Full Program Proposal

1. **Characteristics of the Program**
   a. **Campus Offering Program**
      Purdue University West Lafayette
   b. **Scope of Delivery**
      Specific Site
   c. **Mode of Delivery**
      Classroom
   d. **Other Delivery Aspects (Co-ops, Internships, Practical)**
      Students will have the option of participating in co-op and internship programs, administered by the College of Engineering's Office of Professional Practice. These are paid positions ranging from one summer to several semesters, typically earning 55-85% of starting BS salary.
   e. **Academic Unit Offering Program**
      Division of Environmental and Ecological Engineering in Purdue's College of Engineering

2. **Rationale for the Program**
   a. **Institutional Rationale**
      The EEE program will contribute to the mission of Purdue University by serving the citizens of Indiana, the United States, and the world through dissemination of knowledge which prepares our graduates to succeed as leaders, professionals, informed consumers, responsible citizens, and lifelong learners. The EEE program will play a leadership role in Indiana's economic and social development by providing graduates to join a high quality educated workforce in an area of national need.

A distinguishing feature of the Environmental and Ecological Engineering program at Purdue University is the interdisciplinary approach of its educational mission. This interdisciplinary approach is evident in the disciplinary expertise of the faculty members supporting EEE. The EEE program at Purdue University believes that every student must be knowledgeable about the environmental and ecological impacts associated with the practice of their discipline of engineering. We believe that everyone must take responsibility for stewardship of natural resources, the environment and human health. Thus, we not only educate students majoring in our program with a modern systems based approach to EEE, we offer a minor in EEE and work cooperatively across the College of Engineering to educate students about EEE topics. The engagement of students from all engineering disciplines with EEE is critical to our mission. Serious environmental problems cannot be solved by traditional environmental engineering alone. Complex EEE problems require contributions, change in design practices and altered problem solving approaches across engineering disciplines. The greatest advances in reducing our collective environmental impact will be achieved by improvements in the design, manufacture and performance of all products and technology that utilize natural resources, water and energy. These are the advances that must be accomplished by all engineering graduates. Therefore, the mission of the EEE is to articulate a vision that conveys the importance of understanding and improving environmental and ecological stewardship by every discipline in Engineering.

The curriculum and academic planning are based on the results from a National Science Foundation funded Curriculum Planning Grant awarded to Purdue University in 2002 (award no. 0230631). This curriculum planning grant was entitled "The Future Role of Ecological Engineering Science in

Undergraduate Engineering Education." As part of this grant numerous stakeholders from professional practice, industry, government agencies, environmental advocacy groups and Purdue University faculty, students, administrators and staff provided input. Subsequently, the Division of Environmental and Ecological Engineering was created in 2006, in part to provide an administrative and academic home that would support efforts across the College of Engineering related to the environment. EEE was directed to act as an independent academic unit and offer academic programs in the area of environmental and ecological engineering. The Faculty of the EEE developed a Bachelor's Degree in Environmental and Ecological Engineering. Since 2008, the EEE has been working within the framework of the ABET-accredited Multidisciplinary Engineering Program to offer an EEE plan of study. One function of the Multidisciplinary Engineering Program at Purdue University is to act as a curriculum incubator. In fall 2011 the Engineering Curriculum Committee formally approved the Bachelor of Science in Environmental and Ecological Engineering degree. Therefore, we now seek the approval of the Indiana Commission for Higher Education.

The proposed EEE program will have a significant positive impact on other programs. The unique interdisciplinary structure in which the core traditional disciplines of engineering, and sciences beyond engineering, contribute to the EEE mission will foster greater interaction and collaboration among the Purdue University community. The EEE structure is an innovative model that optimizes responsiveness to educational and economic demands and challenges in a financially efficient and effective manner. By utilizing existing space, courses and faculty across much of the College and University the EEE is contributing to a fuller utilization of existing resources.

Because the Multidisciplinary Engineering (MDE) program has served as an "incubator" space for the EEE plan of study, we expect that the program will likely see a decrease in total enrollment and number of graduations once the BSEEE program launches. This has been part of the design and the plan for years. Since 2008, when the EEE plan of study launched, the total size of the MDE program has grown considerably, but the number of MDE students not in the EEE plan of study has remained essentially constant. We expect that the MDE program will revert to the steady state of the "non-EEE" size when the BSEEE program launches.

b. State Rationale

The proposed Bachelor of Science Degree in Environmental and Ecological Engineering (BSEEE) program has been designed in response to student demand for education that will prepare them to meet employment opportunities in an area of national need. Professionals engaged in environmental and ecological engineering (EEE) apply the principles of biology, chemistry, physics and mathematics to manage to environmental problems and ensure that industries and governmental agencies comply with environmental regulations. In their careers, graduates from the BSEEE program will perform a wide range of critical tasks for companies, the State of Indiana, and other agencies. For example:

- they will address water, wastewater and air pollution control, recycling, solid waste treatment, and public health protection;
- they will complete risk assessment studies that evaluate environmental hazards and develop treatment or containment strategies to minimize risks;
- they will participate in the development of regulations to protect the environment and public health;
- they will design, operate and retrofit municipal water supply and industrial wastewater treatment systems;
- they will be involved with the study and management of local, state and global environmental challenges;

- they will work across the full spectrum of the economy as consultants, for government agencies at all levels, in industries of every type, for NGOs, utilities and as teachers, researchers and attorneys.

c. Evidence of Labor Market Needs

i. National, State, or Regional Need

There are no accredited environmental engineering undergraduate degree programs at any public or private Indiana institution of higher education (though the University of Notre Dame offers a related program: an environmental engineering concentration within their accredited Civil Engineering degree). Our program will therefore be unique in the state as a degree program with a central focus on Environmental Engineering, accredited using the Environmental Engineering standards of ABET.

Within the region there are four accredited environmental engineering or similarly named programs: Northwestern University (Evansville, IL); Ohio State University (Columbus, OH); Michigan Technological University (Houghton, MI); and the University of Wisconsin-Platteville. While there are certainly similarities between the proposed Purdue program and the existing programs in the region, this program has been designed with a distinct ecological focus. We have sought to move beyond traditional environmental engineering topics (including, for example, pollution control and contaminated site remediation) to modern environmental engineering approaches, utilizing ecological design concepts and broad systems thinking. The capacity of the entire U.S. environmental engineering programs is sufficient to meet approximately only 30% of the projected employment demand over the next decade.

ii. **Preparation for Graduate Programs and Other Benefits**

Growth in Environmental Engineering employment within Indiana is expected to be equivalent or better than national projections. The creation of this degree program will position Purdue Engineering students well to meet this need. Excellent employment opportunities in EEE exist for individuals at all degree levels (BS, MS, and PhD). Accordingly, some students completing the EEE program will choose to continue to graduate level education. The requirement for admission to graduate programs in this field is a strong academic performance in an undergraduate program in environmental engineering or science. The top performing graduates of the EEE program will be qualified for admission to any graduate program in this field. The employment prospect for graduates with advanced degrees is excellent.

iii. **Summary of Indiana, DD and/or U.S. Department of Labor Data**

The US Bureau of Labor Statistics predicts that the number of Environmental Engineering jobs will grow "much faster than average" with the addition of almost 17,000 jobs (31% increase) over the next decade.[1] Thus, on the order of 1,700 new positions for Environmental Engineers are expected to be available each year.

[1] US Bureau of Labor Statistics, Occupational Outlook Handbook 2010-2011, http://www.bls.gov/oco/ accessed Nov 15, 2011.

Nationwide U.S. institutions of higher education produced 503 graduates with a Bachelor's Degree in Environmental Engineering in the 2008-2009 academic year, leaving an unmet need of approximately 1,000 employees.[2] These positions have typically been filled by graduates from Civil or Chemical Engineering programs. However, graduates with degrees in Environmental Engineering would be more competitive for Environmental Engineering jobs.

The Indiana Department of Workforce Development projects there will be 63 openings (7.7% growth) for Environmental Engineers in the State requiring a Bachelor's Degree by 2012 paying an annual wage of $76,634. Projections for Indiana through the year 2018 are for the creation of 315 new Environmental Engineering openings (32.9% growth).[3]

The creation of this EEE degree program will position Purdue Engineering students well to meet this need.

iv. **National, State, or Regional Studies--None**

v. **Surveys of Employers or Students and Analyses of Job Postings--None**

vi**. Letters of Support**

See below.

[2] Gibbons, M.T., 2010. Engineering by the Numbers. http://www.asee.org/papers-and-publications/publications/college-profiles/2010-profile-engineering-statistics.pdf, accessed Nov. 15, 2011.

[3] Indiana Department Workforce Development, Occupational Projections (Long Term) http://www.hoosierdata.in.gov/dpage.asp?id=39&page_path=&path_id=&menu_level=smenu4&panel_number=5&view_number=2, accessed Nov 15, 2011.

COCKRELL SCHOOL OF ENGINEERING
THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Architectural and Environmental Engineering • ECJ 4.2
1 University Station C1700 • Austin, Texas 78712-0273 • (512) 471-4921 • Fax (512) 471-0592

26 April 2012

John W. Sutherland, Ph.D.
Professor and Fehsenfeld Family Head
Environmental and Ecological Engineering
Purdue University
West Lafayette, IN 47907

Dear Professor Sutherland:

This letter is prepared at your request in response to the proposal to establish a BSEEE degree program, (Bachelor of Science in Environmental and Ecological Engineering) at Purdue University. I reviewed the summary proposal of the BSEEE degree program that you sent to me, specifically, the Engineering Faculty Document No. 38-11, "Creation of Degree: Bachelor of Science in Environmental and Ecological Engineering (BSEEE)" dated April 5 2011, which was submitted by Faculty of the Division of Environmental and Ecological Engineering to the faculty of the College of Engineering at Purdue University.

The BSEEE degree that is proposed requires a minimum of 128 semester credit hours for completion which generally is consistent with undergraduate environmental engineering degree programs that are accredited by ABET for which the minimum number of semester credit hours typically required for curricula leading to a BS Environmental Engineering (BSEE) is 128 SCHs. Many BSEE programs require more than 128 SCHs. This assessment is based on my years of experience as an engineering program evaluator in the ABET accreditation process.

I have served on the ABET Engineering Accreditation Commission (1982-1989) (chaired 12 teams of evaluators) and have served (1981-2012) as a program evaluator of undergraduate environmental engineering programs for the American Academy of Environmental Engineers (12 programs) and as a program evaluator for civil engineering programs for the American Society of Civil Engineers (8 programs).

The ABET 2011-2012 Criteria for Accrediting Engineering Programs addresses program Curriculum in Criterion 5.

"The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The professional component must include:

(a) ***one year of a combination of college level mathematics and basic sciences****, etc.*

(b) ***one and one-half years of engineering topics, consisting of engineering sciences and engineering design… and***

(c) a general education component that is consistent with the program and institution objectives.

One year is the lesser of 32 semester hours (or equivalent) or one-fourth of the total credits required for graduation."

I encourage and support the efforts of Faculty of the Division of Environmental and Ecological Engineering to establish this new degree program leading to a Bachelor of Science degree in Environmental and Ecological Engineering.

Sincerely,

Joseph F. Malina, Jr., Ph.D., P.E., BCEE, D. WRE
C.W. Cook Professor in Environmental Engineering
Professor of Civil Engineering
Civil, Architectural, and Environmental Engineering
Cockrell School of Engineering

JFM/jfm
cc: Steve Hoffmann, EEE Assistant Head,

Dr. Mark P. Cal, P.E., BCEE
Chair, Professor
801 Leroy Place
Jones Annex 115
Socorro, NM 87801

tel: (505) 349-3542 mcal@nmt.edu www.nmt.edu/~enve

NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

April 21, 2012

Dear Professor Sutherland:

I am a *Professor and Chair* of the Department of Civil and Environmental Engineering at New Mexico Tech, an engineering and science university established in 1889. I manage two accredited programs – civil and environmental engineering. I am a registered Professional Engineer (P.E.) in New Mexico, and a Board Certified Environmental Engineer (BCEE). Through the American Academy of Environmental Engineers (AAEE), I also serve as an ABET- EAC evaluator for the discipline of environmental engineering.

The requirements for accredited environmental engineering programs are attached to this letter. Requirements include a comprehensive background in math, chemistry and physics, an earth science, such as soil science or meteorology, biology and a comprehensive education in environmental engineering. Additionally, faculty teaching courses with significant amounts of engineering design are expected to be professionally licensed (P.E.).

I have reviewed the B.S. degree program in Environmental and Ecological Engineering being proposed by Purdue University - West Lafayette. The proposed BSEEE curriculum requires
128-132 credit hours. This credit hour requirement is very typical of the number of credits required by other ABET accredited environmental engineering programs. In my experience, I am not aware of any accredited environmental engineering program that requires less than 128 credits for a B.S degree (New Mexico Tech's degree requires 132 credits). I have serious doubts that a degree program with only 120 credits will survive an ABET review.

Please note that this evaluation is based on my experience as an ABET-EAC evaluator and as a Department Chair, who has undergone four ABET-EAC evaluations. My views do not necessarily represent the views of ABET or the American Academy of Environmental Engineers (AAEE).

Sincerely,

Mark P. Cal, Ph.D., P.E., BCEE
Department Chair and Professor

2012-2013

PROGRAM CRITERIA FOR ENVIRONMENTAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: American Academy of Environmental Engineers

These program criteria apply to engineering programs including "environmental", "sanitary," or similar modifiers in their titles.

1. Curriculum

The program must prepare graduates to be proficient in mathematics through differential equations, probability and statistics, calculus-based physics, general chemistry; an earth science, e.g., geology, meteorology, soil science, relevant to the program of study; a biological science, e.g., microbiology, aquatic biology, toxicology, relevant to the program of study; fluid mechanics relevant to the program of study; introductory level knowledge of environmental issues associated with air, land, and water systems and associated environmental health impacts; conducting laboratory experiments and critically analyzing and interpreting data in
more than one major environmental engineering focus area, e.g., air, water, land, environmental health; performing engineering design by means of design experiences integrated throughout the professional component of the curriculum; to be proficient in advanced principles and practice relevant to the program objectives; understanding of concepts of professional practice and the roles and responsibilities of public institutions and private organizations pertaining to environmental engineering.

2. Faculty

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

A Heritage Group 7901 W. Morris Street • Indianapolis, IN
317-243-0811 • 486-2985 (FAX)

April 26, 2012

John W. Sutherland, Ph.D.
Professor and Fehsenfeld Family Head
Environmental and Ecological Engineering
Purdue University
Potter Engineering Center, Room 322
500 Central Drive
West Lafayette, IN 47907

Dear Professor Sutherland,

As a member of the External Advisory Board for the newly formed Division of Environmental and Ecological Engineering, I'd like to take this opportunity to express my full support for the BS EEE degree proposed by Purdue University. As a Purdue engineering graduate and long- time practitioner of the environmental engineering profession, I am very pleased with the ecological aspect of environmental engineering that has been incorporated into the proposed BS EEE curriculum. With today's emphasis on sustainability engineering, the Purdue EEE program is precisely what is needed to better prepare our engineering workforce to deal with today's environmental challenges.

As I pointed out during our most recent advisory meeting, Professional Engineer (PE) licensure is an extremely important credential for EEE professionals. It is with that in mind that I reviewed the plan of study for the BS EEE degree that was outlined in your December 20th, 2011 Engineering Faculty Document No. 38-11. After tabulating the various courses and allocations in specific categories, I concluded that the course work was well distributed between the following five areas: (1) general math, physics and chemistry, (2) general education, (3) general engineering, (4) ecological engineering, and (5) core-environmental engineering. In order to prepare the EEE students for professional engineering (PE) licensure, it seems to me that the curriculum should require a balance between the ecological and core-environmental areas. In practice, this will better prepare the graduates to be innovative in their approach to problem solving. Thus I believe consideration should be given to developing two separate lists of "selective" courses – one for ecological engineering courses and one for the more traditional core-environmental engineering courses.

I understand that the State of Indiana now requires justification for degree programs to require more than 120 credit hours of coursework. As reflected in the proposed curriculum, I agree that the dual nature of the program by necessity expands the number of required credit hours to between 124 and 128 compared to the standard 120 hours. This will insure that the EEE curriculum is capable of being ABET accredited which is a necessary criterion for graduates to qualify for "sitting" for the PE exam.

Sincerely,

Ralph E. Roper, Jr., PhD, PE Senior Research Engineer Heritage Research Group

April 26, 2012

John W. Sutherland
Professor and Fehsenfeld Family Head
Environmental and Ecological Engineering
Purdue University
500 Central Drive
West Lafayette, IN 47907

Dear Professor Sutherland:

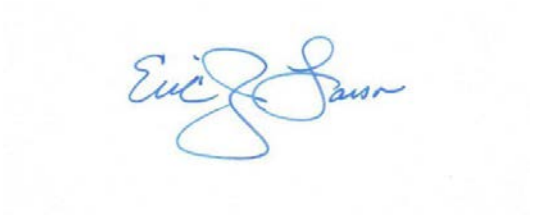
I am writing to express my support for the proposal for the Bachelors of Science in Environmental and Ecological Engineering (BSEEE) degree at Purdue. As a member of the Environmental and Ecological Engineering's External Advisory Board, I am familiar with the proposal and the goals of EEE. Since graduating from Purdue in 1992, I have seen first-hand the value of a well-designed engineering curriculum. Whether I was applying the engineering principles of wastewater treatment as the Water Engineer at BP's Whiting Refinery or as the Project Manager for some of BP's largest, most complex environmental remediation projects along the East Coast, my environmental engineering coursework prepared me well for the technical challenges that I continue to face.

Obtaining a Professional Engineer (PE) license is absolutely essential to being successful in today's engineering workforce - especially in the discipline of environmental engineering. Graduation from an ABET accredited degree program is the first step towards securing a PE. Therefore, I believe that it is imperative that the BSEEE degree program be designed to ensure ABET accreditation. After having reviewed the 128 credit BSEEE curriculum, I believe that the BSEEE degree is well positioned to become accredited, and I would be concerned that a degree program with only 120 credits may not become immediately ABET accredited.

Graduates of the BSEEE degree program are needed in industry and consulting to continue tackling the environmental challenges of the 21st century. Whether it is in the energy sector working for such companies like BP or Exxon Mobil, or in consulting working for national firms like Battelle or URS, there is a significant need for well-prepared graduates with degrees in EEE that go on to secure their PE license.

It is my sincere hope that Purdue University will take the steps necessary to pursue and achieve ABET accreditation for their BSEEE degree program.

Best regards,



Eric J. Larson

3. **Cost of and Support for the Program**

a. **Costs**

Table : 1A Total Direct Program Costs and Sources of Program Revenues

Campus: Purdue-West Lafayette (PWL)
Program: BS in Environmental and Ecologicial Engineering (EEE)
Date: January 2012

	Total Year 1, FY 2013		Total Year 2, FY 2014		Total Year 3, FY 2015		Total Year 4, FY 2016		Total Year 5, FY 2017	
	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost
A. Total Direct Program Costs										
1. Existing Departmental Faculty Resources	3.50	$ 493,900	4.00	$ 567,800	4.50	$ 644,500	5.00	$ 724,000	5.00	$ 738,400
2. Other Existing Resources		$ 218,700		$ 268,400		$ 309,300		$ 314,400		$ 318,400
3. Incremental Resources (see Table 2b)		$ 20,000		$ 20,000		$ 30,000		$ 30,000		$ 30,000
TOTAL		$ 732,600		$ 856,200		$ 983,800		$ 1,068,400		$ 1,086,800

	Total Year 1, FY 2013	Total Year 2, FY 2014	Total Year 3, FY 2015	Total Year 4, FY 2016	Total Year 5, FY 2017
B. Sources of Program Revenues					
1. Reallocation	$ 712,600	$ 836,200	$ 953,800	$ 1,038,400	$ 1,056,800
2. New-to-campus Student Fees	$ 0	$ 0	$ 0	$ 0	$ 0
3. Other (Non-state)	$ 20,000	$ 20,000	$ 30,000	$ 30,000	$ 30,000
4. New State Appropriations					
a. Enrollment Change Funding	$ 0	$ 0	$ 0	$ 0	$ 0
b. Other State Funds	$ 0	$ 0	$ 0	$ 0	$ 0
TOTAL	$ 732,600	$ 856,200	$ 983,800	$ 1,068,400	$ 1,086,800

Table 1B: Detail on Incremental or Out-of-Pocket Direct Program Costs

Campus: Purdue-West Lafayette (PWL)
Program: BS in Environmental and Ecologicial Engineering (EEE)
Date: January 2012

	Total Year 1, FY 2013		Total Year 2, FY 2014		Total Year 3, FY 2015		Total Year 4, FY 2016		Total Year 5, FY 2017	
	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost
1. PERSONNEL SERVICES										
a. Faculty	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
b. Support Staff	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
c. Graduate Teaching Assistants	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
TOTAL	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0	0.00	$ 0
2. SUPPLIES AND EXPENSES										
a. General Supplies/Expenses		$ 0		$ 0		$ 0		$ 0		$ 0
b. Recruiting		$ 0		$ 0		$ 0		$ 0		$ 0
c. Travel		$ 0		$ 0		$ 0		$ 0		$ 0
d. Library Acquisitions		$ 0		$ 0		$ 0		$ 0		$ 0
TOTAL		$ 0		$ 0		$ 0		$ 0		$ 0
3. EQUIPMENT										
a. New Equipment Necessary for Program		$ 20,000		$ 20,000		$ 30,000		$ 30,000		$ 30,000
b. Routine Replacement		$ 0		$ 0		$ 0		$ 0		$ 0
TOTAL		$ 20,000		$ 20,000		$ 30,000		$ 30,000		$ 30,000
4. FACILITIES		$ 0		$ 0		$ 0		$ 0		$ 0
5. STUDENT ASSISTANCE										
a. Graduate Fee Scholarships		$ 0		$ 0		$ 0		$ 0		$ 0
b. Fellowships		$ 0		$ 0		$ 0		$ 0		$ 0
TOTAL		$ 0		$ 0		$ 0		$ 0		$ 0
SUM OF ALL INCREMENTAL DIRECT COSTS		**$ 20,000**		**$ 20,000**		**$ 30,000**		**$ 30,000**		**$ 30,000**

i**. Faculty and Staff**

List program faculty and administrators.

Administration

Dr. John Sutherland
Fehsenfeld Family Head of Environmental and Ecological Engineering
Rank: Professor
Disciplinary Training: Mechanical Engineering, PhD

Dr. Stephen Hoffmann
Assistant Head of Environmental and Ecological Engineering
Rank: Non-faculty, Management/Professional Staff
Disciplinary Training: Environmental Chemistry, PhD

Core Faculty

	Rank	Disciplinary Training	Degree
Ernest Blatchley	Professor	Environmental Engineering	PhD
James Braun	Professor	Mechanical Engineering	PhD
Indrajeet Chaubey	Professor	Biosystems Engineering	PhD
Keith Cherkauer	Assoc. Professor	Civil and Environmental Engr.	PhD
Monica Cox	Assoc. Professor	Engineering Education	PhD
Bernard Engel	Professor	Agricultural Engineering	PhD
Abigail Engelberth	Asst. Professor	Chemical Engineering	PhD

Audeen Fentiman	Professor	Nuclear Engineering	PhD
Jane Frankenberger	Professor	Agricultural and Biological Engr.	PhD
James Garrison	Assoc. Professor	Aerospace Engineering Sciences	PhD
Eckhard Groll	Professor	Mechanical Engineering	PhD
Carol Handwerker	Professor	Materials Science and Engineering	PhD
Michael Harris	Professor	Chemical Engineering	PhD
John Howarter	Asst. Professor	Materials Engineering	PhD
Inez Hua	Professor	Environmental Engineering	PhD
Chad Jafvert	Professor	Environmental Engineering	PhD
Rabi Mohtar	Professor	Agricultural and Biological Engr.	PhD
Loring Nies	Professor	Environmental Engineering	PhD
Karthik Ramani	Professor	Mechanical Engineering	PhD
P Suresh Rao	Professor	Environmental Engineering	PhD
Bernard Tao	Professor	Biological Engineering	PhD
Fu Zhao	Asst. Professor	Mechanical Engineering	PhD

Affiliated Faculty

Douglas Adams	Professor	Mechanical Engineering	PhD
Robin Adams	Assoc. Professor	Engineering Education	PhD
Rakesh Agrawal	Professor	Chemical Engineering	PhD
John Bickham	Professor	Forestry and Natural Resources	PhD
Monica Cardella	Asst. Professor	Engineering Education	PhD
H. Kory Cooper	Asst. Professor	Anthropology	PhD
Melba Crawford	Professor	Industrial and Systems Engineering	PhD
Daniel DeLaurentis	Assoc. Professor	Aerospace Engineering	PhD
Albert Heber	Professor	Agricultural and Biological Engr.	PhD
Ananth Iyer	Professor	Management	PhD
Robert Jacko	Professor	Mechanical Engineering	PhD
Michael Ladisch	Professor	Chemical Engineering	PhD
Linda Lee	Professor	Environmental Chemistry	PhD
William Oakes	Assoc. Professor	Mechanical Engineering	PhD
Alice Pawley	Asst. Professor	Industrial Engineering	PhD
Marshall Porterfield	Professor	Plant Physiology and Biology	PhD
Ming Qu	Asst. Professor	Architectural Engineering	PhD
Yung Shin	Professor	Mechanical Engineering	PhD
Johannes Strobel	Asst. Professor	Info. Sci. and Learning Technol.	PhD
Ronald Turco	Professor	Soil Microbiology	PhD
Nelson Uhan	Asst. Professor	Industrial Engineering	PhD
Jeffrey Youngblood	Assoc. Professor	Polymer Science and Engineering	PhD

ii. Facilities

Laboratory Facilities for EEE Courses

Approximately 1,100 ft^2 of laboratory space is being renovated in the Civil Engineering Building (CIVL room 2146). The EEE program will have scheduling access to this new laboratory space for dedicated EEE courses. Completion of the renovation project is expected in October 2012. The renovation project is being funded by private gifts and the Purdue's

ongoing Renovation and Rehabilitation (R&R) initiatives. This space will supplement existing laboratory and project space available to faculty and students across the College and University.

iii. **Other Capital Costs**

No additional learning resources are necessary for the implementation of the BSEEE program.

b. **Support**

i. **Nature of Support**

Reallocation

Except the Head (who holds a 100% appointment in EEE), the faculty listed as "core faculty" hold either 0% ("courtesy") appointments with EEE, or partial appointments (typically 25%, either permanent or limited-term). As shown on Table 1A, the total faculty need for the program will increase to 5.0 FTE by FY 2017, from the current 2.625 FTE (an increase of 2.375 FTE). This will be primarily accomplished through internal reallocations of appointments of existing faculty. No "new-to-Purdue" faculty are immediately required to implement the program.

ii. **Special Fees above Baseline tuition**

There will be no additional fees for the BSEEE program other than the current College of Engineering Differential Fee."

4. **Similar and Related Programs**

a. List of Programs and Degrees Conferred

i. Similar Programs at Other institutions

A survey of peer institutions shows that most have responded to these societal needs by offering specific BS degrees in Environmental Engineering fields; however, there are no accredited, publicly supported baccalaureate Environmental Engineering degree programs in Indiana.

There are no accredited environmental engineering undergraduate degree programs at any public or private Indiana institution of higher education (though the University of Notre Dame offers a related program: an environmental engineering concentration within their accredited Civil Engineering degree). Our program will therefore be unique in the state as a degree program with a central focus on Environmental Engineering, accredited using the Environmental Engineering standards of ABET.

Within the region there are four accredited environmental engineering or similarly named programs: Northwestern University (Evansville, IL); Ohio State University (Columbus, OH); Michigan Technological University (Houghton, MI); and the University of Wisconsin-Platteville. While there are certainly similarities between the proposed Purdue program and the existing programs in the region, this program has been designed with a distinct ecological focus. We have sought to move beyond traditional environmental engineering topics (including, for example, pollution control and contaminated site remediation) to modern environmental engineering approaches, utilizing ecological design concepts and broad systems thinking. The capacity of the entire U.S. environmental engineering programs is sufficient to meet approximately only 30% of the projected employment demand over the next decade.

ii. Related Programs at the Proposing Institution

The College of Engineering currently awards an ABET-accredited Bachelor of Science in Multidisciplinary Engineering (MDE), which can serve as an "incubator" for new curricular programs. A formal EEE plan of study was implemented within this program in 2007; three students have graduated through the MDE EEE plan of study, and about 12 more students graduated in 2011-12. Upon approval of the BSEEE program, new admissions into the MDE EEE plan of study will be halted, and current students will be provided with the option to switch to BSEEE. A well-coordinated transition plan, made possible by a high level of communication and collaboration between the MDE and EEE offices, is in place. We anticipate that all students graduating in May 2013 or later will be able to transition seamlessly (students graduating in Dec 2012 or earlier will likely remain in the MDE program). The EEE program has an established Academics Committee which has an active role in the MDE EEE curriculum and a long term strategy for the EEE curriculum. A number of EEE courses have been approved and are being offered to students currently.

b. List of Similar Programs Outside Indiana

Northwestern University (Evanston, IL); Ohio State University (Columbus, OH); Michigan Technological University (Houghton, MI); and the University of Wisconsin-Platteville.

c. Articulation of Associate/Baccalaureate Programs

Transfer of students from other degree programs at Purdue-West Lafayette into the BSEEE program will follow standard CODO ("Change of Degree Objective") procedures; course options for core courses (in engineering, science, and general education) have been included in the program whenever possible to facilitate transfer from other College of Engineering programs.

Students transferring from other universities will follow Purdue University's standard transfer admission process. Course equivalencies will be determined through the normal process, including courses in the State of Indiana's Core Transfer Library (CTL, see www.transferIN.net), and other lists managed by Purdue's Credit Evaluation Department in the Office of Admissions.

The Purdue EEE program has entered into a formal Articulation Agreement with Vincennes University, with a full listing of Vincennes courses and their transfer equivalent of courses counting toward the BSEEE degree at Purdue. This agreement was designed to allow students following the plan to complete an AS degree in Engineering Science at Vincennes in two years, followed by the BSEEE at Purdue in an additional two years.

As part of the degree development procedure, EEE investigated a full articulation agreement with Ivy Tech Community College. However, a full agreement is not currently possible, as the Mathematics courses at Ivy Tech do not currently transfer to Purdue as equivalent credit for the courses required at Purdue for the BSEEE degree. EEE believes the decision on this course equivalency is the purview of the respective Departments of Mathematics, and we will seek an articulation agreement if proper course equivalency is determined. However, to facilitate transfer from Ivy Tech Community College, EEE will work with representatives to develop and share advising materials and accepted course transfer lists, based primarily on the CTL (see appendix for current list of required course equivalencies between Ivy Tech and Purdue EEE).

We anticipate that the absolute number of students transferring from other universities into the BSEEE program will be relatively small — our enrollment projections include an assumption of five students per year entering the junior year of the program from other programs at Purdue and from other universities *combined.* However, we desire to be a location of transfer for qualified students, and have developed advising procedures and documents to assist qualified transfer students in completing the degree in a combined four years of undergraduate study.

There are no unique considerations or constraints for transferability of EEE program credits. The EEE program will strive to retain students until their graduation. For students who do choose to transfer to another institution, their credits will transfer according to standard academic equivalency assessments that are routinely accomplished between institutions. For students transferring to other programs within the College of Engineering at Purdue, a large portion of the BSEEE curriculum is common with other programs (the extent of common courses varies with different programs).

d. Collaboration with Similar and Related Programs on Other Campuses--None

ARTICULATION AGREEMENT

between
ENVIRONMENTAL AND ECOLOGICAL ENGINEERING (EEE),
PURDUE UNIVERSITY, WEST LAFAYETTE
and
ENGINEERING SCIENCE PROGRAM, VINCENNES UNIVERSITY

for the transfer from the Engineering Science – Environmental Engineering Concentration (A.S.) at Vincennes into Environmental and Ecological Engineering (BSEEE) at Purdue.

The purpose of this Articulation Agreement is to provide a framework for the effective transfer of Vincennes University students to continue their education at Purdue University-West Lafayette.

To ensure the smooth transition to the BSEEE program at Purdue, West Lafayette, the faculty of both institutions have developed the attached listing of course equivalencies approved for transfer for students beginning their programs at either institution in Fall 2011 or later. In order to benefit from this agreement, Vincennes University students must complete the AS degree with a sufficient grade point average and academic record to be accepted into the Purdue-West Lafayette program. In addition, only courses with a grade of 'C' or above in the required courses for the BSEEE program will be transferred and credited toward the baccalaureate degree.

To ensure consistency and accuracy, these documents must be periodically reviewed by representatives from both institutions to communicate and update information regarding curriculum, course outcomes and objectives, and textbooks.

All coursework taken prior to Fall 2011 will be evaluated by Purdue EEE program faculty in order to determine transferability of coursework. This Articulation Agreement, including any modifications, should be reviewed by both institutions at least every two years. Further, it is expected that both institutions will keep the other party aware of any curriculum changes as they occur. While both parties to the agreement understand its purpose is to maximize transfer opportunities for students, they also recognize that limits may be placed on courses accepted under the provisions of this agreement, should the student subsequently decide to change to another program not covered by the agreement.

The following pages include a table on the course-by-course transfer relationships, and a *sample* eight semester plan of study that a student might take to satisfy requirements for both the AS degree at Vincennes and the BSEEE degree at Purdue-West Lafayette.

Vincennes University Department Chair

Vincennes University Dean Math/Science

Vincennes University Provost

Purdue University Department Chair

Purdue University

Purdue University

5. **Quality and Other Aspects of the Program**
    a. **Credit Hours Required/Time to Completion**

Degree Requirements

The BSEEE degree program will include a minimum of 128 credit hours, including the courses or course options listed below. Minimum graduation GPA requirements include: (a) 2.0 overall; and (b) 2.0 in College of Engineering courses at the 20000-level and above.

Course requirements, distributed into topic area, are listed below. In cases where options exist, the recommended course choices are listed in the table below, with a footnote that lists options. To assist in correlating to the sample plan of study on page 7, the typical year that each course will be taken is listed (FY = first year, SO = sophomore, JR = junior, SR = senior, var. = variable). Extra-curricular activities, such as internships and co-op work experiences are encouraged, but not required for the degree (EEE coordinates with the College of Engineering's Office of Professional Practice to assist students in internship and co-op placement).

	year	cr.	total cr.
Environmental and Ecological Engineering Core:			
EEE 25000: Environmental, Ecological, and Engineering Systems	SO	3	
EEE 30000: Environmental and Ecological Systems Modeling	JR	3	
EEE 39000: EEE Professional Practice Seminar	JR	1	
EEE 43000: Industrial Ecology and Life Cycle Analysis	JR	3	**19**
EEE 48000: Senior Design, 3 credits total, may be taken over two semesters[1]	SR	3	
CE 35000: Introduction to Environmental Engineering[2]	JR	3	
CE 35500: Engineering Environmental Sustainability	SO	3	
Fundamentals of Engineering Core:			
ENGR 13100: Transforming Ideas to Innovation I[3]	FY	2	
ENGR 13200: Transforming Ideas to Innovation II[3]	FY	2	
CE 29700: Basic Mechanics I (Statics)[4]	SO	3	
CE 29800: Basic Mechanics II (Dynamics)[4]	JR	3	**20**
ABE 21000: Thermodynamic Principles of Engr. and Biological Systems[5]	SO	3	
CE 34000: Hydraulics[6]	JR	3	
CE 34300: Elementary Hydraulics Laboratory[6]	JR	1	
IE 23000: Probability and Statistics in Engineering I[7]	JR	3	
Mathematics and Science Fundamentals:			
MA 16500: Analytic Geometry and Calculus I[8]	FY	4	
MA 16600: Analytic Geometry and Calculus II[8]	FY	4	
MA 26100: Multivariate Calculus[9]	SO	4	
MA 26200: Linear Algebra and Differential Equations[10]	SO	4	
CHM 11500: General Chemistry	FY	4	
CHM 11600: General Chemistry	FY	4	**39**
CHM 25700: Organic Chemistry[11]	SO	4	
PHYS 17200: Modern Mechanics	FY	4	
BIOL 12100: Biology I: Diversity, Ecology, and Behavior	JR	2	
BIOL 28600: Introduction to Ecology and Evolution	JR	2	
BIOL 48300 or BIOL 58500: Great Issues: Environmental and Conservation Biology, or Ecology	SR	3	
Environmental and Ecological Engineering Selectives:			
At least six courses, comprising at least 18 credits, from the EEE selective list, with the following constraints:	usually:		
• at least nine credits must be in the College of Engineering at the 20000+ level; of these, at least three credits must be at 40000+ level.	JR SR	6 12	**18**
• at least nine credits must be from a single "EEE Selective Theme List"			
• one course must focus on advanced environmental science			
• one course must be from the list of courses that include a component of engineering design.			
Society and humanity, general education, and other elective courses			
COM 11400: Fundamentals of Speech Communication	FY	3	
ENGL 10600: First-year Composition	FY	4	
General Education: 18 credits, with the following constraints:	usually:		

• following all College of Engineering General Education guidelines	SO	6	**32**
• one course in Economics (ECON 25100 or 25200) is recommended	JR	3	
• at least one course must be at intersection of society and environment	SR	9	
Technical Electives: at least 5 credits, from Colleges of Engineering, Science,	SO	3	
Agriculture, or Technology. Remedial courses not allowed, ENTR allowed.	SR	2	
Free Electives: As many credits as required to reach 128 credits total[12]	var.	2	

FOOTNOTES:

1. also allowed: three credits of EPICS senior design, EPCS 41100 (1cr) and EPCS 41200 (2cr)
2. also allowed: ABE 32500: Soil and Water Resources Engineering
3. also allowed: ENGR 19500 (Honors First Year), parts 1 and 2; or (currently pending approval) ENGR 14100 and ENGR 14200 (Honors Creativity and Innovation in Engineering Design I and II).
4. also allowed: mechanics sequences in ME (ME 27000 and ME 27400, Basic Mechanics I and II); or in AAE (AAE 20300 and AAE 20400, Aeromechanics I and II).
5. also allowed: ME 20000 (Thermodynamics I); CHE 21100 (Introductory Chemical Engineering Thermodynamics); or MSE 26000 (Thermodynamics of Materials). Note that the title listed for ABE 21000 reflects a proposed change in title currently in process and expected to be in place before the Fall 2012 semester.
6. also allowed: fluid mechanics course or sequence in ME (ME 30900, Fluid Mechanics); or AAE (AAE 33300 and AAE 33301, Fluid Mechanics and Fluid Mechanics Laboratory)
7. also allowed: CHE 32000 (Statistical Modeling and Quality Enhancement); STAT 35000 (Introduction to Statistics); STAT 51100 (Statistical Methods); or IDE 33000 (Multidisciplinary Engineering Statistics -- currently in approval process, also allowed is variable title course IDE 49500, IDE Statistics).
8. also allowed for first year of calculus sequence: MA 16100, MA 16200, MA 17300, and/or MA 18100, (many of these courses are 5 credits; only 8 credits total may count for EEE major).
9. also allowed: MA 17400; MA 18200; MA 26100; or MA 27100
10. also allowed: MA 26500 **and** MA 26600
11. also allowed: CHM 22400 (Introductory Quantitative Analysis); CHM 33300 (Principles of Biochemistry); or BCHM 30700 (Biochemistry)
12. For students taking all recommended options, this will likely include both of the Technical Elective courses as three-credit courses, and a single one-credit course (ENGR 103 in the first year is recommended) — this situation is shown in the sample plan of study on page 7. Several other one-credit options exist in all four years. Many of the options listed in these footnotes require more credits than the recommended courses (e.g.: footnote #2, ABE 32500 is one credit more than CE 35000; footnote #3: honors sequences are two credits more than standard sequence; footnote #10: MA 26500 and 26600 option is two credits more than MA 26200 option). Additionally, some EEE Selective courses are four credits. For students who take one of these options, or who enter with undistributed AP or other transfer credit, the free elective requirement may be moot.

Semester-by-semester sample plan of study

The following is a sample plan of study, demonstrating how a student would complete the BSEEE program in eight semesters of study. Actual student plans may vary.

FIRST YEAR

Fall Semester			*Spring Semester*		
ENGR 13100	Ideas to Innovation I	2	ENGR 13200	Ideas to Innovation II	2
MA 16500	Calculus I	4	MA 16600	Calculus II	4
CHM 11500	General Chemistry I	4	CHM 11600	General Chemistry II	4

ENGL 10600	First-Year Composition	4	PHYS 17200	Modern Mechanics	4
ENGR 10300	Engineering for the Planet	1	COM 11400	Fund's of Speech Comm.	3
		15			17
SECOND YEAR					
Fall Semester			*Spring Semester*		
EEE 25000	Env. Ecol. Eng. Systems.	3	CE 35500	Engr. Env. Sustainability	3
MA 26100	Multivariable Calculus	4	MA 26200	Linear Alg. + Diff. Eqns.	4
CHM 25700	Organic Chemistry	4	CE 29700	Basic Mechanics I (Statics)	3
	Technical Elective	3	ABE 21000	Thermodynamic Principles…	3
	General Education Elective	3		General Education Elective	3
		17			16
THIRD YEAR					
Fall Semester			*Spring Semester*		
EEE 30000	Environ. Ecol. Modeling	3	CE 340/343	Hydraulics and lab	4
CE 35000	Environmental Engineering	3	IE 23000	Statistics	3
CE 29800	Basic Mechanics II	3	EEE 39000	EEE Professional Preparation	1
BIOL 12100	Biol. I: Div., Ecol., Behav.	2	EEE 43000	Industrial Ecology and LCA	3
	EEE Selective	3	BIOL 28600	Intro. Ecology & Evolution	2
	General Education Elective	3		EEE Selective	3
		17			16
FOURTH YEAR					
Fall Semester			*Spring Semester*		
EEE 48000	EEE Senior Design	1	EEE 48000	EEE Senior Design	2
	EEE Selective	3		EEE Selective	3
	EEE Selective	3		EEE Selective	3
BIOL 58500	Ecology	3		General Education Elective	3
	Technical Elective	3		General Education Elective	3
	General Education Elective	3			
		16			14

Total Credits Required for Graduation = 128.

All of the required courses in the proposed curriculum are approved and in the university course catalog. No new courses required need to be developed for approval and no courses at other institutions are required for the BSEEE program, though new *elective* courses are likely to be developed as faculty interest and student demand allow. The three-year history of offering of required and common elective courses is given on the following page.
Historical offerings of required and common elective courses over

b. **Exceeding the Standard Expectation of Credit Hours**
ABET Criteria for Accrediting Engineering Programs 2012-2013

Criterion 5. Curriculum
The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:

a) One year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical and physical sciences.
b) One and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study.
c) A general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints.

One year is the lesser of 32 semester hours or one-fourth of the total credits required for graduation.

Criterion 6. Faculty

The program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program, its educational objectives and outcomes.

Program Criteria for Environmental and Similarly Named Engineering Programs

The program must prepare graduates to be proficient in mathematics through differential equations, probability and statistics, calculus-based physics, general chemistry; an earth science (geology, meteorology, soil science, etc.); a biological science (microbiology, aquatic biology, toxicology, etc.); fluid mechanics; introductory level knowledge of environmental issues associated with air, land, and water systems and associated environmental health impacts; conducting laboratory experiments and critically analyzing and interpreting data in more than one major environmental engineering focus area (air, water, land, environmental health); performing engineering design by means of design experiences integrated throughout the professional component of the curriculum; to be proficient in advanced principles and practice relevant to the program objectives; understanding concepts of professional practice and the roles and responsibilities of public institutions and private organizations pertaining to environmental engineering.

ABET Disciplinary and Curriculum Requirements

Requirement	Associated Course(s)	Number of Credits
Math through differential equations	MA 165, 166, 261, 262	16
Probability & statistics	Several options	3
Calculus-based physics	PHYS 172, 241	7
General chemistry	CHM 115, 116	8
Earth science	Several options	3
Biological science	BIOL 121, 286, 585	7
Fluid mechanics	CE 340	3
Environmental issues assoc. with air, land, and water	CE 350, 355, EEE 250	9
Lab experiments in more than one	CE 343, EEE selective	4

major focus area		
Engineering design integrated throughout the curricula	ENGR 131, 132, EEE 480 & selective	10
Professional practice, roles & responsibilities	EEE 390	1
Ecological engineering courses*	EEE 300 plus one EEE selective	6
One and one-half years engineering core topics (not already above)		21
One year math & science (not already above)		0
Statewide general education transfer core		30

Total Credits 128

* Since the program has Ecological Engineering as part of its title, it must have courses specifically related to ecological engineering. The other engineering courses are related to the requirements specifically articulated for environmental engineering, not ecological.

c. **Program Competencies or Learning Outcomes**

The faculty of the Division of Environmental and Ecological Engineering at Purdue have established the following **objectives** for the BSEEE degree program:

Graduates of the EEE Undergraduate program will:

1) be prepared to assume immediate employment in the fields of environmental and ecological engineering or to continue education in an advanced degree program, and
2) participate fully and ethically in the advancement of the profession within five years of graduation, as measured by one or more of the following:
   i) achievement of, or significant progress toward, professional licensure,
   ii) achievement of, or significant progress toward, an advanced degree
   iii) publication of research results and/or field reports,
   iv) advancement to leadership roles within an engineering organization,
   v) professional participation in international engineering activities, and
   vi) participation with organizations, agencies, or companies who offer solutions to major societal and environmental issues.

EEE has further established thirteen **outcomes** that all students will exhibit upon graduation.

The outcomes exhibited by EEE graduates will be:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(l) a knowledge of the roles and responsibilities of public institutions and private organizations pertaining to environmental and ecological engineering
(m) a knowledge of sustainability tools used in all engineering thought, and an ability to use these tools in the design process.

e. Assessment

Evaluation of the EEE program will occur through well established procedures developed by the Purdue College of Engineering. A thorough and intensive assessment process is required to acquire and maintain ABET accreditation status. EEE program stakeholders are assessed or surveyed as components of an overall integrated evaluation process. Key stakeholders are students, faculty, employers, alumni, the EEE advisory board, College of Engineering and the University.

Students are assessed for learning outcomes that are directly mapped to specific courses as part of the ABET accreditation process. Student feedback is obtained from University mandated evaluations of every course. The course evaluation process is administered by the Purdue University Center for Instructional Excellence. Exit surveys will provide additional feedback from students about their experience and satisfaction with their education.

Faculty are an integral part of the evaluation, assessment and continuous improvement process. Faculty receive all the information collected from assessments, surveys and evaluations of all stakeholders. Faculty are responsible for adapting and improving teaching methods, assessment methods, courses and curricula.

Employers of EEE graduates will be surveyed to determine whether EEE graduates have the skills, knowledge and problem solving abilities expected and necessary to meet their needs. Employers will be encouraged to provide constructive suggestions for how courses and curricula can be improved.

Alumni of EEE will be surveyed on a regular basis to assess program outcomes. Our alumni will be asked to reflect on their own perceptions of their skills, contributions from their education, their ability to meet the expectations of employers and career satisfaction.

The EEE External Advisory Board is comprised of professionals and employers working in the EEE discipline. The advisory board plays a critical role in providing feedback on the curriculum, skills needed by employers, trends and new opportunities in the field and assisting in forming the long-term vision of the program.

The College of Engineering and the University, in collaboration with EEE, will assess the program matriculation rates, graduation rates, placement rates, and alumni advancement in the workforce. Periodically the University will conduct faculty satisfaction and institutional program assessments. In addition, an annual faculty performance assessment is supervised by the College administration.

f. Licensure and Certification

Presuming the BSEEE program achieves ABET accreditation, graduates from the program will be eligible to pursue licensure as a "Professional Engineer," or "P.E." Feedback from our External Advisory Board has been unanimous in the support of the P.E. process and the importance of our program fully preparing students to pursue the P.E.

The P.E. process typically involves four steps:

1) Students must graduate from an ABET-accredited program.
2) Students must pass the Fundamentals of Engineering ("F.E.") written examination during their last semester of study. (Purdue typically has an F.E. pass rate in excess of 90%).
3) Graduates must accumulate professional experience, typically about four years.
4) Graduates must pass the Principles and Practice in Engineering ("P.E.") written examination in a chosen engineering discipline.

Both the F.E. and P.E. exams are administered by NCEES (the National Council of Examiners for Engineering and Surveying). Because P.E. licensure requires professional experience, holding a license is not required for entry into the profession. However, a P.E. is often required by state and federal codes for engineers performing or supervising certain kinds of engineering work, and it is therefore a valuable credential that tends to increase employability and salary.

g. Placement of Graduates

Because the program is new, we do not yet have placement statistics. However, students will have support from Purdue's Center for Career Opportunities and from a dedicated staff member within EEE (the Student Services Coordinator) in find employment. We anticipate that student placement will be similar to the excellent record of the College of Engineering as a whole.

h. Accreditation

The proposed EEE program will seek accreditation from the Accreditation Board for Engineering and Technology (ABET). Students must have earned a degree from an ABET accredited program in order to earn certification as a Professional Engineer. The EEE program has been designed to successfully acquire ABET accreditation. Issues such as EEE control of course staffing and content, laboratory courses and access to teaching laboratory facilities have been considered in order to meet the expectations of ABET.

In order to acquire ABET accreditation the EEE program will complete and submit a self-study report in June 2013. On-campus ABET program evaluators will visit in the Fall of 2013. Accreditation decisions are expected in spring 2014 which will be retroactive to May 2013.

6. **Projected Headcount and FTE Enrollment and Degree Conferred**

(See Table 2: Enrollment and Completion Data.)

Table 2: Program Enrollments and Completions

Annual Totals by Fiscal Year (Use SIS Defintions)

Campus: Purdue-West Lafayette (PWL)

Program: BS in Environmental and Ecologicial Engineering (EEE)

Date: January 2012

	Total Year 1, FY 2013	Total Year 2, FY 2014	Total Year 3, FY 2015	Total Year 4, FY 2016	Total Year 5, FY 2017 and steady state
A. PROGRAM CREDIT HOURS GENERATED					
1. Existing Courses	1515	2325	3000	3255	3450
2. New Courses	135	75	0	45	0
TOTAL	1650	2400	3000	3300	3450
B. FULL-TIME EQUIVALENTS (FTEs)					
1. FTEs generated by Full-time students	55	80	100	110	115
2. FTEs generated by Part-time students	0	0	0	0	0
TOTAL	55	80	100	110	115
3. On-campus Transfer FTEs	55	80	100	110	115
4. New-to-Campus FTEs	0	0	0	0	0
C. PROGRAM MAJORS (HEADCOUNT)					
1. Full-time students	55	80	100	110	115
2. Part-time students	0	0	0	0	0
TOTAL	55	80	100	110	115
3. On-campus Transfer	55	80	100	110	115
4. New-to-Campus	0	0	0	0	0
5. In-State	35	50	65	70	75
6. Out-of-State	20	30	35	40	40
D. PROGRAM COMPLETIONS	12	18	25	33	36

Note: In FY2012, approximately 45 students in the Multidisciplinary Engineering (MDE) program are pursuing the MDE degree with an EEE plan of study / area of concentration. Many of these students will be able to transition immediately to the new BSEEE program as soon as it is implemented. We therefore expect BSEEE graduates starting in the first year.

Enrollment projections were derived from a combination of analysis of steady state enrollments in similar programs at peer institutions around the country and trends in the growth within the EEE plan of study offered through Multidisciplinary Engineering. The projections culminate in a steady-state size of approximately 115 students (sophomore year and up; first-year students in the College of Engineering are not officially in a degree program) and 30-35 graduates per year. This size represents about 2.5% of the students within the College of Engineering, a number in line with established peer university programs. To date, the EEE plan of study in Multidisciplinary Engineering has met all enrollment growth targets.