

**Program Review (12-11-2020)**  
**UW-Green Bay Environmental Engineering Technology**

**Submitted by:**        **RSE Chair Professor Patricia Terry**  
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The **Environmental Engineering Technology BS** is part of the **Resch School of Engineering**, housed in the **College of Science, Engineering, and Technology** led by **Dean John Katers**.

**General and Overview**

1. Describe your program's most significant opportunities and significant challenges. (Narrative)

The Environmental Engineering Technology program's best opportunity remains meeting the regional manufacturing community's need for skilled employees and to provide students with adequate opportunities for internships that lead to jobs after graduation. Our most significant challenge is student recruitment. The Environmental Science major at UW-Green Bay has such a successful history, that many environmentally minded students don't consider Environmental Engineering. There are also fewer internship opportunities for students than there are in the other engineering disciplines. There is also only one NWTC program with which Environmental ET has an articulated transfer agreement, so we have had fewer Associate degree to BS completion transfers.

2. What are some things that would help make your program and its students more successful? (Narrative)

Increasing recruitment into regional high schools/technical colleges and enhanced marketing would help grow this program. Covid has put on hold plans to recruit at regional high schools. One very useful action that would benefit students would be increased tutoring in math, physics, chemistry, and basic engineering classes. Many students come to us under-prepared in basic quantitative skills and additional tutoring would help them. Finally, in many of our labs, we have only one piece of equipment, which limits hands-on lab opportunities or requires faculty to have labs that are not optimally aligned with lecture. Additional equipment would help, however, this equipment is often expensive, so I recognize that this is a luxury we likely cannot afford.

3. What are some program accomplishments worth highlighting? (Narrative)

The Environmental Engineering Technology program has been at UW-Green Bay for over five years now and we have had twenty successful graduates gain employment or continue to graduate school. We have hired two outstanding new faculty, Drs. Michael Holly and Stephan Gunn, who in addition to having strong individual research programs, also have a proven collaborative scholarship record. Recently, they have been PIs on two grants. The first is to develop

a Hybrid Environmental Engineering Technology Program, which would help with our long term goals below and our ability to recruit new students. The second is a grant, Sludge land Application and the Occurrence, Fate, and Mitigation of Per- and polyfluoralkyl Substances and Nitrate. Submitted to the Fresh Water Collaborative of Wisconsin, which was Funded at \$122,727 in September 2020. This latter will raise the profile of the program and create research opportunities for students. There are also thirteen industry sponsored scholarships to support all engineering technology students.

4. Have there been any significant changes that have affected your program? (Narrative)

No significant changes have been made to the program's curriculum over the past five years. Hiring a second faculty member specific to Environmental Engineering has allowed us to offer more upper level elective courses, such as Hazardous and Toxic Materials and Solid Waste Management. Because of the mathematical rigor and specific course content required, the upper level Water and Waste Water Treatment class that was previously cross listed with the same course for Environmental Science is now a separate and very different class.

5. Where do you want your program to be 5 to 7 years from now? (Narrative)

In five years, we would like to have a robust Environmental Engineering Technology program with at least forty majors and within seven years start the preliminary discussion of adding a BS in Civil Engineering. Working with the Environmental Science program, we would also like to offer as much of the BS as possible on the Manitowoc campus in the next one to three years. We are currently in the process of applying for ABET accreditation with a site visit planned for September 2021 and accreditation granted in Spring 2022. This latter was pushed back a year by ABET due to concerns of conducting a site visit in Fall 2020 during the pandemic.

### **Demand**

*All data in this area is provided with the materials. (Graduates, majors, minors, etc.) This space is for any commentary you would like to apply to that material. (Narrative)*

### **Internal**

1. Program goals (Mission, vision, learning outcomes; present as narrative/lists)

The **Environmental Engineering Technology** program has the **Student Learning Outcomes** listed below. These are determined by ABET, the accreditation agency for engineering programs. Each of these outcomes is assessed annually in a required upper level course and an annual review of this assessment drives curricular changes in the lower level curriculum.

1. an ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline;
2. an ability to design systems, components, or processes meeting specific needs for broadly-defined engineering problems appropriate to the discipline;
3. an ability to apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;
4. an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and
5. an ability to function effectively as a member as well as a leader on technical teams.

The **Environmental Engineering Technology program** also has the following **Program Educational Objectives**, which are what we want students to have achieved within five years of graduation:

1. Program graduates will be employed as environmental engineering technologists and perform all functions assigned to an environmental engineering technologist.
2. Graduates will apply multidisciplinary approaches including engineering, chemistry, mathematics, physics, geosciences, and biology to manage the unique challenges and balance the competing social, political, economic, and technical goals of environmental problems and solutions.
3. Graduates will exhibit a desire for life-long learning through higher education, technical training, teaching, membership in professional societies, and other developmental activities and will achieve positions of increased responsibility through these activities.
4. Graduates will demonstrate high levels of oral and written communication skills, critical thinking, responsibility and ethical behavior, and leadership in their careers.
5. Graduates will function effectively both as a leader and as a member of project teams and demonstrate an appreciation for diversity.

2. Curriculum development (Lists, brief narrative if appropriate)

The only curriculum development in the past few years is separating the once cross listed ET331/ENV SCI 335 courses into separate courses.

3. Connections to other programs (Lists, brief narrative if appropriate)

Other than a few courses like ET330/ENV SCI 330 Hydrology and BIOL 322, Environmental Microbiology, that are common to the Environmental Science major, there are no significant connections to other programs. There are also some courses that are either required by or electives for the Environ ET, Env Science, and Water Science programs.

4. Number of courses offered (Overall number provided in materials. Chairs: short commentary if appropriate. Provide a sub-grouping of various modalities by percentage. For example, what percentage of your program is available online, hybrid, etc.?)

The Environmental ET program includes 22 courses that are specifically ET or cross listed with ENV SCI classes. Because of the previously mentioned program development grant to make more ENV ET courses on-line or hybrid, we are in flux with the exact numbers. If we include as on-line or hybrid all courses in the proposal, the percentages will be as follows:

Available on-line or hybrid: 7 courses (some like ET 424 are electives): 31%

Available completely on-line: (ET 400, ET 424, ET 360): 13.6%

5. Diversity of students, faculty, and curriculum (Overall number provided in materials. Chairs: short commentary if appropriate; provide examples from curriculum if appropriate.)

Environmental ET has three faculty members, all tenured or tenure track: Patricia Terry (full), Michael Holly (assistant), and Stephan Kpoti Gunn (assistant). While this is too small a number to be statistically significant, we can say that 1/3 of the faculty is female and 1/3 represents a non-Caucasian ethnicity.

Between 2017 and 2020, 20 students graduated from the program. Their demographics are presented in Table 1 below. In the earlier years of the program, Environmental ET had a number of Environmental Science students switch to the ET major, which required at least one additional year of schooling. This is reflected in the number of graduates 25 years of age or older.

**Table 1: Diversity of Env ET Graduates 2017-2020**

N=20 graduates	number	percent
Gender Identity		
Male	10	50
Female	10	50
First generation college graduate	11	55
Age range		
20-24	8	40
25 and older	12	60

6. Gen Ed, FYS/GPS, CCIHS (Lists)

Within Engineering and Engineering Technology as a whole, the following courses exist:

WE: ENGR 203, ET 360, ET 400, ET 410

FYS/GPS: ENGR 198 (not required)

Capstone: ET 400 ET Internship, ET 410

Natural Sciences: ET 206 Chemistry for Engineers

Sustainability: ENGR 202 Intro to Smart Cities, ET 201 (to be added)

Humanities: ENGR 260 Intro to Engineering Ethics

CCIHS: ET 101, ET 105, ET 207, ET 221

7. Program support and staffing (Chairs: History, trends, and future needs. Depending on program, could be connected to accreditation.)

As stated above, the Environmental Engineering program is staffed by three full time positions (Professor Patricia Terry and Assistant Professors Michael Holly and Stephan Gunn), although Patricia Terry teaches less than a full load due to administrative re-assignments and Michael Holly is the Director of the collaborative on-line MS in Sustainable Management, for which he also has teaching re-assignments. Additional needs are met by three ad-hoc instructors (Scott Guttschow, Nic Zeitler, and Wes Schroeder) and one UWGB faculty from NAS (Chris Houghton).

The RSE budgetary chair and the Engineering discipline chair have been the same person, Patricia Terry, since RSE split from NAS. This fall, Jagadeep Thota was elected to a three-year term as Engineering discipline chair (2020-2023) and Patricia Terry was re-elected RSE Budgetary chair through August 2024.

Program support is provided by two program assistants shared between Human Biology, NAS and RSE, although one of these primarily serves NAS and Human Biology. Additional support for RSE comes from the program assistant in the dean's office.

8. Cost per credit hour (TBD)

All Engineering and Engineering Technology declared majors pay a differential tuition of \$700 per semester for those within the plateau (12-18 credits). Those taking fewer than 12 credit hours, pay an additional 58.33 per credit hour. This differential tuition applies to all credit hours, not just ET or ENGR ones, and students are required to declare their major prior to registering for the spring semester of their freshman year. If they wish to apply for ET or ENGR scholarships, they must declare the major in their first semester at UW-Green Bay (freshman or transfer students). The Engineering and Engineering Technology programs rely on this tuition revenue to cover faculty and equipment costs.

## **External**

1. Outreach: student/faculty partnerships, collaborations, participation with organizations or individually (Lists)

The Engineering/ET programs have an advisory board that includes over forty organizations, who may participate in one or multiple disciplines. The Environmental Engineering Technology program advisory board includes organizations such as NWTC, LTC, Foth, NEW Water, WI-DNR, Einstein Project, FEECO, and NEW ERA.

2. Contributions to regional infrastructure (Lists)

UWGB Environmental Engineering faculty sit on advisory boards for NTWC's Waste and Water Technology Associate's programs and engineering faculty also serve on the NEW ERA advisory board and the NEW Manufacturing board.

3. Scholarly activity of faculty (Lists that are not all-inclusive; maybe seek to highlight the different areas/types of activity)

## **Environmental Engineering**

**Michael Holly: Sustainable Agriculture and Environmental Remediation (PFAs)**

**Stephan Gunn: Sustainable Agriculture and Impacts of Climate Change on Agriculture and Water Availability**

**Gunn, K. M., Holly, M. A., Veith, T. L., Buda, A. R., Prasad, R., Rotz, C. A., Stoner, A. M. K.** (2019). Projected heat stress challenges and abatement opportunities for U.S. milk production. PLOS ONE, 1–21. <https://doi.org/10.6084/m9.figshare.7146995>

**Holly, M. A., Gunn, K. M., Rotz, C. A., & Kleinman, P. J. A.** (2019). Management characteristics of Pennsylvania dairy farms \*. Applied Animal Science, 35(3), 325–338. <https://doi.org/10.15232/aas.2018-01833>

Kleinman, P. J. A., Spiegel, S., Liu, J., **Holly, M.**, Church, C., & Ramirez-Avila, J. (2019). Managing Animal Manure to Minimize Phosphorus Losses from Land to Water. In Animal Manure: Production, Characteristics, Environmental Concerns and Management (Manuscript accepted for publication April 1, 2019).

**Gunn, K.M., Allred, B.J., Baule, W.J., Brown, L.C.** 2019. Investigating maize subirrigation strategies for three Northwest Ohio soils. Journal of Soil and Water Conservation 74 (2), 111-125.

PI, Hybrid and Online Program Development Proposal: Development of a Hybrid Environmental Engineering Technology Program (**Stephan Gunn and Michael Holly**) Submitted May 2020 to the UWGB Online or Hybrid Development Grant, total amount requested \$30,000. Status: Successfully funded, project-initiated June 2020.

**Gunn, K.M.** (July 2020). Proposed and moderated session at the 2020 ASABE Annual Meeting (virtual). Title: Long-term effectiveness of agricultural Best Management Practices: Opportunities and challenges.

**PI: Michael Holly and co-Investigator Stephan Gunn**, Sludge land Application and the Occurrence, Fate, and Mitigation of Per- and polyfluoralkyl Substances and Nitrate. Submitted to the Fresh Water Collaborative of Wisconsin. Funded at \$122,727 September 2020.

**Patricia Terry: Water Remediation and resources, sustainable systems**

**Terry, P.A.**, “Germany and the United States: A comparison of support for wind energy,” World Journal of Research and Review, August 2016.

Jeewan, O., **Terry P.A.**, “Impact of the Karkheh River dam on surface temperature of the Hawizeh Marsh.” World Journal of Engineering Research and Technology. Volume 6, Issue 5, August 2020.

**Terry, P.A.**, Pearson, D., Holder, G., “Sustainable agriculture: Nutrition of Native American 3 Sisters garden compared to monoculture corn production and a ‘Cool Old Squash’” Journal of Scientific Research and Reports, October 2020.

**Student Success**

1. High-impact practices and individualized-learning opportunities (Some data provided; lists and/or brief narrative)

All Engineering Technology students are required to complete a capstone high impact experience with the majority of students completing an internship with an appropriate company or industry. In the past three years Environmental ET students have worked for companies such as Nature’s Way, the City of Fond du Lac, WI Public Service, and TNT Professional Land Surveyors. Students who are not employable off campus (foreign students with specific student visas) complete an individualized instruction opportunity with a faculty member, usually undergraduate research. Students have worked on research or projects in water remediation, sustainable agriculture, and hazardous materials management. Students are not limited to one experience. They may complete an internship and engage in undergraduate research. Students also complete a number of classes with a lab component, most significantly ET 103 (Surveying), where they work in small groups learning to use and apply the industry standard tools of modern surveying.

UW-Green Bay has an active Engineering club that schedule industry tours and invites guest speakers from industry and professional organizations, such as the American Society for Civil Engineers and the Wisconsin Society of Professional Engineers to visit and discuss their companies. Environmental Engineering Technology students may also participate in Environmental organizations on campus, such as Round river Alliance.

2. Retention (TBD. Note: if program-level data is not provided, maybe list some things your program does that you believe aid in retention.)

The Environmental ET program achieves high retention rates by keeping class sizes under roughly 20-30 students, providing state-of-the-art lab experiences, offering individualized advising, and very high quality instruction (I can offer the course evaluations of any of my faculty to demonstrate their excellence).

### **Mission Relevant**

1. Relevance to mission (Narrative or lists as appropriate)

### **Environmental Engineering Technology**

Starting with the **UW-Green Bay select mission**, the **Program Educational Objectives** (PEOs), listed in this document under program goals, align well with, “provides a problem focused educational experience that promotes critical thinking and student success.” PEO 1 reflects promoting student success because securing and maintaining employment in the field of study after graduating is a clear measure of success and PEO 3 states that students will achieve positions of increased responsibility, which also comes from success in the workplace. PEOs 2 and 4 specifically speak to a “problem focused education” and “promotes critical thinking.” The nature of the engineering technology degree is to be hands-on, applied, and problem focused. “The culture and vision of the University reflect a deep commitment to diversity and inclusion,” is met by PEO 5, which emphasizes appreciation for diversity and teamwork. Ethical behavior, PEO 4, also supports inclusivity. “Community based partnerships” are one foundation of UW-Green Bay’s engineering programs and this is reflected in PEO 1, maintaining employment, and PEO 3, membership in professional societies. The “commitment to educational opportunity at all levels” is supported by PEO 3’s goal that graduates will exhibit a desire for life-long learning. The mission states a commitment to a University that promotes access, career success, cross discipline collaboration, cultural enrichment, economic development, entrepreneurship, and environmental sustainability is included in all five PEOs. PEO 1 supports the economic development of the northeast Wisconsin region, which is the industrial base of the state of Wisconsin. The need for graduates with engineering degrees is very high and supplying these is critical to the state’s economic future. PEO 2 speaks to entrepreneurship because solutions to modern day problems rely on novel, multi-discipline approaches. PEOs 3, 4, and 5 address career success directly through “positions of greater responsibility” and “leadership” and indirectly through “high levels of oral and written communication skills, responsibility and ethical behavior, teamwork and appreciation for diversity” because career success requires all of these skills. Environmental sustainability is core foundation of the Environmental Engineering Technology degree, so, the

specific curricular content that meets PEO 2 and the employment positions students will attain will create a more sustainable future.

The **core mission** of the university reflects not just the student experience, but also how the entire university operates within itself and in the greater community. PEOs met by the core mission are outlined in the table below. Those that are operational in nature and are the responsibility of administration, faculty, and staff are noted.

UW-Green Bay Core Mission	Environmental ET Program Educational Outcome
<p>1. Offer associate and baccalaureate degree level and selected graduate programs within the context of its approved select mission’</p>	<p>Program graduates will be employed as environmental engineering technologists and perform all functions assigned to an environmental engineering technologist. (PEO 1)</p>
<p>2. Offer an environment that emphasizes teaching excellence and meets the educational and personal needs of students through effective teaching, academic advising, counseling, and through university-sponsored cultural, recreational, and extracurricular programs.</p>	<p>This is the responsibility of the university administration, faculty, and staff.</p>
<p>3. Offer a core of liberal studies that support university degrees in the arts, letters, and sciences, as well as for specialized professional/technical degrees at the associate and baccalaureate level.</p>	<p>Program graduates will be employed as environmental engineering technologists and perform all functions assigned to an environmental engineering technologist. (PEO1)</p> <p>Graduates will apply multidisciplinary approaches including engineering, chemistry, mathematics, physics, geosciences, and biology to manage the unique challenges and balance the competing social, political, economic, and technical goals of environmental problems and solutions. (PEO 2)</p> <p>Graduates will demonstrate high levels of oral and written communication skills, critical thinking, responsibility and ethical behavior, and leadership in their careers. (PEO4)</p> <p>Graduates will function effectively both as a leader and as a member of project teams and demonstrate an appreciation for diversity. (PEO 5)</p>

<p>4. Offer a program of pre-professional curricular offerings consistent with the university's mission.</p>	<p>Program graduates will be employed as environmental engineering technologists and perform all functions assigned to an environmental engineering technologist. (PEO1)</p>
<p>5. Expect scholarly activity, including research, scholarship and creative endeavor, that supports its programs at the associate and baccalaureate degree level, its selected graduate programs, and its approved mission statement.</p>	<p>This applies to faculty, but undergraduate research opportunities are also created by faculty scholarship.</p> <p>Graduates will apply multidisciplinary approaches including engineering, chemistry, mathematics, physics, geosciences, and biology to manage the unique challenges and balance the competing social, political, economic, and technical goals of environmental problems and solutions. (PEO 2)</p>
<p>6. Promote the integration of the extension function, assist University of Wisconsin-Extension in meeting its responsibility for statewide coordination, and encourage faculty and staff participation in outreach activity.</p>	<p>This applies to faculty, staff, and curriculum.</p>
<p>7. Participate in inter-institutional relationships in order to maximize educational opportunity for the people of the state effectively and efficiently through the sharing of resources.</p>	<p>This does not apply to PEOs, but is met via transfer agreements with regional technical colleges (NWTC, FVTC, LTC, NTC, MATC) and College Credit in High School opportunities.</p>
<p>8. Serve the needs of women, minority, disadvantaged, disabled, and nontraditional students and seek racial and ethnic diversification of the student body and the professional faculty and staff.</p>	<p>This is a mission for operation of the university. The Resch School of Engineering is meeting this via a diverse faculty and scholarship opportunities to support students.</p>
<p>9. Support activities designed to promote the economic development of the state.</p>	<p>Program graduates will be employed as environmental engineering technologists and perform all functions assigned to an environmental engineering technologist. (PEO1)</p>

2. Cultural enrichment (Narrative or lists as appropriate)

Engineering/Engineering Technology does not directly provide cultural enrichment, but this discipline has a diverse faculty that includes three female faculty (including the Budgetary chair) to help promote inclusion and cultural diversity by example.

3. Access (Does the program have any agreements with other institutions? For example, a transfer agreement with a technical college.)

The **Environmental Engineering Technology BS** has transfer agreements with the following regional technical colleges for students who have completed the following associate degrees.

Northeast Wisconsin Technical College  
Waste and Water Technology

Lakeshore Technical College  
Waste and Water Technology

UW-Green Bay's Engineering Technology programs also participate in CCIHS with Bayport HS (Howard-Suamico ISD), Preble HS (Green Bay ISD), Pulaski HS (Pulaski ISD), and West DePere HS (DePere ISD).