

1. Describe the proposed new degree program, including the following:

a. A brief description of the program

The Bachelor of Science in Environmental Engineering will be a new degree offered by the College of Engineering and housed in the Department of Civil, Construction, and Environmental Engineering. Undergraduate students in this BS Environmental Engineering degree will complete a newly established core curriculum covering the engineering and science (geology, biology, and chemistry) knowledge necessary for the design and implementation of affordable solutions for environmental challenges involving land, air, and water. These new graduates will have a strong academic foundation in the engineering methods necessary to solve complex current and future infrastructure challenges within the diverse areas of environmental engineering.

b. A statement of academic objectives

Objectives

The B.S. degree in environmental engineering is designed to prepare students with the engineering skills necessary for entry into environmental engineering positions within public (federal, military, state, and community) and private (industry) sectors.

A few years after graduation, students completing the environmental engineering B.S. degree will have

- Pursued successful careers and expertise in environmental engineering or a related profession
- Collaborated effectively on multi-disciplinary teams to address the needs of society and the environment
- Pursued lifelong learning, professional development, and licensure as appropriate for their career goals.

Learning Outcomes

After earning the B.S. degree in environmental engineering students will:

- apply knowledge of environmental engineering concepts, tools, and technologies for advancing the environmental aspects of critical infrastructure systems.
- explain the engineering and science of water supply and distribution, waste collection and processing, air quality control, residuals recycling, and public health protection.
- design environmental engineering systems which are able to meet organizational needs within realistic constraints such as economic, environmental, social, legal, and ethical expectations.
- function effectively on multi- and inter-disciplinary teams.

c. What the need for the program is and how the need for the program was determined

This program is motivated by the following goals:

- to meet our world's need for environmental engineering graduates able to provide leadership to meet five challenges identified by the National Academy of Sciences in the report

“Environmental Engineering for the 21st Century: Addressing Grand Challenges”: (1) sustainably supply food, water, and energy, (2) curb climate change and adapt to its impacts, (3) design a future without pollution and waste; (4) create efficient, healthy, resilient cities, and (5) foster informed decisions and actions.

- to advance Iowa State University's status among national-level peer programs. The 74 accredited environmental engineering programs are spread over 32 states and Puerto Rico, and fourteen states have two or more programs. Eight of ISU's ten peer institutions have environmental programs, seven of which are accredited.
- to meet the demand of students who would like more depth in environmental engineering than the CE degree with an emphasis in environmental engineering can provide.
- to magnify the existing culture of highly interdisciplinary academic and research collaboration maintained by our environmental and water resources engineering faculty amongst other engineering departments (e.g., notably including Agricultural and Biological Engineering and Mechanical Engineering) plus programs in the Colleges of Design, Agriculture and Life Sciences, Liberal Arts and Sciences in relation to environmental sciences, water resources, natural resources, community and regional planning, etc.,
- to meet our State's continuing need for environmental engineers to provide leadership with efforts to improve surface and ground water quality.
- to meet our country's need for environmental engineering graduates to provide leadership with a focus on infrastructure systems to sustain and enhance national air-water-land quality. The Bureau of Labor Statistics predicts job growth for 2016-2026 of 8% for environmental engineers, with a total annual hiring need of 4,500 environmental engineers; this level is roughly double the current graduation rate of the nation's 74 BS environmental engineering programs).
- to improve our college's ability to recruit women. Enrollment of women in the majority of current BS environmental engineering programs (>45%) is significantly higher than that in civil engineering (~18% in CCEE).
- to reinforce our university's continued academic and research growth in the area of sustainability.

d. The relationship of the proposed new program to the institutional mission and how the program fits into the institution's and college's strategic plan;

- **Program Fit with Iowa State University Strategic Plan:**



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Environmental Engineering for the 21st Century: Addressing Grand Challenges

DETAILS

120 pages | 7.5 x 11 | PAPERBACK
ISBN 978-0-309-47652-2 | DOI 10.17226/25121

CONTRIBUTORS

Committee on the Grand Challenges and Opportunities in Environmental Engineering for the Twenty-First Century; Board on Agriculture and Natural Resources; Board on Atmospheric Sciences and Climate; Board on Chemical Sciences and Technology; Board on Energy and Environmental Systems; Board on Earth Sciences and Resources; Board on Environmental Studies and Toxicology; Board on Life Sciences; NAE Office of Programs; Ocean Studies Board; Water Science and Technology Board; Division on Earth and Life Studies; Division on Engineering and Physical Sciences; National Academy of Engineering; National Academies of Sciences, Engineering, and Medicine

Iowa State University's 2017-2022 Strategic Plan offers a compelling motivation for educating students in the area of environmental engineering, based on *"the belief that with hard work and innovation, future generations will have ample food and fuel, good health, and a safe, bountiful planet."* The discipline of environmental engineering is, indeed, fully committed to the sustained availability of clean water, clean skies, and clean lands by which a safe planet which fosters public health can assuredly be maintained. In addition, the third goal for the ISU Strategic Plan also has a clear environmental connection: *"Improve the quality of life for all Iowans through services and programs dedicated to economic development and the promotion of healthy communities, people, and environments"*.

- **Program Fit within Iowa State University College Strategic Plan:**

The Implementation Plan for Iowa State University's College of Engineering 2018-2023 Strategic Plan has two goals under the 'Education' theme which are well aligned with this new environmental engineering BS degree initiative. First, the college intends to *"create a mechanism to integrate stakeholder information across the college (e.g. IACs) to inform decision making for educational program."* In turn, the planning process for developing the new environmental engineering BS degree will carefully align with this goal by conducting IAC discussions and reviews regarding the suitability and benefits of this initiative. Second, this implementation plan also indicates that the college will *"explore and develop new educational programs (including certificates and minors) in the undergraduate and graduate areas that leverage areas of excellence in the college and institutional strength."* Here again, this goal of leveraging and broadening existing levels of academic excellence is well suited to developing the new environmental engineering BS degree program.

- e. The relationship of the proposed new program to other existing programs at the institution; describe how the proposed program will enhance other programs at the university. Will the proposed program duplicate existing programs at the university?

No other program at ISU offers an accredited environmental engineering degree. To explore possible overlap with existing programs, we discussed this proposal with the Department of Agricultural and Biosystems Engineering (ABE), the Department of Chemical and Biological Engineering (CBE), and the interdisciplinary Environmental Science program. For example, ABE offers a Land and Water Resources Engineering option in agricultural engineering and a bioenvironmental option in biological systems engineering, and CBE offers several courses with similar fundamental concepts but different application. As documented in letters of support, all are positive about the development of a new environmental engineering degree. Such a degree will complement other environmental programs on campus.

- f. The relationship of the proposed new program to existing programs at other colleges and universities in Iowa, including how the proposed program is different or has a different emphasis than the existing programs.

The University of Iowa recently received Board of Trustees approval to start a four-year B.S. degree in Environmental Engineering. This program is the first such offering in the State of Iowa. The relationship between the proposed B.S. degree and the program at the University of Iowa is similar to the relationship between the existing B.S. degrees in civil engineering at the two universities.

- g. Special features or conditions that make the institution a desirable, unique, or appropriate place to initiate such a degree program.

ISU has a long history of environmental engineering excellence at both academic and research levels and a commensurate reputation within academic, public, and private sectors. One such

noteworthy feature is that our environmental engineering emeritus faculty member, Professor Jack Cleasby, is one of ISU's current members of the National Academy of Engineering. As a source of some of the best civil engineers in the country, the Department of Civil, Construction, and Environmental Engineering continues to seek ways to meet the current and future needs of engineering and society.

- h. Are the university's personnel, facilities, and equipment adequate to establish and maintain a high quality program?

Iowa State University's Department of Civil, Construction, and Environmental Engineering has the necessary faculty, staff, and facilities resources to launch this new environmental engineering BS degree offering. As this new degree program grows in size, however, additional resources will naturally be necessary in terms of additional faculty slots, additional advisory staff support, and additional teaching assistant investments. These additions will be reasonably paced in relation to escalating enrollments.

- i. How does student demand for the proposed program justify its development?

This new degree option will allow students who have a strong interest in obtaining an environmental engineering degree to directly pursue this education. Student interest and demand for this new degree offering has been repeatedly confirmed during discussions with freshmen and sophomores in C E105 Introduction to the Civil Engineering Profession, as well as graduating seniors in C E 403 Program and Outcome Assessment. Many of these students express a strong interest in pursuing environmental engineering in more depth than the environmental emphasis of the civil engineering B.S. currently allows.

- j. Describe the state and/or national workforce need and/or demand for graduates of the proposed program currently and in the foreseeable future (provide documentation about the current sources of data used to estimate need and demand).

The job outlook for environmental engineers is excellent. The following quote validating the current and expected high-level job growth conditions for environmental engineering was taken from a 2018 Bureau of Labor Statistics web site: "Employment of environmental engineers is projected to grow by 8 percent from 2016 to 2026, about as fast as the average for all engineering occupations. State and local governments' concerns regarding water availability and quality should lead to efforts to increase the efficiency of water use." The latter point about state and local water quality concerns is particularly relevant for Iowa, where there is significant national-level attention being given to ongoing, and rapidly escalating, environmental engineering efforts within our cities to remediate the release of wastewater nitrate contaminants into surface waters. And much the same escalation with environmental engineering efforts is also underway with many western states faced with severe drought challenges and acute requirements for water reclamation improvements.

- k. List all other public and private institutions of higher education in Iowa currently operating programs similar to the proposed new degree program. (For comparison purposes, use a broad definitional framework, e.g., such identification should not be limited to programs with the same title, the same degree designation, having the same curriculum emphasis, or purporting to meet exactly the same needs as the proposed program.)

The University of Iowa has recently received Board of Trustees approval to start an environmental engineering BS degree. The circumstance of having two or more similar BS environmental engineering degree programs within a state is not unusual. Fourteen states already have at least

two accredited environmental engineering programs, and larger states such as NY, CA, PA, and FL have anywhere from three to seven different programs. The expanding bioeconomy in Iowa will likely lead to increased need for environmental engineers, and the new program will contribute to retain talented graduates in the state.

- I. If the same or similar program exists at another public or private institution of higher education in Iowa, respond to the following questions:
 - a. Could the other institution reasonably accommodate the need for the new program through expansion? Describe collaboration efforts with other institutions.

The issue of possible expansion by the University of Iowa has not been discussed with them. It is noteworthy, though, that there has been a high level of pro-active collaboration between Iowa State University and the University of Iowa during their planning efforts to start a new environmental engineering BS degree. Notably, the academic chair of the new program has provided our ISU faculty with a complete account of the logistical steps and efforts which they've pursued during this process. Pursuant to these collaborative measures, therefore, and based on a long-standing history of positive interaction between our departments, there is a positive attitude on both sides in regards to doing this on both campuses.
 - b. With what representatives of these programs has there been consultation in developing the program proposal? Provide a summary of the response of each institution consulted.

Multiple contacts have been made with the prior (to 2018) departmental executive officer (DEO) of the University of Iowa's Department of Civil and Environmental Engineering, Michelle Scherer, and in addition she travelled to Ames to meet with our environmental and water resources faculty to talk in detail about our plans and about her own department's efforts while going through this same process. These discussions have been positive, with no indication whatsoever of any negative perspectives about our upcoming Iowa State planning efforts. As noted below, the current DEO, Allen Bradley has provided a letter of support for this proposal.
 - c. Has the possibility of an inter-institutional program or other cooperative effort been explored? What are the results of this study? (Consider not only the possibility of a formally established inter-institutional program, but also how special resources at other institutions might be used on a cooperative basis in implementing the proposed program solely at the requesting institution.)

This issue was not raised by the University of Iowa at any point during their own planning efforts for starting their environmental engineering BS degree.
 - d. Do other colleges in Iowa offer programs similar to the proposed program at comparable quality and cost?

Yes, the University of Iowa's environmental engineering BS degree would offer similar degree quality and cost.
 - e. Are letters of support included with the program proposal?

We have included letters of support from Steven Mickelson, chair of the Department of Agricultural and Biosystems Engineering; Andrew Hillier, chair of the Department of Chemical and Biological Engineering; William Crumpton, chair for environmental programs; Allen Bradley, departmental executive officer of the Department of Civil and

Environmental Engineering at the University of Iowa; Alec Scranton, dean of engineering at the University of Iowa; and the Civil Engineering External Advisory Council.

- m. Estimate the number of majors and non-majors students that are projected to be enrolled in the program during the first seven years of the program.
 - a. Undergraduate

Undergraduate	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7
Majors	25	60	100	150	200	220	240
Non-Majors							

- b. Graduate
Not applicable
 - c. What are the anticipated sources of these students?

First, we anticipate that new freshmen students will be drawn away from other regional universities offering similar environmental engineering degree programs—notably those in Illinois and Minnesota, where ISU offers a strong financial motivation to leave those states. A highly favorable recruiting aspect with drawing in students from Illinois is that only one university (Northwestern) offers a BS Environmental Engineering degree.

Second, we anticipate that some new and current students will switch out of our civil or construction engineering degree programs on a basis of personal degree goals which offer a better fit than that of the CE and ConE coursework.

Third, we anticipate that some new and current students in engineering and other programs on campus will also choose environmental engineering based on their personal goals.

- n. If there are plans to offer the program away from the campus, briefly describe these plans, including potential sites and possible methods of delivery instruction. Will off-campus delivery require additional **HLC accreditation**?

This will be an on campus degree only.

- o. Has the proposed program been reviewed and approved by the appropriate campus committees and authorities?

The program has been reviewed by the Civil Engineering Curriculum Committee; the Construction Engineering Curriculum Committee; the faculty in Department of Civil, Construction, and Environmental Engineering; and the faculty of the College of Engineering; and the Faculty Senate Curriculum Committee.

- p. List date the program proposal was submitted to the Iowa Coordinating Council for Post High School Education (ICCPHSE) and results of listserv review.

This submission and review has not yet been started.

- q. Will the proposed program apply for programmatic accreditation? When?

Yes. As with all engineering programs at ISU, the environmental engineering program will apply

for accreditation through ABET, which has accredited over 70 environmental engineering programs in the U.S. The application for accreditation will occur once students graduate from the program, and we will strive to apply to be reviewed in 2024, the next ABET review of engineering programs at ISU.

- r. Will articulation agreements be developed for the proposed program? With whom?

The program will use the articulation agreements already developed with community colleges and other universities. Many of the current students in the Department of Civil, Construction, and Environmental Engineering transfer courses from community colleges. Those procedures will not change for the new program. Other existing articulation agreements, such as one with William Penn University, will be updated to include the proposed B.S. degree.

- s. Will there be opportunities for student internships?

Yes. Company hiring of environmental engineering students for internship positions is expected to proceed in a fashion similar to that of our CCEE's other degree (i.e., both civil and construction) students, and in many instances with the same employers.

- t. Describe the faculty, facilities, and equipment that will be required for the proposed program.

Faculty: The Department of Civil, Construction, and Environmental Engineering has 5 FTEs that teach our current undergraduate and graduate courses in the areas of environmental and water resources engineering. This faculty group will be able to handle the initial, startup course delivery requirements of the new environmental engineering BS degree.

Staff: The Department of Civil, Construction, and Environmental Engineering has 1 FTE environmental lab technician who will fully support the environmental engineering lab course delivery. Therefore, no further staffing investment would be necessary. However, in terms of advisory support staff, this additional student enrollment will necessitate the hiring of a new advisor as the enrollment goes above 100 new students.

Facilities: The Department of Civil, Construction, and Environmental Engineering a dedicated facility to teach environmental engineering labs. The current size of this lab (i.e., 1200 sq. ft.) and available equipment will be able to handle the anticipated delivery of all lab-related coursework for the environmental engineering degree. Therefore, no further facility investment would be necessary.

- u. From where will the financial resources for the proposed program come (list all that apply, e.g., department reallocation, college reallocation, grants, new to the university)?

As explained below, while the new environmental engineering BS degree initiative will not require additional funding investments prior to starting the program, additional funds will be required as the program enrollment expands. These investment projections are explained in the following section.

- v. Estimate the specific per-year and recurring expenditures that will be necessary for the next seven years as a result of the new program. Be as specific as possible.

	Specific Costs	Recurring Costs	Hiring Needs
Year 1	Replacement tenure-track faculty salary, benefits,	Ongoing funding required for this hire	One new tenure-track faculty replacement for retiring senior environ engrg faculty
Year 2	No added cost	None	
Year 3	1) New junior tenure-track faculty salary, benefits, start-up 2) New academic adviser salary and benefits 3) New TA stipend, benefits, and partial tuition	Ongoing funding required for new faculty and staff plus TAs as well as specific costs	One new tenure track faculty hire. PLUS one new academic adviser hiring as student enrollment exceeds first 100 students at Year 3. Additional ¼-TA allocations also needed at a rate of one-each per 25 enrolled students.
Year 4		Ongoing funding required for new faculty and staff plus TAs as well as specific costs	Continued additional ¼-TA allocations at one-each per 25 enrolled students.
Year 5	New junior tenure-track faculty salary, benefits, start-up	Ongoing funding required for new faculty and staff plus TAs as well as specific costs	One additional tenure track faculty hiring after student enrollment exceeds 200. Continued additional ¼-TA allocations at one-each per 25 enrolled students.

- w. Describe the marketing plan developed to communicate the new program and recruit students.

The program will be marketed through the outlets that the Department of Civil, Construction, and Environmental Engineering usually uses. In the marketing we will highlight the new program and make clear the differences between existing programs on campus (especially the relevant programs in Agricultural and Biosystems Engineering.)

- x. Describe the program evaluation plan to determine if the program is meeting the intended objectives, if the expected student enrollment has occurred, funding for the program, and any other components that affect the effective operation of the program.

The program will strive to become accredited through ABET. As part of the ABET process the program will need to assess student outcomes. The CCEE department has an established assessment process that will oversee the assessment of the environmental engineering degree. The department is also evaluated by the college based on enrollment and student performance.

- y. Include any additional information that justifies the development of this program.

Environmental Engineering
131 Total Credits

First Year

Semester 1

3 C E 160 Engineering Problem Solving
 4 CHEM 177 General Chemistry I
 1 CHEM 177L General Chemistry Lab
 3 ENGL 150 Critical Thinking & Communication
 1 LIB 160 Information Literacy
 4 MATH 165 Calculus I
 1 ENV E 101/ENGR 101 Engineering Orientation

17 Total Credits

Semester 2

1 ENV E 105 Intro to Profession
 3 CHEM 178 General Chemistry II
 1 CHEM 178L General Chemistry II Lab
 4 MATH 166 Calculus II
 5 PHYS 221 Intro Classical Physics I
 2 ENV E 190 Intro Undergrad Research

16 Total Credits

Second Year

Semester 3

3 ENGL 250 WOVE Comp
 3 E M 274 Engineering Statics
 4 MATH 265 Calculus III
 3 ENV E 201 EnvE Measurements & Analysis
 3 BIOL 251 Biological Processes in the Environment

16 Total Credits

Semester 4

3 C E 206 Economic Analysis & Prof Issues
 3 C E 306 Project Management
 3 E M 324 Mechanics of Materials
 3 CHEM 231 Organic Chemistry
 1 CHEM 231L Organic Chemistry Lab
 3 MATH 266 Differential Equations

16 Total Credits

Third Year

Semester 5

3 C E 326 Intro Environmental Engineering
 3 C E 388 or C E 488 Sustainability
 3 E M 378 Mechanics of Fluids
 3 STAT 305 Statistics for Engineers
 3 GEOL 201 Geology for Engineers
 3 SSH Elective

18 Total Credits

Semester 6

3 C E 372 Engineering Hydrology & Hydraulics
 4 C E 360 Geotechnical Engineering
 3 Technical communication elective
 2 MICRO 201 Intro Microbiology
 3 SSH Elective
 3 M E 231 Eng Thermodynamics I

18 Total Credits

Fourth Year

Semester 7

3 ENV E 426 Phys & Chem Processes in EnvE
 3 ENV E 429 Air Quality
 3 ENV E 430 Solid and Hazardous Waste
 3 Eng Topics Elective
 (e.g., C E 473 Groundwater Hydrology)
 3 SP CM 212 Speech Communication I
 3 SSH Elective

18 Total Credits

Semester 8

3 C E 428 Water & Wastewater TP Design
 3 ENV E 427 Environmental Systems
 3 Eng Topics Elective
 (e.g., C E 594W Stormwater Management)
 3 SSH Elective

12 Total Credits

PROGRAM APPROVAL PROCESS
(Revised January 28, 2015)

Highlights of the Program Approval Process:

- The Regent universities shall submit an annual program planning list to the Board Office in the spring of each year, which includes the name and educational level of proposed programs that have already undergone an initial institutional review, are currently undergoing an in-depth institutional review, and are likely to be submitted for program approval by the Board of Regents within the year. The proposed program must reside on the program planning list for at least six months prior to submitting a program proposal to allow sufficient time for discussion within the three Regent universities.
- The Board Office and the Council of Provosts shall review the annual program planning list at each Council of Provosts meeting.
- During the year, the universities shall complete their in-depth review of the proposed programs and submit their proposals to the Board Office using a program approval format developed by the Board Office (Form A). The form incorporates the key characteristics of a proposed program critical for Board decision-making – immediate and long-term need/demand for the program, cost to implement and operate the program, link to the institution's and Board's strategic plans, and potential for unnecessary duplication. Workforce data must include recent projections.
- Letters of support must be included with the program proposal. The staff member requesting the letters of support from the other two universities must send a copy of the request to the provosts at the other universities.
- A review by the Iowa Coordinating Council for Post-High School Education (ICCPHSE) shall also occur prior to being submitted for Board approval. A program with unresolved concerns by the ICCPHSE should be so noted.
- The program proposals shall be reviewed in-depth by the Council of Provosts and the Board Office.
- With the recommendation for approval by the Board Office and the Council of Provosts, the program proposal shall be submitted to the Board of Regents Education and Student Affairs Committee and Board of Regents for discussion and action.
- Substantial expenditures for the proposed program or advertising/marketing of the proposed program shall not occur until after the program is approved by the Board of Regents. This means that the institutions shall not hire any new faculty, secure facilities, develop curriculum, or advertise the program until it has been approved by the Board of Regents.

Academic Program Approval Voting Record

This document is to be appended as the last page of the proposal for any new or revised academic program to record the successive votes of approval as the proposal moves through its required review and approval steps. Consult Faculty Handbook Section 10.8 or the Faculty Senate Curriculum Committee website for information regarding Committee review and voting requirements for each action.

Curricular Action: (check appropriate boxes below)

1. New Program Name Change Discontinuation Concurrent Degree for:
2. Undergraduate Major Graduate Major Undergraduate Minor Graduate Minor
 Undergraduate Certificate Graduate Certificate Other: _____
3. Name of Proposed Change: _____ Environmental Engineering _____
4. Name of Contact Person: David Sanders e-mail address: sandersd@iastate.edu
5. Primary College: _____ Engineering _____ Secondary College: _____
6. Involved Department(s): Civil, Constr., & Environ. Eng. _____

Voting record for this curricular action:

Voting Body	Votes			Date of Vote
	For	Against	Abstain	
Dept. or Program Committee	28	0	0	April 18, 2019
College Curriculum Committee	7	0	0	April 19, 2019
College Approval Vote	149	10	5	May 2, 2019
Graduate Council				
Faculty Senate Curriculum Committee	6	0	0	September 12, 2019
Faculty Senate Academic Affairs Council	6	0	0	October 23, 2019
Faculty Senate				

Memorandum

TO: David Sanders, *Professor and Don and Sharon Greenwood Endowed Department Chair*
Department of Civil, Construction, and Environmental Engineering
Iowa State University
Ames, Iowa 50011-3232

FROM: Steven Mickelson, *Charles R. & Jane F. Olsen Professor and Department Chair*
Department of Agricultural and Biosystems Engineering
Iowa State University
Ames, Iowa 50011-1098

DATE: 6 February 2019

RE: Recommendation for new ISU-CCEE BS Environmental Engineering Degree Program

This memo is being forwarded to confirm my ABE department's support for your CCEE program's proposed new BS Environmental Engineering degree offering. In this regard, I have reviewed your prospectus for this new degree and its accompanying draft curriculum, and am willing to offer my unqualified support for this initiative.

Our ABE department's undergraduate degree programs do have a 'bioenvironmental' option for our biological systems engineering degree track and in the 'land and water resources engineering' option within our agricultural engineering degree track. However, the context of our own 'environmental' focus has a more specialized relevance to agricultural (i.e., designing and evaluating soil and water conservation systems to mitigate and improve the environmental impacts of production agriculture) and with rural-related food and bio-based materials processing (i.e., apply biology and engineering principles to improve and protect soil, water, and air quality). In turn, our ABE course content and knowledge delivery at the undergraduate level is distinctly different from the far broader civil infrastructure aspects which would be covered by your own CCEE environmental engineering education (i.e., connected with urban water supply management, public and private wastewater facilities, municipal solid waste, industrial waste management, etc.). I'll append our ABE web site details on the following pages, with which these cut-and-pasted ABE 'biosystems engineering' and 'agricultural engineering' details will clarify these latter points.

Overall, I do not foresee any expected conflicts between our ABE and CCEE degree offerings in regards to either student recruiting or degree overlap with your department's new BS Environmental Engineering offering. In turn, our ABE team extends best wishes for your upcoming successful launch of this exciting new academic opportunity.

The Biological Systems Engineering Profession:

Biological systems engineering involves the sustainable production, storage, and conversion of biobased materials into useful products. Examples range from breakfast cereals to biologically derived fuels like today's ethanol and biodiesel.

What will the second- and third-generation biofuels look like? How can we convert low-cost biomass into a liquid fuel? How do we make biomass production systems more sustainable? What are the best opportunities for improving them? Biological systems engineers at Iowa State learn to innovate, to communicate, and to work as team members to address these sorts of critical questions.

Biological systems engineers have high-impact careers. Maintaining air quality, a secure food supply, and clean water is important to everyone. In today's global marketplace, grains, produce, and livestock are transported from country to country, and food security is increasingly of concern. Biological systems engineers help safeguard our air, water, and food supply by developing sensors to detect problem compounds and by developing management plans to track materials and to minimize the chances of contamination.

Option Areas of Study

- **Bioenvironmental Engineering:** Apply biology and engineering principles to improve and protect soil, water, and air quality. Enjoy a career that emphasizes the management and improvement of environmental systems through consulting, government agencies, and industry.
- **Biorenewable Resources Engineering:** Improve the economic and environmental sustainability of biorenewable resource production systems. Enjoy a career that emphasizes the design and operation of industrial-scale bioconversion systems, including but not limited to biodiesel and ethanol plants.
- **Food Engineering:** Design and operate modern food processing systems, such as food pasteurization, sterilization, freezing, and hydration. Enjoy a career improving the safety and quality of food by applying engineering, biology, and chemistry principles.
- **Open Option:** Prepare for a professional degree program outside of engineering. Enjoy a career in academia, law, or industry that has a foundation in fundamentals, systems approaches, biology, and chemistry.

The Agricultural Engineering Profession

As an agricultural engineer, you apply your knowledge of the biological, physical, and engineering and technical sciences to solve problems for the world's largest industry – the agriculture and food system. Here's just the beginning of the things you could do:

- Design, development, and testing of advanced machinery systems for agricultural, food, and bioenergy production systems
- Evaluation, development and modeling of systems for sustainable protection and improvement of soil and water resources
- Design and development of environmentally and economically sustainable animal production systems
- Development and evaluation of management systems to ensure food quality, safety and biosecurity
- Manage complex agricultural and biological systems

Option Areas of Study

- **Power Machinery and Engineering:** This area challenges the creative mind to design and improve upon the next generation of off-road vehicles and agricultural equipment.
- **Land and Water Resources Engineering:** This emphasis enables you to design and evaluate soil and water conservation systems to mitigate and improve the environmental impacts of production agriculture. Areas of study also include GIS and natural resource management, water quality, and environmental engineering.
- **Animal Production Systems Engineering:** This option allows you to focus on all aspects of animal productions including structural design and analysis, environmental control options for housed animals, and air quality issues associated with animal production.

Memorandum

TO: David Sanders, *Professor and Don and Sharon Greenwood Endowed Department Chair*
Department of Civil, Construction, and Environmental Engineering
Iowa State University
Ames, Iowa 50011-3232

FROM: Andrew Hillier, *Professor and Reginald R. Baxter Endowed Department Chair*
Department of Chemical and Biological Engineering
Iowa State University
Ames, Iowa 50011-1098

Andrew C. Hillier

DATE: 17 April 2019

RE: Support for new ISU-CCEE BS Environmental Engineering Degree Program

This memo confirms the Chemical and Biological Engineering Department's support for your proposed new BS Environmental Engineering degree offering. CBE has reviewed your prospectus for this new degree and the accompanying draft curriculum, and we foresee minimal conflicts between our BS Chemical Engineering degree offerings and the proposed BS Environmental Engineering degree offerings in regard to student recruiting, and few conflicts in course offerings. In cases where there is potential for content overlap, we would encourage you to consider collaboration on course development and instruction.

CBE currently recommends several areas of emphasis to our undergraduate students, including an emphasis in Environmental Science and Engineering. This emphasis recommends several technical electives offered by CCEE, and CH E 406 and CH E 408 offered by CBE. We would welcome the opportunity to collaborate on these and other technical elective courses in the future to serve students in both the BS Chemical Engineering and BS Environmental Engineering curricula.

Letter of Recommendation

FROM: Iowa State University Civil and Environmental Engineering Advisory Council

KLL Kent Lage, P.E. Advisory Council Member & BS Environmental Engineering Planning Liaison

DATE: 1 April 2019

RE: Recommendation for New ISU-CCEE BS Environmental Engineering Degree Program

On behalf of the CCEE department's 'Civil Engineering Industrial Advisory Council', we are herewith confirming our enthusiastic support for Iowa State University's creation of a new BS Environmental Engineering degree program. The following specific factors were considered during our pro-active review of this program's related proposal:

- This ISU initiative follows on the heels of similar degree programs already launched by civil engineering programs at two regional student recruiting competitors (i.e., the University of Iowa and the University of Minnesota) within just the past two years,
- Similar BS Environmental Engineering degree programs have also been started at roughly 70 other civil engineering universities over the past four decades,
- These latter existing BS Environmental Engineering programs have typically exhibited positive escalation patterns with their enrollment metrics,
- A recently released report by the National Academics also projects a significant demand for environmental engineering graduates, based on compelling grand challenge factors with which this discipline will incur major future challenges (e.g., clean water supply, waste management, etc. which will be critically necessary given massive upcoming population growth, etc.). The 'executive summary' for this report is appended.
- Based on the latter report, and our own experience as practicing professional engineers, we believe that the latter needs for environmental engineers will sustain strong hiring demands for upcoming undergraduate degree recipients,
- The departmental proposal also documents a credible plan by which this new degree offering could be realistically launched with limited expectations for near-term university investment using existing faculty and staff personnel.
- The department proposal also provides a credible plan for modest upcoming investments with new faculty, advising staff, and TA support which are suitably matched with this new degree's expected future registrant tuition income,
- Our advisory council has also reviewed the draft curriculum for this new offering, and are confident that its content has been suitably planned for insuring both necessary student education and upcoming full ABET accreditation.

Simply stated, we fully support this new BS Environmental Engineering degree initiative, and would highly recommend that this proposal be rapidly pushed forward during upcoming upper administration review and confirmation.

Appended: National Academy of Science 2018 Report: 'Environmental Engineering for the 21st Century Addressing Grand Challenges' – Executive Summary

April 23, 2019

Dr. David H. Sanders, Greenwood Department Chair & Professor
Civil, Construction and Environmental Engineering
394 Town Engineering
813 Bissell Rd.
Ames, Iowa 50011

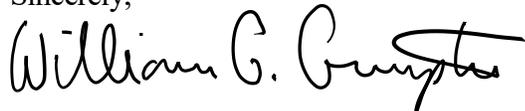
Dear Prof. Sanders:

On behalf of ISU's undergraduate Environmental Science Program, I am delighted to support your department's proposed B.S. in Environmental Engineering degree. I have reviewed the prospectus for this new degree and its accompanying draft curriculum and discussed the program with your faculty in environmental engineering and water resources. They have incorporated my suggestions in the proposed curriculum and I offer my enthusiastic and unqualified support for this initiative.

The proposed environmental engineering program would fill a critical gap and provides an important complement to the EnSci program and other environmental initiatives at ISU. The Environmental Science major provides students a strong foundation in biological and physical natural sciences and the specialized training necessary for integrated analysis of natural environmental systems. The new degree would focus on analyzing and designing engineering systems, especially infrastructure involving water supply, wastewater treatment, air quality, and solid and hazardous waste management. I see no conflict or unnecessary overlap between the two programs and in fact see greater opportunities for synergy. The magnitude and complexity of environmental problems are creating a growing need for both scientists and engineers with the rigorous and focused training needed to address these problems.

Please let me know if there is anything more we can do in support of your proposal or in preparing and implementing this new program.

Sincerely,



William G. Crumpton,
Chair of Environmental Science Undergraduate Program



COLLEGE OF ENGINEERING
Civil & Environmental Engineering

4105 Seamans Center
for the Engineering Arts and Sciences
Iowa City, Iowa 52242-1527
319-335-5647 Fax 319-335-5660
www.cee.engineering.uiowa.edu

February 15, 2019

Iowa State University
Civil, Construction and Environmental Engineering
813 Bissell Road
Ames, IA 50011-1066

Dear Professor David Sanders:

As Chair of the Department of Civil and Environmental Engineering at The University of Iowa (UI), 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, Construction, and Environmental Engineering at Iowa State University (ISU). 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 2020. We began offering a similar undergraduate program in environmental engineering at the UI in Fall 2017. The degree program addresses unmet needs in the environmental engineering field; interest in the program is high and enrollment has grown. As the National Academy of Engineering's recent publication of *Environmental Engineering for the 21st Century* shows, the challenges of the future will need professionals specifically trained in this area.

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 A. Allen Bradley Jr.
Department Chair



College of Engineering

Office of the Dean

3100 Seamans Center for the
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Iowa City, Iowa 52242-1527
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September 23, 2019

Professor David Sanders, Department Chair
Civil, Construction, and Environmental Engineering
Iowa State University
394 Town Engr
813 Bissel Rd
Ames, IA 50011

Dear Professor Sanders:

As Dean of the College of Engineering at the University of Iowa, I support your plans to offer a new Bachelor of Science in Environmental Engineering in the Department of Civil, Construction, and Environmental Engineering at Iowa State University. I understand that the degree is intended for students preparing for practice and advanced study in environmental engineering and that the proposed program start date is Fall 2020.

I am pleased with the continued collaboration of your department with the Department of Civil and Environmental Engineering at the University of Iowa. The collaboration includes your support of the degree program in environmental engineering offered here starting in Fall 2017, as well as discussions on developing a similar program at ISU. I believe that Iowa needs more environmental engineers and that 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,

Alec B. Scranton
Dean of Engineering