor of Structural Steel Design
and Department Head
The Charles E. Via, Jr. Department of Civil & Environmental Engineering
Virginia Tech
Blacksburg, VA 24061
540-231-5143 (office) 540-231-7532 (fax)

CSES and ENSC
From: Thompson, Thomas
Sent: Monday, March 25, 2013 11:13 AM
To: Schoenholtz, Stephen
Cc: Zipper, Carl; Eick, Matt; Sumner, Susan
Subject: RE: Request to include CSES/ENSC courses in the new Water Degree Curriculum

Dear Stephen,

The Department of Crop and Soil Environmental Sciences supports the inclusion of the CSES/ENSC courses listed below in the curriculum of the new B.S. degree: Water: Resources, Policy, and Management. Please note that we will no longer offer CSES 4754-Instrumental Analysis. We are planning to create a new senior-level course, tentatively titled “Environmental
Monitoring" that may be of interest for this new degree. We will be sure to inform you when this course is proposed and approved.

Please contact me if you have more questions.

Sincerely,

Tom

Thomas L. Thompson, Ph.D.
Professor and Department Head
Department of Crop and Soil Environmental Sciences
Virginia Tech, 330 Smyth Hall (0404)
Blacksburg, VA 24061

(540) 231-9775
thomas.thompson@vt.edu
www.cses.vt.edu

From: Schoenholtz, Stephen
Sent: Tuesday, March 19, 2013 9:09 PM
To: Thompson, Thomas
Cc: Zipper, Carl
Subject: Request to include CSES/ENSC courses in the new Water Degree Curriculum

Dear Tom,

I am seeking a letter of support from you as Head of the Department of CSES that permits inclusion of the following CSES/ENSC courses in the curriculum of the proposed new interdisciplinary undergraduate degree in Water: Resources, Policy, and Management:

**Required Courses:**
- ENSC 3604 Fund Env Sci
- ENSC 4314 Water Quality

**Restricted Elective Courses (not required):**
- CSES 3114 Soils
- CSES 4734 Env Soil Chem
- ENSC 4324 Water Quality Lab
- CSES 3124 Soils Lab
- CSES 4754 Instrumental Analysis
- ENSC 4854 Wet Soils & Mitigation
- CSES 3134 Soil in Landscape
- CSES 4774 Reclam Drast Distrub Lands

**Elective Courses Within Areas of Specialization Offered in the Water Curriculum (not required):**
- CSES 3614 Soil Phys & Hydrok Proc
- CSES/GEOG/GEOS 3304 Geomorph
- CSES 4754 Instrumental Analysis
- CSES 4644 Land Based Sys Waste Treat
- CSES 4114 Soil Physics
- CSES 3634 Physics of Pollution
- CSES 4774 Reclam Dras Disturb Lands
- CSES 4595 Soil & Gwater Pollution
- CSES/BIOL 4164 Env Microbiology
- CSES 4734 Env Soil Chem
- CSES 4644 Land Based Systems Waste Mgt.
I have attached a copy of the DRAFT curriculum for the new degree, which includes required courses, restricted electives, and electives within Areas of Specialization. The CSES/ENSC courses are highlighted. As you will note, the only required courses from CSES are ENSC 3604 and 4314. Not all students in the new program will enroll in the above-listed elective courses. As such, demand for CSES/ENSC courses is likely to be relatively low.

We are proposing a class of 20 per year to SCHEV and the degree will be offered through the Department of Forest Resources and Environmental Conservation. I will be submitting the proposal for this new degree into the university governance process within the next couple of weeks. As such, I would greatly appreciate a short email from you allowing us to use these CSES/ENSC courses in the new water major.

Please let me know if you have any questions.

Best regards,
Stephen

Stephen H. Schoenholtz, Ph.D.
Professor and Director
Virginia Water Resources Research Center
College of Natural Resources and Environment
210 Cheatham Hall (MC 0444)
Virginia Tech
Blacksburg, VA 24061-0001
Phone: 540-231-0711
Fax: 540-231-6673
stephen.schoenholtz@vt.edu
http://vwrcc.vt.edu/
http://water.vwrcc.vt.edu/

---

ECON
From: Sheryl Ball [mailto:sball@vt.edu]
Sent: Wednesday, March 27, 2013 11:09 AM
To: Schoenholtz, Stephen
Cc: Perdue, Erika
Subject: Econ Support for Water Degree Curriculum

Dear Stephen,

The economics department supports the creation of the proposed new interdisciplinary undergraduate degree in Water: Resources, Policy, and Management.

We can accommodate students from this major into (required courses) ECON 2005 and 2006 as well as (restricted elective) ECON 4104 without additional resources.

Some notes that might be useful going forward. Economics does enforce prerequisites for all courses (in this case 2005 for both 2006 and 4104). Also, the department is in the process of renumbering our elective courses to better reflect their “level.” Once these changes are approved by governance ECON 4104 will become ECON 3034.

Warm Regards,

Sheryl
Sheryl Ball  
Virginia Tech Carillion Research Institute (on sabbatical) Associate Department Head Virginia Tech  
Department of Economics sball@vt.edu

**ESM**
From: Case, Scott  
Sent: Saturday, March 23, 2013 7:32 PM  
To: Schoenholtz, Stephen  
Cc: Stanley, Amanda; Puri, Ishwar; Stremler, Mark  
Subject: RE: Request to include ESM course in the new Water Degree Curriculum

Stephen,
ESM 3024 has two listed prerequisites: ESM 2304 and MATH 2224. The inherited prerequisites are: ESM 2104, MATH 2214, and MATH 1114. In ESM, we enforce the prerequisites for all undergraduate courses. As a result, Water students who wished to take ESM 3024 would need to have credit for 5 courses not listed on the checksheet. As you’ve indicated, that’s likely to be a very small subset of students. (I suspect the most likely candidates would be students who started in engineering and then decided to change majors after completing most/all of the listed courses.)

On that basis, ESM agrees to having the course listed. I trust that as part of the advising process you will make students aware of the (long) prerequisite chain.

Best regards,
Scott

Scott Case  
Professor and Associate Department Head  
Engineering Science and Mechanics  
225A Norris Hall  
Virginia Tech  
Blacksburg, VA 24061  
Phone: (540) 231-3140  
Fax: (540) 231-4574  
http://www.esm.vt.edu

**GEOG**
From: Carstensen, Bill  
Sent: Monday, April 01, 2013 10:20 AM  
To: Schoenholtz, Stephen  
Subject: RE: Request to include GEOG courses in the new Water Degree Curriculum

Hi Stephen,

Just catching up on my emails. Sorry for the delay. Geography is pleased for the water program to use the courses you have listed below, but there are two that are not likely good candidates because of prerequisites, and one that I cannot speak for:

**GEOG 3515:**
- calculus based physics of the atmosphere classes that are pretty inaccessible unless one has had MATH 1205-1206 and PHYS 2305-2306.

**GEOG 4524:**
Requires that you take Dynamic sequence (3515-3516) first
GEOG 4404:
Not taught by our faculty so will need permission from UAP

Bill

From: Schoenholtz, Stephen
Sent: Monday, March 25, 2013 3:45 PM
To: Carstensen, Bill
Subject: Request to include GEOG courses in the new Water Degree Curriculum

Dear Bill,

I am seeking a letter of support from you as Head of the Department of Geography that permits inclusion of the following GEOG courses in the curriculum of the proposed new interdisciplinary undergraduate degree in Water: Resources, Policy, and Management:

Required Courses:
4084 Intro GIS* 4354 Intro Remote Sensing*
*Choose either one

Restricted Elective Courses (not required):
2506 Weather 3515 Dynamic Meteorology I
2505 Weather Analysis I 3504 Severe Weather Meteorology II
Analysis II
3524 Meteorological Field Methods 4524 Phys Meteorology 4554 Remote Sensing of Atm

Elective Courses Within Areas of Specialization Offered in the Water Curriculum (not required):
4204 Geog of Resources 3104 Env Problems & Pop Devp 3114 Intro Meteorology
3304 Geomorphology 4404 Approaches Intl Devp (ALS/GEOG/NR/UAP)
(CSES/GEOG/GEOS)

I have attached a copy of the DRAFT curriculum for the new degree, which includes required courses, restricted electives, and electives within Areas of Specialization. The GEOG courses are highlighted. As you will note, the two required courses (4084 or 4354) are among five choices to fulfill a 3-credit requirement in GIS. Furthermore, not all students in the new program will enroll in the above-listed elective courses. As such, demand for GEOG courses is likely to be relatively low.

We are proposing a class of 20 per year to SCHEV and the degree will be offered through the Department of Forest Resources and Environmental Conservation. I will be submitting the proposal for this new degree into the university governance process within the next couple of weeks. As such, I would greatly appreciate a short email from you allowing us to use these GEOG courses in the new water major.

Please let me know if you have any questions.

Best regards,
Stephen

Stephen H. Schoenholtz, Ph.D.
Professor and Director
GEOS
From: Ross, Nancy
Sent: Thursday, April 04, 2013 1:04 PM
To: Schoenholtz, Stephen
Cc: Schreiber, Madeline; Lowe, Connie
Subject: RE: Request to include GEOG courses in the new Water Degree Curriculum

Dear Stephen,

I am writing to confirm that you may include GEOG/GEOS 4354: Intro Remote as a required course in the new Water Degree Curriculum as well as the following courses as electives. We will, however, give priority to our majors in geosciences for seats in these courses.

3034 Oceanography                      4804 Groundwater Hydrology                      3014 Environmental Geosciences
3304 Geomorphology (CSES/GEOG/GEOS)

Best wishes,

Nancy

Nancy L. Ross
Professor and Head
Department of Geosciences
Virginia Tech
Blacksburg, VA 24061
USA

IS
From: Timothy Luke [mailto:twluke@vt.edu]
Sent: Tuesday, March 26, 2013 7:22 PM
To: Schoenholtz, Stephen
Cc: Luke, Timothy; Stivachtis, Yannis
Subject: Re: Request to include IS course in the new Water Degree Curriculum

Stephen:

Thank you for this information on the new Water Resources degree. We support you including IS 4014 into your list of electives.
Best regards,

Tim Luke

__________________________________
MATH
From: Peter Haskell [mailto:phaskell@math.vt.edu]
Sent: Friday, March 29, 2013 4:33 PM
To: Schoenholtz, Stephen
Cc: Long, Gary, Haymore, Susan
Subject: Re: Request to include MATH courses in the new Water Degree Curriculum w Attachment

Dear Stephen,

Thank you for sending me a description of your proposed new curriculum leading to a water degree. I note that it includes either Math 1016-2015 or Math 1205-1206 as requirements for the approximately twenty students per year you expect to enroll. We do face enrollment pressures on our undergraduate classes; but as long as enrollment support keeps pace with our increasing enrollments and as long as your program does not grow much beyond the twenty students you expect, we should be able to offer your students the required math classes without our needing any additional resources.

Peter

---
Peter Haskell
Professor and Chair
Department of Mathematics
Virginia Tech
Blacksburg, VA 24061-0123
540-231-6538
fax: 540-231-5960
phaskell@math.vt
March 19, 2013

Stephen H. Schoenholtz, Ph.D.
Professor and Director
Virginia Water Resources Research Center
College of Natural Resources and Environment
210 Cheatham Hall (MC 0444)

Dear Dr. Schoenholtz,

The Department of Biological Sciences supports your request to use BIOL 1106 and 1116 as required courses for the proposed new undergraduate degree in Water: Resources, Policy, and Management. We also support the use of BIOL 1105, BIOL 1106, BIOL 2504, BIOL 2604, BIOL 2704, and BIOL 2804 as restricted electives, and the use of BIOL 4004, BIOL 4554, and BIOL 4114 as elective courses within areas of specialization.

Please note our ability to provide sufficient seats in the above BIOL 1XXX and 2XXX courses is dependent on continued enrollment support. Also note that seats are limited in the fall offerings of BIOL 2604, and that BIOL 4004, BIOL 4554, and BIOL 4114 can be high demand courses for BIOL majors.

Sincerely,

[Signature]

Richard A. Walker
Associate Head
Department of Biological Sciences
March 29, 2013

Stephen H. Schoenholtz, Ph.D.
Professor and Director
Virginia Water Resources Research Center
Virginia Tech
Blacksburg, VA 24061-0001

Dear Dr. Schoenholtz:

The Department of Biological Systems Engineering (BSE) supports inclusion of BSE 4344 GIS for Engineers as a required course (one of five choices for GIS) in the proposed new undergraduate degree in Water: Resources, Policy, and Management. In addition, the BSE Department supports inclusion of six BSE courses as elective courses for the degree, specifically, BSE 3324 Small Watershed Hydrology, BSE 3334 Nonpoint Source Assessment and Control, BSE 4224 Field Methods in Hydrology, and BSE 4304 NPS Pollution Modeling & Management, BSE 4324 NPS Pollution, and BSE 4394 Water Supply and Sanitation in Developing Countries.

Sincerely,

Mary Leigh Wolfe
Professor and Head
April 1, 2013

Stephen H. Schoenholtz, Ph.D.
Professor and Director
Virginia Water Resources Research Center
College of Natural Resources and Environment
210 Cheatham Hall (MC 0444)
Virginia Tech
Blacksburg, VA 24061-0001

Dear Stephen,

On behalf of the Department of Chemistry, I am replying to your request for a letter of support for a new degree in Water. As you might be aware, we receive many proposals for new degrees, each of which predict only “small” additional enrollments in chemistry courses. Although for each new degree, the individual demand is modest, the sum of all of these students is not inconsequential and is placing an increasing burden on us. In particular, additional space and support for laboratories is costly. As a result, we are happy to support the concept of your new degree, but with the caveat that we might need new resources from your college to handle the added load.

Regards,

Gordon T. Yee

Cc: JMT
21 March 2013

Prof. Stephen H. Schoenholtz,
Virginia Water Resources Research Center,
College of Natural Resources and Environment,
210 Cheatham Hall (MC 0444),
Virginia Tech,
Blacksburg, VA 24061.

Dear Prof. Schoenholtz,

The Department of English is glad to support the inclusion of ENGL 1105–1106 Freshman Composition, 3754 Advanced Composition, and 3764 Technical Writing on the checksheet for the new degree program in Water: Resources, Policy, and Management.

All good wishes,

Joseph F. Eska
Professor & Chair
Stephen Schoenholtz, Director
Virginia Water Resources Research Center
0324

April 1, 2013

Dear Dr. Schoenholtz –

You recently wrote me asking permission for inclusion of several of our courses in the curriculum of the proposed undergraduate degree in Water Resources, Policy, and Management. We agree to the inclusion of the courses below, with two minor caveats noted:
- 2114 Principles of Fisheries and Wildlife Management,
- 3514 Fisheries Techniques.
- 4514 Principles of Aquaculture
- 4534 Ecology and Management of Wetland Systems (note that it is taught only in odd-numbered years)
- 4626 Marine Ecology
- 4714 Fisheries Management (the pre-requisite 3514 will be enforced because students otherwise are not prepared for this course), and
- 4484 Freshwater Biomonitoring.

We wish you every success in realizing this degree program.

Regards,
Eric M. Hallerman
Eric M. Hallerman,
Professor and Head
April 22, 2013

Stephen Schoenholtz, Director
Water Resources Research Center
VA Water Resources Research Center
210-G Cheatham Hall
Blacksburg, VA 24061

Dear Stephen,

The Landscape Architecture Program supports the inclusion on LAR 3154, Watershed Sensitive Design and Construction, as an elective in the curriculum of the new B.S. degree. Water: Resources, Policy, and Management.

Please contact me if you have any additional questions or need additional information.

Sincerely,

[Signature]

Brian Katen, ASLA
Landscape Architecture Program Chair
School of Architecture + Design
121E Burruss Hall
Virginia Tech
Blacksburg, Va. 24061
bkaten@vt.edu
540.231.7505
May 16, 2013

Professor Stephen Schoenholtz
Director, Virginia Water Resources Research Center
College of Natural Resources and Environment

Professor Schoenholtz,

The Mechanical Engineering Department supports including ME 4194, Sustainable Energy Solutions for a Global Society, in the curriculum for the proposed interdisciplinary degree in Water: Recourses, Policy, and Management, consistent with the Water Degree Curriculum DRAFT 20130325 (recently sent as an attachment to our Department Head, Dr. Parker).

It is understood that whether ME 4194 is offered in any given semester or academic year will depend upon available resources, and that the enrollment capacity will be limited due to the structure and design of the course.

We do look forward to the different backgrounds and perspectives which the students in this new program will bring to the course.

Sincerely,

Clint Dancey
Associate Department Head
Department of Mechanical Engineering
Virginia Tech University
17 April 2013

Dr. Stephen Schoenholtz
Professor and Director
Virginia Water Resources Research Center
College of Natural Resources and Environment
Virginia Tech
Blacksburg, VA 24061

Dear Stephen,

The College of Natural Resources and Environment supports the inclusion of the NR 2004 (required), NR 4614 (required), and NR 4444 (elective) courses in the curriculum of the new B.S. degree: Water: Resources, Policy, and Management.

Please contact me if you have more questions.

Sincerely,

Dean F. Stauffer
Associate Dean for Academic Programs
April 8, 2013

Prof. Stephen Schoenholtz
Director, Virginia Water Resources Research Center
College of Natural Resources and Environment
Virginia Tech
0444

Dear Prof. Schoenholtz:

We understand that you would like to list PHYS 2205 and PHYS 2215 as required courses and PHYS 2206 and PHYS 2216 as additional physical-science electives on your proposed checksheet for the new Bachelor of Science degree in "Water: Resources, Policy, and Management."

Our introductory physics courses, including the four mentioned above (two required and two electives), are offered to all qualified students and will continue to serve students outside the College of Science on a first-come first-serve basis during the course request times.

The current enrollment capacity in PHYS 2205, 2215, 2206, and 2216 is presently supported by enrollment support funds from the Provost's office; these support funds have historically been adjusted to match demand. We estimate that the new enrollment of about 20 new students for your degree will require the creation of a new PHYS 2215 lab section and may require the creation of a new PHYS 2205 lecture section. Provided that the existing enrollment support model continues and sufficient resources are provided to us by the College of Natural Resources and Environment and/or the Provost's office—but not from the College of Science—to create these new sections, if they are needed, and we can identify qualified instructional personnel, we will be happy to lend our support to your request to include PHYS 2205, 2215, 2206, and 2216 on your proposed checksheet.

Sincerely,

[Signature]

Leo Pillonen
Chair, Department of Physics
March 29, 2013

Stephen H. Schoenholtz, Ph.D.
Professor and Director
Virginia Water Resources Research Center
College of Natural Resources and Environment
210 Cheatham Hall (MC 0444)
Virginia Tech
Blacksburg, VA 24061-0001

Dear Dr. Schoenholtz,

The Department of Statistics approves the requested to use STAT 3005 and STAT 3615 as restricted electives for the new program in Water: Resources, Policy and Management. We would be happy to discuss how to best integrate material from the program into our statistics courses.

Please be aware that enrollments in these courses are at capacity and it may be difficult to accommodate needs if many students desire the courses.

Sincerely,

[Signature]

Eric P. Smith
Professor and Department Chair
November 7, 2013

Stephen H. Schoenholtz, Professor and Director  
Virginia Water Resources Research Center (MC0444)  

Dr. Schoenholtz:  

This letter conveys my support for including the following courses in the proposed B.S. in Water Resources, Policy and Management, major in Water:  

UAP 3014 Urban Policy and Planning  
UAP 3024 Urban and Regional Analysis  
UAP 3224 Policy Implementation  
UAP 3354 Introduction to Environmental Policy and Planning  
UAP 4184 Community Involvement  
UAP 4344 Critical Areas Law  
UAP 4374 Land Use and Environment: Planning and Policy  
UAP 4384 Pollution Control Planning  
UAP 4754 Legal Foundations of Planning  
UAP 4784 International Development Planning  

Students will be expected to complete the necessary prerequisite and to meet any established minimum grade requirements for the above courses.  

Please note that we are not offering support for the following three courses listed on the proposed checksheet:  

UAP 4214 Women, Environment and Development  
UAP 4614 Health Policy  
UAP 4394 Community Renewable Energy Systems  

After further discussion in UAP, we felt it would inappropriate to include these three courses because we are not able to fully staff them on a regular basis, and it would be unfair to set an expectation that the three will be taught in the future.  

Should you have questions or concerns, please feel free to contact me.  

Sincerely,  

Diane L. Zahm, PhD, AICP  
Associate Professor  
Program Co-Chair and Undergraduate Program Coordinator
COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
B.S. Degree in Water: Resources, Policy, and Management
Major: Water: Resources, Policy, and Management
For Students Graduating in Calendar Year 2016
Department of Forest Resources and Environmental Conservation

Minimum credits required for graduation is 120.

Core Degree Requirements (57 credits)

Water Core (18 credits)
___* GEOG/NR 2004 Introduction to Water Resources and Environmental Issues (3) Sophomore standing required.
___ PHYS 2205 General Physics (3) Pre: MATH 1015 or MATH 1016H or MATH 2015 or MATH 1205H or MATH 1525 or MATH 1535.
___ PHYS 2215 General Physics Lab (1) Co: PHYS 2205.
___* FOR 3104 Principles of Watershed Hydrology (3) Pre: Junior standing required. MATH 1206 or MATH 2015.
___* ENSC 3604 Fundamentals of Environmental Science (3) Pre: BIOL 1105 or CHEM 1035.
___* ENSC 4314 Water Quality (3) Pre: (ENSC 3604 or BIOL 4004), MATH 2105, BIOL 1106, CHEM 1035.
___* ALS/NR 4614 Watershed Assessment, Management, and Policy (2) Pre: Two 4000 level courses in environmental/natural resource science, management, engineering, and/or policy in BSE, CEE, FOR, GEOG, LAR, CSES, ENT, BIO, GEOG, AAEC, UAP or equivalent.

Writing (3 credits – choose one course)
___ ENGL 3754 Advanced Composition (3) Junior standing required.
___ ENGL 3764 Technical Writing (3) Junior standing required.

Water Law, Planning, and Economics (9 credits – choose one course from each area below)
___* AAEC 3314 Environmental Law (3), OR UAP 4344 Law of Critical Environmental Areas (3)
___* UAP 3354 Introduction to Environmental Policy and Planning (3), OR UAP 4374 Land Use and Environment: Planning and Policy (3) Junior standing required.
___* AAEC 3324 Environmental and Sustainable Development Economics (3) Pre: AAEC1003 or ECON 2005, OR CEE 4344 Water Resources Planning (3) Senior standing required.

Geospatial Technology (3 credits – choose one course)
___* GEOG 4084 Introduction to GIS (3)
___* GEOG 4354 Introduction to Remote Sensing (3)
___* FOR 4114 Information Technology for Natural Resource Management (3) Pre: FOR 2214 or GEOG 2314
___* FOR 4214 Forest Photogrammetry and Spatial Data Processing (3) Senior standing required.
___* BSE 4344 GIS for Engineers (3) Laboratory work and senior standing required.

Water Science Specialization (12 credits – choose 9 credits in one of the four Water Science Specializations listed below and remaining 3 credits from any of the four Water Science Specializations listed below)
(see Water Science Specialization course list)
___ I. Aquatic Ecosystems
___ II. Hydrology
___ III. Water Quality
___ IV. Water Treatment and Public Health

Water Policy Specialization (12 credits – choose 9 credits in one of the four Water Policy Specializations listed below and remaining 3 credits from any of the four Water Policy Specializations listed below)
(see Water Policy Specialization course list)

I. Watershed Management
II. Water Planning, Policy, and Economics
III. International Water Management
IV. Water, Climate, Energy, and Global Issues

Restricted Electives (Minimum 18 credits – see course lists: choose from courses listed under the Water Science or Water Policy Specializations or from those listed as Restricted Electives)

Free Electives (9 credits)

CLE Requirements (36 credits)
Area 1: Writing and Discourse (0-6 credits – depending on placement)
   CLE Area 1 course: ______________________________ (3)
   CLE Area 1 course: ______________________________ (3)

Area 2: Ideas, Cultural Traditions, and Values (6 credits)
   CLE Area 2 course: ______________________________ (3)
   CLE Area 2 course: ______________________________ (3)

Area 3: Society and Human Behavior (6 credits)
   ECON 2005 Principles of Economics I (3), OR AAEC 1005 Economics of Food and Fiber I (3)
   ECON 2006 Principles of Economics II (3), OR AAEC 1006 Economics of Food and Fiber II (3)

Area 4: Scientific Reasoning and Discovery (8 credits, including 2 labs)
   BIOL 1106 Principles of Biology (3)
   BIOL 1116 Biology Lab (1) Co: BIOL 1106
   CHEM 1035 Chemistry (3)
   CHEM 1045 Chemistry Lab (1) Co: CHEM 1035 or 1035H

Area 5: Quantitative and Symbolic Reasoning (6 credits)
   MATH 1015 Elementary Calculus w Trig I (3) Assumes 2 units of high school algebra and 1 of plane geometry, OR MATH 1205 Calculus (3) Pre: 2 units of high school algebra, 1 unit of geometry, 1/2 unit each of trigonometry and precalculus and placement by Math Dept.; or a grade of B or better in one of MATH 1015, 1016, or 1026, or a passing grade on the Calculus Readiness Exam
   MATH 2015 Elementary Calculus w Trig II (3) Pre: MATH 1015, OR MATH 1206 Calculus (3) Pre: MATH 1205

Area 6: Creativity and Aesthetic Experience (1 credit)
   CLE Area 6 course: ______________________________ (1)

Area 7: Critical Issues in a Global Context (3 credits)
   CLE Area 7 course: ______________________________ (3)
WATER: RESOURCES, POLICY, AND MANAGEMENT NOTES

1. **Prerequisites:** Prerequisites for all courses on this checksheet are indicated. Please refer to the Undergraduate Course Catalog or consult your advisor for information about prerequisites.

2. **In-Major GPA Computation:** *Indicates courses counted toward in-major GPA. For restricted electives and free electives, any course taken from either a water science specialization or a water policy specialization counts toward the in-major GPA.

3. **Satisfactory Progress:** By the end of the semester in which the student has attempted 60 credits (including transfer, advanced placement, advanced standing, and credit by examination), “satisfactory progress” towards a B.S. degree in Water: Resources, Policy, and Management will include the following minimum criteria:
   - Having an in-major and overall grade point average of at least 2.0
   - Passing at least 24 semester credits that apply to the Curriculum for Liberal Education (CLE)
   - Passing the following courses, or their equivalents: BIOL 1106, 1116; CHEM 1035, 1045; and MATH 2015

4. **Foreign Language Requirement:** Students who did not successfully complete at least two years of a single foreign, classical, or sign language during high school must successfully complete six semester hours of a single foreign, classical, or sign language at the college level. Course taken to meet this requirement do not count toward the hours required for graduation. Please consult the Undergraduate Catalog for details.

5. **Policy on Student Exchanges:** Studying overseas or at another U.S. university is a wonderful opportunity to enhance your education. However, planning for an exchange should begin at least nine months prior to leaving for the exchange. This will allow time to determine what substitutions, if any, will be allowed and time to arrange your schedule at Virginia Tech to ensure that all requirements for graduation are met.

6. **GPA for Graduation:** An in-major and overall GPA of 2.0 is required for graduation.

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**Water Science Specialization Courses**

All water science specialization courses count toward in-major GPA.

**I. Aquatic Ecosystems**

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL</td>
<td>4004</td>
<td>Freshwater Ecology (4) Senior standing required. Pre: BIOL 2804</td>
</tr>
<tr>
<td>CSES/BIOL/CEE/ENSC</td>
<td>4164</td>
<td>Environmental Microbiology (3) Pre: BIOL 2804.</td>
</tr>
<tr>
<td>BIOL/ENT</td>
<td>4354</td>
<td>Aquatic Entomology (4) Pre: (BIOL 1005, 1006), (BIOL 1015, 1016) or (BIOL 1105, 1106, 1115, 1116).</td>
</tr>
<tr>
<td>BIOL</td>
<td>4454</td>
<td>Invertebrate Zoology (4) Pre: BIOL 2504</td>
</tr>
<tr>
<td>BIOL/FIW/ENT</td>
<td>4484</td>
<td>Freshwater Biomonitoring (4) Pre: (BIOL 2804), (BIOL 4004 or 4354 or ENT 4354 or FIW 4424 or FIW 4614).</td>
</tr>
<tr>
<td>FIW</td>
<td>4514</td>
<td>Principles of Aquaculture (3) Pre: FIW 2114.</td>
</tr>
<tr>
<td>FIW</td>
<td>4534</td>
<td>Ecology &amp; Management of Wetland Systems (3) Enrollmen restricted to junior, seniors</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Prerequisites</td>
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<tr>
<td>FIW 4614</td>
<td>Fish Ecology (3)</td>
<td>Pre: BIOL 1006</td>
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<tr>
<td>FIW 4624</td>
<td>Marine Ecology (3)</td>
<td>Pre: BIOL 2804 or BIOL 2804 or GEOS 3034</td>
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<tr>
<td>FIW 4714</td>
<td>Fisheries Management (3)</td>
<td>Pre: FIW 3354</td>
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<tr>
<td>FOR 4374</td>
<td>Forested Wetlands (3)</td>
<td>Pre: CSES 3114 or CSES 3134</td>
</tr>
<tr>
<td>GEOS 3034</td>
<td>Oceanography (3)</td>
<td>Pre: MATH 1206 or MATH 2205</td>
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**II. Hydrology**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>BIOL 4114</td>
<td>Global Change Ecology (3)</td>
<td>Pre: BIOL 2704, 2804</td>
</tr>
<tr>
<td>BSE 3324</td>
<td>Small Watershed Hydrology (3)</td>
<td>CEE 3304 or CHE 3114 or ESM 3015 or ESM 3024 or ME 3404</td>
</tr>
<tr>
<td>BSE 4224</td>
<td>Field Methods in Hydrology (3)</td>
<td>CEE 3324 or CEE 3314 or FOR 4354</td>
</tr>
<tr>
<td>CEE 3304</td>
<td>Fluid Mechanics for Civil and Environmental Engineering (3)</td>
<td>A grade of C- or better in pre-requisite ESM 2104. Pre: ESM 2104</td>
</tr>
<tr>
<td>CEE 3314</td>
<td>Water Resources Engineering (3)</td>
<td>A grade of C- or better required in pre-requisite CEE 3304. Pre: CEE 3304</td>
</tr>
<tr>
<td>CEE 4304</td>
<td>Hydrology (3)</td>
<td>A grade of C- or better required in pre-requisite CEE 3304. Pre: CEE 3304</td>
</tr>
<tr>
<td>CEE 4314</td>
<td>Groundwater Resources (3)</td>
<td>A grade of C- or better required in pre-requisite CEE 3304. Pre: CEE 3304</td>
</tr>
<tr>
<td>CEE 4324</td>
<td>Open Channel Flow (3)</td>
<td>Pre: CEE 3314</td>
</tr>
<tr>
<td>CEE 4354</td>
<td>Environmental Hydrology (3)</td>
<td>A grade of C- or better required in pre-requisites CEE 3104 and 3314. Pre: CEE 3104, 3314</td>
</tr>
<tr>
<td>CSES 3614</td>
<td>Soil Physical &amp; Hydrological Properties (3)</td>
<td>(CSES 3114, 3124) or (GEOS 3614, GEOS 3624)</td>
</tr>
<tr>
<td>CSES/ENSC</td>
<td>Geomorphology (3)</td>
<td>Pre: GEOG 1104 or GEOS 1001 or GEOS 2104</td>
</tr>
<tr>
<td>FOR 4354</td>
<td>Forest Soils &amp; Hydrology (3)</td>
<td>Pre: FOR 3314</td>
</tr>
<tr>
<td>GEOS 3014</td>
<td>Environmental Geosciences (3)</td>
<td>Pre: GEOS 1004 or 1024 or 2104</td>
</tr>
<tr>
<td>GEOS 4804</td>
<td>Groundwater Hydrology (3)</td>
<td>Pre: (GEOS 1014, PHYS 2205) or (PHYS 2305, MATH 1206)</td>
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</tbody>
</table>

**III. Water Quality**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>BSE 3334</td>
<td>Nonpoint Source Assessment &amp; Control (3)</td>
<td>Pre: BSE 2004, BSE 3324, CSES 3114</td>
</tr>
<tr>
<td>BSE 4304</td>
<td>Nonpoint Source Pollution Modeling &amp; Management (3)</td>
<td>Pre: BSE 3334</td>
</tr>
<tr>
<td>BSE 4324</td>
<td>Nonpoint Source Pollution (3)</td>
<td>Pre: CEE 3104</td>
</tr>
<tr>
<td>BSE 4394</td>
<td>Water Supply &amp; Sanitation in Developing Countries (3)</td>
<td>Pre: CEE 3104</td>
</tr>
<tr>
<td>CEE 3104</td>
<td>Introduction to Environmental Engineering (3)</td>
<td>A grade of C- or better required in pre-requisites. Pre: (CHEM 1035 or CHEM 1074), (CHEM 1045 or CHEM 1084), (MATH 1208 or MATH 1208H or MATH 2106), (PHYS 2205 or PHYS 2225)</td>
</tr>
<tr>
<td>CSES 3634</td>
<td>Physics of Pollution (3)</td>
<td>Pre: CSES 3114, PHYS 2206, MATH 2015</td>
</tr>
<tr>
<td>CSES/ENSC</td>
<td>Environmental Soil Chemistry (3)</td>
<td>Pre: CSES 3114, CSES 3124, CHEM 2514 or CHEM 2535, CHEM 2114, MATH 2015</td>
</tr>
<tr>
<td>FOR 3354</td>
<td>Forest Soils &amp; Hydrology (3)</td>
<td>Pre: FOR 3314</td>
</tr>
<tr>
<td>FOR 3374</td>
<td>Forested Wetlands (3)</td>
<td>Pre: CSES 3114 or CSES 3134</td>
</tr>
<tr>
<td>GEOS 4804</td>
<td>Groundwater Hydrology (3)</td>
<td>Pre: (GEOS 1014, PHYS 2205) or (PHYS 2305, MATH 1206)</td>
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**IV. Water Treatment & Public Health**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>BSE 4394</td>
<td>Water Supply &amp; Sanitation in Developing Countries (3)</td>
<td>Pre: CEE 3104</td>
</tr>
<tr>
<td>CEE 3104</td>
<td>Introduction to Environmental Engineering (3)</td>
<td>A grade of C- or better required in pre-requisites. Pre: (CHEM 1035 or CHEM 1074), (CHEM 1045 or CHEM 1084), (MATH 1208 or MATH 1208H or MATH 2106), (PHYS 2205 or PHYS 2225)</td>
</tr>
<tr>
<td>CEE 4104</td>
<td>Water &amp; Wastewater Treatment Design (3)</td>
<td>Pre: CEE 3104, 3304</td>
</tr>
<tr>
<td>CEE 4114</td>
<td>Fundamentals of Public Health Engineering (3)</td>
<td>A grade of C- or better required in pre-requisite. Pre: CEE 3104</td>
</tr>
<tr>
<td>CEE 4174</td>
<td>Solid &amp; Hazardous Waste Management (3)</td>
<td>A grade of C- or better required in pre-requisite CEE 3104. Pre: CEE 3104</td>
</tr>
<tr>
<td>CSES/BIOL/CEE/ENSC 4164</td>
<td>Environmental Microbiology (3)</td>
<td>Pre: BIOL 2804</td>
</tr>
<tr>
<td>CSES 4644</td>
<td>Land Based Systems for Waste Treatment (3)</td>
<td>Taught odd years.</td>
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</table>
**Water Policy Specialization Courses**
All water policy specialization courses count toward in-major GPA.

### I. Watershed Management

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>ALS 3404</td>
<td>Ecological Agriculture Theory &amp; Practice (3)</td>
<td>Pre: ALS 2204.</td>
</tr>
<tr>
<td>BSE 3324</td>
<td>Small Watershed Hydrology (3)</td>
<td>Co: CEE 3304 or CHE 3114 or ESM 3015 or ESM 3024 or ME 3404.</td>
</tr>
<tr>
<td>BSE 3334</td>
<td>Nonpoint Source Assessment &amp; Control (3)</td>
<td>Pre: BSE 2004, BSE 3324, CSES 3114.</td>
</tr>
<tr>
<td>BSE 4304</td>
<td>Nonpoint Source Pollution Modeling &amp; Management (3)</td>
<td>Pre: BSE 3334.</td>
</tr>
<tr>
<td>BSE 4324</td>
<td>Nonpoint Source Pollution (3)</td>
<td>Pre: CEE 3104.</td>
</tr>
<tr>
<td>CEE 3274</td>
<td>Intro Land Development (3)</td>
<td>A grade of C- or better in prerequisite. Pre: CEE 2814.</td>
</tr>
<tr>
<td>CEE 4264</td>
<td>Sustainable Land Development (3)</td>
<td>Pre-requisite: Senior Standing required.</td>
</tr>
<tr>
<td>FOR 4374</td>
<td>Forested Wetlands (3)</td>
<td>Pre: CSES 3114 or CSES 3134.</td>
</tr>
<tr>
<td>LAR 3154</td>
<td>Watershed Sensitive Design &amp; Construction (4)</td>
<td>Pre-requisite: LAR 2164 or consent of instructor.</td>
</tr>
<tr>
<td>UAP 3354</td>
<td>Introduction to Environmental Policy &amp; Planning (3)</td>
<td></td>
</tr>
<tr>
<td>UAP 4374</td>
<td>Land Use &amp; Environment: Planning &amp; Policy (3)</td>
<td>Pre: Junior standing.</td>
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</table>

### II. Water Planning, Policy, & Economics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>AAEC 3004</td>
<td>Agricultural Production &amp; Consumption Economics (3)</td>
<td>Pre: AAEC 1005.</td>
</tr>
<tr>
<td>AAEC 3014</td>
<td>Analytical Methods of Applied Economics (3)</td>
<td>Pre: STAT 3005 or BIT 2405 or STAT 3615.</td>
</tr>
<tr>
<td>AAEC 3314</td>
<td>Environmental Law (3)</td>
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<tr>
<td>AAEC 3324</td>
<td>Environmentally Sustainable Development Economics (3)</td>
<td>Pre: AAEC 1005 or ECON 2005.</td>
</tr>
<tr>
<td>AAEC 3604</td>
<td>Agricultural Law (3)</td>
<td></td>
</tr>
<tr>
<td>AAEC 4314</td>
<td>Environmental Economic Analysis &amp; Management (3)</td>
<td>Pre: AAEC 3324 or ECON 4014 or FOR 3424.</td>
</tr>
<tr>
<td>AAEC 4344</td>
<td>Sustainable Development Economics (3)</td>
<td>Pre: AAEC 3324 or AAEC 3004 or ECON 4014.</td>
</tr>
<tr>
<td>CEE 4134</td>
<td>Engineering Solutions for Environmental Sustainability (3)</td>
<td>Pre: CEE 3104.</td>
</tr>
<tr>
<td>CEE 4344</td>
<td>Water Resources Planning (3)</td>
<td>Senior standing required.</td>
</tr>
<tr>
<td>FOR 4014</td>
<td>Natural Resources Economics (3)</td>
<td>Pre: ECON 2005 or AAEC 1005.</td>
</tr>
<tr>
<td>GEOG 4204</td>
<td>Geography of Resources (3)</td>
<td></td>
</tr>
<tr>
<td>LAR 3154</td>
<td>Watershed Sensitive Design &amp; Construction (4)</td>
<td>Pre-requisite: LAR 2164 or consent of instructor.</td>
</tr>
<tr>
<td>UAP 3224</td>
<td>Policy Implementation (3)</td>
<td>Must complete prerequisites UAP 3014 (B- or higher) or UAP 3354, and UAP 3024 (B- or higher).</td>
</tr>
<tr>
<td>UAP 4184</td>
<td>Community Involvement (3)</td>
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<tr>
<td>UAP 4344</td>
<td>Law of Critical Environmental Areas (3)</td>
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<tr>
<td>UAP 4374</td>
<td>Land Use &amp; Environment: Planning &amp; Policy (3)</td>
<td>Pre: Junior standing.</td>
</tr>
<tr>
<td>UAP 4384</td>
<td>Pollution Control Planning &amp; Policy (3)</td>
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### III. International Water Management

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>ALS/HORT</td>
<td>4714 Global Seminar (1)</td>
<td>Pre-requisite: Junior or Senior Standing required.</td>
</tr>
<tr>
<td>BSE</td>
<td>4394 Water Supply &amp; Sanitation in Developing Countries (3)</td>
<td>Pre: CEE 3104.</td>
</tr>
<tr>
<td>IS</td>
<td>4014 Seminar in Grassroots Development (3)</td>
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<tr>
<td>UAP/GEOG/SOC</td>
<td>4764 International Development Policy &amp; Planning (3)</td>
<td>Junior standing required.</td>
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</table>

### IV. Water, Climate, Energy, & Global Issues

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>BIOL</td>
<td>4114 Global Climate Change (3)</td>
<td>(Pre: BIOL 2704, 2804.)</td>
</tr>
<tr>
<td>CEE</td>
<td>4134 Engineering Solutions for Environmental Sustainability (3)</td>
<td>Pre: CEE 3104.</td>
</tr>
<tr>
<td>CEE</td>
<td>4264 Sustainable Land Development (3)</td>
<td>Pre-requisite: Senior Standing required.</td>
</tr>
<tr>
<td>GEOG</td>
<td>3104 Environmental Problems &amp; Population Development (3)</td>
<td></td>
</tr>
<tr>
<td>GEOG</td>
<td>3114 Introduction to Meteorology (3)</td>
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</tr>
<tr>
<td>ME/ESM</td>
<td>4194 Sustainable Energy Solutions for a Global Society (3)</td>
<td>Senior Standing in major may be substituted.</td>
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</table>

5
Restrictive Electives (substitutions possible with approval)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Prerequisites/Co-requisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALS 2204</td>
<td>Introduction to Civic Agriculture (3)</td>
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<tr>
<td>BIOL 1105</td>
<td>Principles of Biology (3) Co: B.IOL 1115</td>
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<tr>
<td>BIOL 1115</td>
<td>Principles of Biology Lab (1) Co: BIOL 1105</td>
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<tr>
<td>BIOL 2504</td>
<td>General Zoology (3) Pre: (BIOL 1005 or 1105 or 1205H), (BIOL 1006 or 1106 or 1206H)</td>
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<tr>
<td>BIOL 2604</td>
<td>General Microbiology (3) Pre: CHEM 1015, CHEM 1016 or (CHEM 1036, CHEM 1036) or (BIOL 1205H, BIOL 1206H), (BIOL 1005, BIOL 1006) or (BIOL 1105, BIOL 1106)</td>
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<tr>
<td>BIOL 2704</td>
<td>Evolutionary Biology (3) Pre: (BIOL 1005 or 1105 or 1205H), (BIOL 1006 or 1106 or 1206H)</td>
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<tr>
<td>BIOL 2804</td>
<td>Ecology (3) Pre: (BIOL 1005 or 1105 or 1205H), (BIOL 1006 or 1106 or 1206H)</td>
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<tr>
<td>CEE 2814</td>
<td>Civil and Environmental Engineering Measurement (4) Pre: ENGE 1114 or BC 1224, (MATH 1206 or 1206H), (MATH 1224 or 1224H), Co: ENGE 2824</td>
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<tr>
<td>CEE 3514</td>
<td>Introduction to Geotechnical Engineering (3) A grade of C- or better required in pre-requisites GEOS 2104 and ESM 2204, Pre: ESM 2204, (GEOS 1004 or GEOS 2104)</td>
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<tr>
<td>CHEM 1036</td>
<td>General Chemistry (3)</td>
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<tr>
<td>CHEM 1046</td>
<td>General Chemistry Lab (1) Co: CHEM 1036</td>
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<tr>
<td>CSES/ENSC/GEOS 3124</td>
<td>Soil Lab (1) Partially duplicates CSES 3134, Co: CSES 3114.</td>
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<tr>
<td>CSES/ENSC 3134</td>
<td>Soils in the Landscape (3) Partially duplicates CSES 3114 and 3124, Pre: one year of introductory CHEM or B.IOL, or GEOS.</td>
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<tr>
<td>CSES/CHEM/ENSC 4734</td>
<td>Environmental Soil Chemistry (3) Pre: CSES 2114, CSES 3124, CHEM 2514 or CHEM 2535, CHEM 2114, MATH 215.</td>
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<tr>
<td>CSES/ENSC 4774</td>
<td>Reclamation of Drastically Disturbed Lands (3) Pre: CSES 3114 or GEOS 3014 or GEOS 3034 or GEOS 3304 or GEOS 3004 or GEOS 3304.</td>
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<tr>
<td>ECON 4014</td>
<td>Environmental Economics (3) Pre: ECON 3005 or 2116 or 2126 or 2026H.</td>
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<tr>
<td>ENSC/CES 4324</td>
<td>Water Quality Lab (1) Pre: CHEM 1046, Co: ENSC 4314.</td>
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<tr>
<td>ENSC/CSES 4854</td>
<td>Wetland Soils and Mitigation (3) Odd years. I Pre: ENSC 3114 or 3134 or CSES 3304.</td>
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<tr>
<td>ESM 3024</td>
<td>Introduction to Fluid Mechanics (3) Pre: ESM 2304, MATH 2224.</td>
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<tr>
<td>FIW 2114</td>
<td>Principles of Fisheries and Wildlife Management (3) Pre: BIOL 1005 or BIOL 1106.</td>
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<td>FIW 3514</td>
<td>Fisheries Techniques (3) Pre: FIW 2114.</td>
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<tr>
<td>FOR/LAR 2554</td>
<td>Nature and American Values (3)</td>
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<tr>
<td>FOR 4424</td>
<td>Forest Resources Economics and Management (3) Pre: FOR 3524 or 3364, or consent of instructor.</td>
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<tr>
<td>GEOG 2505</td>
<td>Weather Analysis I (3)</td>
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<tr>
<td>GEOG 2506</td>
<td>Weather Analysis II (3)</td>
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<tr>
<td>GEOG 3504</td>
<td>Severe Weather (3) Pre: GEOG 2505.</td>
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<tr>
<td>GEOG 3515</td>
<td>Dynamic Meteorology I (3) Pre: GEOG 2505, MATH 2214, PHYS 2208, (PHYS 2216 or PHYS 2306)</td>
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<tr>
<td>GEOG 3516</td>
<td>Dynamic Meteorology II (3) Pre: GEOG 3515</td>
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<tr>
<td>GEOG 3524</td>
<td>Meteorological Field Methods (3) Pre: GEOG 2506, 3564.</td>
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<td>GEOG 4524</td>
<td>Physical Meteorology (3) Pre: GEOG 3516.</td>
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<tr>
<td>PHYS 2206</td>
<td>General Physics (3) Pre: PHYS 2205 or 2205</td>
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<tr>
<td>PHYS 2216</td>
<td>General Physics Lab (1) Co: PHYS 2206</td>
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<tr>
<td>STAT 3005</td>
<td>Statistical Methods (3) STAT 3005 supersedes STAT 3165 and STAT 4604, only one may be taken for credit. Pre: MATH 1206</td>
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<tr>
<td>STAT 3615</td>
<td>Biological Statistics (3) STAT 3615 partially supersedes STAT 3005 and STAT 4604, only one may be taken for credit.</td>
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<tr>
<td>UAP 3014</td>
<td>Urban Planning and Policy (3) Pre: UAP 1024.</td>
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<tr>
<td>UAP 3024</td>
<td>Urban and Regional Analysis (3) Restricted to UAP majors and minors only.</td>
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<tr>
<td>UAP 4754</td>
<td>Legal Foundations of Planning (3)</td>
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