

Application for Environmental Health and Sustainability Management

1. Environmental Health and Sustainability Management.

2. Statement of Justification and Suitability for the Offering.

Sustainability has long been a priority of Widener University with one university strategic goal being to “adopt policies and practices that promote efficient use and conservation of natural resources.” As our new website proclaims, Widener values “Green Pride” in the classroom, on the campus, and in the community. The innovative new multidisciplinary BA in Environmental Health and Sustainability Management rests on these foundations even as it will offer Widener students highly relevant preparation for the rapidly evolving green economy that is producing a variety of new job opportunities in this region.

In the environmental area, Widener currently offers one major degree program: a BS in Environmental Science and Sustainability. The new multidisciplinary and experiential BA in Environmental Health and Sustainability Management (EHSM) will attract additional students to Widener who are looking for a unique environmental degree that educates them in both science and management. To use some of Widener’s learning outcomes language, the EHSM student “evaluates the workings of the natural and physical world,” “draws conclusions from data,” and addresses “questions of human behavior, mental processes, communication,... and institutions.” This new EHSM major also aligns well with three Widener academic growth directions: STEM and Business combinations, Health-related programs, and Multidisciplinary collaborations that are both intellectually innovative and student-centered. Furthermore, the new major uniquely combines aspects of environmental health with human health and environmental sustainability, while looking at business practices and management. There are no other programs in this region that can claim such. Additionally, current and future employment opportunities are very promising.

The BA in Environmental Health and Sustainability Management will generate new opportunities for students. Among the possibilities are summer internships, an environmentally themed Living Learning Community, collaboration with the Environmental Law program at Widener’s Delaware Law School, and an MOU partnership pathway to graduate study in Sustainability Management at schools such as Stevens Institute of Technology. Above all, the new major will offer students who come to Widener the opportunity to study with excellent science and management faculty members who will teach them how to gather and evaluate evidence, think critically, and communicate clearly in team taught courses reflecting multiple lenses. With a major based on both technical and human

skills, on knowledge of both science and management, these students will be equipped to participate in the urgent environmental problem-solving arena that will define this century.

3. Specification of the Qualifications Required of Faculty Teaching in the Proposed Offering.

Stephen Madigosky

Professor Madigosky has taught a variety of courses in both the biology department and environmental science department at Widener University over the past 30 years. He has extensive knowledge of biological and environmental systems and has a broad background that nicely matches the content areas that will be covered in the newly proposed introductory courses (EHSM 151 & 152). His content expertise spans environmental toxicology, risk characterization and assessment, urban and regional environmental planning, environmental policy, along with sustainable development issues and policy. He has interfaced with local, regional, national, and international agencies that help to direct safe water, soil, air quality and land use practices throughout his career. His extensive work over the past 30 years in the Amazon Basin in Iquitos, Peru characterizing the microclimate conditions are now proving useful in documenting climate change in one of the most stable environments on Earth. Additionally, he is currently conducting meteorological research with faculty from the National University of Costa Rica on the effect of global climate change on coffee production. Students in the newly proposed major will have ample opportunity to work in these areas.

Itzick Vatnick

Professor Vatnick has worked 26 years at Widener University and is a member of three departments: Biochemistry, Biology and Environmental Science and Sustainability. He has taught various components of the Anatomy and Physiology I and II lab and lecture sequence (BIOL 121-124) during his entire tenure here. He also had significant input and authorship of laboratories in both courses and continues to examine and tweak this sequence in collaboration with other faculty who teach it. Professor Vatnick also teaches Human Physiology (BIOL 325) for biology majors, that is one area of his expertise. Professor's Vatnick research is in field of eco or environmental toxicology and he has a research collaboration with the University of Buenos Aires, Argentina in this area. Professor Vatnick has a keen academic interest in sustainability and co teaches a course in collaboration with Professor Madigosky as well as a Freshman Seminar in this area. Professor Vatnick has worked extensively with Professor Grant thoroughly researching curricula of related programs

to this program and designing the proposed EHSM first-year new course pair (EHSM 151. 152).

Bruce W. Grant

Since coming to Widener University and joining the Faculties in Biology and Environmental Science and Sustainability in 1993, Professor Grant's research and teaching activities have included (1) research on urban ecology in southeastern PA with numerous publications and presentations (co-authored with Widener students) on urban biodiversity and conservation biology spanning herpetofauna (reptiles and amphibians), invertebrates (nocturnal Lepidoptera and aquatic macroinvertebrates), and invasive plants, and more recently DNA barcoding; (2) research on the biodiversity of tropical lepidoptera at the Uyuca Cloud Forest Preserve in Honduras in collaboration with faculty at Zamorano University and with faculty at the Academy of Natural Science in Philadelphia; (3) research on the pedagogy of academic service learning (locally in Chester, PA, [most recently with the Stetser Elementary School community garden project], and internationally in Honduras) to enhance students' higher-level critical thinking and metacognitive skills, civic engagement, and understanding of and engagement in global human sustainability; and (4) research on undergraduate ecological education, which includes three co-authored NSF grants (we created the peer-reviewed journal "Teaching Issues and Experiments in Ecology" [tiee.esa.org], published by the Ecological Society of America and now in its 14th volume), and additional NSF grant in collaboration with Dr. Steve Madigosky from which we created faculty institutes for infusing the emerging field of sustainability science into our courses and programs, and lastly a publication by the National Academy of Sciences on using evidence-based practitioner research to teach evolution. Courses taught by Professor Grant at Widener span introductory biology and environmental science, freshmen seminars (in campus ecology, service learning, and pre-FRS-semester study abroad in Costa Rica in collaboration with Dr Itzick Vatnick and Dr Normaje.an Colby), courses on service learning in Chester, sophomore courses in research methods and statistics (including the computer language R), junior and senior level courses in ecology, evolution, biodiversity, urban ecology, advanced statistics and modeling, and a co-taught senior values seminar on environmental ethics.

Professor Chad Freed has taught a variety of courses within the department of environmental science at Widener University. Dr. Freed currently teaches Physical Geology, Engineering Geology, and Geographic Information Systems and has taught Introduction to Environmental Science, Natural Disasters, Environmental Challenges and Solutions, Hydrology, Advanced Geographic Information Systems, Remote Sensing and Digital Mapping, and Oceanography in past semesters. His specialty in integrating geographic information system science with earth science allows our students to solve practical environmental problems in the geologic environment. His new concentration in applications of remote sensing technology to the study of the environment utilizes data from both satellites and unmanned aerial vehicles (UAV), more commonly referred to as drones. The use of drone technology coupled with

cameras and infrared sensors is a new area of study for environmental scientists and our students are benefitting from the academic experience. Dr. Freed maintains an active research program in the environmental and engineering geosciences at Widener University and has collaborative projects with the Freshwater Research Institute at Susquehanna University and the graduate Engineering Geology Program at the University of Pennsylvania.

Scott Van Bramer

Professor Van Bramer has been teaching chemistry and environmental science at Widener University for twenty-five years. This teaching has focused on developing critical thinking skills and has resulted in numerous publications, presentations, workshops and teaching awards. Including the 2017 Philadelphia Section ACS Award for Excellence in Undergraduate Teaching, The 2014 Fitz Dixon Innovation in Teaching Award from Widener University. His teaching experience includes general chemistry lecture and lab, where he has introduced a number of innovative teaching strategies in both the lecture and lab; instrumental analysis, where the class often focuses on environmental analysis; advanced synthesis and spectroscopy, which also uses analytical techniques frequently used for environmental analysis; and an environmental analysis course previously taken by environmental science students. Currently he is working with students to develop methods so that Widener students can analyze samples from the local community for environmental pollutants. His background and expertise will assure that students in the new EHSM major will be well trained for the workforce or graduate school upon graduation.

Shirley Fischer-Drowos

Dr. Fischer-Drowos graduated with a PhD in Chemistry. Her areas of expertise include analytical and instrumental methods of analysis. She has taught at Widener University for 16 years and has been a member of three departments (Biochemistry, Chemistry, and Environmental Science and Sustainability). She has taught courses in all three departments, including co-developing a Bioanalytical laboratory course (BCH 453), teaching an Environmental Chemistry lecture and lab (ENVR 303), Analytical Chemistry lecture and lab (CHEM 365&367), Instrumental Analysis lecture and lab (CHEM 366&368), as well as many general chemistry lectures and labs and physical chemistry lectures and lab. She is versed in applications of spectrometric and chromatographic methods to environmental areas. In addition to her work at Widener, she also taught a masters course at the University of Pennsylvania focusing on environmental analysis. She has conducted research on VOCs (volatile organic compounds) and product lifecycles, with respect to their presence in air, water, and soil, as well as evaluating any byproducts that might be generated that could exhibit toxicological properties. Her academic and industrial experience at E.I. DuPont de Nemours, Co. nicely aligns with courses that the new EHSM major will offer. Professor Fischer-Drowos will contribute to the development and execution of several newly proposed

courses in the EHSM major. Her expertise in the development and analysis of novel and competitive materials, conducting toxicological analysis, and industrial hygiene expertise are all areas that will be important in delivering the unique curriculum that we propose.

4. Statement of the Primary Learning Objectives and an Overview of a Systematic Assessment Plan for the Program.

- 1) Core Goals in Content Development: Students will ...
 - a) understand multidisciplinary approaches
 - b) understand basic principles of sustainability design of our built world across multiple spatial and temporal scales,
 - c) understand foundational principles of business entrepreneurship as applied to environmental health and sustainability,

- 2) Core Goals in Analysis and Synthesis: Students will ...
 - a) understand the foundations of scientific literacy including data management and analysis
 - b) exhibit effective written and oral communication skills,
 - c) excel in systems thinking and mathematical modeling of challenges in public health

- 3) Core Goals in Critical Thinking and Knowledge Application: Students will ...
 - a) acquire skills in leadership, professionalism, and cooperation in decision-making in environmental health
 - b) understand ethical codes of conduct, social responsibility, and environmental justice in decision
 - c) demonstrate understanding the conduct of responsibly engaged citizens

The Department of Environmental Science and Sustainability will be responsible for the ongoing assessment of the Environmental Health and Sustainability Management major. To conduct this assessment the department will work closely with interested faculty in the School of Business Administration and other faculty from within the College of Arts and Sciences who teach courses

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in the program and who have relevant expertise. The assessments will be conducted in an ongoing manner with the department selecting two or three of the student learning objectives to evaluate each year. The assessment cycle will include:

1. Articulating expectations and scaffolding of expectations in the curriculum.
2. Articulating departmental expectations and rubrics for evaluating student learning outcomes.
3. Identifying assessment points in the curriculum.
4. Assessing student work at key points in the curriculum.
5. Discussing modifications to improve the curriculum based upon the assessment results.

5. Statement or List of Anticipated Graduate/Employment Options.

1. What are the possible outcomes with this degree?

1. Graduate School
 1. Advanced degrees in environmental health practice, toxicology exposure sciences, epidemiology, and public health.
 2. Graduate school in Allied Health, and other careers in health.
2. Possible Careers; Offices, Labs, Field Specialists
 1. Government agencies; environmental regulations and policies
 2. Health departments
 3. Inspectors for businesses that manage harmful chemicals
 4. Investigate and regulate any activities that compromise a community's health
 5. Air pollution analysis & control
 6. Drinking water quality
 7. Hazardous waste management
 8. Solid waste management & control
 9. Urban and Regional Planners
10. Industrial hygiene
11. Emergency and disaster management
12. Housing quality
13. Emergency response
14. Environmental remediation

15. Occupational safety and health

16. Food protection and safety

17. Radiation protection

18. Noise control

3. Potential Employers:

1. Local, county and state health departments
2. Local and region businesses/employers e.g. (Tetra Tech, Triumvurate Environmental, Johnson & Johnson, Merck and Aecom, UPenn, Anthem, Deloitte, Accenture)

4. Federal health, environmental and developmental agencies

1. Center for Disease Control & Prevention
2. Environmental Protection Agency
3. Federal Drug Agency
4. United States International Development Agency
5. National Center for Environmental Health
6. Agency for Toxic Substances and Disease Registry

5. Private Sector:

7. Environmental or occupational health and safety consulting firms
8. Pharmaceutical
9. Biotech
10. Disease Control
11. Agricultural companies
12. Tourism
13. Labor and consumer organizations
14. Food and Restaurant Quality Control and Inspections
15. Non-profit organizations/private foundations
16. Colleges & universities

6. International Employers:

1. World Health Organization
2. World Bank
3. United Nations Development Program
4. The United Nation Children's Fund Food and Agriculture Organization

5. Save the Children
6. Center for Disease Control (international outreach)
7. CARE
8. World Food Program
9. Office of the UN High Commissioner for Refugees
10. Fellowships; Peace Corp, AmeriCorp, etc.

Average Salaries and Potential Growth in Opportunities

A labor market analysis was conducted using the University's Economic Modeling Database, searching for job market data related to bachelor's degree graduates and the two related major CIP codes – Environmental Health and Sustainability Studies.

Environmental Health

This labor market search included a search for job postings using the target occupation codes of 19-2041 Environmental Scientists and Specialists, Including Health and 19-4091 Environmental Science and Protection Technicians, Including Health, with the following keywords: "environmental health" OR health OR sustainability. This target occupational group indicated 89 annual job openings and projected growth of 3.9% over the 2018 – 2023 period in the Philadelphia/Camden/Wilmington region. Projected growth is higher during this period in greater Pennsylvania (6.1%) and across the Nation (7.2%). There were 1,141 total job postings for this occupational group in the region from October 2017 to September 2018, of which 208 were unique. The monthly number of job postings has been steadily increasing since October 2017. Median hourly earnings are \$28.22/hour. The top "hard skills" sought in postings (in order of frequency) included Biology, Chemistry, Environmental Science, OSHA, Soil Science, Environmental Health, Geology, Groundwater, Statistics and Hazardous Waste Operations. The top "common skills" sought in postings (in order of frequency) included Management, Communications, Research, Operations, Innovation, Leadership, Problem Solving, Presentations, Interpersonal Skills, and Written Communication. Most common area employers include Tetra Tech, Triumvurate Environmental, Johnson & Johnson, Merck and Aecom.

Sustainability Studies

This labor market search included a search for job postings using the target occupation codes of 19-2041 Environmental Scientists and Specialists, Including Health, 13-1199 Business Operations Specialists, All Other, 19-3051 Urban and Regional Planners, and 11-9199 Managers, All Other, with the following keywords: "environmental health" OR health OR sustainability. This target occupational group indicated 1,063 annual job openings and projected growth of 4.3% over the 2018 – 2023 period in the Philadelphia/Camden/Wilmington region. Projected growth is slightly higher during this period in greater Pennsylvania (4.5%) and across the Nation (6.5%). There were 18,849 total job postings for this occupational group in the region from October 2017 to September 2018, of which 3,915 were unique. The monthly number of job postings has been steadily increasing since September 2016. Median hourly earnings are \$36.66/hour. The top "hard skills" sought in postings (in order of frequency) included Pharmaceuticals, Business Development, Business Process, Business Process Improvement, Timelines and Quality Management. The top "common skills" sought in postings (in order of frequency) included

Management, Communications, Operations, Leadership, Innovation, Research, Problem Solving, Presentation and Project Management. Most common area employers include Anthem, Merck, UPenn, Johnson & Johnson, Deloitte, and Accenture

6. Description of Courses Constituting the Core Curriculum

Curriculum Requirements

1. Environmental Health and Sustainability Management
 - EHSM 188 (151) Principles of Environmental Health I (4cu)
 - EHSM 188a (152) Principles of Environmental Health II (4cu)
 - EHSM 351 Models in Environmental and Public Health (4cu)
2. FRS 101 – Environmental Health and Sustainability (Costa Rica trip is optional) (2cu)
3. Biology
 - BIOL 121/123 Anatomy & Physiology I (4cu)
 - BIOL 122/124 Anatomy and Physiology II (4cu)
 - BIOL 219/220 Microbiology w Lab (4cu)
4. Chemistry
 - CHEM 105/106 General, Organic, and Biochemistry or Chemistry 101/103 Introduction to Chemistry I (4cu)
 - CHEM 120 Sustainable Chemistry (3 cu)
5. Environmental Science
 - ENVR 172 Principles of Sustainability Science (3cu)
 - ENVR 261 Geographic Information Systems (4cu)
 - ENVR 299 Research Methods & Analysis (4cu)
6. MATH 117 (3cu)
7. ENGL 101 (3cu)
8. ENGL 102 (3cu)
9. Business
 - EC 101 (3cu)
 - EC 202 (3cu)
 - BLAW 250 Legal and Ethical Environment of Business (3cu)
 - MGT 210 Foundations of Management (3cu)
 - MGT 335 Sustainability, Innovation, and Entrepreneurship (3cu)
10. POLS 215 (3cu)
11. Environmental Health and Sustainability Management (EHSM) Electives
 - 300 level ENVR courses (3/4cu)
 - EHSM 302 Sustainable Cities (4cu)
 - EHSM 408- 410 Senior Thesis (5 cu)
 - EHSM 498 Undergraduate Research in Environmental Health & Sustainability Management (\geq 3cu)

- OPM 352 Operations Management (3cu)
- MKT 300 Marketing Principles (3cu)

Curriculum Ladder

First Year Fall (13.5cu)

EHSM 188 (151) Principles of Environmental Health I (4cu)

FRS 101 Environmental Health and Sustainability (optional August trip to Costa Rica) (2cu)

CHEM 105/106 General, Organic, and Biochemistry or Chemistry 101/103 Introduction to Chemistry I (4cu)

ENGL 101 (3cu)

Physical Education (0.5cu)

First Year Spring (17cu)

EHSM 188a (152) Principles of Environmental Health II (4cu)

ENVR 172 Principles of Sustainability Science (3cu)

BIOL 121/123 Anatomy & Physiology I (4cu)

MATH 117 (3cu)

ENGL 102 (3cu)

Sophomore Fall (14.5cu)

ENVR 261 Geographic Information Systems (4cu)

BIOL 122/124 Anatomy and Physiology II (4cu)

SSCI intro course elective (3cu) {recommend POLS 101}

EC 101 (3cu)

Physical Education (0.5cu)

Sophomore Spring (15cu)

ENVR 299 Research Methods & Analysis (4cu)

EC 202 (3cu)

SSCI intro course elective (3cu) {recommend POLS 101}

CHEM 120 Sustainable Chemistry (3 cu)

BIOL 219/220 Microbiology w/ Lab (4cu)

Junior Fall (15/16 cu)

BLAW 250 Legal and Ethical Environment of Business (3cu)

MGT 210 Foundations of Management (3cu)

POLS 215 (3cu)

EHSM elective (3/4cu)*

HUM elective (3cu)

Junior Spring (15/16cu)

EHSM 351 Models in Environmental & Public Health (4cu)

EHSM elective (3/4cu)*

HUM elective (3cu)

SSCI intro course elective (3cu)

Free elective (3cu)

Senior Fall (15/17cu)

EHSM elective or ASC 400 Values Seminar (Biomedical Ethics or Environmental Ethics) (3/4cu)

EHSM elective (3/4cu)*

MGT 335 Sustainability, Innovation, and Entrepreneurship (3cu)

HUM elective (3cu)

Free elective (3cu)

Senior Spring (12/15cu)

ASC 400 Values Seminar (Biomedical Ethics or Environmental Ethics) or ENVR Elective (3/4cu)

Two EHSM electives (6/8cu)*

Free elective (3cu)

Total Credits: 121-127

*Select Six from the following:

EHSM 302 Sustainable Cities (4cu)

EHSM 408 - 410 Senior Thesis Proposal (5 cu)

EHSM 498 Undergraduate Research in Environmental Health & Sustainability Management (≥3cu)

ENVR 301 Ecology (4cu)

ENVR 304 Environmental Pollution (4cu)

ENVR 340 Tropical Ecology and Public Health (3-4cu)

ENVR 345 Biodiversity (4cu)

ENVR other (≥300 level) (3-4cu)

OPM 352 Operations Management (3cu)

MKT 300 Marketing Principles (3cu)

Catalog Descriptions

EHSM 151 Principles of Environmental Health I (4cu) This course will explore the extent of how environmental health can greatly impact human health both in a positive and negative manner. This course will examine and explain how concerns over human health and well-being inform the design and management of a safe, just, and sustainable environment. Prerequisites: none. 3 hours lecture, 3 hours lab.

EHSM 152 Principles of Environmental Health II (4cu) This course will address applications of environmental health in solving management challenges to promote environmental sustainability. Topics include air and water quality, food production, sustainable agriculture, waste management, occupational health and safety, and sustainable urban design. Each topic will be presented at local to global scales and infused with important themes from EHSM 151 such as risk assessment and management, environmental justice and ethics, and environmental health policy, regulation, and management. Prerequisite: EHSM 151. 3 hours lecture, 3 hours lab.

EHSM 302 Sustainable Cities (W) (4cu) This course will facilitate students' understanding and appreciation of the ecology, design, and management of sustainable cities. Students will explore (1) urban biodiversity, natural history, and natural resources management through urban parks and preserves, (2) ecological processes due to which disturbance, invasive species, and other factors affect urban biodiversity in both aquatic and terrestrial urban ecosystems, (3) the structure and function of urban ecosystems, and the modeling of those processes to estimate urban energy, water, and materials demands, ecological footprints, waste impacts, toxicology, and ecosystem services, (4) how the above attributes of urban environments affect public health, including disease epidemics, especially in this time of rapidly changing global climate, and lastly, (5) the socio-ecological challenges to urban design and re-design for sustainability and urban environmental justice, especially focused on our region and our Widener University campus. Prerequisites: EHSM 151 & 152, or permission of the instructor, 3 hours lecture, 3 hours lab.

EHSM 351 Models in Environmental and Public Health (4cu) This course will use a case study approach to improve students' (1) understanding of models used in environmental health research and management, and (2) quantitative skills in data analysis, visualization, interpretation, and modeling using epidemiological, economic, and spatially structured environmental data. Core examples will include constructing and interpreting mathematical models of infectious disease epidemics using Excel, MatLab, ArcGIS, and R. Students will develop skills in using deterministic and stochastic models, compartmental models, and individual-based models. The course will also explore the biostatistical analysis of public health data with examples using more advanced statistical methods such as logistic regression, survival analysis, and models of environmental risk. 3 hours lecture, 3 hours computer laboratory. Prerequisites: EHSM 151 & 152, 299 or permission of instructor.

EHSM 408 Senior Thesis Proposal (2cu) This course involves generating a research proposal with an extensive literature review in an area of environmental health and sustainability. Prerequisite: ENVR 299

EHSM 409, 410 Senior Thesis in Environmental Health & Sustainability Management (2cu) The Senior Thesis in Environmental Science provides an opportunity for students to participate in independent, investigative research under the direction of select faculty mentors. Prerequisite: ENVR 408

EHSM 496 Undergraduate Research Experience (≥ 3 cu) The undergraduate research experience is intended to provide an opportunity for students to participate in an independent, investigative research project as part of the requirements for the Bachelor of Arts degree in Environmental Health and Sustainability Management. Students conduct research in close collaboration with a faculty mentor. Collaborative projects with the School of Business Administration, Small Business Development Center and outside agencies will be strongly promoted. A written report and a public presentation are required. Prerequisites: EHSM 152, ENVR 299, BLAW 250, MGT 210, GPA 2.5, and permission of instructor(s).

Freshman Seminar

FRS 101 Environmental Health and Sustainability (2cu) This course begins with an optional pre-course study-abroad trip in August to Widener's CARES 21 facility in Costa Rica. There students will explore culture, education, economics, ecology, and biodiversity at the nexus of ecosystem health, community health, and management for environmental sustainability. During the fall semester, we will use a similar template of engagement, excursions, and learning outcomes applied to our local community in Chester for all students in the course. Students will engage with Widener organizations (such as the Center for Global and Civic Engagement), and local groups and organizations in Chester (such as local schools, businesses, and industries) to explore Chester culture, education, ecology, environmental health and sustainability. As above, these activities are designed to afford students multiple opportunities to interact and engage with people from cultures different from their own. As above, we will focus upon the complex relationships between education, economics, biodiversity, at the nexus of ecosystem and community health, and engage in the discourse processes necessary for management for environmental sustainability. In addition, many of the topics of FRS 101 that deal with the transition to college will be addressed during these fall semester classes, and the topics that necessitate presentations by different offices (e.g., CAPS, Student Health, time management, student conduct, etc.) or visits to Campus resources will occur during then, as well. Prerequisite: none (however, an application and interview process are necessary for instructors' permission for the study-abroad option for this course). 2 hours hybrid lecture/discussion classes.

Environmental Science

ENVR 172 Principles of Sustainability Science (3cu) This course addresses the cultivation, integration, and application of knowledge about our planetary environment from a dimension that considers the dynamics of human-centered environmental activity and systems. This approach is taken to facilitate the evaluation and implementation of essential interventions that not only promote sustainability but also help arrest conditions that we as a global society must resolve over the next several decades. Specific topic areas include scientific and systems thinking, global climate change, human population growth, sustainable agriculture, ecological footprint analysis, environmental ethics, biological diversity and conservation, solid waste recycling, natural capital and services provided by ecosystems, ecological economics and globalization, alternative energy, green transportation and building design, sustainable architecture, environmental health, and community-based environmental literacy. In addition to the above, this course requires that students engage in real-world problem solving activities and student presentations. Prerequisites: none. 3 hours lecture.

ENVR 261 Geographic Information Systems (3cu) This course provides a skill that is cross-disciplinary and applicable to the interpretation of any data that has a spatial relationship. Of particular interest are environmental data sets that are collected within a geographic context. The lecture portion of the class introduces the basic principles of using and interpreting data within a computerized Geographic Information System (GIS). Topics of spatial data analysis are introduced as a way to showcase the extended data analysis capabilities of a GIS. This course provides students with a broad framework upon which to access and assess geographic information for the purpose of better understanding spatial relationships. The lab component of the course integrates lecture material into a GIS assessment. An important component of the lab is the collection of digital data using global positioning system (GPS) equipment and uploading the data to the GIS system. Students are required to develop and demonstrate a working knowledge of the GPS/GIS techniques through an independent research project that they will present orally to the class. Lab students are required to submit a final written project report. Open to all students across disciplines. Prerequisites: none. 3 hours hybrid lecture/lab.

ENVR 299 Research Methods and Analysis (W) (4cu) This course is designed to provide students with sufficient theoretical and practical knowledge to plan, conduct, evaluate, and present faculty directed original research. Topics include the historical and philosophical development of scientific research, introduction to the scientific method, writing a research proposal, selection of research arena, qualitative and quantitative observations, sampling techniques, collecting, recording, summarizing, statistically analyzing, and graphically presenting data, bibliographic searching techniques, oral presentation of research, and writing a research paper. Prerequisites: Sophomore standing in EHSM or permission of the instructor. 3 hours lecture, 3 hours laboratory.

All 300 level ENVR courses (3-4cu) also count as EHSM electives, for example:

ENVR 301 Ecology (4cu) This course teaches ecological and environmental literacy. Participants will understand (1) the physical, biological, and evolutionary processes that determine ecosystem structure and function, and (2) the process of ecological inquiry, which is the scientific method, through which natural phenomena are observed, interpreted, and reported. This course also teaches how to read global environmental signposts (climate change, declining ecosystems services, and biodiversity loss), recognize our role in causing these trends, and evaluate the courses of action, in terms of our consumer and disposer decisions, we all must take to sustain ourselves. Prerequisites: ENVR 299 or permission of instructor. 3 hours lecture, 6 hours field and laboratory.

ENVR 304 ENVIRONMENTAL POLLUTION (4cu) A critical examination of the integral processes that affect Earth's atmosphere, hydrosphere, and lithosphere with regard to human activities. Topics addressed include chemistry of the atmosphere, soil, and water chemistry, waste disposal and treatment, regulatory strategies, for air, water, and soil pollution abatement, principles of wastewater, treatment, solid and hazardous waste management, thermal pollution, and mining and reclamation. Prerequisite: CHEM 255, or permission of instructor. 3 hours lecture, 3 hours lab.

ENVR 340 Tropical Ecology (3/4 cu) This course examines the nature, evolution, structural and functional components, and relationships that exist within tropical forests worldwide. A broad range of topics covering the physical, biological, and chemical aspects of tropical environments are explored. Specific topics include forest succession and architecture, tropical microclimate, vertical organization of canopy biota, evolution of tropical plants, tropical parasites, decomposition and nutrient cycling, plant/animal coevolutionary interactions, survival strategies, and the evolutionary history of tropical forests. This course is open to upper division biology and environmental science majors. Prerequisite: ENVR 299, or permission of the instructor. 3 hours lecture, 3 hours lab (which may include a short-term study abroad trip to Peru over spring break).

ENVR 345 Biodiversity (4cu) This course facilitates students' understanding and appreciation of (1) the incredible diversity of Earth's biota, especially that found in neotropical Central and South American habitats in comparison to southeastern Pennsylvania; (2) the prodigious and intricate processes of evolutionary ecology from which this biodiversity emerges; (3) direct engagement in the measurement of biodiversity using methods of DNA barcoding and other bioinformatics methods; (4) engagement with the archiving and preservation of specimens at internationally recognized natural history museums in Philadelphia and Latin America; and (5) perspectives on human land use, development, and international efforts at conservation and management for biodiversity preservation spanning urban Chester, PA, and Latin America. Prerequisite: junior standing EHSM major, or permission of the instructor. 3 hours lecture, 3 hours field and laboratory.

Biology

BIOL 121/123 Anatomy & Physiology I (4 Credits) This is an integrated lecture/laboratory course. The principal animal used for dissection is the cat. Fundamental principles of biological systems are presented in the context of human anatomy and physiology. The cell as the fundamental unit of life is discussed and examined, including structure and metabolism. The organization of cell into tissues, into organs, and organs into systems is thoroughly explored, and the integumentary, skeletal, muscular and nervous systems are the focal points of study. The somatic and special senses are examined, and the basic principles of the endocrine and prostaglandin physiology are introduced. This course does not satisfy any biology or science elective requirements for a biology major. Prerequisite: CHEM 105-106, CHEM 101-103, or CHEM 145-147. 3 hours lecture, 3 hours lab.

BIOL 122/124 Anatomy and Physiology II (4cu) This course is a continuation of BIOL 121. The course examines the structure and function of seven organ systems: (1) endocrine system, (2) cardiovascular system, (3) lymphatic and immune system, (4) respiratory system, (5) digestive system, (6) urinary system, (7) reproductive system and inheritance. The course emphasizes structure and function relationships as well as the interaction among the organ systems. Many of the laboratory exercises involve the use of computerized data acquisition and computerized data analyses. This course does not satisfy any biology or science elective requirements for a biology major. Prerequisite: BIOL 121. 3 hours lecture, 3 hours lab.

BIOL 219 Microbiology (3cu) An introduction to the basic principles of microbiology. The classification, structure, function, and metabolism of bacteria, fungi, algae, protozoans, and viruses are discussed. The role of microorganisms in human health and disease and the control of microbial growth is stressed. Prerequisites: BIOL 121–124, CHEM 101-103 or CHEM 105–106. 3 hours lecture.

BIOL 220 Microbiology Laboratory (1cu) A laboratory course designed to introduce basic microbiological techniques. Topics include bright field and phase contrast microscopy, aseptic techniques, simple and differential bacterial staining methods, pure culture techniques, identification of unknown microorganisms, cultivation of bacterial viruses, serological methods, and the isolation and identification of microorganisms from clinical specimens. Corequisite: BIOL 219. 3 hours lab.

Chemistry

CHEM 101 Introduction to Chemistry I (3cu) This course is designed for students who are in a nonscience pre-physical therapy major and students who do not intend to major in science or engineering. The various principles of chemical behavior are discussed and correlated with other sciences. Topics include bonding, structure, reactivity, stoichiometry, gas laws, solutions, solubility, equilibrium, energy relationships, periodic table, an introduction to organic chemistry, and hydrocarbons. 3 hours lecture. 1 hour recitation. Prerequisite(s): MATH 101 or at least Level 3 on the Mathematics Assessment - Must be completed prior to taking this course. Corequisite(s): CHEM 101 must be taken concurrently with CHEM 103.

CHEM 103 Introduction to Chemistry Laboratory I (1cu) This laboratory course is closely coordinated with CHEM 101 and serves to illustrate the principles examined in that course. Qualitative and quantitative experiments involving primarily inorganic systems are carried out. CHEM 101 must be taken concurrently with CHEM 103.

CHEM 105 General, Organic, and Biochemistry (3cu) Designed for nursing majors and students who do not intend to major in science or engineering. This course presents principles of chemical constitution and their relation to chemical, physical behavior with particular emphasis on compounds of biological interest. Topics include atomic structure, chemical bonding, properties of gases and solutions, acid/base equilibria, organic functional groups and their reactions, and properties of biologically important molecules— proteins, carbohydrates, nucleic acids, and lipids. Nursing majors are required to take CHEM 106 concurrently with CHEM 105. 3 hours lecture. 1 hour recitation. Prerequisite(s): MATH 101 or at least Level 3 on the Mathematics Assessment.

CHEM 106 General, Organic, and Biochemistry Laboratory (1cu) A laboratory program closely coordinated with and designed to accompany CHEM 105. Experiments develop basic principles of laboratory technique with an emphasis on observations and measurement. Qualitative and quantitative characterizations and syntheses are performed. Nursing majors are required to take CHEM 106 concurrently with CHEM 105. The combination of both CHEM 103 and CHEM 104 is equivalent to CHEM 106. 3 laboratory hours. Prerequisite(s): MATH 101 or at least Level 3 on the Mathematics Assessment. Corequisite(s): CHEM 105 or successful completion of CHEM 105.

CHEM 120 Sustainable Chemistry (4cu) This course is open to all students who have an interest in sustainability and the role of chemistry in the environment and a sustainable world. The course introduces basic chemical concepts through their relationship with our natural world using a

triple-bottom line and cradle-to-cradle approach. The chemical topics discussed include matter, chemical nomenclature, reactivity, atomic theory, molecular structure, stoichiometry, energy relationships, solutions, solubility, acids and bases, radiation, electrochemistry, and polymers. These topics are broached using the following environmental issues: air pollution, the ozone layer, global climate change, energy, water, acid rain, nuclear power, alternative energy, and recycling. Prerequisite(s): MATH 101 or at least Level 3 on the Mathematics Assessment.

Mathematics

MATH 117 Elementary Functions (3cu) The course starts with a review of elementary algebra and moves on to the study of functions and graphs (emphasizing polynomial, exponential, and logarithmic functions), systems of linear equations, and matrices and linear programming. Prerequisite(s): MATH 101 or at least Level 3 on the Mathematics Assessment.

Social Science

POLS 215 Environmental Politics and Policy (3cu) This course examines the context surrounding the debate, enactment, and implementation of environmental policies in the United States. It will explore the complex interactions between politicians, bureaucrats, pressure groups, and the public on issues of the environment. It will then examine the policies that the political system produces and their effects on American society. The course places a special emphasis on the way in which political actors frame issues related to the environment. Prerequisite(s): none.

English

ENGL 101 Reading, Thinking, and Writing (3cu) Success in college calls for curiosity, engagement, and a willingness to be challenged, as well as having a strong foundation in reading, writing, and thinking. First-year students at Widener begin their college career with ENGL 101, a course designed to prepare undergraduates for serious academic inquiry, full participation in the intellectual life and mission of the university, and sustained self-directed learning throughout the curriculum. Students have the opportunity to select a section of ENGL 101 focused on a particular theme or topic. Through a variety of challenging reading and writing assignments engaging with the topic of choice (including a common reading), students become

more careful and discerning readers. They will express insights and craft sustained arguments supported by carefully chosen evidence from primary and secondary material, and they will strengthen their ability to ask questions, evaluate, and synthesize complex information and draw conclusions. Prerequisites: none.

ENGL 102 Literature and Critical Writing (W) (3cu) Students are introduced to the principal literary genres of fiction, drama, and poetry as a means of stimulating critical thinking and further developing skills in writing and analysis. Students should consult the descriptions for ENGL 115–ENGL 125 for specific information about the different focuses offered. This course contributes toward satisfying the humanities distribution requirement. All sections are writing enriched. Satisfies a humanities general education requirement for non-majors. Students who have taken ENGL 103 are exempt from taking ENGL 102 to fulfill first-year writing requirements but may take the equivalent courses ENGL 115–ENGL 125 for humanities distribution credit. Students pursuing majors that require ENGL 102 should register for ENGL 102 and consult with advisors to identify the theme and focus for their preferred section. Once the 102 requirement has been completed, students may register for a course from ENGL 115 to ENGL 125 to fulfill a humanities general education requirement, as long as a different theme and focus is chosen. Students whose majors do not require ENGL 102 may register for sections of ENGL 115–ENGL 125 to fulfill a humanities general education requirement. Prerequisite(s): ENGL 101 or equivalent.

School of Business Administration

EC 101 - Principles of Macroeconomics (3cu) An introductory study of the determinants of the aggregate level of economic activity in a global economy. Attention focuses on the demand for output by households (consumption), businesses (investment), government and trade with the rest of the world (net exports), as well as the roles played by fiscal and monetary policies. In addition, interest centers on the problems of inflation, unemployment, federal budget deficits, and stimulating economic growth. Topics include measuring the levels of output and income, Keynesian and classical models of aggregate demand and supply, the banking system and money creation, impacts of government fiscal and monetary policies, inflationary processes and models of inflation, unemployment- inflation tradeoff controversies, public debt burdens, international trade policies, and determinants of economic growth. This course may be used to satisfy the social science general education distribution requirement. Students may not receive credit for both EC 101 and EC 201. Prerequisite(s): Second-semester freshman.

EC 202 - Principles of Microeconomics (3cu) This course provides an introduction to product and resource markets; failures of markets to effectively allocate resources; demand and supply

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decisions by households, businesses, and government; and the impact of international trade. Topics include market systems, consumer behavior, production functions and costs, output pricing under various market structures, and input pricing. Throughout the course, students may work in teams to solve problems. Working in groups, students may interview representatives of businesses, and use the findings from the interviews to apply course content. To further engage students, a game format may be used to review content. This course may be used to satisfy the social science general education distribution requirement. Prerequisite(s): Sophomore standing.

BLAW 250 - Legal and Ethical Environment of Business (3cu) This course includes an examination of the contemporary legal and ethical environment as it relates to the formation and management of business and other organizations. A study of the major classifications of the law such as civil law, criminal law, constitutional law, and administrative law, as well as a review of our legal system, is therefore necessary. Emphasis is placed on recent legislation governing areas such as employment, consumer rights, and environmental issues, as well as the ethical dilemmas that are present in the modern business organization. This course is required of all majors in the School of Business Administration. Students may not receive credit for both BLAW 150 and BLAW 250. Prerequisite(s): Sophomore standing.

MGT 210 - Foundations of Management (3cu) This course is an introduction to management and organization theory. It integrates management thought with contemporary business and behavioral concepts. Students learn the role that managers play in guiding the business firm to success. The course focuses on the development of students' understanding of the four functions of management: planning, leading, organizing controlling at various levels. Furthermore, students demonstrate their understanding of the ethical and environmental impact of business decisions. Professional preparation continues with a focus on career exploration; networking and developing professional relationships; and career planning. Prerequisite(s): Sophomore standing.

MGT 335 - Sustainability, Innovation, and Entrepreneurship (3cu) Three trends are shaping the current business landscape: the role of entrepreneurs as the driving force in the global economy, the use of innovation to gain competitive advantage in the marketplace, and the move toward environmentally sustainable products, services, practices, and business models. These three trends represent the sweet spot for future job growth and career development in a variety of fields and industries. MGT 335 positions students to capitalize on these trends by helping them gain knowledge and develop competencies in the areas of entrepreneurship, innovation, and sustainability. Its interdisciplinary nature enables students to pursue careers in a diverse and changing world. Students engage in class discussion, problem solving, and experiential learning to assimilate the methods and skills of successful entrepreneurs with a focus on sustainability-related innovation in product, process, and strategy development. Students investigate complex issues, deliver oral presentations, meet and interact with business and technology leaders, and develop a personal journal, notebook, or blog. This course is suitable for students in business, technology, the arts, and sciences. Prerequisite(s): Junior standing.

MKT 300 Marketing Principles (3cu) This course fulfills a core requirement and serves as the foundation for further study in marketing. The course primarily has a micromarketing orientation in that it presents marketing from the perspective of an individual manager or firm in the design of the marketing mix, target market selection, environmental assessment, securing information, and understanding consumer/buyer behavior. Marketing's macro interface with society and the ethical responsibilities of managers in a global context are examined. A dynamic computer simulation stressing team-work and group decision making is an integral part of the course. Prerequisites: EC 202, and junior standing.

OPM 352 Operations Management (3cu) No product or service can be produced without operations. In fact, nearly 80 percent of any organization is comprised of operations. This course covers the techniques needed to understand, manage, and improve organizational processes whether within a manufacturing or service organization. Specifically, students evaluate business process flows using financial measures and performance metrics. Various operations techniques are used to evaluate capacity, identify bottlenecks, and determine appropriate inventory levels. Six Sigma techniques are used to understand variability, process capacity, and process capability. Prerequisites: QA 251 or ENVR 299, and junior standing.

7. Overview of anticipated start-up costs and on-going costs (including, but not limited to, additional faculty, library resources, equipment, technology, space, and marketing).

Anticipated Start-up costs:

- a. One faculty line in year 2 of the program if the target projections are reached.
- b. Office Space for new faculty member. We propose converting an existing space (K-204) into a faculty office. This is currently a small GIS research room. The GIS research lab can be easily relocated to K-212 which is currently designated for adjunct faculty. Adjunct faculty will be allowed to use the environmental science conference room (K-201) to meet students when necessary and can use this room as their offices.
- c. Laboratory/Technology Space: Currently no laboratory space exists for an incoming environmental science faculty member.
- d. Evidence of a sustainable market for the program: EMSI market analysis suggests that there is ample need to support and sustain a program directed at Environmental Health and Sustainability Management. Additionally, while other program in health exist along with programs in environmental science, no programs combining the specific areas that we propose exist in this region to date. Additionally, no programs closely align with the proposed new program. Yet, the need for trained professionals in this region and beyond is actively increasing.
- e. There may be instances where courses covered by the biology and chemistry departments will be impacted by the addition of students from our program but not dramatically.

8. Name, location, phone number and email address of the Program Administrator or primary contact for questions

Name: Stephen R. Madigosky

Location: Kirkbride 206

Office Number: 610 499-4269

Email address: srmadigosky@widener.edu

9. An Acknowledgement Memo

Administrators and faculty from business, math, chemistry, biology, and nursing have been alerted to our proposed Environmental Health and Sustainability Management major. Although supportive, some have voiced concern about having enough space for their students in courses that we have listed in the new curriculum. We feel that there is ample space in most courses but have included a few additional sections in microbiology, and chemistry 105/106. Our estimate of attracting 8 students per cohort is a reasonable assumption. If our expectations are not met or if they are exceeded, we will adjust our plans and offerings to assure that there is room for all students needing required courses in their respective majors.