Michigan Tech

Office Memo

Office of the Provost and
Senior Vice President for Academic Affairs

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TO: Richard Koubek, President

FROM: Andrew Storer, Provost & Senior Vice President for Academic Affairs

DATE: April 15, 2025

SUBJECT: Senate Proposal 16-25

Attached is Senate proposal 16-25, “Bachelor of Science in Ecological Engineering,” and a memo stating the Senate passed this proposal at their March 27, 2025 meeting. In the administration’s initial response dated April 3, 2025 additional information related to the delivery of courses was requested. The department has addressed the request, and I recommend approving the proposal.

If you concur with my recommendation, the provost’s office will seek the following approvals.

X Board of Trustees
X Michigan Association of State Universities (MASU)
X Higher Learning Commission (HLC); screening required for all degree programs as well certificates

Programs cannot be fully advertised until all noted approvals are obtained. Once Board of Trustees approval has been granted, limited advertising to make prospective students aware of the planned program may be conducted so long as any outstanding regulatory approvals are noted, e.g., "pending state and Higher Learning Commission approval".

I concur X do not concur _____ with the provost’s recommendation as stated in this memo.

Richard Koubek, President

4/16/25
Date

University Senate

Michigan Tech

DATE:	March 27, 2025
TO:	Richard Koubek, President
FROM:	Robert Hutchinson, University Senate President
SUBJECT:	Proposal 16-25
COPIES:	Andrew Storer, Provost & Senior VP for Academic Affairs

At its meeting on March 27, 2025, the University Senate approved Proposal 16-25, "Bachelor of Science in Ecological Engineering." Feel free to contact me if you have any questions.

The University Senate of Michigan Technological University

Proposal 16-25

Bachelor of Science in Ecological Engineering

Basic Program Information

Primary Contacts: Audra Morse, Chair, Civil, Environmental, and Geospatial Engineering (CEGE) and

David Flaspohler, Dean, College of Forest Resources and Environmental Science (CFRES)

With support from:

- Stacy Cotey, Assistant Teaching Professor, College of Forest Resources and Environmental Science
- Rodney Chimner, Professor, College of Forest Resources and Environmental Science
- Brian Barkdoll, Professor, Civil, Environmental, and Geospatial Engineering
- Judith Perlinger, Professor, Civil, Environmental, and Geospatial Engineering
- Noel Urban, Professor, Civil, Environmental, and Geospatial Engineering

Program/Degree type: Interdisciplinary Bachelor of Science, jointly administered by CEGE and CFRES

Program Title: Bachelor of Science in Ecological Engineering

Planned Implementation Date: Fall 2026

Program location/modality: Face to Face

Target student population: new students

General description and characteristics of program

The Bachelor of Science in Ecological Engineering will prepare graduates to define systems and components of systems that bridge the gap between ecology and engineering for the mutual benefit of humans and nature.The proposed ecological engineering program intends to blend engineering and science, and focuses on the design of sustainable systems (natural and urban) that integrate human activities into the natural environment to the benefit of both. The ecological engineering program at Michigan Tech will be unique as the curriculum includes elements from civil engineering, environmental engineering, ecology, and environmental science.

Rationale

It is essential that MTU tries new programs to stay current and nimble in the changing times that we are in by continually adapting and offering new programs to support industry needs. Job titles used by engineering professionals currently practicing in this field include river engineer, restoration engineer, habitat restoration engineer, etc. Kimberly Powell, PE, Project Engineer at Anchor QEA in New York and member of the CEGE Professional Advisory Board indicated her company is looking for engineers with an ecological engineering background for opportunities on the east coast, south east and west coast[1]. A quick Google search identified career opportunities with consulting firms all over the U.S., including Tighe & Bond, Verdantas, SWCA Environmental Consultants, Sherwood Design Engineers, and Geosyntec Consultants, Chronicle Heritage, RES, plus many others[2]. According to Powell, due to the limited programs producing graduates with the ecological engineering specialties, civil engineers and environmental engineers with a water resources background are filling these roles. However, the ecological engineering profession is seeking to define itself independently of civil and environmental engineering, which is why the American Ecological Engineering Society developed ABET EAC Program Criteria for Ecological Engineering as well an Ecological Engineering Body of Knowledge[3]. Due to the recent ABET accreditation of ecological engineering, job growth will most likely follow the trend of civil and environmental engineers, which according to the Bureau of Labor and Statistics is 6% and 7%, respectively.[4]

MTU could be on the cutting edge with this major since only one other university has a stand-alone ecological engineering degree program (Table 1 below). Other programs have concentrations with other degree programs or use different degree names entirely. In addition, ABET has just proposed the criteria for assessing ecological engineering as a bachelors program, so MTU could be one of the first accredited programs in the country under this criteria.

Currently students who have an interest in this area major in civil engineering, environmental engineering or environmental science. However, neither program is an exact fit to their needs. This program brings together campus strengths so that students can pursue their interests.

Related programs: within MTU and at other institutions

Ecological Engineering depends on a broad mix of disciplines, which like many other engineering programs include mathematics, physics, chemistry, and engineering principles. However, ecological engineering students will receive training in biology, ecology, soil science, geographic information systems (GIS), going beyond coursework requirements of the Environmental Engineering, the Applied Ecology and Environmental Science, and the Environmental Science and Sustainability programs.

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[1] Personal communication September 2024

[2] Google Search September 12, 2024; search term ecological engineering jobs

[3] Moore, T., Etheridge, J.R., Dale, G.T., McMillan, S.W, Aryal, N., Austin, D., and Thompson, T. 2024. An Ecological Engineering (EcoE) Body of Knowledge to Support Undergraduate Eco Education, ASEE Annual Conference, Portland, OR

[4] Occupational Handbook, Bureau of Labor and Statistics, search term civil engineering and environmental engineer, search September 13, 2024

Programs at other Institutions

Table 1 presents universities with degree programs named ecological engineering or similar in the U.S.

Table 1. Current listing of undergraduate ecological engineering programs or concentration/ emphasis areas under other engineering programs in the U.S.[5]

Institution	**Program or Concentration Name**	**Degree Program Affiliation**
Oregon State University	Ecological Engineering	Ecological Engineering
Auburn University	Ecological Engineering	Biosystems Engineering
Clemson University	Ecological Engineering	Biosystems Engineering
University of Illinois	Ecological Engineering	Agricultural & Biological Eng.
Michigan State University	Ecosystems Engineering	Biosystems & Agricultural Eng.
North Carolina State University	Ecological Engineering	Biological & Agricultural Eng.
The Ohio State University	Ecological Engineering	Food, Agricultural & Biological Eng.
University of Minnesota	Environmental & Ecological Eng.	Bioproducts and Biosystems Engineering
University of Nebraska	Environmental & Ecological Eng.	Biological Systems Engineering
Purdue	Environmental & Ecological Eng.	Environmental & Ecological Engineering
St. Francis University	Ecological Engineering	Environmental Engineering
State University of New York	Ecological Engineering	Environmental Resources Engineering
University of Colorado Boulder	Applied Ecology	Environmental Engineering
University of Maryland	Ecotechnology Design	Environmental Science & Technology

Oregon State University – Oregon State University established one of the first Ecological Engineering BS programs in the country. The program integrates engineering and science so

[5] Moore, T., Etheridge, J.R., Dale, G.T., McMillan, S.W, Aryal, N., Austin, D., and Thompson, T. 2024. An Ecological Engineering (EcoE) Body of Knowledge to Support Undergraduate Eco Education, ASEE Annual Conference, Portland, OR

that graduates are able to design sustainable systems. The program consists of 180 quarter credit hours and takes 4-4.5 years. The program touts 10:1 student to faculty ratios and an average class size of 20-30 students and a placement rate of greater than 80% soon after graduation. In Fall 2022 the enrollment was 96 students.

The Ohio State University – Ecological Engineering is a pathway in the Food, Biological, and Ecological Engineering program, which is accredited under the ABET EAC General Engineering Criteria. The program is 132 semester credit hours. The current enrollment is 89 with 25 degrees awarded.

Purdue University - Purdue has a Department of Environmental and Ecological Engineering. This department has one degree that combines both environmental and ecological engineering. Students do not choose one or the other. This degree is ABET accredited under the Environmental Engineering criteria. 128 credits are required. In Fall 2023, enrollment was 177 with 10 degrees awarded in the Fall of 2022 (https://engineering.purdue.edu/EEE).

Projected Enrollment

The expected start date is Fall 2026. The initial enrollment is expected to be 7 to10 students in year one. The majority of the students may transfer to the program from environmental engineering or environmental science. Incoming student numbers are expected to be 2 to 4 students. However, program recruiting is expected to enhance the size of the interesting class for Fall 2027. The program anticipates an incoming freshman class of 10 to 15 students per year and an internal transfer yield of another 5 students from other programs. Within 4 years, the program is expected to grow to 40 to 50 students. Upon steady-state the program is expected to have between 75 and 100 students.

Specialized Accreditation Requirements

The Engineering Accreditation Commission of ABET has proposed criteria for Ecological Engineering. The proposed criteria are expected to be approved in 2024 and made official in 2025. The program criteria served as a guide in developing the curriculum for this program.

https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2024-2025/.

The program will seek accreditation the year following the first graduate of the program, per ABET requirements to ensure graduates of the program are ABET accredited. If necessary, the program will seek 2-year retroactive accreditation following ABET policies and procedures.

Professional Licensure Requirements

Graduates of this program may choose to become professional engineers. However, no registration is required for these graduates.

Curriculum Details

Learning Goals

The Ecological Engineering program will satisfy the eight criteria expected of all engineering programs. In particular, the Ecological Engineering program will adopt the ABET EAC Criterion 3 Student Outcomes. Upon completion of the program, graduates must demonstrate the following student outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

EAC ABET Criteria and Program Criteria referenced herein are from the 2024-2025 Accreditation Cycle, the most recent at the time of writing this proposal. The information may be found at https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2024-2025/.

Additionally, the degree program must also fulfill the Ecological Engineering Program Criteria, which are as follows. Please note, these program criteria have been in the approval process and will be official in the 2025-2026 accreditation cycle.

1. Curriculum

The curriculum must include:

a. mathematics through differential equations, probability and statistics, calculus based physics, and college-level chemistry.

b. earth science, fluid mechanics, hydraulics, and hydrology.

c. biological and advanced ecological sciences that focus on multi-organism self sustaining systems at a range of scales, systems ecology, ecosystem services, and ecological modeling.

d. material and energy balances; fate and transport of substances in and between air, water, and soil phases; thermodynamics of living systems.
e. applications of ecological principles to engineering design that include considerations of climate, species diversity, self-organization, uncertainty,sustainability, resilience, the role of humans in ecosystems interactions between ecological and social systems, and system-scale impacts and benefits.

2. Faculty

The program must demonstrate that those faculty members teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure or by education and equivalent design experience.

Assessment Plan

The Ecological Engineering program assessment will be based on the model used by the other undergraduate engineering programs in the CEGE Department. Student Outcomes 1 to 7 will be mapped to ecological engineering specific classes, ECEN prefix where able, and to the specific FW and CEGE classes. The Student Outcomes will be assessed once every three years so that the outcomes are assessed twice during the ABET 6-year accreditation cycle. The table below presents the Student Outcome assessment cycle employed by CEGE programs. The Ecological Engineering program will jump into the current cycle followed by the other programs in CEGE, assuming the program is launched in 2026-2027.

Table 2. ABET EAC Student Outcome Assessment Cycle

Cycle	Academic Year	Student Outcome						
		1	2	3	4	5	6	7
1	2024-2025	X	X				X	
	2025-2026			X		X		
	2026-2027				**X**			**X**
2	2027-2028	X	X				X	
	2028-2029			X		X		
	2029-2030				X			X
3	2030-2031	X	X				X	
	2031-2032			X		X		
	2032-2022				X			X

Curriculum Design

Total Credits: 120 minimum
The breakdown of credits are presented as would be expected in Table 5-1 of an ABET Self-Study Report.

Required Courses (120 to 123 credits)
EC 3400 Economic Decision Analysis
Math and Science (48 to 51 credits)
- BL 1400 Principles of Biology
- BL 3310 Environmental Microbiology
- CH 1150 University Chemistry
- CH 1151 University Chemistry Lab
- CH 1160 University Chemistry II
- CH 1161 University Chemistry II Lab
- FW 3020 Forest Ecology or BL 3490 Principles of Ecology and Evolution
- FW 3540 Introduction to GIS
- FW 3330 Soil Science or CEE 3810 Soil Mechanics for Engineers
- FW 4220 Wetlands or FW 4370 Forest and Landscape Hydrology
- FW 4XXX Restoration Ecology or BL 4447 Stream Ecology
- MA 1160/1161 Calculus with Technology 1 or Calculus Plus with Technology I
- MA 2160 Calculus with Technology II
- MA 3160 Multivariable Calculus with Technology
- MA 2330 Introduction to Linear Algebra or MA 2321 Elementary Linear Algebra
- MA 3520/3521 Elementary Differential Equations/Elementary Differential Equations
- PH 1100 Physics Lab I
- PH 2100 Physics Lecture I

Engineering (48 credits)
- ECEN 1000 Introduction to Ecological Engineering
- ECEN 3501 Ecological Engineering Fundamentals
- ECEN 4000 Ecological Engineering Design
- ENG 1101 Engineering Analysis
- ENG 1102 Modeling and Design
- ENG 2120 Statics/Strengths of Materials
- CEE 3331 Professional Practice
- CEE 3502 Environmental Monitoring, Measurements and Data Analysis
- CEE 3200 Thermo/Fluids
- CEE 3620 Water Resource Engineering
- CEE 4506 Sustainable Engineering
- CEE 4620 River and Floodplain Hydraulics
- CEE 4505 Surface Water Quality Engineering
- CEE 4665 Stream Restoration
- CEE 4905 Senior Design
- Engineering Elective - 3 Credits

Essential Education (37 cr requirement, 21 credits not met through major)
- Michigan Tech Seminar (1 cr): **met through ENG 1101**
- Composition
- Foundations of the Human World
- Math: **met through Math and Science list**

Natural and Physical Science: **met through Math and Science list**
STEM: **met through Math and Science list**
Distribution Pathway
Communications Intensive
Arts and Culture
Intercultural Competency
SHAPE elective: **met through EC 3400**
STEM: **met through Math and Science list**
Essential Education Experience
Activities for Well-Being and Success (3 courses /3 cr total)

Model Schedule

Table 3. Ecological Engineering Model Schedule by Semester (green highlighted cells denote Essential Education Courses)

Year 1

Semester	Course	Credits	Pre-req	Co-req
1-Fall	MA 1160/1161 Calculus with Technology 1 or Calculus Plus with Technology I	4 or 5		
	PH 1100 Physics Lab I	1		MA 1160
	ENG 1101 Engineering Analysis	3	(MA 1031(C) or MA 1032(C) or MA 1120(C) or MA 1160(C) or MA 1161(C) or MA 1121(C) or MA 2160(C) or MA 3160(C)) and (Spatial Visualization Score >= 19 or ENG 1002(C))	
	ECEN 1000 Introduction to Ecological Engineering	1		
	BL 1400 Principles of Biology	3		
	Composition	3		
	Total Credits	15/16		
2-Spring	MA 2160 Calculus with Technology II	4	MA 1160	
	PH 2100 Physics Lecture I	3	MA 1160, PH 1100	PH 1100
	ENG 1102 Modeling and Design	3	(MA 1031 or MA 1032 or MA 1120 or MA 1160(C) or MA 1161(C) or MA 1121(C) or MA 2160(C) or MA	

			3160(C)) and (ENG 1101 or (ENG 1001 and ENG 1100)) and (Spatial Visualization Score >= 19 or ENG 1002)	
	CH 1150 University Chemistry	3		CH 1151
	CH 1151 University Chemistry Lab	1		CH 1150
	Foundations in the Human World	3		
	Total Credits	17		

Year 2

Semester	Course	Credits	Pre-req	Co-req
3-Fall	MA 3160 Multivariable Calculus with Technology	4	MA 2160	
	ECEN 3500 Ecological Engineering Fundamentals	3	(MA 1160 or MA 1161) and MA 2160 and (CH 1112 or (CH 1150 and CH 1151))	
	CH 1160 University Chemistry II	3	CH 1150/1151	CH 1161
	CH 1161 University CHemistry II Lab	1	CH 1150/1151	CH 1160
	Communication Intensive	3		
	Activities for Well-being and Success	1		
	Total Credits	15		
4-Spring	MA 2330 - Introduction to Linear Algebra or MA 2321 - Elementary Linear Algebra	2	MA 1160 or MA 1161 or MA 1135 or MA 1121 or MA 2160	For MA 2321, MA 3521
	CEE 3502 Environmental Monitoring, Measurements and Data Analysis	3	MA 2160 and CH 1150/1151	
	CEE 3200 Thermo/Fluids	4	CH 1150 and CH 1151 and PH 2100 and ENG 1102 and MA 2160	
	FW 3540 Introduction to GIS	4	MA 2710 or MA 2720 or MA 3710 or ENVE 3502 or CEE 3502	
	Arts and Culture	3		
	Activities for Well-being and Success	1		

	Total Credits	17		

Year 3

Semester	Course	Credits	Pre-req	Co-req
5-Fall	MA 3520/3521 Elementary Differential Equations/Elementary Differential Equations	2	MA 2160 and MA 2320, 2321, 2330 / MA 2160	None/MA 2321
	CEE 3620 Water Resource Engineering	4	(ENG 3200 or CEE 3200) and (MA 3710(C) or MA 2710(C) or MA 2720(C) or CEE 3502(C) or CEE 3710(C))	
	FW 3020 Forest Ecology or BL 3490 Principles of Ecology and Evolution	3 / 4	FW 2051(C) BL 1010 or BL 1040 or (BL 1100 and BL 1110) or (BL 1400 and BL 1410)	
	ENG 2120 Statics/Strengths of Materials	4	MA 2160/PH 2100 and ENG 1102	
	Activities for Well-being and Success	1		
	Total Credits	14 / 15		
6-Spring	CEE 3331 Professional Practice	2	JR. Standing	
	ECEN 4000 Ecological Engineering Design	3	ECEN 3501	
	Essential Education Experience	3		
	Intercultural Competency	3		
	EC 3400 Economic Decision Analysis - SHAPE	3	JR Standing	
	Total Credits	14		

Year 4

Semester	Course	Credits	Pre-req	Co-req
7-Fall	FW 3330 Soil Science or CEE 3810 Soils	4	CH 1112(C) or (CH 1150(C) and CH 1151(C)) or GE 2000(C) and (MEEM 2150 or ENG 2120) and (ENG	

			3200 or CEE 3200 or GE 3850)	
	FW 4220 Wetlands or FW 4380 Landscape Ecology and Planning	4 / 3	BL 1100 or BL 1400 or BL 2160 or BL 3080 MA 2720 or CEE 3502	JR or SR Standing
	CEE 4620 River and Floodplain Hydraulics	3	CEE 3620	
	CEE 4505 Surface Water Quality Engineering	3	ECEN 3501 or CEE 3501 or CEE 3503	
	Engineering Elective	3		
	Total Credits	17/16		
8-Spring	CEE 4905 Senior Design	3	SR Standing	
	CEE 4506 Sustainable Engineering	3	ECEN 3501	
	FW XXXX Restoration Ecology or BL 4447 Stream Ecology	3	BL 1010 or (BL 1100 and BL 1110) or BL 1040 or (BL 1400 and BL 1410) or BL 3400	
	CEE 4665 Stream Restoration	3	CEE 3620	
	Total Credits	12		

Total Credit Hours: 120 to 123

Total Curriculum meets ABET EAC Criterion 5 Curriculum requirements >30 hours Math and Science and >45 hours Engineering

New Course Description

Table 3. New course descriptions and credits

Course Number and Title	Credits	Description
ECEN 1000 Introduction to Ecological Engineering	1	Provides a series of activities that explore the field of ecological engineering. Through completion of the course, students will gain fundamental experiences with the skills, knowledge, and attitudes needed to solve the ecological engineering problems needing solutions from today's ecological engineers.

		Prerequisite: None
ECEN 3500 Fundamentals of Ecological Engineering	3	Basic principles and calculations for ecological engineering. Covers application of material and energy balances; fate and transport of substances in and between air, water, and soil phases; thermodynamics of living systems. Prerequisite: (MA 1160 or MA 1161) and MA 2160 and (CH 1112 or (CH 1150 and CH 1151))
ECEN 4000 Ecological Engineering Design	3	Principles of ecological engineering and design of sustainable ecosystems. Prerequisite: ECEN 3501

Faculty Qualifications

Current CFRES Faculty and CEGE Faculty and staff will support the new program. Instructors teaching core ecological engineering courses are listed below. Students in the program would be advised primarily by Julie Ross (CEGE) with backup advising support by Katrina Hanson (CFRES).

Table 4. Supporting Faculty by Department and Qualifications

Name	**Unit**	**Role**	**Courses**
Andrea Andres, P.E.	CEGE	Faculty	CEE 4905
Brian Barkdoll, P.E., BCEE	CEGE	Faculty	CEE 3620, CEE 4665, ECEN 4000
Rod Chimner	CFRES	Faculty	FW 4220 and a to-be-developed undergraduate version of FW 5115
Mike Hyslop	CFRES	Faculty	FW 3540
Audra Morse, P.E., BCEE	CEGE	Faculty	ECEN 1000, ECEN 3501
Judith Perlinger	CEGE	Faculty	CEE 4506
Noel Urban	CEGE	Faculty	CEE 3502, CEE 4505
David Watkins, P.E.	CEGE	Faculty	CEE 4620
Veronica Webster, P.E.	CEGE	Faculty	CEE 3620

Xinyu Ye	CEGE	Faculty	CEE 3200, ENG 2120

Program-specific policies, regulations, and rules

If a student is involved in Enterprise, they may use an Enterprise project as their capstone design project, pending departmental approval. Students must have at least 4 semesters remaining to fulfill the Enterprise Project Work requirements. All students electing the Enterprise project must submit an ENT 4950 Enterprise Design Verification Form to verify that the objectives expected from senior design are also achieved in enterprise work. These are read and approved by the enterprise advisor and the CEGE Department Chair prior to the student enrolling in ENT 4950. If it is determined that the objectives are not met, the student must either modify his or her enterprise project or is required to take CEE 4905. The students participating in the Enterprise program may choose to do a 12-credit concentration, a 20-credit minor or just participate in the Enterprise Project Work (6 credits).

Administration

For students majoring in Ecological Engineering, student credit hours, majors, and graduates will be split evenly between CEGE and CFRES. Both academic units will promote, market, and advertise the major to prospective students.

Resources Needed

Library and other learning resources needed

The current library subscriptions in engineering will support the ecological engineering program. No additional library resources are required.

Suitability of existing space, facilities, and equipment

The Ecological Engineering program will use lab classes that currently exist in the CEGE and CFRES programs. Initially, program growth may be accommodated in existing lab sections of CEE 3502 and 3620. However, growth may require additional lab sections of CEE 3502 and CEE 3620. Program establishment may require an additional lab section of FW 3540 Introduction to GIS, as the course is already at capacity.

Program Costs

The program will be relying on faculty and staff already employed at the university to launch the program. Drs. Barkdoll, Chimner, Urban, Webster, and Watkins teach course content appropriate for the ecological engineering program. The major expands work to establish an ecological engineering minor approved in 2023-2024 academic year.

Moreover, the CEGE Department is hiring a new faculty member in the 2024-2025 academic year, the area of expertise is environmental engineering with a focus on surface water quality, which aligns with the ecological engineering program delivery. CFRES may be hiring a faculty position in environmental data science, which may be able to support delivery of this program in time.

Program delivery is also relying on existing environmental engineering (CEE) and Forest Resources and Environmental Science (FW) laboratory courses with lab fees. As such, laboratory fees will cover the cost to deliver these laboratory courses.

The program will seek ABET accreditation the year after the first graduate of the program. ABET requires payment of annual fee and re-accreditation cost.

108.1.2: Criteria for Financial Evaluation Proposed Academic Programs

Relation to University Strategic Plan

Michigan Technological University's stated vision and mission are as follows:

> **Vision**
> Michigan Tech is a globally recognized technological university that educates students, advances knowledge, and innovates to improve the quality of life and to promote mutual respect and equity for all people within the state, the nation, and the global community.
>
> **Mission**
> Create solutions for society's challenges by delivering action-based undergraduate and graduate education, discovering new knowledge through research, and launching new technologies through innovation.

Ecological engineering is defined as the design of sustainable ecosystems that integrate human society with its natural environment for the benefit of both with goals to restore ecosystems that have been substantially disturbed by human activities and the development of new sustainable ecosystems that have both human and ecological values[6]. Ecological Engineering lies at the intersection between civil engineering, environmental engineering, ecology, and environmental science. Michigan Tech is strategically poised to bring together faculty from CFRES and CEGE who teach courses related to ecological engineering together to deliver this program.

[6] Mitsch, W.J. 2012. What is Ecological Engineering, Ecological Engineering 45, 5-12, https://doi.org/10.1016/j.ecoleng.2012.04.013

Impact on University Enrollment

- **Projected number of students in the program**: the program enrollment is expected to grow to 20 to 25 students per year, with a total program enrollment of approximately 100 students. It is anticipated that students currently pursuing environmental engineering or environmental science may choose this degree plan. The addition of this degree plan will aid the environmental engineering program to manage student enrollment in 4000-level laboratory classes that are at near max capacity under current operational conditions.
- **Source of new students**: it is believed that new students seeking to combine their passion for the environment with engineering will be interested in this program. Currently, students often choose between environmental engineering and environmental science. This program will bridge that gap.
- **How will demand for the new program correlate with existing enrollment patterns?** The program is likely to draw students from the environmental engineering, civil engineering, and environmental science programs.
- **Current enrollment in the unit**: Per the MTU Compendium, the CEGE Department has a total enrollment of 545 students whereas CFRES has a total enrollment of 262 students (Compendium 2023-2024 enrollment numbers).

Impact on Resources in Home Department

This would include, but not be limited to:

- **Faculty lines**: At this time the program can be launched with existing faculty. However, program growth over the next 3-4 years may warrant additional faculty.
- **Faculty and student labs**: No new lab courses are needed. Enrollment in the program is likely to impact CEE 3620 and 3502, which may need additional lab sections.
- **Advising**: Students in the program would be advised primarily by Julie Ross (CEGE) with backup advising support by Katrina Hanson (CFRES).
- **Assessment**: The program will seek ABET accreditation upon graduation of the first graduate. The CEGE Department has two faculty members (Jeffery Hollingsworth and Audra Morse) who are highly qualified to develop and execute the assessment program. The program will work with the Associate Dean of COE to submit a request for accreditation at that time.

Impact on Resources in Other Units Within the University

The first year of this program will be common to other engineering programs. As such, the program will increase enrollment in the two first year Engineering Fundamentals courses used by all engineering programs. Engineering students also take many hours of math, chemistry, and physics, which are fundamental areas for which engineers base their engineering knowledge.

Impact on other resources

All students will be covered by the laptop requirement and no special software is required so additional IT resources should be minimal. One-time assistance above normal needs would be required to onboard all faculty and students. Minimal impact is expected on units like the library.

Assessment of the ability to obtain the necessary resources assuming requested funds are obtained

Past Proposal Outcomes

The proposing departments have produced the following proposals.

- CEGE Ecological Engineering Minor (proposal 20-20)
- CFRES
    - Environmental Data Science (proposal 29-23)
        - Enrollment Fall 2024: 1
        - Projected: 30
    - Environmental Science and Sustainability (proposal 59-21)
        - Enrollment: 31
        - Projected:100 students

Departmental Budget Contribution

- What is the department's total general fund budget?
    - For FY 2024-2025
        - CEGE General Fund Budget (salary and fringe) is $5,574,524
        - CFRES is $4,225,476
- How much tuition does the department generate?
    - In FY 2024-2025 based on SCH
        - CEGE $7,065,957
        - CFRES $5,379,555

How do the benefits from this program compare to other alternatives that are currently under consideration or development?

There are no other alternatives under development.