

From: [Smith, Randy](#)
To: [Lenhart, John](#); [May, Andy](#)
Cc: [Sutherland, Sue](#); [Marzette, Russell](#); [Smith, Randy](#); [Griffiths, Rob](#); [Reed, Katie](#); [Duffy, Lisa](#); [Hunt, Ryan](#); [MacKay, Allison](#); [Matyas, Cory](#); [Tomasko, David](#)
Subject: Proposal to revise the Environmental Engineering undergraduate program
Date: Tuesday, June 2, 2026 9:37:55 AM
Attachments: [image001.png](#)

Andy and John:

The proposal from the Department of Civil, Environmental and Geodetic Engineering to revise the Bachelor of Science in Environmental Engineering was approved by the Council on Academic Affairs at its meeting on May 28, 2026. Thank you for attending the meeting to respond to questions/comments.

During the Council's discussion, it was noted that you should complete Appendix A: Proficiency Mapping so that the fully completed proposal can be sent to the Board of Trustees for review/approval. Please send me that Appendix by **July 24, 2026**. Let me know if you have any questions about this.

No additional level of internal review/approval is necessary. This action will be included in the Council's next Annual Activities Report to the University Senate (July 2026).

The Office of the University Registrar will work with you on any implementation issues.

Please keep a copy of this message for your file on the proposal and I will do the same for the file in the Office of Academic Affairs.

If you have any questions please contact the Chair of the Council, Professor Sue Sutherland (.43), or me.

I wish you success with this important program development.

Randy



W. Randy Smith, Ph.D.

Vice Provost for Academic Programs

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Memo

To: Randy Smith, Vice Provost for Academic Programs, Office of Academic Affairs
From: Cory Matyas, Assistant Dean for Curriculum and Assessment
Date: February 26, 2026
Re: Proposal to Revise Environmental Engineering Undergraduate Curriculum

Please find enclosed the proposal to revise the Environmental Engineering (ENVENG) undergraduate curriculum within the Department of Civil, Environmental, and Geodetic Engineering. This comprehensive revision reflects a multi-year effort by faculty, advisors, and partners to modernize the curriculum, enhance alignment with ABET program criteria, and ensure that our graduates are well prepared to address the rapidly evolving challenges of environmental engineering practice. Requested implementation date of AU27.

The Engineering College Committee on Academic Affairs reviewed the proposal on February 25, 2026, a vote was taken, and it was unanimously endorsed. The committee recognized that the proposed structure provides greater curricular flexibility, strengthens foundational and advanced technical preparation, and integrates emerging competencies such as data science, sustainability, and systems-level design.

Thank you for your consideration.



February 19, 2026

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Dear Dr. Shannon Morrison,

The Department of Civil, Environmental, and Geodetic Engineering (CEGE) is submitting a revised curriculum for the Environmental Engineering major. Based on discussions with the CEGE faculty and academic advisors, as well as External Advisory Board (EAB) members, we are proposing to revise the Environmental Engineering curriculum to better prepare our students to obtain the skills, attributes, and knowledge necessary for the future of the profession.

Additional information is provided in the attached proposal, and we highlight key elements within this letter.

Rationale for Change

Environmental Engineering, while a well-established field, is evolving in its practice. We believe that tomorrow's environmental engineer will need to understand and leverage technology and data that differs from what was traditionally used to solve problems associated with legacy contamination and to create today's environmental infrastructure. We anticipate that these engineers will need to provide systems-based solutions that address a range of issues and that practice will be driven by overarching macrotrends, e.g., sustainably sourcing food, water, and energy; understanding climate change and mitigating its impacts; sustainable design to minimize pollution and waste; developing resilient, healthy cities. Further, our existing curriculum includes a heavy focus on water treatment, yet our students are interested in other areas of Environmental Engineering in their careers, ranging from wastewater treatment to energy systems to ecosystem restoration. Thus, the changes discussed below are needed to provide students with the tools they will need to meet these demands in whatever area of environmental engineering they choose to pursue.

Effective Date

Implementation of the updated curriculum is anticipated to be the Autumn 2027 semester.

Timeline of Revision Process

- Process initiation via discussion at faculty retreat in Autumn 2019
- Follow-up discussion in CEGE Undergraduate Studies Committee in Autumn 2019
- Formation of a CEGE Undergraduate Curriculum Renewal Committee in Spring 2020
- Development of Program Goals, Outcomes, and Proficiencies that graduates will achieve (i.e., backwards-design approach) in Autumn 2020 & Spring 2021*
- Development of curricular structure, while considering both internal (e.g., Program Goals, Outcomes, and Proficiencies) and external (e.g., OSU General Education requirements, College of Engineering requirements, ABET Program Criteria, ABET Student Outcomes) constraints in Autumn 2023 through Spring 2025
- Periodic discussion with CEGE faculty and EAB members throughout the process
- Approval of the curricular structure by CEGE faculty in Spring 2025

* At this point, we opted to focus on the recently-launched ("new") Civil Engineering curriculum, and we convened an ad hoc committee to focus specifically on this proposed Environmental Engineering curriculum during Autumn 2023.

Changes to be Made

The proposed changes are extensive and are discussed in greater detail in the attached proposal. We highlight considerations of specific questions immediately below; specific references to section numbers refer to the attached curriculum proposal.

New Course Development: The proposed curriculum structure does not necessitate the development of any new required courses. We have sufficient existing courses to populate the Foundational, Fundamental, Advanced Core, and Design course categories. However, we are encouraging the faculty to brainstorm new courses that are appropriate for each category, but we do not need these courses to launch the proposed curriculum. At present, we can only envision the development of an Advanced Wastewater Treatment Design (or similarly named) course as an option for a Design course (see Section 3.3.5), but again, this is not a requirement to launch the new curriculum. Likewise, we may create a new course related to air pollution control, but this would simply enable the cross-listing of an existing course (see Effects on Constituents outside CECE below). Other Design courses may require course change requests to update them to include the criteria outlined for a Design course (Section 3.3.5).

Existing Course Modifications: The proposed curriculum structure will require some course change requests, but the majority of these are reorganization of content from existing courses. These proposed changes are briefly summarized here, and more details can be found in the full proposal. For context, we are proposing to eliminate CIVILEN 2090: Professional Aspects of Civil and Environmental Engineering and ENVENG 2100: Environmental Engineering Analytical Methods in the proposed curriculum. Further, CIVILEN 2001: Introduction to Infrastructure was designed in anticipation of a new curriculum and included content from CIVILEN 2090 from the outset.

- CIVILEN 3080: Engineering Economics and Optimization (Section 3.3.1.2). This course will be modified to consider more broadly factors that influence engineering decision-making (e.g., society, the environment, and ethics in addition to economics), and thus, it also draws upon some content from CIVILEN 2090. This course has been evolving in this direction over time, and it is already in process to support the current (new) Civil Engineering curriculum.
- ENVENG 3200: Fundamentals of Environmental Engineering (Section 3.3.2.1). This course has served as overview of Environmental Engineering practice, essentially introducing the breadth of the field and previewing content found within subsequent courses (e.g., Environmental Engineering unit operations found in ENVENG 3210; environmental fate and transport principles found in ENVENG 4400). At its core, however, this course is an introduction to material and energy balances (an ABET Program Criterion). We will retain this focus, while adding course content related to: 1) licensure and ethics within the context of Environmental Engineering; and 2) environmental regulations, policies, etc. that are relevant for engineering practice. Removed content will be covered elsewhere in the curriculum (e.g., ENVENG 3210, ENVENG 4400). This redesign co-optimizes the needs of both Environmental Engineering students (who will be required to take this course) and Civil Engineering students (who may opt to take this course).
- ENVENG 3210: Environmental Engineering Unit Operations (Section 3.3.3.2). This course has historically had an emphasis on water treatment, including both traditional and so-called “advanced” or “emerging” technologies. The latter group will be moved to an existing course, ENVENG 5210: Advanced Physicochemical Treatment Processes, enabling the movement of wastewater treatment technologies from ENVENG 5110 to ENVENG 3210.

- ENVENG 4200: Environmental Engineering Unit Operations Laboratory (Section 3.3.3.3). This course has historically been a 1-credit laboratory course. In our proposed revisions to the curriculum, we will increase this to a 3-credit lecture + laboratory course (note: this will not yield an increase in the total credits required for the degree; see the attached curriculum proposal for details). This increase in credits will serve two functions: 1) the ability to enhance instruction on data analysis, interpretation, and presentation; and 2) the assimilation of laboratory content from ENVENG 2100. Currently, ENVENG 4200 has ENVENG 2100 as a pre-requisite, which we will remove when updating this course for the proposed curriculum. Further, this course currently has ENVENG 5110 as a co-requisite, which will be removed when ENVENG 4200 undergoes modification.
- ENVENG 4400: Integrated Environmental Chemical Fate and Transport (Section 3.2.2.2). This course was designed as a technical elective for students to go deeper into environmental thermodynamics and mass transfer processes, which are included in both ENVENG 3200 and ENVENG 2100 in the current Environmental Engineering curriculum. However, with the modifications to ENVENG 3200 and the elimination of ENVENG 2100, there would be a gap in the curriculum related to this content related to chemical fate and transport. Thus, ENVENG 4400 will be modified to ensure that students have adequate instruction on this material related to chemical fate and transport (another ABET Program Criterion) through the elimination of some in-class sessions allocated to working on the final projects for the course.
- ENVENG 5110: Environmental Engineering Bioprocesses (Section 3.3.1.4). This course has historically included a review of MICRBIO 4000.0x: Basic and Practical Microbiology content in the context of Environmental Engineering, in addition to bioprocesses and an introduction to wastewater treatment. The introduction to wastewater treatment will move into ENVENG 3210, allowing for an expansion of relevant microbiology to Environmental Engineers.

The most substantial changes will be to ENVENG 3200, ENVENG 4200, and ENVENG 4400, while we have been piloting some of the changes for other courses (CIVILEN 3080, ENVENG 3210, ENVENG 5110), independent of the other curriculum changes.

If our proposed curriculum change is approved, we will submit course change requests to CCAA for these courses. Further, several courses are under consideration for conversion to become a Design Elective (see Section 3.3.5), which may require a course change request, depending on what changes are necessary. Finally, as we are working through these course modifications, we will evaluate the existing pre-requisite chains for all of our courses that serve the proposed Environmental Engineering curriculum, and we will submit any changes to pre-requisites to CCAA for review.

Change in Overall Credit Hours: There is no net change in overall credit hours; the total remains at 130 for the proposed Environmental Engineering program.

Effects on Constituents outside CEGE: Impacts of this proposed curriculum change on other constituents exist. However, some required elements have previously been approved by CAA (in Spring 2024): the requirement of ENGR 1300: Introduction to STEM Writing; the requirement of CIVILEN 2001; the elimination of MECHENG 2030: Dynamics as a requirement.

MATH 2173: Engineering Math B + MATH 2174: Linear Algebra and Differential Equations for Engineers is the proposed math sequence for this proposed Environmental Engineering curriculum. This follows a change that was approved in Spring 2024 for our Civil Engineering

curriculum. We will communicate this to the Mathematics department in parallel to review by CCAA.

STAT 3470: Introduction to Probability and Statistics for Engineers is currently an alternative to CIVILEN 2050: Probabilistic Applications and Data Interpretation in Civil and Environmental Engineering. Historically, enrollment in these courses has been split roughly 50%/50%. However, with the launch of the new Civil Engineering curriculum, we have discontinued offering CIVILEN 2050, and our Environmental Engineering students have been taking STAT 3470. Thus, the Statistics department is aware of this increase in demand from our department.

If the proposed curriculum is approved, we will pursue the revival of CBE 5771: Air Pollution through communication with CBE. To our knowledge, Dr. Andy May, a faculty member in CECE, was the last instructor of record for this course in AU18, as the faculty member from CBE was on sabbatical and CBE 5771 was required for the Environmental Engineering degree at that time. Subsequently, that CBE faculty member discontinued its offering and later retired. We will work to ensure that upon its revival, the course remains accessible to CBE students, as we will likely pursue cross-listing of this course between CBE and ENVENG. This course is not required to ensure the success of our proposed curriculum, so we will contact CBE if our proposed curriculum is approved.

Within the proposed curriculum, we are expanding the list of courses that are acceptable as elective offerings (see Sections 3.1.4, 3.3.1.5 and 3.4 of the proposal). This list contains more elective options outside of our department than previously. We anticipate that the demand for these courses will be distributed among options and not concentrated within a single course. However, we cannot forecast the exact demand of Environmental Engineering students for any of these aforementioned elective courses, but we can disseminate the list of courses, once finalized, to other units from which we have identified elective courses, if CCAA feels that it is appropriate. The following paragraphs briefly describe the different elective categories within the proposed curriculum.

The Earth Science Elective (see Section 3.1.4 of the proposal) will replace the current option students have between EARTHSC 1121: The Dynamic Earth + EARTHSC 1200: Introduction to Earth Science Laboratory and ENR 3000: Soil Science Lecture + ENR 3001: Soil Science Laboratory. This change is aligned with the American Association of Environmental Engineers and Scientists' Commentary on ABET, which states that "Earth sciences include but are not limited to the disciplines of geology, soil science, hydrologic science, meteorology, oceanography, and limnology." Thus, this new elective category will provide students with the opportunity to take a course that is best aligned with their career interests from a list that includes courses from Earth Sciences and Environment and Natural Resources, as well as Atmospheric Sciences and Geography.

The Foundational Elective (see Section 3.3.1.5 of the proposal) will replace the requirement of an organic chemistry course (either CHEM 2310: Introductory Organic Chemistry or CHEM 2510: Organic Chemistry I) with an elective in some foundational area (including organic chemistry, thermodynamics, electronics, solid mechanics). We will provide guidance regarding which course to select based on career interests. We have had some initial conversations with ECE about the inclusion of their courses on the Foundational Electives list.

Technical and Breadth Electives (see Sections 3.4.1 and 3.4.2 of the proposal) expand upon the electives available in the current curriculum. Our preliminary list of courses (see Appendix C), which have not yet been voted on by the CECE faculty, includes more non-CECE offerings than

in the current curriculum. Some of the non-CEGE courses carry over from the current listing of Technical Electives, while others are courses that we have identified as Breadth Electives, or courses that complement the Environmental Engineering degree.

Data Science Electives (see Section 3.4.3 of the proposal) reinforce the need for more knowledge and skills related to data analysis for our students when they enter the workforce. These are primarily application-focused (e.g., remote sensing, geographical information systems). We offer some of these courses in support of the Surveying and Mapping minor within CECE, but similar courses exist elsewhere in the university (e.g., Earth Sciences, Geography). We anticipate there will be growth in courses related to Artificial Intelligence, specifically within the context of data analytics, both in support of the Provost's AI Fluency initiative and through independent identification of this need.

For all of these elective categories, we have not yet had any discussions with constituents outside of the department, unless otherwise specified. We will contact the appropriate units for the Earth Science, Foundational, and Data Science Electives in parallel to review by CCAA. If the proposed Environmental Engineering curriculum is approved by CCAA, we will initiate a formal outreach process with relevant units regarding the Technical and Breadth Electives.

ABET Compliance: The proposed curriculum continues to satisfy ABET requirements for accreditation. These are described in detail within the attached full curriculum proposal, as follows:

- Math and basic science credits: Section 3.1
- ABET Program Criteria: Appendix B
- Laboratory experiences: Sections 3.3.3.1, 3.3.3.3, and 3.3.4
- Design experiences: Sections 3.3.3.2 and 3.3.5

We have not explicitly discussed the total number of credits of engineering coursework in the full curriculum proposal, but we still maintain the minimum requirement of ≥ 45 credits of engineering coursework. This information is readily available (e.g., in the attached, marked-up curriculum sheet) and summarized here:

- At least 4 credits of college-required courses (e.g., ENGR 1181 + 1182 or equivalent)
- 36 credits of required major courses
- At least 4 credits of required non-major courses (i.e., ENGR 1221[†] or equivalent + MECHENG 2010 + Foundational Elective option)
- At least 3 credits of elective courses

Thus, Environmental Engineering students will complete at least 47 credits of engineering coursework within the proposed curriculum.

Transition Policy: Students in the current Environmental Engineering curriculum will be given the option to either continue on their current curriculum or shift entirely to pursuing the proposed curriculum. Students will be encouraged to meet with the CECE academic advisors to discuss this decision. Many courses within the current curriculum will satisfy requirements within the proposed curriculum, and we discuss the necessary substitutions, applicable only to students who switch from the current Environmental Engineering curriculum to the proposed curriculum,

[†] We acknowledge that the Department of Engineering Education may be discontinuing the offering of this course, but we have had some internal conversations about the potential to take over sections of this course for our students.

in the list below. A summary of how all courses within the existing Environmental Engineering curriculum map to the proposed curriculum is included as an attachment to this letter.

The deadline for a current student to opt to shift to the proposed curriculum will be one academic year following the implementation of the proposed curriculum (e.g., by Autumn 2028 if the proposed curriculum launches in Autumn 2027). Students must have completed any courses listed below prior to Autumn 2028 for the following transition plan to apply.

Specific details are included here:

- MATH 2177 has been replaced with MATH 2173 + 2174 in the proposed curriculum. MATH 2177 will be an acceptable substitute for the MATH 2173 + 2174 sequence if and only if a student has completed MATH 2177 prior to entering the proposed Environmental Engineering curriculum[‡]. The sequence of MATH 2153 + 2568 + 2415/2255 will remain an acceptable alternative pathway within the proposed curriculum; this is most likely to apply to students transferring into the program from outside the university.
- EARTHSC 1121 + 1200 is no longer on the approved list of Earth Science electives. EARTHSC 1121 + 1200 will be an acceptable substitute to satisfy the Earth Science elective requirement if and only if a student has completed these courses prior to entering the proposed Environmental Engineering curriculum.
- MICRBIO 4000.0x is no longer a requirement in the proposed curriculum. This will count as a technical elective if and only if a student has completed this course prior to entering the proposed Environmental Engineering curriculum.
- CIVILEN 2050 has been replaced with STAT 3470 in the proposed curriculum. CIVILEN 2050 will be an acceptable substitute for STAT 3470 if and only if a student has completed CIVILEN 2050 prior to entering the proposed Environmental Engineering curriculum. Further, if a student has completed STAT 3450 as a substitute for CIVILEN 2050, STAT 3450 will be an acceptable substitute for STAT 3470 if and only if a student has completed STAT 3450 prior to entering the proposed Environmental Engineering curriculum.
- ENVENG 2100 will be discontinued in the proposed curriculum. ENVENG 2100 will be an acceptable substitute for ENVENG 4400 if and only if a student has completed ENVENG 2100 prior to entering the proposed Environmental Engineering curriculum. Further, we will continue to offer this course for at least two years after our new curriculum is in place, after which point ENVENG 4400 will be an acceptable substitute for ENVENG 2100 for any students who remain on the current Environmental Engineering curriculum beyond those two years.
- ENGR 1300 is a required technical writing course within the proposed curriculum. This requirement will be waived if and only if a student has completed both their GE Writing and Information Literacy Foundation and GE Citizenship Theme requirements prior to entering the proposed Environmental Engineering curriculum. Currently, we have identified both ENGR 2301: Exploring Citizenship in Engineering (Integrative Designation) and ENGLISH 3305: Technical Writing as acceptable substitutes for ENGR 1300 for any student who has credit for ENGLISH 1110 prior to taking ENGR 1300, and we are exploring additional alternatives to ENGR 1300 that satisfy the technical writing requirement.
- MECHENG 2010: Statics will be required in the proposed curriculum, replacing the requirement of MECHENG 2040: Statics and Introduction to Mechanics of Materials.

[‡] Neither this substitution nor the substitution for STAT 3470 below will cause these Environmental Engineering students to fall below the minimum requirement for ABET Math and Science credits.

However, we propose that MECHENG 2040 is an acceptable alternative to MECHENG 2010 for all students, whether in the current or proposed curriculum.

- CIVILEN 2060: Numerical Analysis Methods for Civil and Environmental Engineering is a required course in the current curriculum, but it is not required in the proposed curriculum. However, CIVILEN 2060 is on the preliminary list of Technical Electives for the proposed curriculum, so this course would count as a Technical Elective for a student opting to switch from the current to the proposed curriculum.
- CIVILEN 2090: Professional Aspects of Civil and Environmental Engineering is a required course in the current curriculum, but it will be discontinued if the proposed curriculum is approved. If a student opts to switch from the current curriculum to the proposed curriculum after completing CIVILEN 2090, it will count as a Technical Elective.
- CIVILEN 3160: Water Resources Engineering has recently been converted to a laboratory course, supporting both the new Civil Engineering curriculum and the proposed Environmental Engineering curriculum. We will not require a student who opts to switch from the current Environmental Engineering curriculum to the proposed Environmental Engineering curriculum to repeat this course.
- ENVENG 4200: Environmental Engineering Unit Operations Laboratory will undergo a course change from 1 credit hour to 3 credit hours within the proposed curriculum[§]. We will not require a student who opts to switch from the current Environmental Engineering curriculum to the proposed Environmental Engineering curriculum to repeat this course.
- Students must complete either CHEM 2310 or CHEM 2510 in the current Environmental Engineering curriculum, but neither course is required in the proposed curriculum. However, both courses are included in the list of Foundational Electives for the proposed curriculum.
- ENVENG 5140: Air Quality Engineering is a required course in the current Environmental Engineering curriculum, but it will not be required in the new curriculum. However, it is an option as a Technical Elective in the proposed curriculum.

Thus, a student could easily switch from the current curriculum to the proposed curriculum, through both a combination of the substitutions listed above and courses required in the current curriculum still counting, although differently, in the proposed Environmental Engineering curriculum. However, it is possible that some students who opt to switch from the current curriculum to the proposed curriculum are short on total credits towards their degree as a consequence of what they have or have not yet completed within the current curriculum at the time of the switch; we anticipate that this will be a rare occurrence, but not one with a non-zero probability. Any student in this situation will be required to complete additional coursework from the Technical Elective courses.

The only requirement in the proposed curriculum that is not covered somehow in the current curriculum is the Design Elective (Section 3.3.5); however, many of these courses are not accessible to students due to the course pre-requisites until their third year in the program, at earliest. We will work with departmental academic advisors to ensure that any student who is considering a switch from the current to the proposed curriculum understands this additional requirement of the proposed curriculum.

[§] A student who has completed this course prior to switching from the current curriculum to the proposed curriculum will have also completed ENVENG 2100, a current pre-requisite for ENVENG 4200.

Implications for Students who Change Majors: In our Environmental Engineering program, we have a number of students who enter the program after starting in another major at OSU. For these students who change their majors, we will:

- Accept MATH 2177 as a substitute for MATH 2173 + MATH 2174, if and only if MATH 2177 has been completed prior to the student changing their major.
- Accept STAT 3450 as a substitute for STAT 3470, if and only if STAT 3450 has been completed prior to the student changing their major.

We anticipate that these two substitutions will cover the majority of students who change their major, as many students who switch to Environmental Engineering after starting at OSU are either a) changing from a different major within the College of Engineering; or b) changing from a major outside the College of Engineering that does not require a math course beyond a typical Calculus sequence.

We acknowledge that the Statistics requirement may be something to monitor over time, especially as data analysis skills are becoming a more prevalent need in many fields; specifically, we will monitor for other common Statistics courses that should be added to the approved substitution list for major changers; for example, STAT 2450.0x: Introduction to Statistical Analysis I covers similar topics to STAT 3470. However, we cannot anticipate the number of students who will change into the proposed Environmental Engineering program with credit for this course. In other words, we will track which, if any, Statistics courses students have already completed prior to changing into the Environmental Engineering program and update CCAA of any changes to our substitution policy, as needed.

Additional Resources from the Department: If we pursue the development of an Advanced Wastewater Treatment Design (or similarly named) course, we will likely need to hire a part-time lecturer to teach this course. Depending on the magnitude of course changes necessary for individual faculty members, those faculty members may need to request teaching release, which may also necessitate the hiring of part-time lecturers to cover required courses as we transition between the current and the proposed curriculum. We do not anticipate the need for additional facilities or equipment beyond existing departmental resources.

Inclusion of Specializations: Within the proposed curriculum, students inherently will have more freedom to tailor their degree path to satisfy their career goals. However, one potential challenge with freedom is a lack of a clear path through the degree. To address this challenge, we will develop guidance documentation that will aid students in navigating the freedom. We have categorized electives by disciplinary focus in our preliminary list, but we have not yet determined whether to simply use these disciplinary foci or the National Academies of Sciences, Engineering, and Medicine (NASEM) Grand Challenges for Environmental Engineering in the 21st Century within this guidance documentation**. In either approach, we will ensure that prerequisite chains are explicitly clear (e.g., some Technical or Breadth Elective courses require

** The former is more likely for categorizing the electives, as many courses can address more than one of the five NASEM Grand Challenges for Environmental Engineering in the 21st Century (i.e., there would be redundancy in the electives list). However, guidance documentation relating to each of the Grand Challenges could, and arguably should, include this redundancy to demonstrate how a given topic can apply to more than one Grand Challenge.

students to have completed a thermodynamics course, which is included in the list of Foundational Electives). At this time, we do not envision that these specialization pathways are codified in Stellar or Buckeye Degree Planner, as their primary purpose is to provide students with sufficient information to make choices.

Modification to Elective Requirements: The proposed structure expands the number of required elective courses within the Environmental Engineering curriculum (Section 3.4 in the proposal). The lists of courses from which a student may choose are under development, but briefly, these will include: 1) all technical electives that currently exist within the Environmental Engineering curriculum; and 2) courses that we identify outside of CEGE that we feel are complementary to the Environmental Engineering degree (see Effects on Constituents outside CEGE above). We do not require the creation of new technical electives in support of the proposed curriculum, but we anticipate that some new courses may be available in the near future, as the teaching responsibilities of our recent faculty hires expand towards a full teaching load.

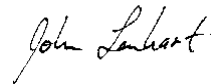
Curriculum Sheets and Example Course Sequence

We provide visual examples of the Environmental Engineering curriculum as attachments.

These include:

- 1) The curriculum sheet for the current Environmental Engineering curriculum.
- 2) A curriculum sheet for the proposed Environmental Engineering curriculum.
- 3) An example course sequence for the proposed Environmental Engineering curriculum.

Sincerely,



John J. Lenhart, Ph.D.

Professor and Associate Chair

Department of Civil, Environmental and Geodetic Engineering

Ohio State University

Attachments:

- Full proposal for a new curriculum in Environmental Engineering
- The curriculum sheet for the current Environmental Engineering curriculum
- A curriculum sheet for the proposed Environmental Engineering curriculum
- An example course sequence for the proposed Environmental Engineering curriculum
- A summary table describing how each course in the current Environmental Engineering curriculum will count in the proposed curriculum

A Proposal for a New Structure in the Environmental Engineering (ENVENG) Curriculum

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1. Background

During the Autumn 2019 faculty retreat, the faculty within the Department of Civil, Environmental, and Geodetic Engineering (CEGE) brainstormed knowledge and skills that we felt were important for our graduates, which was followed by conversations in the departmental Undergraduate Studies Committee. Then, in Spring 2020, a committee was formed to initiate the process of renewing the undergraduate curriculum. This committee was comprised of Drs. John Lenhart (Chair; 2020 – 2022), Andy May (Chair; 2023 – present), Lisa Burris, Gil Bohrer, Jordan Clark, Anthony Massari, and Daniel Pradel from the CEGE faculty, as well as Ms. Liz Riter and Mr. Barry Tolchin, the CEGE academic advisors. This committee received support from the Michael V. Drake Institute for Teaching and Learning, initially with the assistance of Dr. Teresa Johnson and then Dr. Larry Hurtubise.

Initially, this committee focused on both undergraduate programs within CEGE – Civil Engineering and Environmental Engineering. During Autumn 2023, a separate committee was formed to focus on the Environmental Engineering curriculum, including Drs. Andy May (Chair; 2023 – present), Karen Dannemiller, and Linda Weavers. In Autumn 2024, Drs. Daniel Gingerich and John Lenhart were added to this committee. In preparation of this proposal, the committee both requested and received input from the CEGE academic advisors.

2. Process

The committee followed a backward-design approach in their process. The committee developed a set of educational goals, outcomes, and proficiencies (see Appendix A), which was designed to be independent of any specific technical content. The goals represent higher-order learning objectives for the program, and the outcomes organize sets of knowledge and skills within each goal; proficiencies are learning objectives that can be assessed directly within the curriculum.

During the Spring 2024 faculty retreat, Environmental Engineering faculty discussed the needs for our students within a new curriculum. We agreed that using the National Academies of Sciences, Engineering, and Medicine (NASEM) Grand Challenges for Environmental Engineering in the 21st Century will provide guidance for shaping this curriculum. Thus, the vision for the proposed curriculum is for students to develop skills to address at least one NASEM Grand Challenge in their future careers. Briefly, these Grand Challenges are:

1. Sustainably supply food, water, and energy
2. Curb climate change and adapt to its impacts
3. Design a future without pollution or waste
4. Create efficient, healthy, resilient cities
5. Foster informed decisions and actions

Our redesign follows the “T” structure outlined in this NASEM report, as the curriculum is designed to provide depth in Environmental Engineering and breadth in related disciplines. Specifically, that report lists “systems analysis, data science, social sciences, policy, law, humanities, health, global cultures, and engagement” as topics that provide this broader context. Breadth in the curriculum will be addressed through a combination of course re-design (e.g., ENVENG 3200: Fundamentals of Environmental Engineering; see Section 3.3.2.1), breadth electives (see Section 3.4.2), a data science elective (see Section 3.4.3), and the OSU General Education requirements (see Section 3.6).

We then considered criteria set forth by ABET, which establishes minimum standards that are essential for Environmental Engineering graduates. We drew upon the commentary on the ABET criteria that was prepared by the American Academy of Environmental Engineers and Scientists (AAEES), as well as the Environmental Engineering Body of Knowledge, also prepared by AAEES. We present how we satisfy both ABET criteria and our vision to meet the NASEM Grand Challenges in Appendix B.

Ultimately, we believe that the revised curriculum will deliver technical depth that spans sufficient breadth in Environmental Engineering to support preparation for any career or the FE exam. Moreover, the flexibility provided within the new curriculum will support technical training that supports any number of different career directions that a student may wish to follow after graduation.

Moreover, as a committee, we sought an emphasis in data analysis. Not only is data science specifically called out in the NASEM report, but also data are more prevalent than they ever have been, and how to analyze and interpret data is becoming an important skill for the modern environmental engineer.

This proposal was distributed to CEGE faculty for review, as well as CEGE Academic Advisors Barry Tolchin and Liz Riter. The CEGE Faculty voted to approve the proposed curriculum change on May 12, 2025.

3. Summary of Changes and Rationale

The following sections describe the proposed changes and associated justification. The net, high-level result is a degree program that enables more flexibility for student choice, while enabling sufficient coverage of core content that is necessary for Environmental Engineers.

3.1. Math and Basic Science

ABET requires that Environmental Engineering students complete mathematics through differential equations, calculus-based physics, chemistry (including stoichiometry, equilibrium and kinetics), earth science, and biological science. Environmental Engineering students must also apply probability and statistics to address uncertainty. The minimum requirement for math and basic science courses, per ABET, is 30 credit hours.

The College of Engineering requires that all students take PHYSICS 1250 (Mechanics, Work and Energy, Thermal Physics), the equivalent course for honors students (PHYSICS 1260), or the equivalent course for physics majors (PHYSICS 1270), the latter of which applies to Engineering Physics students. Each of these courses are 5 credit hours.

Our proposed ABET math and science requirements for the new Environmental Engineering curriculum is summarized in Table 1.

Table 1. Summary of ABET math and science hours in the proposed Environmental Engineering curriculum.

Course	Credit Hours
MATH 1151	5
MATH 1172	5
MATH 2173	3
MATH 2174	3
PHYSICS 1250	5
CHEM 1210	5
CHEM 1220	5
STAT 3470	3
Earth Science Elective	3
ENVENG 5110	3
Total	40

The earth science electives represent a broad set of courses from various disciplines (see Section 3.1.4).

Note that this new course sequence removes the previous requirement of MICRBIO 4000.0x (Basic and Practical Microbiology). In place of that course, we propose a modified form of ENVENG 5110 (Environmental Engineering Bioprocesses) to provide students with fundamental microbiology content (see Section 3.1.5).

3.1.1. Math Sequence

The new curriculum follows a 4-course sequence of courses from the Department of Mathematics. As a faculty, we have observed deficiencies in our students' math performance, and the new sequence is in alignment with the recent change to the undergraduate Civil Engineering curriculum.

The new sequence includes:

1. MATH 1151: Calculus 1
2. MATH 1172: Engineering Math A
3. MATH 2173: Engineering Math B
4. MATH 2174: Linear Algebra and Differential Equations

MATH 2173 and MATH 2174 replace the old requirement of MATH 2177 (Math Topics for Engineers). The new sequence covers the same material, but MATH 2173 + MATH 2174 cover the same content, spread across two semesters. Other programs in the College of Engineering (e.g., Biomedical Engineering, Chemical Engineering, Integrated Systems Engineering, and Welding Engineering) have made a similar change in their curricula related to this math sequence in recent years.

An acceptable alternative pathway to MATH 2173 + MATH 2174 is MATH 2153 (Calculus 3), MATH 2568 (Linear Algebra), and MATH 2415 (Differential Equations). This pathway is most likely to apply to students transferring into the program from outside of the university, but it may apply to some major changers within the university as well.

3.1.2. Physics

We propose to retain the requirement of calculus-based physics, specifically through PHYSICS 1250 (Mechanics, Work and Energy, Thermal Physics) or an equivalent course*.

3.1.3. Chemistry

The current Environmental Engineering curriculum required students to take CHEM 1210 (General Chemistry I), CHEM 1220 (General Chemistry II), and CHEM 2510 (Organic Chemistry I). CHEM 2310 (Introductory Organic Chemistry) was an acceptable alternative to CHEM 2510. CHEM 2310 combines Organic Chemistry I and Organic Chemistry II, which provides a broader range of knowledge of this content. Both CHEM 2310 and CHEM 2510 are 4 credit-hour courses.

We propose to maintain the requirements of CHEM 1210 and CHEM 1220 but to remove the requirement that Environmental Engineering students take an organic chemistry course, because there are many possible career paths for our graduates, and not all of them will be related to organic contaminants in the environment. CHEM 2310 and CHEM 2510 remain options for students to take to satisfy a “Foundational Elective” (see Section 3.3.1).

3.1.4. Earth Science

In the current Environmental Engineering curriculum, students have the option to take EARTHSC 1121 (The Dynamic Earth) and EARTHSC 1200 (Introduction to Earth Science Laboratory); or EARTHSC 1151 (Natural Hazards) and EARTHSC 1200; or ENR 3000 (Soil Science Lecture) and 3001 (Soil Science Lab). These courses provide both content related to earth science and a hands-on laboratory experience.

The AAEES Commentary on ABET states that “Earth sciences include but are not limited to the disciplines of geology, soil science, hydrologic science, meteorology, oceanography, and limnology. The emphasis of an earth science is on basic science rather than engineering, and therefore courses such as geotechnical engineering, soil mechanics, and engineering hydrology might not normally have sufficient earth science coverage to meet this criterion.” With this commentary in mind, in the new curriculum, we propose a revised list of options that span the breadth of earth sciences included within the commentary. Further, we no longer require a hands-on laboratory experience associated with this earth science course due to proposed modifications to ENVENG 4200 (Environmental Engineering Unit Operations Lab; see Section 3.3.3). We propose an initial list of earth science elective courses in Table 2; some of these courses satisfy OSU General Education requirements (indicated with a pound sign #; see Section 3.6 for more discussion on General Education). This list will be maintained by the departmental Undergraduate Studies Committee, and any updates to the list will be shared with CCAA for review.

Table 2. Proposed Earth Science electives for the new Environmental Engineering curriculum.

Course Number	Course Title
ATMOSSC 2940	Basic Meteorology
EARTHSC 2203	Environmental Geoscience [#]
EARTHSC 2210	Energy, Mineral Resources, and Society [#]
EARTHSC 2911	The Climate Crisis: Mechanisms, Impacts, and Mitigation [#]
ENR 3000	Soil Science
GEOG 2960	Introduction to Physical Geography

* Equivalent alternatives include PHYSICS 1250H (Honors Physics: Mechanics and Conservation Laws; Special Relativity), PHYSICS 1260 (FEH Physics: Mechanics, Thermal Physics, Waves), and PHYSICS 1270 (Classical Mechanics, Conservation Laws, and Special Relativity for Majors)

3.1.5. Microbiology

In the old curriculum, Environmental Engineering students took MICRBIO 4000.0x to meet the ABET requirement for biological science. In the new curriculum, we propose to replace MICRBIO 4000.0x with ENVENG 5110. ENVENG 5110 has been redeveloped, and in its most recent offering, the course reviews microbiology and introduces both bioprocesses and wastewater treatment design. In this redeveloped state, MICRBIO 4000.0x is still required. Thus, to maintain the ABET requirement for a biological science, the next iteration of ENVENG 5110 will provide deeper microbiology content and introduce only bioprocesses; there would then be an opportunity to develop a new course in wastewater treatment design as a technical elective. A laboratory experiment focused on microbiology is under consideration for the redesign of ENVENG 4200.

3.1.6. Probability and Statistics

The new curriculum includes a change in the required course covering probability and statistics. We propose to require STAT 3470.0x (Introduction to Probability and Statistics for Engineers), which is currently an alternative to CIVILEN 2050 (Probabilistic Applications and Data Interpretation in Civil and Environmental Engineering). This differs from the recent change to the Civil Engineering curriculum, which replaced CIVILEN 2050 with STAT 3450.0x (Basic Statistics for Engineers). As a committee, we felt that the additional topics of regression and Bayesian statistics in STAT 3470 aligns with our emphasis on data analysis (see Section 2).

The department will sunset CIVILEN 2050 as the result of these changes to the two curricula.

3.2. Engineering Fundamentals

3.2.1. College Requirements

The College of Engineering requires students to take MATH 1151; PHYSICS 1250 or equivalent; ENGR 1181 (Fundamentals of Engineering I; or equivalent for Honors or transfer students); and ENGR 1182 (Fundamentals of Engineering II; or equivalent for Honors or transfer students). Our students also take ENGR 1100.15 (Introduction to Ohio State and Engineering)[†]. Some of these college requirements overlap with the math and basic science courses (MATH 1151; PHYSICS 1250).

3.2.2. Programming

We propose to maintain the requirement of ENGR 1221 (Introduction to Computer Programming in MATLAB for Engineers and Scientists), with CSE 1222 (Introduction to Computer Programming in C++ for Engineers and Scientists), CSE 1223 (Introduction to Computer Programming in Java), and CSE 1224 (Introduction to Computer Programming in Python) as acceptable alternatives. We would like our students to gain the skill of programming, but we do not want to prescribe a specific language. Further, including additional options may facilitate the pursuit of, e.g., a minor in Computer Science that complements the Environmental Engineering degree.

ENGR 1221 is a 2 credit-hour course, while the others are 3 credit hours. Thus, the minimum requirement is 2 credit hours of programming.

[†] We are aware that the Department of Engineering Education is considering the inclusion of ENGR 1100.15 within the first-year sequence, but it is our understanding that this will not change the total number of credits across the Fundamentals of Engineering sequence + “Engineering Survey”.

3.2.3. Engineering Mechanics

We propose to change the requirement of MECHENG 2040 (Statics and Introduction to Mechanics of Materials) to MECHENG 2010 (Statics). The need for every Environmental Engineering graduate to understand concepts related to mechanics of materials (e.g., stress/strain; Mohr's circle; and beam deflections) is unclear to the committee. However, this change will impact an Environmental Engineering student's ability to take certain Civil Engineering courses as electives (e.g., CIVILEN 3540 – Geotechnical Engineering). Therefore, we propose to include MECHENG 2020 (Mechanics of Materials) as a Foundational Elective (see Section 3.3.1.5) to enable access to these courses. Moreover, MECHENG 2040 will be an acceptable alternative to MECHENG 2010 with this proposed change.

MECHENG 2030 (Dynamics) was removed as a required course from the Environmental Engineering curriculum via faculty vote in Autumn 2023, and the committee proposes to uphold this decision. Students will still have the option to take MECHENG 2030 as a Foundational Elective (see Section 3.3.1.5).

3.3. Major Courses

For context, in the new Civil Engineering curriculum, major courses were categorized into required courses, core courses, laboratory courses, design courses, and Capstone. Herein, we propose a different categorization of courses within the Environmental Engineering curriculum. Our rationale for these differences is that these are two different degree programs within our department that are subject to two different sets of ABET Program Criteria. Specifically, the ABET Program Criterion relevant to Environmental Engineering states that “the curriculum must include material and energy balances; fate and transport of substances in and between air, water, and soil phases; and advanced principles and practices relevant to program objectives.”

Thus, the course categories for the proposed Environmental Engineering curriculum include Foundational courses; Fundamental courses; and Advanced Core courses, each of which builds towards addressing at least one of the NASEM Grand Challenges for Environmental Engineering in the 21st Century. Within these categories, we include a Foundational Elective (see Section 3.3.1.5) and a Design Elective (see Section 3.3.5). We also propose a set of Elective courses (both “Technical” and “Breadth”) to complement these major courses (see Section 3.4).

We propose the outright cancellation of three courses herein: CIVILEN 2050; CIVILEN 2090 (Professional Aspects of Civil and Environmental Engineering); and ENVENG 2100 (Environmental Engineering Analytical Methods). CIVILEN 2050 will be replaced by STAT 3470 (see Section 3.1.6). We propose that content from the 1-credit CIVILEN 2090 course be distributed across CIVILEN 2001 (Section 3.3.1.1), CIVILEN 3080 (Section 3.3.1.2), ENVENG 3200 (Section 3.3.2.1), and ENVENG 4090.0x (Section 3.5), and efforts are already underway to implement this. For discussion of ENVENG 2100, see Sections 3.3.2 and 3.3.4. In addition to fitting with the new vision for the Environmental Engineering curriculum, these proposed cancellations will enable additional teaching flexibility, enabling both teaching relief for other courses, as needed, and the potential development of new courses to serve the curriculum.

We propose that CIVILEN 2060 (Numerical Analysis Methods for Civil and Environmental Engineering Applications) will become an Elective course for students, identical to the recommendation for the Civil Engineering curriculum. We suggest that it be reduced to 3 credit hours and be re-branded to a title similar to “Software and Simulation for Civil and Environmental Engineering”. The existing pre-requisite chain does not demonstrate a dependency on this course in our current curriculum. Thus, we recommend that any required skills from CIVILEN 2060 be taught within the appropriate context of the course where those skills are needed, e.g., specific numerical methods for use in support of computational tools in Design

courses (see Section 3.3.5). Where appropriate, CIVILEN 2060 could be included in guidance documentation for students interested in certain technical areas within the department.

3.3.1. Foundational Courses

Foundational courses are required courses, which provide content upon which the Environmental Engineering curriculum will build. These courses meet some combination of CEGE curricular proficiencies and ABET Program Criteria. Each Foundational course is described below. The proficiencies met by each is included in Appendix A.

3.3.1.1. CIVILEN 2001: Introduction to Infrastructure

This course was developed during the curriculum renewal process by Drs. Lisa Burris, Daniel Gingerich, Anthony Massari, Andy May, and Daniel Pradel and was subsequently built upon by Drs. Burris and May with Drs. Andre Carrel and Allison MacKay. Dr. May, along with Drs. Natassia Brenkus and Rabi Mishalani, delivered this course during Spring 2025, and it has continued to be offered during AY25-26. It directly addresses concerns raised by the CEGE faculty related to Environmental Engineering graduates' "Professional Identity"; as such, it covers many proficiencies within that educational goal.

Briefly, the course considers the role of both Civil and Environmental Engineers in infrastructure projects. It provides an overview of different technical areas within the programs; an introduction to analysis, design, and engineering drawings within the context of the programs; and an introduction to environmental, social, and economic factors that influence infrastructure projects. The course embeds professionalism and professional development, including the importance of licensure, both written and oral communication, and engineering ethics.

This course will include a foundational writing objective that will be defined as part of broader departmental efforts.

This course requirement was approved for the current Environmental Engineering by the CEGE faculty in Autumn 2023 and by CAA in Spring 2024.

3.3.1.2. CIVILEN 3080: Engineering Economics and Optimization

This course provides foundational content related to engineering economics and operations research. Moreover, there is an opportunity to modify this course to more broadly cover "engineering decision-making" content, which would include more sustainability, societal, and ethical considerations within the context of this course, all of which are related to other ABET Program Criteria and ABET Student Outcomes. Adding more ethics context to this course facilitates the cancellation of CIVILEN 2090 (see above under Section 3.3). This course directly addresses NASEM Grand Challenge #5 (see Section 2).

3.3.1.3. CIVILEN 3130

Fluid mechanics is specifically listed as a requirement in the ABET Program Criteria for Environmental Engineering.

3.3.1.4. ENVENG 5110

ENVENG 5110 has been redeveloped to provide not only content on bioprocesses but microbiology relevant to Environmental Engineering (see Section 3.1.5). Hence, this course will fill the role of a biological science course in the ABET Program Criteria. It currently contains content related to wastewater treatment design; some of this content will be moved into ENVENG 3210 (Environmental Engineering Unit Operations), but we emphasize the need for a standalone wastewater treatment design course.

3.3.1.5. Foundational Elective

In the current Environmental Engineering curriculum, students are required to take either CHEM 2310 (Introductory Organic Chemistry) or CHEM 2510 (Organic Chemistry I). An organic chemistry course can serve as foundational knowledge for subsequent courses related to chemical fate, transport, treatment, or remediation; however, not all students entering the major will pursue a career path related to these areas.

Therefore, we propose to replace the organic chemistry requirement with Foundational Elective courses, which will span a breadth of topics relevant to Environmental Engineering. Students will be required to take two of these courses to provide this breadth in foundational knowledge. Our initial proposed list of these Foundational Elective courses, which does include the two organic chemistry courses as options, is provided in Table 3. This list will be maintained by the departmental Undergraduate Studies Committee, and any updates to the list will be shared with CCAA for review.

Table 3. Proposed Foundational Electives for the new Environmental Engineering curriculum.

Course Number	Course Title
CHEM 2310 CHEM 2510	Introductory Organic Chemistry OR Organic Chemistry I
MECHENG 3500 FABENG 3120	Engineering Thermal Sciences OR Thermodynamics in FABENG
ECE 2300* ECE 2360*	Electrical Circuits and Electronic Devices OR Electronics for CSE Majors
MECHENG 2020 [#]	Mechanics of Materials
MECHENG 2030	Dynamics
PHYSICS 1251	E&M, Waves, Optics, Modern Physics
MICRBIO 5155	Environmental Microbiology [§]

*Final details to be worked out with the Department of Electrical and Computer Engineering, but a conditional agreement is in place.

[#]A student who completes MECHENG 2040 as an alternative to MECHENG 2010 will be unable to take MECHENG 2020. Further, completing MECHENG 2040 will not satisfy both the Statics requirement and the Foundational Elective requirement via substitution.

[§]We are discussing the inclusion of this course with its instructor from the Department of Microbiology, specifically related to a waiver of the pre-requisite of MICRBIO 4000. That department had previously waived the pre-requisite of a “3 credit hours in Biology” for MICRBIO 4000.0x in our current curriculum.

3.3.2. Fundamental Courses

ABET Program Criterion 1b for Environmental Engineering highlights three key elements that are central to an Environmental Engineering degree. The Fundamental courses will introduce two critical elements of this criterion, namely “material and energy balances”; and “fate and transport of substances in and between air, water, and soil phases”. The third element will be addressed in the Advanced Core Courses.

3.3.2.1. ENVENG 3200

We recommend that ENVENG 3200 remains as a required course for the Environmental Engineering program. This course will introduce the concepts related to “material and energy balances” from the ABET Program Criterion, which will be built upon in subsequent courses within the program. However, we propose that the course is modified in the following ways:

1. It is updated to meet the criteria outlined for a “Core course” in the Civil Engineering degree, namely:
 - a. An explicit connection to both engineering licensure and engineering ethics to emphasize these topics within the context of the course’s technical area.
 - b. An explicit connection between the course and other options within the curriculum. This could be as simple as discussing the courses that come next and how they relate to the core course during both the first and last lectures of the semester, or it could manifest as a thread throughout the semester. Regarding the latter, this could include highlighting limitations in the core course and how those limitations will be addressed in subsequent courses.
2. It is partially re-designed to co-optimize the needs of both Civil Engineering and Environmental Engineering students.
 - a. For example, a Civil Engineer should understand things like the National Environmental Policy Act (NEPA) and stormwater pollution prevention plans (SWPPP), as well as concepts related to material and energy balances, which are relevant for a general understanding of environmental pollution. These topics would also support an Environmental Engineering student, who will later go on to apply material and energy balances to more sophisticated problems later in the undergraduate curriculum.
 - b. To enable additional emphasis on certain topics, we propose moving some content to other courses, as appropriate.

The Environmental Engineering Curriculum Renewal Committee is currently working to develop a more detailed proposal to share with the ENVENG 3200 instructors for further discussion about these course modifications. We plan to submit a course change request to CCAA after approval of this curriculum proposal.

3.3.2.2. ENVENG 4400

ENVENG 4400 is currently an elective course for Environmental Engineering students. We propose to convert this into a required course as it addresses the ABET Program Criterion “fate and transport of substances in and between air, water, and soil phases”. Further, it will reinforce concepts related to “material and energy balances”.

The chemical fate and transport concepts within this course facilitate:

- The removal, or at least de-emphasis, of course content in other courses. For example, ENVENG 3200 currently introduces students to the concepts of Gaussian plumes for atmospheric transport modeling. However, ENVENG 4400 currently includes a full module on dispersion modeling in the environment, considering dispersion in one, two, and three dimensions in space and including treatment of dispersion that varies in time.
- The cancellation of ENVENG 2100. The lecture portion of ENVENG 2100 includes many concepts related to water chemistry, including carbonate chemistry, acid-base titration, and mineral dissolution. ENVENG 4400 currently contains a review of these environmental chemistry processes, but there is space to expand upon this to ensure that these chemistry topics are sufficiently covered within ENVENG 4400 to ensure that students are adequately prepared for ENVENG 4200.

The committee is working to develop a more complete plan to redesign this course, ensuring that all necessary material from other courses will be covered. We plan to submit a course change request to CCAA after approval of this curriculum proposal.

3.3.3. Advanced Core Courses

Advanced Core Courses represent the final set of required courses within the curriculum. These courses begin to explore the “advanced principles and practices relevant to the program objectives” in the ABET Program Criteria, and they directly build upon content from the Foundational and Fundamental Courses. Additionally, some provide experiences with “hands-on laboratory experiments, and analysis and interpretation of the resulting data in more than one major environmental engineering focus area, e.g., air, water, land, environmental health” or “design of environmental engineering systems that includes considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts”, which are two additional ABET Program Criteria.

3.3.3.1. CIVILEN 3160

CIVILEN 3610 (Water Resources Engineering) serves multiple functions in the proposed Environmental Engineering curriculum. It builds upon the formulation of material and energy balances, especially those introduced in CIVILEN 3130. Further, it advances student knowledge related to environmental physics.

Within the revised Civil Engineering curriculum, CIVILEN 3160 has been converted into a laboratory course, providing students with experiences in laboratory, field, and numerical settings. Thus, this course is subject to additional criteria (see Section 3.3.4).

3.3.3.2. ENVENG 3210

ENVENG 3210 introduces concepts related to pollution treatment technologies. Historically, there has been a large emphasis on water treatment, although this has evolved over time. Within the new curriculum, there is an opportunity to modify this course to provide additional breadth – many of the physical, chemical, and/or biological processes follow the same underlying principles regardless of the environmental medium. We propose to update this course to provide an emphasis on not only water treatment but also wastewater treatment, and consequently, we may consider retitling the course. The committee is discussing a plan to facilitate this redesign. We plan to submit a course change request to CCAA after approval of this curriculum proposal.

This course will also provide an initial design experience to Environmental Engineering students, and it will serve as a pre-requisite to subsequent design courses related to treatment approaches (e.g., advanced water treatment, advanced wastewater treatment, air pollution control). All design courses, including ENVENG 3210, are subject to additional criteria (see Section 3.3.5).

3.3.3.3. ENVENG 4200

We propose that ENVENG 4200 be modified in several ways:

1. It will increase from a 1 credit hour course to a 3 credit hour course. This will facilitate the expansion of lecture content to provide students with additional guidance on data analysis and interpretation (including uncertainties and error propagation) and presentation of data in figures and tables.
2. It will retain its inclusion of experiments in multiple environmental media (e.g., air, water), but new experiments in other media (e.g., land, environmental health) should be explored to account for the removal of the requirements of other lab courses (i.e., MICRBIO 4000, ENR 3000/3001).

These modifications, in combination with the proposed changes to ENVENG 4400, facilitate the cancellation of ENVENG 2100. As with other courses, the committee is working to develop a plan to aid

in the redesign. We plan to submit a course change request to CCAA after approval of this curriculum proposal.

3.3.3.4. ENVENG 5170

ENVENG 5170 (Sustainability and the Circular Economy) builds upon concepts introduced in CIVILEN 2001 and CIVILEN 3080, namely life-cycle thinking and engineering decision-making. Thus, this course supports students' ability to design systems that consider sustainability, life-cycle principles, and environmental impacts, all of which are explicitly required in the ABET Program Criteria.

3.3.4. Laboratory Courses

In our revision of the Civil Engineering curriculum, we identified a subset of our curricular proficiencies that should be met by any laboratory course; these are noted in Appendix A. Per the ABET requirements, Environmental Engineering students are required to conduct laboratory experiments in “more than one major environmental engineering focus area, e.g., air, water, land, environmental health”. This requirement does not need to be met in multiple courses, and the modifications of ENVENG 4200 will continue to satisfy this requirement.

The laboratory experience should include the following (adopted from the more-comprehensive American Society of Civil Engineering (ASCE) commentary on ABET for Civil Engineering):

- 1) Understand the objectives and procedures associated with an experiment
- 2) Conduct an experiment, including setup, measurement and data collection
- 3) Observe and document error and uncertainties in data collection procedures
- 4) Analyze data
- 5) Interpret experimental results, with appropriate conclusions and recommendations, and
- 6) Apply experimental procedures and analysis of results consistent with real-world Environmental Engineering problems or situations

Context for the item 6) is provided within the AAEES commentary; experiments may be related to characterization, monitoring, process analysis, or pilot plant studies that are relevant to Environmental Engineers.

Within the Civil Engineering curriculum revisions, we proposed an additional list of criteria that laboratory courses should meet, and we propose that these criteria are applied to the Environmental Engineering curriculum as well:

- 1) A direct connection to a technical area will provide students with the proper context in their experiences. This criterion will be applied to the proposed Environmental Engineering curriculum in the context of addressing the requirement of laboratory experiences in more than one major environmental engineering focus area.
- 2) The laboratory experiences should have a “hands-on” component. Two examples include a) physical experiments in which the students set up the experiments and conduct measurements to collect data; and b) numerical experiments in which the students configure the inputs to a software package and conduct simulations to obtain data (i.e., not just “clicking buttons”)[‡].

[‡] Virtual lab experiences are only permissible under extreme circumstances (e.g., pandemic) per the AAEES commentary. In this context, a virtual lab would entail watching a video on how the data were collected and solely conducting data analysis on results provided to students.

- 3) The minimum amount of time devoted to the laboratory aspects of the course should be equivalent to 1 credit hour (i.e., 3 hours of student work per week). Within this 1 credit hour, the balance between “hands-on” experimentation (including both physical and computational), and subsequent data analysis, data interpretation, uncertainty analysis, and other supporting activities related to the hands-on experience will depend on the instructor and/or nature of the course content. To achieve this 1 credit hour requirement, we recommend a minimum of 36 hours to be spent over the semester associated with laboratory content.
- 4) The laboratory experiences should meet a consistent writing objective across all lab courses to build technical literacy skills. This will be defined through a departmental ad hoc committee.

3.3.5. Design Courses

Students will take a minimum of two design courses. Unlike the ABET Civil Engineering criterion related to design, the Environmental Engineering criterion does not require design in two different contexts, but the AAEES Commentary states that “the breadth of the design experiences across the curriculum should reflect the breadth of the environmental engineering discipline”. All students will take ENVENG 3210, and they will be required to take at least one additional design course; an example listing based on current courses is provided in Table 4. As indicated in the table footnotes, some of these courses may require course change requests, which we will submit to CCAA after approval of this curriculum proposal if we decide to convert any such that the satisfy the requirements for a design class outlined below.

Table 4. Proposed design electives for the new Environmental Engineering curriculum.

Course Number	Course Title
CIVILEN 5220	Open Channel Hydraulics
ENVENG 5760	Design of Urban Stormwater Control Measures
ENVENG 5410	Hazardous Waste Management and Remediation
ENVENG 5210	Advanced Physical Chemical Treatment Processes
ENVENG 5195	Engineering Design for Environmental Health*
CBE 5771	Air Pollution [#]
CIVILEN 4210	Physics of Sustainable Buildings*
ENVENG 5xxx	Advanced Wastewater Treatment Processes [§]
ENVENG 4090.0x	Environmental Engineering Capstone Design [%]

*Indicates a course that would need to be redesigned to satisfy design criteria

[#]Indicates a course that would need to be revived

[§]Indicates a course that would need to be developed

[%]Indicates that students would have the opportunity to complete both Capstone courses. One would satisfy ABET requirements to complete a Capstone course, while the other would satisfy the design course requirements – however, a student could not double-count a single Capstone course in both categories.

We identified a subset of our curricular proficiencies that should be met by any design course; these are noted in Appendix A. Design courses beyond the minimum requirement will be options as elective courses.

The ABET criterion related to design requires the curriculum to include “constraints [including] a minimum of the following five considerations: risk, uncertainty, sustainability, life-cycle principles, and environmental impacts...” The design experience should meet the following criteria (adopted from the more-comprehensive ASCE commentary on ABET):

- 1) Include both analysis (the application of engineering tools and principles to predict performance) and synthesis (the creation of something new)

- 2) Include iterations
- 3) Require solutions to ill-defined and/or open-ended problems
- 4) Apply engineering standards and realistic constraints
- 5) Involve multi-disciplinary teams

Items 1) – 4) should be met by any design course, but item 5) is only required for Capstone courses.

As a committee, we propose an additional list of criteria that design courses should meet:

- 1) A design course should include content related to risk and uncertainty.
- 2) A design course should include the use of appropriate computational tools. We unanimously agree that computer-based calculations are an important aspect of student learning for the design process. The choice of these tools is up to the instructor and may include:
 - a. Design software (e.g., HydroCAD); or
 - b. Parametric-based design in Excel, Matlab, or similar
- 3) The inclusion of visualization in the design. While this could be, e.g., AutoCAD or SolidWorks, it could take the form of hand sketches or GIS-based efforts. 4000-level and above courses should use some computer-aided visualization approaches.
- 4) Design courses should include an individual project deliverable with a written component.
 - a. This written component should meet a consistent writing objective across all design courses. This will be defined through a departmental ad hoc committee.
 - b. The written component should include discussion of at least:
 - i. Standards that were incorporated into the design.
 - ii. Constraints related to risk, uncertainty, sustainability, life-cycle principles, and environmental impacts.
 - iii. Sequencing, specifications, and/or tolerances.

We advise against team projects in these courses, because not all students will be responsible for all aspects of the projects. While oral communication is important, we should cover this elsewhere (e.g., with presentation deliverables in other courses).

3.4. Elective Courses

The proposed elective structure is designed to provide students with flexibility, allowing for the opportunity to pursue additional courses within the department and elsewhere. There are three categories of electives presented here (excluding the earth science electives, foundational electives, and design electives discussed previously): technical electives (Section 3.4.1), which provide technical depth or breadth within different areas of environmental engineering or environmental science; breadth electives (Section 3.4.2), which provide complementary technical or professional training to environmental engineering; and data analysis electives, which support our emphasis on data analysis within the curriculum (Section 3.4.3). There are no curricular proficiency requirements for elective courses.

There are six elective courses included in the proposed Environmental Engineering curriculum. Of these, students are required take between 1-2 breadth electives along with 1 data analysis elective. The balance (3-4 courses) must be technical electives. All earth science, foundational, and data analysis electives will be included in the list of breadth electives to provide additional opportunities to take these courses. Students will be required to take at least one elective course in an Engineering discipline.

A full preliminary list of technical and breadth electives are provided in Appendix C; these are thematically grouped in the table within this appendix to aid in student decision-making, but there is no requirement to take courses across the groupings. The preliminary data science elective list is provided in Section 3.4.3.

This list will be maintained by the departmental Undergraduate Studies Committee, and any updates to the list will be shared with CCAA for review.

3.4.1. Technical Electives

Technical electives provide depth or breadth in the field of environmental engineering or environmental science. Many of the technical electives are either CIVILEN or ENVENG courses (including those not taken to satisfy requirements above), but we also include courses from other engineering disciplines (e.g., FABENG), natural sciences (e.g., ATMOSSC, EARTHSC, ENR), and life sciences (e.g., MICRBIO). Undergraduate research (e.g., ENVENG 4998) will be considered as a technical elective, because this experience will require students to apply their technical knowledge to address a research question. The list of relevant courses will be maintained by the departmental Undergraduate Studies Committee.

3.4.2. Breadth Electives

Breadth electives complement environmental engineering and science, and they may be technical or non-technical courses. As such, the proposed list includes courses related to (construction) management, planning, policy, and public health. Some of these breadth courses may overlap with General Education requirements (Section 3.6) and may facilitate the completion of undergraduate minors. Internships (e.g., CIVILEN 4191) will be considered to be a breadth elective; while students will apply some of their technical knowledge during this experience, they will gain professional skills that advance their career development. A list of breadth electives will be provided upon its completion; as with other lists, this will be maintained by the departmental Undergraduate Studies Committee.

3.4.3. Data Science Elective

An elective related to data science supports our emphasis on data analysis within the proposed curriculum. We have not identified any specific learning outcomes for this elective, but the listed courses focus on applications (e.g., geospatial analysis, remote sensing, machine learning). We acknowledge that this list may expand within the near future, as additional data-science-related courses, which are accessible to our students, are likely to become available.

Table 5. Initial proposed Data Science electives for the new Environmental Engineering curriculum.

Course Number	Course Title
CIVILEN 5400 GEOG 5210	Introduction to GIS OR Fundamentals of Geographic Information Systems
CIVILEN 5420 EARTHSC 5310 GEOG 5225	Remote Sensing of Environment OR Remote Sensing in the Earth Sciences OR Geographic Applications of Remote Sensing
EARTHSC 5641	Geostatistics
EARTHSC 5757	Artificial Intelligence in Earth Sciences
CSE 5052	Survey of Artificial Intelligence for Non-Majors
GEOG 4103 GEOG 5103	Introductory Spatial Data Analysis OR Intermediate Spatial Data Analysis

3.5. Capstone

ENVENG 4090 (Environmental Engineering Capstone Design) satisfies the ABET Program Criterion for a “culminating major engineering design experience”. A change is currently in process to create two sections of this course, with different pre-requisites, based on the focus of each course; this update will

occur independently from this curriculum proposal. Traditionally, the Autumn offering has projects within the area of water resources, while the Spring offering has projects within the area of water treatment.

3.6. General Education

All our students must complete the University's general education requirements.

3.6.1. Bookends

Students are required to take two seminars as part of the general education requirements. The launch seminar (GENED 1201) enables students to define academic and career goals and provides guidance through the general education requirements. The reflection seminar is a culminating experience that enables students to demonstrate their growth across their academic career. This is embedded within the Environmental Engineering Capstone course.

3.6.2. Foundations

Students must take courses in seven Foundation categories. These include the following, along with pathways to meet each category:

- 1) Historical or cultural studies: student choice
- 2) Literary, visual, and performing arts: student choice
- 3) Mathematical and quantitative reasoning or data analysis: MATH 1151
- 4) Natural sciences: PHYSICS 1250
- 5) Race, ethnicity, and gender diversity: student choice
- 6) Social and behavioral sciences: student choice
- 7) Writing and information literacy: ENGR 1300

MATH 1151 and PHYSICS 1250 are requirements for both ABET and the College of Engineering. We propose that ENGR 1300 (Introduction to Writing for STEM) be added as a “major-foundational” course to provide our students with training on writing within an appropriate context.[§] This requirement of ENGR 1300 was already approved in the current Environmental Engineering curriculum by CAA in Spring 2024.

3.6.3. Themes

Students must take 4 – 6 credit hours in two thematic areas:

- 1) Citizenship for a Diverse and Just World
- 2) One additional theme:
 - a. Health and Well-Being
 - b. Lived Environments
 - c. Migration, Mobility, Immobility
 - d. Number, Nature, Mind
 - e. Origins and Evolution
 - f. Sustainability
 - g. Traditions, Cultures, and Transformations

[§] Incoming students with course credit for ENGL 1110: First-Year English Composition are excluded from taking ENGR 1300. In the new Civil Engineering curriculum, we have approved ENGR 2301: Exploring Citizenship in Engineering: Integrative Designation. However, this substitution has led to its own issues, and we have identified ENGLISH 3305: Technical Writing as another option. We are still exploring other options for potential *technical writing* course substitutions.

Some earth science electives (Section 3.1.4) and some breadth electives (Section 3.4.2) are classified as Theme courses; thus, if a student opts to take one of these courses, it may count towards both requirements.

3.6.4. Embedded Literacies

There are three additional requirements for the general education program that are outside of the Bookends, Foundations, and Themes: data analysis; advanced writing; and technology. These competencies must be embedded within the major programs.

3.6.4.1. Data Analysis

Our students will meet all data analysis embedded literacies through the combination of STAT 3470, laboratory courses (e.g., CIVILEN 3160, ENVENG 4200), and the requirement to complete a Data Science elective.

3.6.4.2. Advanced Writing

Our students will meet all advanced writing embedded literacies through the technical writing content embedded within the proposed curriculum. This includes ENGR 1300, CIVILEN 2001, laboratory courses, design courses, and Capstone.

3.6.4.3. Technology and Society

Our students will meet all technology and society embedded literacies through a sequence of required courses: CIVILEN 2001, CIVILEN 3080, and ENVENG 5170, as well as design courses and Capstone.

3.7. Artificial Intelligence (AI) Fluency

Similar to the General Education program, our students will achieve the AI Fluency Learning Outcomes put forth by the Provost's Office. While we have submitted our responses through the AI Fluency Roadmap Templates, the exact plan is largely incomplete as we have limited AI content within our current curriculum. Further, we require additional time to have conversations both with the department's External Advisory Board and with our broader alumni base to understand how AI is emerging within Environmental Engineering practice.

4. Example Curriculum Sheet

The figure below provides a visual example of how the proposed structure fits together. We have been intentional to avoid overloading a single semester with 18 credit hours of STEM coursework in this guide. We anticipate that this example curriculum sheet represents a "generic" pathway through the major; student interests will drive different pathways.

Further, the various electives within the proposed curriculum (e.g., Foundational, Earth Science, Data Science) enable flexibility with regards to when a student may take these courses. However, some of these courses are pre-requisites for Technical or Breadth Electives, so we will work with our departmental academic advisors to remind students to pay attention to necessary pre-requisite chains.

				Total hours: 130			
Autumn				Spring			Categories
	Number	Name	Hours	Number	Name	Hours	
1	ENGR 1100	Engineering Survey	1	CIVILEN 2001	Introduction to Infrastructure	3	ABET M/S
	ENGR 1181	Fundamentals of Engineering 1	2	ENGR 1182	Fundamentals of Engineering 2	2	Foundational
	ENGR 1300	Intro. to STEM writing	3	MATH 1172	Engineering Math A	5	Advanced core
	MATH 1151	Calculus I	5	CHEM 1210	General Chemistry I	5	Gen. Ed.
	PHYSICS 1250	Mechanics, Work, and Energy	5	MECHENG 2010	Statics	2	
		Gen Ed - Opening Bookend	1				
	Semester hours:		17	Semester hours:		17	
2	CHEM 1220	General Chemistry II	5	CIVILEN 3080	Engineering Decision-Making	3	
	MATH 2173	Engineering Math B	3	ENGR 1221	Programming in MATLAB	2	
	CIVILEN 3130	Fluid Mechanics	3	ENVENG 3200	Fund. Env. Eng.	3	
	STAT 3470.0x	Intro. Prob. Stat. for Engineers	3	MATH 2174	Lin. Alg. and Diff. Eq.	3	
		Gen Ed - Foundation	3		Gen Ed - Foundation	3	
		Semester hours:		17	Semester hours:		17
3	CIVILEN 3160	Water Resources Engineering	3	ENVENG 3210	Unit Operations	3	
	ENVENG 4400	Fate and Transport	3	ENVENG 5170	Sustainability Circ. Econ.	3	
	ENVENG 5110	Bioprocesses	3		Earth Science Elective	3	
		Gen Ed - Foundation	3		Gen Ed - Foundation	3	
		Data Science Elective	3		Foundational Elective	3	
		Semester hours:		15	Semester hours:		15
4	ENVENG 4200	Environmental Engineering Lab	3	ENVENG 4090.0x	ENVENG Capstone	3	
		Gen Ed - Theme	4		Gen Ed - Theme	4	
		ENVENG Design Elective	3		Technical Elective	3	
		Technical Elective	3		Technical Elective	3	
		Breadth Elective	3		Breadth Elective	3	
		Semester hours:		16	Semester hours:		16

Figure 1. Sample sequence of courses for the proposed curriculum.

5. Next Steps

If the proposed structure is approved, the next steps are as follows:

1. Present the proposed lists of the Technical, Breadth, and Data Science Electives to the full faculty for discussion and a vote, following the protocol applied to the current curriculum.
2. Develop implementation strategies for proficiency assessment.
3. Discuss course-specific modifications with the instructor(s) beyond the course change proposals appended to this curriculum change proposal, if needed.

6. Thematic Threads through the Curriculum

Throughout the curriculum, we have identified the following cross-cutting threads spanning different themes. These threads will satisfy some combination of ABET Program Criteria, ABET Student Outcomes, and the vision of the Department Chair and/or Undergraduate Curriculum Renewal Committee – each are important for the Civil Engineering of the future.

Table 6. Summary of cross-cutting thematic threads across the proposed curriculum.

Writing	Licensure	Ethics	Sustainability, Risk, Uncertainty, Resilience	Societal Implications
ENGR 1300	CIVILEN 2001	CIVILEN 2001	CIVILEN 2001	Gen. Ed.
CIVILEN 2001	ENVENG 3200	CIVILEN 3080	CIVILEN 3080	CIVILEN 2001
Lab courses	Design courses	ENVENG 3200	ENVENG 3200	CIVILEN 3080
Design courses	Capstone	Design courses	ENVENG 5170	ENVENG 5170
Capstone		Capstone	Design courses	Capstone
			Capstone	

Appendix A: Proficiency Mapping

The following table summarizes the curricular Goals, Outcomes, and Proficiencies and the courses within the Environmental Engineering curriculum that will be used in assessment. We have not yet populated this list, as a current undertaking of the departmental Undergraduate Studies Committee is to review and reassess these proficiencies through the lens of curriculum implementation in the context of the new Civil Engineering program. These proficiencies are internal to the department, as a metric to assess our curricula.

This list of courses differs from the new Civil Engineering curriculum as we do not have categories in which students can make a choice; rather, we specify a common set of courses for all students. We have yet to map proficiencies to these courses, as several will undergo redesign as part of the proposed curricular revision process.

Courses to be used in proficiency assessment include:

- CIVILEN 2001
- CIVILEN 3080
- CIVILEN 3130
- CIVILEN 3160
- ENVENG 3200
- ENVENG 3210
- ENVENG 4200
- ENVENG 4400
- ENVENG 5110
- ENVENG 5170
- Capstone (ENVENG 4090)

In the following table, for brevity, CIVILEN courses are preceded with a “C”, and ENVENG courses are preceded with an “E” (e.g., ENVENG 3200 is represented as E3200).

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
<u>A. Civil and Environmental Engineering Tools and Techniques</u>												
Goal: Students will be familiar and approaching proficiency with state-of-the-art protocols, modeling/simulation platforms, data analysis, numerical methods and physical experimentation used in civil and environmental engineering analysis and design.												
Outcomes: Students will be able to:												
<i>1. Apply branch-specific tools and techniques to address engineering concerns</i>												
(a) Explain the underlying theory, operating principle and proper application of a particular tool												
(b) Define the conditions under which a certain tool will apply and the limits of its applicability												
(c) Recognize the differences between controlled lab or desktop experiments and real-world measurements												

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
(d) Utilize appropriate data collection and preparation techniques												
(f) Utilize appropriate analytical and computational methods												
(g) Analyze and interpret experimental and/or computational results												
(h) Apply experimental or computational output to satisfy design and compliance criteria												
<i>2. Combine multiple tools or techniques in analysis and design</i>												
(a) Apply a combination of tools and techniques to a particular design problem												
(b) Synthesize the output of multiple tools / techniques to solve a design problem												
<u>B. Application of Knowledge and Skills to Problem Solving in Civil and Environmental Engineering</u>												
<i>1. Identify and locate information necessary to set up engineering problems</i>												

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
(a) List applicable governing codes, standards, zoning and/or legal/ethical framework												
(b) Identify boundary conditions, loads, inputs, data, assumptions and/or design criteria												
(c) Identify the context surrounding a problem (e.g., information from other disciplines, team members, and stakeholders)												
<i>2. Solve and analyze solutions to engineering problems</i>												
(a) Apply codes, regulations, standards or protocols												
(b) Check solution satisfies constraints and client needs, troubleshoot problems, and iterate as necessary												
(c) Incorporate risk, reliability, and uncertainty analyses as needed												
<u>C. Professionalism and Professional Development in Civil and Environmental Engineering</u>												

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
Goal: Students will be resilient, skilled in collaboration, and exhibit professionalism necessary for success in their careers.												
Outcomes: The successful student will be able to:												
<i>1. Successfully execute a project as a member of a team.</i>												
(a) As an individual, contribute to the success of a team (e.g., communicate effectively with team members; demonstrate leadership when appropriate; identify individual strengths and growth areas)												
(b) As a team, conduct work cohesively (e.g., accept/adjust to feedback; demonstrate willingness to consider everyone's ideas; identify the distribution of tasks, knowledge, and skills; maintain organization)												
(c) Explain the value of having diverse teams, comprised of individuals with different backgrounds and perspectives												

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
<i>2. Describe how engineers contribute to the acquisition, budgeting and follow-through of engineering contracts.</i>												
(a) Provide proper estimates of fees and time required for engineering services they will perform												
(b) Develop and understand the proposal process in obtaining work												
<i>3. Recognize the importance of staying current with professional practice, obtaining licensure or other credentials, and finding resources to continue life-long learning.</i>												
(a) Identify the importance, benefits, and limitations of professional licensure or certifications in civil and environmental engineering												
(b) List the requirements for maintaining technical knowledge required for professional licensure												

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
(c) Identify opportunities, and the need for, participation in post-graduate engineering training (e.g., ASCE Short Courses)												
(d) Identify the need and limitation of engineering certifications and licensure for specific tasks and roles in civil and environmental works and projects (I-4)												
<i>5. Understand the broader social, economic, ethical, and political context in which engineering decisions are made.</i>												
(a) Identify how societal context may impact project goals and outcomes												
(b) Explain the sustainability consequences of engineering designs												
(c) Describe the importance of ethics in engineering												
<u>D. Communication in Civil and Environmental Engineering:</u>												

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
Goal: Students will be able to communicate civil and environmental engineering concepts effectively, both orally, visually, and in writing, to a range of audiences.												
Outcomes: Students will be able to:												
<i>1. Effectively utilize a variety of communication modes</i>												
(a) Present data and information in plots and figures effectively												
(b) Create a visually effective presentation to accompany an oral presentation												
(c) Speak effectively in public												
(d) Document, present and discuss technical content in written format												
(e) Develop personal professional documents, such as resumes and cover letters												
(f) Communicate through informal communication media (email, verbally in meetings, communication with colleagues and co-workers, “elevator” pitch)												

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
(g) Communicate as a team, with a unified vision and goal												
<i>2. Tailor communication to a variety of audiences</i>												
(a) Discuss civil (environmental) engineering concepts, tools, and processes with other professionals												
(b) Explain civil (environmental) engineering concepts and tools with an audience of non-experts												
<i>3. Provide, receive, and respond to feedback</i>												
(a) Provide helpful feedback in a professional manner												
(b) React appropriately to, and integrate feedback from, various sources												
<u>E. Civil and Environmental Engineering Professional Identity:</u>												
Goal: Students will develop an identity within the fields of civil and environmental engineering.												
Outcomes: Students will be able to:												

Goal / Outcome / Proficiency	Total	C2001	C3080	C3130	C3160	E3200	E3210	E4200	E4400	E5110	E5170	Capstone
<i>1. Articulate the roles that civil and environmental engineers play in society</i>												
(a) Explain the role of infrastructure in the public and private domain												
(b) Develop an understanding of the career paths and job market trends for Civil and Environmental Engineers												
(c) Describe the consequence on public safety and trust of civil and environmental engineering success and failure												
<i>2. Discern among the technical specialties within Civil and Environmental Engineering</i>												
(a) Identify types of problems specific to the field of civil and environmental engineering												
(b) Identify the specialties needed for specific projects within the fields of civil and environmental engineering												
(c) Discern the roles and responsibilities of civil or environmental engineers from those of other project contributors												

Appendix B: ABET Program Criteria

The following table demonstrates how the new curriculum will satisfy ABET Program Criteria. We subdivide the program criterion related to “advanced principles and practices relevant to the program objectives” into categories related to the five NASEM Grand Challenges. This does not include the large number of elective courses, most of which would satisfy at least one NASEM Grand Challenge.

ABET Program Criterion	Foundational	Fundamental	Advanced Core
Formulate material and energy balances	CIVILEN 3130	ENVENG 3200 ENVENG 4400	CIVILEN 3160 ENVENG 3210 ENVENG 5170
Fate and transport in and between air, water, and soil		ENVENG 4400	
<i>Interactions with biota in these media*</i>	ENVENG 5110		
Lab experiments, data analysis, and interpretation			
<i>Water</i>			CIVILEN 3160 ^{\$} ENVENG 4200 ^{\$}
<i>Land</i>			@
<i>Air</i>			ENVENG 4200
<i>Environmental health</i>			
Design of environmental engineering systems with consideration of:			ENVENG 3210 Design elective ENVENG 4090 [^]
<i>Risk, uncertainty</i>			ENVENG 3210 Design elective ENVENG 4090 [^] ENVENG 5170 [#]
<i>Sustainability and life-cycle thinking</i>			ENVENG 3210 Design elective ENVENG 4090 [^] ENVENG 5170 [#]
<i>Environmental impacts</i>			ENVENG 3210 Design elective ENVENG 4090 [^] ENVENG 5170 [#]
Use of computational tools in design*			ENVENG 3210 Design elective ENVENG 4090
Advanced principles and practices			
<i>Sustainably supply food, water, and energy</i>	ENVENG 5110	ENVENG 3200 ENVENG 4400	CIVILEN 3160 ENVENG 3210 ENVENG 5170
<i>Curb climate change and adapt to its impacts</i>		ENVENG 3200 ENVENG 4400	CIVILEN 3160

ABET Program Criterion	Foundational	Fundamental	Advanced Core
<i>Design a future without pollution or waste</i>	ENVENG 5110	ENVENG 3200 ENVENG 4400	ENVENG 3210 ENVENG 5170
<i>Create efficient, healthy, resilient cities</i>		ENVENG 3200	ENVENG 3210 ENVENG 5170
<i>Foster informed decisions and actions</i>	CIVILEN 2001 CIVILEN 3080	ENVENG 3200	ENVENG 5170
Professional practice and project management	CIVILEN 2001		ENVENG 4090^ ENVENG 4200
Environmental policy and regulations (protection and improvement of the environment*)	CIVILEN 2001	ENVENG 3200	ENVENG 4090^
Application of economics and ethics in environmental engineering*	CIVILEN 2001 CIVILEN 3080	ENVENG 3200	ENVENG 5170

*We acknowledge this as a proposed change to the ABET Program Criteria for Environmental Engineering (see <https://www.abet.org/accreditation/accreditation-criteria/proposed-changes/>). We will ensure that, if approved, ENVENG 5110 will address the criterion related to interactions with biota in air, water, and soil. The use of some computational tool within a design course is one of the criteria outlined for a Design Course (see Section 3.3.5). We currently address the proposed change of “roles and responsibilities of public institutions and private organizations pertaining to the protection and improvement of the environment, and applications of economics and ethics in environmental engineering” in existing courses.

§CIVILEN 3160 contains laboratory experiments related to water transport (e.g., open channel flow, hydrology), while ENVENG 4200 contains laboratory experiments related to water treatment (e.g., coagulation/flocculation, disinfection).

@In our redesign of ENVENG 4200, we may add laboratory experiments related to soil. The ABET requirement is for students to conduct laboratory experiments in “more than one major environmental engineering focus area, e.g., air, water, land, environmental health”, so even if we do not include an experiment in this context, we will still satisfy the ABET requirement through the other media.

^For formatting purposes, we include ENVENG 4090 in the category of Advanced Core courses within this table.

#While not a design course, ENVENG 5170 supports students’ ability to consider risk, uncertain, sustainability, life-cycle thinking, and environmental impacts.

Appendix C: Preliminary Elective Lists

Our initial list of elective courses is provided below. The categories are intended to indicate thematic groupings to guide students, but they may be subject to change. There is no requirement to take courses across different categories. This list also includes an indication of whether a course is grouped as a technical elective (TE) or breadth elective (BE).

When communicating these options to students, we will include a statement similar to “Note that not all courses may be offered in any given academic year. Further, courses offered outside of CECE may be subject to discontinuation without the department’s notice. Finally, courses on this list may have pre-requisites that must be satisfied, so students should plan accordingly.”

Course Number	Category / Course Title	Tech. Elective (TE) / Breadth Elective (BE)
	Water Resources and Hydrology	
CIVILEN 5220	Open Channel Hydraulics	TE
CIVILEN 5230	Transp. Phenom. for Water Res.	TE
EARTHSC 5206	Advanced Oceanography	BE
EARTHSC 5651	Hydrogeology	TE
EARTHSC 5655	Land Surface Hydrology	TE
ENR 4285	Watershed Hydrology	BE
ENVENG 5760	Urban Stormwater Control Meas.	TE
FABENG 5750	Stream Geomorphology and Watershed Hydrology	TE
	Air Quality and Atmospheric Processes	
ATMOSSC 5950	Atmospheric Thermodynamics	BE
ENVENG 5140	Air Quality Engineering	TE
PUBHEHS 5340	Air Contaminants and Public Health	BE
ATMOSSC 5901	Climate System Modeling: Basics and Applications	BE
GEOG 5900	Weather, Climate, and Global Warming	BE
	Environmental Chemistry and Contaminant Fate	
CBE 3610	Kinetics and Reactor Design	TE
ENR 5262	Environmental Soil Chemistry and Remediation	TE
ENR 5273	Env. Fate and Impact of Contam. in Soil and Water	TE
ENVENG 5210	Adv. Phys. Chem. Treatment Processes	TE
ENVENG 5718	Aquatic Geochemistry	TE
ENVENG 5410	Hazardous Waste Management and Remediation	TE
EARTHSC 5621	Introduction to Geochemistry	BE
	Biological and Ecological Systems	
EEOB 3410	Ecology	BE
FABENG 5310	Ecological Engineering	TE
MICRBIO 4010	Foundations of Microbio. and Human Health	BE

Course Number	Category / Course Title	Tech. Elective (TE) / Breadth Elective (BE)
BIOCHEM 4511	Intro. To Biological Chemistry	TE
EARTHSC 5160	Geomicrobiology	BE
	Public Health and Toxicology	
EARTHSC 5203	Geo-environment and Human Health	BE
ENVENG 5195	Eng. Des. For Public Health	TE
PUBHEHS 3320	Fundamentals of Environ. Health Risk Assessment	BE
PUBHEHS 4340	Mol. Tech. for Environ. Health Sciences	BE
PUBHEHS 5315	Principles of Toxicology	BE
PUBHEPI 2410	Epidemiology in Public Health	BE
PUBHEHS 4325	Climate Change and Public Health	BE
PUBHEHS 3310	Current Issues in Global Environmental Health	BE
	Earth Systems	
EARTHSC 4450	Water, Ice, and Energy in the Earth System	BE
EARTHSC 4911	Earth's Climate: Past and Future	BE
EARTHSC 5268	Soils and Climate Change	BE
EARTHSC 5656	Ecohydrology in a Changing Climate	BE
EARTHSC 5663	Global Change and Sust. in the Earth System	BE
ENVENG 5218	Meas. and Mod. of Climate Change	TE
CIVILEN 3540	Geotechnical Engineering	TE
EARTHSC 5751	Quantitative Reservoir Modeling	BE
ENR 3001	Soil Science Laboratory*	TE
ENR 5261	Environmental Soil Physics	TE
FABENG 5550	Sustainable Waste Management	TE
CIVILEN 5240	Groundwater and Geoenergy Engineering	TE
	Building Systems and Green Infrastructure	
ARCH 5810 CONSYSM 2345	Intro. to Environ., Mech., and Elec. Syst. in Arch. OR Mechanical Systems for Buildings	BE
CIVILEN 4210	Physics of Sustainable Buildings	TE
CONSYSM 5670	Green Building and Sustainable Construction	BE
	Energy Systems	
FABENG 3150	System Dynamics and Electricity	BE
MECHENG 5535	Advanced Topics in Solar Energy Systems	BE
MECHENG 4505	Intro. To Nuclear Science and Engineering	BE
CBE 5200	Intro. To Petroleum Engineering	BE
MECHENG 5500	Sustainable Energy Science and Technology	BE
CRPLAN 5500	Energy Planning	BE

Course Number	Category / Course Title	Tech. Elective (TE) / Breadth Elective (BE)
AEDECON 4320	Energy, the Environment, and the Economy	BE
	Policy, Planning, and Communication	
CRPLAN 3210	Sust. Urban. Planning Policy and Practice	BE
ENR 3200	Env. and Nat. Resources Policy	BE
ENR 4450	Climate Change Policy	BE
ENR 5210	US Env. Impact Assess.	BE
ENR 5211	Int. Env. Impact Assess.	BE
PUBAFRS 2620	Sci., Eng., and Tech. for Policy and ...	BE
PUBAFRS 3000	Public Policy Analysis	BE
PUBAFRS 3500	Public Management	BE
PUBAFRS 5610	Innovation, Policy, and the Global Economy	BE
PUBAFRS 5770	Risk Management and Policy	BE
ENVENG 5600	Science, Engineering, and Public Policy	BE
PUBAFRS 5770	Risk and Decision Analysis	BE
COMM 4240	Science Communication	BE
COMPSTD 2341	Technology, Science, and Society	BE
AEDECON 2500	Intro. To Sustainability	BE
BUSMHR 2210	Personal Leadership and Team Effectiveness	BE
BUSMHR 3211	Leadership and Character	BE
	Humanitarian and Social Dimensions	
FABE 3200S	Engineering for Food Justice	BE
CIVILEN 5610.01	WaSH Infrast. for Developing Rural Communities	TE
CIVILEN 5610.02	Safe Water on Tap	TE
FABENG 3210	Introduction to Humanitarian Engineering	BE
	Other Areas	
CIVILEN 2060	Numerical Analysis for Civil and Environ. Engineers	TE
CIVILEN 2405 CONSYSM 2210	Com. Graphics for Civil Engineers OR Graphic Presentation	BE
CIVILEN 2410 CONSYSM 2440	Intro. to Surveying OR Const. Surveying and Site Development	BE
	Earth Science Electives	
ATMOSSC 2940	Basic Meteorology	BE
EARTHSC 2203	Environmental Geoscience	BE
EARTHSC 2210	Energy, Mineral Resources, and Society	BE
EARTHSC 2911	The Climate Crisis: Mechanisms, Impacts, and Mitigation	BE

Course Number	Category / Course Title	Tech. Elective (TE) / Breadth Elective (BE)
ENR 3000	Soil Science (with or without ENR 3001)	BE
GEOG 2960	Introduction to Physical Geography	BE
	Foundational Electives	
CHEM 2310 CHEM 2510	Introductory Organic Chemistry OR Organic Chemistry I	BE
MECHENG 3500	Engineering Thermal Sciences OR Thermodynamics in FABENG	BE
ECE 2300 ECE 2360	Electrical Circuits and Electronic Devices OR Electronics for CSE Majors	BE
MECHENG 2020	Mechanics of Materials	BE
MECHENG 2030	Dynamics	BE
PHYSICS 1251	E&M, Waves, Optics, Modern Physics	BE
MICRBIO 5155	Environmental Microbiology	BE
	Data Science Electives	
CIVILEN 5400 GEOG 5210	Introduction to GIS OR Fundamentals of Geographic Information Systems	BE
CIVILEN 5420	Remote Sensing of Environment OR	BE
EARTHSC 5310 GEOG 5225	Remote Sensing in the Earth Sciences OR Geographic Applications of Remote Sensing	BE
EARTHSC 5641	Geostatistics	BE
EARTHSC 5757	Artificial Intelligence in Earth Sciences	BE
CSE 5052	Survey of Artificial Intelligence for Non-Majors	BE
GEOG 5103	Intermediate Spatial Data Analysis	BE

*Course must be taken concurrently with ENR 3000 Soil Science, which serves as an Earth Science elective within the proposed curriculum.

Autumn			
	Number	Name	Hours
1	ENGR 1100	Engineering Survey	1
	ENGR 1181	Fundamentals of Engineering 1	2
	ENGR 1300	Intro. to STEM writing	3
	MATH 1151	Calculus I	5
	PHYSICS 1250	Mechanics, Work, and Energy	5
		Gen Ed - Opening Bookend	1
	Semester hours:		17

2	CHEM 1220	General Chemistry II	5
	MATH 2173	Engineering Math B	3
	CIVILEN 3130	Fluid Mechanics	3
	STAT 3470.0x	Intro. Prob. Stat. for Engineers	3
		Gen Ed - Foundation	3
	Semester hours:		17

3	CIVILEN 3160	Water Resources Engineering	3
	ENVENG 4400	Fate and Transport	3
	ENVENG 5110	Bioprocesses	3
		Gen Ed - Foundation	3
		Data Science Elective	3
	Semester hours:		15

4	ENVENG 4200	Environmental Engineering Lab	3
		Gen Ed - Theme	4
		ENVENG Design Elective	3
		Technical Elective	3
		Breadth Elective	3
		Semester hours:	

			Total hours:	130
Spring				
	Number	Name	Hours	
	CIVILEN 2001	Introduction to Infrastructure	3	
	ENGR 1182	Fundamentals of Engineering 2	2	
	MATH 1172	Engineering Math A	5	
	CHEM 1210	General Chemistry I	5	
	MECHENG 2010	Statics	2	
		Semester hours:		17

	CIVILEN 3080	Engineering Decision-Making	3	
	ENGR 1221	Programming in MATLAB	2	
	ENVENG 3200	Fund. Env. Eng.	3	
	MATH 2174	Lin. Alg. and Diff. Eq.	3	
		Gen Ed - Foundation	3	
		Foundational Elective	3	
		Semester hours:		17

	ENVENG 3210	Unit Operations	3	
	ENVENG 5170	Sustainability Circ. Econ.	3	
		Earth Science Elective	3	
		Gen Ed - Foundation	3	
		Foundational Elective	3	
		Semester hours:		15

	ENVENG 4090.0x	ENVENG Capstone	3	
		Gen Ed - Theme	4	
		Technical Elective	3	
		Technical Elective	3	
		Breadth Elective	3	
		Semester hours:		16

Categories
ABET M/S
Foundational
Fundamental
Advanced core
Gen. Ed.

Mapping of Current and Proposed Curricula for the Environmental Engineering Program

Course	Current Curriculum	Proposed Curriculum	Notes
GE Launch Seminar	Gen. Ed.	Gen. Ed.	
Foundations: Writing and Information Literacy	Gen. Ed.	Gen. Ed.	
Foundations: Mathematical & Quantitative Reasoning/Data Analysis	Gen. Ed.	Gen. Ed.	
Foundations: Literary, Visual and Performing Arts	Gen. Ed.	Gen. Ed.	
Foundations: Historical & Cultural Studies	Gen. Ed.	Gen. Ed.	
Foundations: Natural Science	Gen. Ed.	Gen. Ed.	
Foundations: Social & Behavioral Sciences	Gen. Ed.	Gen. Ed.	
Foundations: Race, Ethnic and Gender Diversity	Gen. Ed.	Gen. Ed.	
Theme: Citizenship for a Diverse & Just World b	Gen. Ed.	Gen. Ed.	
Theme: Student Choice	Gen. Ed.	Gen. Ed.	
GE Reflection	Gen. Ed.	Gen. Ed.	
MATH 1151	College Req.	College Req.	
MATH 1172	College Req.	College Req.	
PHYSICS 1250	College Req.	College Req.	
ENGR 1181.0x (or equivalent)	College Req.	College Req.	
ENGR 1182.0x (or equivalent)	College Req.	College Req.	
ENGR 1100.0x	College Req.	College Req.	
ENVENG 5140	Major Core	Technical Elective	
CIVILEN 2001	Major Core	Major Core	
CIVILEN 2050	Major Core	Course discontinued	Substitute for STAT 3470 in transition plan
CIVILEN 2060	Major Core	Technical Elective	
CIVILEN 2090	Major Core	Course discontinued	Technical elective in transition plan
CIVILEN 3080	Major Core	Major Core	

Mapping of Current and Proposed Curricula for the Environmental Engineering Program

Course	Current Curriculum	Proposed Curriculum	Notes
CIVILEN 3130	Major Core	Major Core	
CIVILEN 3160	Major Core	Major Core	
ENVENG 2100	Major Core	Course discontinued	Substitute for ENVENG 4400 in transition plan
ENVENG 3200	Major Core	Major Core	
ENVENG 3210	Major Core	Major Core	
ENVENG 4200	Major Core	Major Core	
ENVENG 5110	Major Core	Major Core	
ENVENG 5170	Major Core	Major Core	
ENVENG 4090	Major Core	Major Core	
CHEM 1210	Req. Non-Major	Req. Non-Major	
CHEM 1220	Req. Non-Major	Req. Non-Major	
CHEM 2510	Req. Non-Major	Foundational Elective	
ENGR 1221	Req. Non-Major	Req. Non-Major	
ENGR 1300	Req. Non-Major	Req. Non-Major	Alternates includes ENGR 2301 and ENGLISH 3305, if ENGLISH 1110 exclusion applies
MATH 2177	Req. Non-Major	Not applicable	Substitute for MATH 2173 + 2174 in transition plan
MECHENG 2040	Req. Non-Major	Req. Non-Major	Substitute for MECHENG 2010
MICROBIO 4000.0x	Req. Non-Major	Not applicable	Technical elective in transition plan
EARTHSCI 1121 & 1200 OR ENR 3000 & 3001	Req. Non-Major	Earth Science Elective	EARTHSC 1121 & 1200 are only applicable in transition plan

Bachelor of Science Major: Environmental Engineering

Students in this major will complete a minimum of 130 hours outlined as follows.

General Education Requirements		
Requirement	Course Options	Hours
GE Launch Seminar	GenEd 1201	1
Foundations: Writing and Information Literacy	Student Choice	0-3
Foundations: Mathematical & Quantitative Reasoning/Data Analysis	Student Choice*	0-5
Foundations: Literary, Visual and Performing Arts	Student Choice	3
Foundations: Historical & Cultural Studies	Student Choice	3
Foundations: Natural Science	Student Choice*	0-5
Foundations: Social & Behavioral Sciences	Student Choice	3
Foundations: Race, Ethnic and Gender Diversity	Student Choice	3
Theme: Citizenship for a Diverse & Just World ^b	Student Choice**	4
Theme: Student Choice	Student Choice	4
GE Reflection	Capstone***	Embedded into Major Core Capstone
Total		21-34
If must take ENGR 2301.0x due to ENGR 1300 English 1110 exclusion		20-30**

College / Degree Requirements ^{a, b}		
Requirement	Course Options	Hours
MATH 1151*, 1172* (Math & Quantitative Reasoning / Data Analysis)		10
PHYSICS 1250* (Nat Sci)		5
ENGR 1181.0x, 1182.0x		4
ENGR 1100.0x		1
Total		20

Major Coursework		
Course	Title	Hours
Major Core		
CIVILEN 2001	Introduction to Infrastructure	3
CIVILEN 3080	Economic Evaluation and Optimization in Civil and Environmental Engineering	3
CIVILEN 3130	Fluid Mechanics	3
CIVILEN 3160	Water Resources Engineering	3
ENVENG 3200	Fundamentals of Environmental Engineering	3
ENVENG 3210	Environmental Engineering Unit Operations	3
ENVENG 4200	Environmental Engineering Unit Operations Lab	3
ENVENG 4400	Integrated Environmental Chemical Fate and Transport	3
ENVENG 5110	Environmental Engineering Bioprocesses	3
ENVENG 5170	Sustainability and Pollution Prevention Practices	3
Design Elective		3
ENVENG 4090.0x***	Environmental Engineering Capstone Design	3
Total		26

Required Non-Major General Courses		
CHEM 1210	General Chemistry I	5
CHEM 1220	General Chemistry II	5
ENGR 1221	Introduction to Computer Programming in MATLAB for Engineers and Scientists	2
ENGR 1300 (2301.0x (4) OR ENGLISH 3305 (3) only if English 1110 exclusion applies) ****	Technical Writing for STEM	3-4
MATH 2173	Engineering Math B	3
MATH 2174	Linear Algebra and Differential Equations	3
MECHENG 2010	Statics	2
STAT 3470.0x	Introduction to Probability and Statistics for Engineers	3
Total		26
If ENGR 2301 taken due to English 1110 exclusion		27****
Required Technical / Directed / Targeted Electives; Career Courses		
Technical Electives		Total 0-12
Breadth Electives		Total 3-6
Foundational Electives		Total 6-9
Earth Science Elective		Total 3-4
Data Science Elective		Total 3

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Dynamic Earth OR Soil Science

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Effective Term: Autumn 2027

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General Education with & w/out ENGLISH 1110 exclusion	21-34	20-34**
College / Degree Requirements	20	20
Major Core	26	26
Required Non-Major with & w/out ENGLISH 1110 exclusion	26	26-27***
Required Technical / Directed / Targeted Electives; Career Courses	27	27
Minimum Total Credit Hours for Degree	130	130

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Bachelor of Science Major: Environmental Engineering

Students in this major will complete a minimum of 130 hours outlined as follows.

General Education Requirements		
Requirement	Course Options	Hours
GE Launch Seminar	GenEd 1201	1
Foundations: Writing and Information Literacy	<i>Student Choice</i>	0-3
Foundations: Mathematical & Quantitative Reasoning/Data Analysis	<i>Student Choice*</i>	0-5
Foundations: Literary, Visual and Performing Arts	<i>Student Choice</i>	3
Foundations: Historical & Cultural Studies	<i>Student Choice</i>	3
Foundations: Natural Science	<i>Student Choice*</i>	0-5
Foundations: Social & Behavioral Sciences	<i>Student Choice</i>	3
Foundations: Race, Ethnic and Gender Diversity	<i>Student Choice</i>	3
Theme: Citizenship for a Diverse & Just World ^b	<i>Student Choice**</i>	4
Theme: Student Choice	<i>Student Choice</i>	4
GE Reflection	Capstone***	Embedded into Major Core Capstone
Total		21-34
If must take ENGR 2301 due to ENGR 1300 English 1110 exclusion		20-30**

College / Degree Requirements ^{a, b}		
Requirement	Course Options	Hours
MATH 1151*, 1172*, (Math & Quantitative Reasoning / Data Analysis)		10
PHYSICS 1250* (Nat Sci)		5
ENGR 1181.0x, 1182.0x		4
ENGR 1100.0x		1
Total		20

Major Coursework		
Course	Title	Hours
Major Core		
ENVENG 5140	Air Quality Engineering	3
CIVILEN 2001	Introduction to Infrastructure	3
CIVILEN 2050	Probabilistic Applications and Data Interpretation in Civil and Environmental Engineering	3
CIVILEN 2060	Numerical Analysis Methods	4
CIVILEN 2090	Professional Aspects of Civil and Environmental Engineering	1
CIVILEN 3080	Economic Evaluation and Optimization in Civil and Environmental Engineering	3
CIVILEN 3130	Fluid Mechanics	3
CIVILEN 3160	Water Resources Engineering	3
ENVENG 2100	Environmental Engineering Analytical Methods	3
ENVENG 3200	Fundamentals of Environmental Engineering	3
ENVENG 3210	Environmental Engineering Unit Operations	3
ENVENG 4200	Environmental Engineering Unit Operations Lab	1
ENVENG 5110	Environmental Engineering Bioprocesses	3
ENVENG 5170	Sustainability and Pollution Prevention Practices	3
ENVENG 4090***	Environmental Engineering Capstone Design	3
Total		42

Required Non-Major General Courses		
Course	Title	Hours
CHEM 1210	General Chemistry I	5
CHEM 1220	General Chemistry II	5
CHEM 2510	Organic Chemistry	4
ENGR 1221	Introduction to Computer Programming in MATLAB for Engineers and Scientists	2
ENGR 1300 (2301 (4) <i>only if English 1110 exclusion applies</i>)****	Technical Writing for STEM	3
MATH 2177	Math Topics for Engineers	4
MECHENG 2040	Statics and Introduction to Mechanics of Materials	4
MICROBIO 4000.0x	Microbiology	4
EARTHSCI 1121 & 1200 OR ENR 3000 & 3001	Dynamic Earth OR Soil Science	4
Total		35

If ENGR 2301 taken due to English 1110 exclusion		36****
Required Technical / Directed / Targeted Electives; Career Courses		
Technical Electives	Total	12

General Education with & w/out ENGLISH 1110 exclusion	21-34	20-34**
College / Degree Requirements	20	20
Major Core	42	42
Required Non-Major with & w/out ENGLISH 1110 exclusion	35	36****
Required Technical / Directed / Targeted Electives; Career Courses	12	12
Minimum Total Credit Hours for Degree	130	130