

Contact: Rachel Boon

**REQUEST FOR NEW PROGRAM AT THE UNIVERSITY OF IOWA:
BACHELOR OF SCIENCE IN ENGINEERING, ENVIRONMENTAL ENGINEERING**

Action Requested: Consider approval of the request by the University of Iowa to establish a Bachelor of Science in Engineering with a major in Environmental Engineering (BSEnvE) in the Department of Civil and Environmental Engineering of the College of Engineering.

Executive Summary: The proposed BSEnvE degree is intended for students preparing for practice and advanced study in environmental engineering. The proposed BSEnvE will complement the existing graduate program in Environmental Engineering and Science, and will not duplicate existing programs in the State of Iowa since there are no existing BSEnvE degree programs in the State. The proposed program addresses the Board of Regents Strategic Plan objective 1.1; "The Regent institutions provide clear pathways for students to enter, move through and complete their education and career goals."

Background:

◇ **Description of proposed program.** Environmental engineering is the study of the effect of human activities on the environment and the use of engineering principles to solve environmental problems that arise from human activities. Environmental engineers help design systems for treating and conveying clean drinking water and wastewater, providing clean air, managing solid waste, managing environmental remediation, and stimulating the economies of resource-constrained communities wishing to secure food, energy and water.

The proposed environmental engineering curriculum differs substantially from a curriculum in environmental science. An environmental engineer has a strong understanding of environmental science, but is also trained in quantitative problem solving skills and design strategies to provide solutions to environmental challenges within practical constraints of an engineered system. Environmental engineers are also well-suited to interact with engineers from other sub-disciplines.

◇ **Academic objectives.** The proposed degree will be accredited by the Accreditation Board for Engineering and Technology, Inc. (ABET). An ABET approved curriculum in environmental engineering must have the following academic objectives:

- Prepare graduates to apply knowledge of mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, and fluid mechanics.
- Prepare graduates to formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases; conduct laboratory experiments, and analyze and interpret the resulting data in more than one major environmental engineering focus area, e.g., air, water, land, environmental health; design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and apply advanced principles and practice relevant to the program objectives.
- Prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.

- ◇ Need for proposed program. The Bachelors of Science in Environmental Engineering (BSEnvE) is in demand. Five of the Big Ten schools (Michigan, Michigan State, Ohio State, Northwestern and Penn State) provide accredited BSEnvE degrees. Students from Iowa that seek the BSEnvE must enroll in these competitive Big Ten programs, or other programs nationally, since no such program is currently offered in Iowa. An ABET-accredited BSEnvE is important because it provides a route to licensure as a professional engineer.

Environmental engineers are in demand within the state of Iowa and nationally. Governor Branstad's recent call for increased efforts and funding to improve water quality in Iowa highlights the need for innovative solutions that can be provided by environmental engineers. Nationally, the occupational outlook for environmental engineers is very good with the Bureau of Labor Statistics estimating a 12% growth in this occupation - outpacing overall growth in all other occupations¹. Forbes Magazine cites these statistics to conclude that Environmental Engineering is the 5th most valuable major.

- ◇ Link to institutional strategic plan. This new degree is consistent with the goals of the 2016 Draft University of Iowa Strategic Plan – including the pillars of Student Success, Engagement, and Research & Discovery. Measures of **Student Success** include high retention and graduation rates of first-generation, underrepresented and non-traditional students. A 2016 survey of the Chairs of Big 10 Departments of Civil and Environmental Engineering found that the BSEnvE degree attracts a larger percentage of underrepresented women engineers than average for their programs. The same survey indicated that the Environmental Engineering Programs were a source of overall enrollment growth. Overall, the UI College of Engineering and the Department of Civil and Environmental Engineering has a strong history of student success and will provide the resources and infrastructure to advise and support the students completing the BSEnvE degree.

The BSEnvE is consistent with the Strategic Plan pillar of **Engagement** because the graduates of this degree will provide valuable technical expertise for managing some of the most difficult and important problems relating to Iowa's natural and economic resources. As noted above, Governor Branstad has specifically identified water quality management as an important focus area for which Iowa needs well-trained professionals. One measure of this success is the increasing number of media stories highlighting UI expertise relating to sustainability and environmental issues. The creation of the BSEnvE degree contributes to economic and cultural vitality and to the health and quality of life of the people of Iowa.

The BSEnvE degree is also consistent with the Strategic Plan pillar of **Research & Discovery**. As mentioned previously, the graduate program in Environmental Engineering and Science is consistently ranked highly among other similar programs in the country. Adding an undergraduate degree in environmental engineering will serve to fortify the tradition of comprehensive research excellence and creativity.

The 2010-2016 College of Engineering Strategic plan identifies an aim to increase the size and mix of students. The number and percentage of women students, and the overall number of undergraduate students in our programs was specifically identified as a key metric of success. The BSEnvE degree, as described above, responds to both goals.

¹ <http://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm#tab-6>

- ◇ Relationship to existing programs at the institution. Currently the Civil Engineering BSE includes environmental engineering as one of four main subject areas required of all Civil Engineering students. A Civil Engineering student can concentrate in environmental engineering, but currently they cannot earn a BSEnvE degree. The proposed program is unique and does not duplicate any existing programs at the University. Importantly, the proposed BSEnvE will complement our existing graduate program in Environmental Engineering and Science.
- ◇ Relationship to existing programs at other colleges and universities. This proposed program will not duplicate existing programs in the State of Iowa since there are no existing BSEnvE degree programs in the State. Similar to the University of Iowa, Iowa State University does have a Civil Engineering - Environmental Track. But the ISU Environmental Track is not a separate, accredited BSEnvE degree.
- ◇ Unique features. The University of Iowa is an appropriate place to initiate a degree program in environmental engineering. The Environmental Engineering & Science graduate program is currently ranked 10th among public schools and 18th overall. The existing infrastructure at the University of Iowa is able to accommodate new undergraduate students. This includes the environmental teaching laboratories, research opportunities for undergraduates through the department, and the presence of professional schools (e.g. Law, Medicine, and Public Health) where additional courses are available for students. The College of Engineering, which is currently the largest growing unit at the University, is currently undergoing a building expansion.
- ◇ Resources to establish a high-quality program. It is anticipated that no new faculty will be needed to teach the program for the 7 year projected enrollment growth to 130 students. There currently are a strong group of 18 faculty in the area of environmental engineering and water resources. Additional teaching capacity to implement this program is available from three new faculty hires that will transition from reduced teaching loads to full teaching loads over the next two years, as well as one faculty member who was in administration returning to a full teaching load.

No new facilities or equipment will be needed to support the creation and implementation of this BSEnvE degree program.
- ◇ Student demand. Local demand for the degree is evident in the technical electives students are choosing. For the last four years, our course on Sustainable Systems has been the most highly enrolled CEE technical elective with more than twice the number of students of most of our technical electives. One of our second most popular courses is Design for the Developing World which focused on water issues in resource constrained communities.
- ◇ Workforce need/demand. The creation of a new BSEnvE at the University of Iowa will respond to current and future needs of the State of Iowa. Recent events, such as Des Moines waterworks lawsuit regarding high nitrate concentrations in surface waters² and Governor Branstad's call for increased efforts and funding to improve water quality in Iowa³ highlight the need for innovative water quality solutions that can be provided by environmental

²<http://www.desmoinesregister.com/story/money/agriculture/2015/07/15/des-moines-water-works-lawsuit-buena-vista-calhoun-sac-counties-water-quality/30191169/>

³ <https://governor.iowa.gov/2016/01/gov-branstad-delivers-the-2016-condition-of-the-state-address-to-the-iowa-general-assembly>

engineers. The recent \$97M Housing and Urban Development award⁴ to the state further demonstrates needs for trained environmental engineers in Iowa. Graduates from the CEE department with environmental engineering focus have been placed in a variety of positions around the State (e.g., City of Iowa City, HBK Engineering (LLC), HR Green, Shive-Hatter, Inc., Stanley Consultants, and Strand Engineering).

The occupational outlook for environmental engineers in Iowa is quite strong. A 10.7% growth in need for environmental engineers is projected over the long-term (out to 2024). In Illinois, the projected growth is also robust at 15.6%. Nationally, the occupational outlook for environmental engineers is very good as well. The Bureau of Labor Statistics estimates a 12% growth in this occupation, which is outpacing overall growth in all other occupations⁵. In response to these statistics, Forbes indicated that Environmental Engineering is the 5th most valuable major. This demand for Environmental Engineers can also be reflected by relatively high reported salaries. Based on these sources and statistics, we think that a BSEnvE program in Iowa is in demand and our intent to offer this program is strategically aligned with the University goals.

◇ Cost.

| | TOTAL COSTS | TOTAL NEW COSTS |
|--------|--------------------|------------------------|
| Year 1 | | \$0 |
| Year 2 | | \$0 |
| Year 3 | | \$0 |
| Year 4 | | \$0 |
| Year 5 | | \$0 |
| Year 6 | | \$0 |
| Year 7 | | \$0 |

◇ Projected enrollment.

| Undergraduate | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Yr 5 | Yr 6 | Yr 7 |
|---------------|------|------|------|------|------|------|------|
| Majors | 15 | 35 | 55 | 75 | 100 | 115 | 130 |
| Non-Majors | n/a |

◇ Anticipated sources of students. Iowans interested in environmental engineering are likely to apply to Iowa and not be drawn to neighboring BigTen schools when this degree is made available. Students who are interested in environmental issues that are also considering other degree programs (e.g. Environmental Science or Chemical Engineering) might decide to pursue the BSE/EnvEng degree instead. Finally, some civil engineering students who would otherwise complete the civil engineering degree with an environmental subtrack may choose the environmental engineering degree option instead.

◇ Articulation agreement. The College of Engineering has explicit course transfer guides and/or articulation agreements with over 40 community colleges and universities. These agreements will apply to courses required by the BSEnvE major. New courses developed

⁴<https://governor.iowa.gov/2016/01/branstad-reynolds-northey-announce-flood-reduction-and-water-quality-grant>

⁵ <http://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm#tab-6>

for the major will be evaluated for equivalence with courses offered by these institutions and on a case-by-case basis as requested by incoming students.

- ◇ Off-campus delivery. There are no plans to offer this program away from the SUI campus.
- ◇ Accreditation. The program will apply for ABET accreditation as soon as it is eligible. According to ABET, the program must have at least one graduate before an application for accreditation can be made. It will be 2-4 years until we have a graduate of the new program. The goal is to apply for accreditation in 2020, the same year the department is scheduled to be reviewed for the Civil Engineering program accreditation.
- ◇ Opportunities for internships. The College of Engineering provides strong support for engineering students to complete internships. Students interested in environmental engineering (within their civil engineering degree), have completed internships and coops with many outside organizations. A variety of internship opportunities exist in environmental engineering (e.g., HR Green, Shive-Hattery, McClure Engineering, Stanley Consultants, Strand Engineering).
- ◇ Marketing plan. A marketing plan for undergraduate studies in the department of Civil and Environmental Engineering is already in place and information is on www.civilhawks.org. Updates to this website will clearly advertise the new program and distinguish it from civil engineering. The Office of Admissions will provide additional student recruitment support.
- ◇ Evaluation plan. ABET has published criteria for environmental engineering that the proposed program will meet, and must be evaluated and approved by ABET every 6 years. The process is intensive and includes conducting a program self-study as well as data collection and assessment procedures on a semester-by-semester basis. The self-study includes collecting data on student enrollment and performance, assessing program educational objectives, assessing student outcomes, the curriculum, faculty expertise, adequacy of facilities and institutional support. This self-study also entails developing a plan for continuous improvement.
- ◇ Date of implementation.

Creation of the proposed program will become effective upon approval by the Board of Regents and will be included in the University's General Catalog. The anticipated implementation date is August 2017.

LETTERS OF SUPPORT

College of Humanities, Arts and Sciences
Office of the Dean



January 19, 2017

Office of the Provost
111 JH
University of Iowa
Iowa City, IA 52242

Associate Provost Moeller:

The College of Humanities, Arts and Sciences supports the proposal for the Bachelor of Science in Engineering with a major in Environmental Engineering. The proposed program will not overlap with programs at the University of Northern Iowa (UNI). UNI does not offer BSE degrees, so the students attracted to the program would be different from the students attracted to Environmental Science degrees at UNI. The differentiation between the engineering focus of the BSE and the natural sciences focus of the BA in Environmental Sciences at UNI suggests that there would be little, if any, overlap between the two programs.

Our own enrollments in the BA in Environmental Science suggests that students are quite interested in programs focused on environmental concerns. Our program in Environmental Science saw its first enrollees in Fall 2014 and currently has 49 majors. Such enrollments on our campus suggest there will be strong enrollments in the BSE at the University of Iowa.

Again, the College of Humanities, Arts and Sciences is supportive of the proposal for the Bachelor of Bachelor of Science in Engineering with a major in Environmental Engineering.

Sincerely,

A handwritten signature in purple ink, appearing to read "John Fritch".

John Fritch
Dean, College of Humanities, Arts and Sciences

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

College of Engineering
Department of Civil, Construction
and Environmental Engineering
813 Bissell Rd
Ames, Iowa 50011-3232
Phone 515 294-2140
FAX 515 294-8216

January 9, 2017

Dear Professor Scherer,

As Department Chair of the Civil, Construction, and Environmental Engineering Department at Iowa State University (ISU), we are supportive of your plans to offer a new Bachelor of Science in Engineering (BSE) with a major in Environmental Engineering in the Department of Civil and Environmental Engineering at The University of Iowa (U of I). We understand that BSE degree is intended for students preparing for practice and advanced study in environmental engineering and that the proposed program start date is Fall 2017. We have had discussions in the past at ISU regarding development of a similar undergraduate program that you are pursuing at the U of I, and we would ask for your support should we decide in the future to develop a similar major.

Our two departments have a long history of collaborating to educate Iowans and conduct high-quality research in environmental, transportation, structures, and water resources. Offering this new degree will provide a broader set of opportunities for Iowans to become trained to help design systems for treating and conveying clean drinking water and wastewater, providing clean air, managing solid waste, managing environmental remediation, and stimulating the economies of resource-constrained communities wishing to secure food, energy, and water.

We look forward to continuing to work with you to increase educational opportunities for Iowans.

Sincerely,



Professor Terry Wipf, P.E.
Don and Sharon Greenwood Department Chair