BOARD OF GOVERNORS
STATE UNIVERSITY SYSTEM OF FLORIDA
NEW DOCTORAL DEGREE PROPOSAL STAFF ANALYSIS

Program: Ph.D. in Environmental Engineering
CIP Code: 14.1401
Institution: University of South Florida
Proposed Implementation Date: Spring 2012
Staffed By: Marion Merzer
Initial Review Date: 9/6/2011 **Last Update: 9/23/11**

Estimated Costs:

	Total	% & $ Current Reallocated	% & $ New Recurring	% & $ New Non-Recurring	% & $ C&G	Cost per FTE	SUS 09-10 Average Cost per FTE
Year 1	$579,767	22% $129,767	0% $0	0% $0	78% $450,000	$5,767	$23,267 14 CIP
Year 5	$735,456	19% $141,456	0% $0	0% $0	81% $594,000	$4,795	

Projected FTE and Headcount are:

	Student Headcount	Student FTE
First Year	30	22.5
Second Year	30	22.5
Third Year	35	26.25
Fourth Year	35	26.25
Fifth Year	40	29.5

On March 29, 2007, the Florida Board of Governors approved BOG Regulation 8.011, which sets forth criteria for implementation and authorization of new doctorates by the Board of Governors, as well as criteria for implementation and authorization of Bachelor's, Master's and Specialist degrees by Boards of Trustees. The following staff analysis is an assessment of how well the university meets BOG Accountability and Readiness criteria for implementation of this degree program.

Proposal Page Numbers:

INTRODUCTION		ACCOUNTABILITY		READINESS				
Program Description	**System Analysis**	**Overall**	**Budget**	**Mission and Strength**	**Program Quality**	**Curriculum**	**Faculty**	**Resources**
2	3	3	10	13	17	18	25	28

A. Program Description:

The University of South Florida (USF) is proposing to offer a PhD degree program in Environmental Engineering. This new program will replace the current Environmental Engineering track offered within the PhD in Civil Engineering, making it a specific stand alone degree program.

According to the USF proposal, the primary goal of the PhD Environmental Engineering program is to allow students to perform specialized training and research, resulting in a degree that recognizes the student's scholarly competence and ability to practice and conduct and report original and significant environmental engineering research. USF proposes that this PhD program will serve the state's need by enabling Florida to advance, via research and creation of new information and technology, a knowledge-based economy to manage the many environmental stressors on its water, land, and air resources which impacts social and economic opportunities for current and future generations.

The total minimum credits required for a student with a Master's degree is 48 credits and the total minimum credits required for a student without a Master's degree is 78 credits. PhD students may work in one or more of the following specialty areas: 1) Water Quality Engineering, 2) Air Quality Engineering, 3) Fate and Transport of Contaminants in the Environment, 4) Waste Management, 5) Sustainable Design and Sustainable Engineering and, 6) Environmental Biotechnology Applied to Environmental Problems.

B. System-Level Analysis and Evaluation in accordance with BOG Regulation 8.011:

The PhD in Environmental Engineering program meets the economic development goals of the SUS Strategic Plan with its focus on Healthy Communities; Research and Innovation; Integrated Interdisciplinary Inquiry; and Community Engagement. The program directly supports the following goals: 1) access to and production of degrees; 2) meet statewide professional and workforce needs, 3) building world-class academic programs and research capacity, and, 4) meeting community needs and fulfilling unique institutional responsibilities. USF proposes that this program will help meet the needs of Florida communities because by definition, environmental engineering is that branch of engineering concerned with the application of scientific and engineering principles for: 1) protection of human populations from the effects of adverse environmental factors; and, 2) protection of environments, both local and global from the potentially deleterious effects of natural and human activities; and improvement of environmental quality.

Reported in the proposal and confirmed by staff review, ***CNNMoney.com*** reported in 2010 that environmental engineering was the 5th best job available (out of 100 ranked). They wrote, "An undergraduate degree in any engineering specialty can be enough, and a state license is not always required. But you'll fare better with a graduate degree in environmental engineering." The proposal cites several sources as evidence that Florida (and the Nation) is in need of graduate level environmental engineering students. The proposal quotes Engineering News Record (ENR) (www.enr.com) as reporting that the environmental engineering design market

now exceeds $30 billion in annual revenue and all of the top 15 companies on the ENR list of design firms have offices in Florida.

A staff review of the Bureau of Labor Statistics Occupational Employment Statistics, Employment and Wages, May 2010 report confirmed the proposal's findings. BLS reported that Florida is second in states with the highest employment level for Environmental Engineers. In the same report, Northeast Florida region is listed as the second highest nonmetropolitan area in the country in employment in this occupation, and Northwest Florida is listed as 5th highest. The U.S. Bureau of Labor predicts that environmental engineers are expected to have employment growth of 31 percent between now and 2018, one of the highest growth of all engineering disciplines and much faster than the average for all occupations. The proposal reports that *Empower Me Magazine* (May 10, 2010) listed environmental engineering as one of five of "the hottest green, environmental and infrastructure jobs for the next ten years" and includes it in the 30 fastest growing occupations for the decade of 2008-2018.

Florida is an ideal location for the work of Environmental Engineers. The lead state agency for environmental management and stewardship, the Florida Department of Environmental Protection (FDEP) is responsible for protecting our air, water and land. Research confirmed that the FDEP initiates and manages many projects and research studies in the areas of water, wastewater, air, brown field redevelopment, and waste management, which would employ Environmental Engineers. One major project currently for the FDEP, together with the South Florida Water Management District, is implementing the 30-year, $10.9 billion Comprehensive Everglades Restoration Plan (CERP), which covers 16 counties over an 18,000 square mile area (http://www.dep.state.fl.us/mainpage/about/about_dep.htm). The FDEP is involved with numerous projects in environmental conservation, sustainability or restoration, and partners with other agencies including the Department of Community Affairs, the Department of Business and Professional Regulation, the Department of Financial Services, the Board of Governors, Department of State, Department of Transportation and several of the state universities and municipal governments (Long Range Program Plan, http://floridafiscalportal.state.fl.us/PDFDoc.aspx?ID=3454). USF also proposes that its program will link well with research in Sustainability. A growing area, Sustainability programs have access to Federal funding for research from the National Science Foundation (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=501027). As USF proposes, there will be practice and research opportunities for students throughout the program and the ability to interact with experts statewide, nationally, and internationally. However, due to deep budget cuts this past fiscal year and in the near future, employment opportunities with the FDEP may be diminished.

The proposal states that the USF environmental engineering graduate program is currently well integrated with other USF colleges for research. USF's College of Public Health, College of Marine Sciences, and School of Global Sustainability will provide unique training and research collaboration opportunities with a doctoral graduate program in Environmental Engineering to advance social, economic, and environmental needs. USF Environmental Engineering graduate students currently take courses offered by the College of Public Health and there is existing collaboration between faculty in environmental engineering, public health, and applied anthropology in obtaining external research funding. According to the proposal, one Environmental Engineering faculty member is appointed in the College of Public Health in the

Department of Environmental and Occupational Health, which provides this proposed doctoral program a direct line of communication for collaboration.

Addressing the issue of student demand, the proposal reports that many current and prospective students have requested the doctoral program. With USF's Master's program in Environmental Engineering graduate class enrollment exceeding 30 to 40 students per course offering, it will be a good feeder for the doctoral program. A Master's level graduate program that combines training and service with the U.S. Peace Corps (see http://cee.eng.usf.edu/peacecorps/) and has a focus on sustainable development that has grown to 33 students in 2.5 years (the students in this program are from 31 different U.S. universities that represent 21 states) (p.6), will provide a natural transition for students. This partnership allows graduate environmental engineering students to combine their graduate education with 10 weeks of international training and 2 years of service as a water/sanitation engineer (see http://cee.eng.usf.edu/peacecorps/). Students then integrate their service with an international research experience. USF is the only university in Florida with this partnership.

More than 30 students are currently majoring in the PhD Civil Engineering program. The proposal reports that USF conducted an internal survey of students currently enrolled in the PhD Civil Engineering program with a track in Environmental Engineering, and suggested that close to 90% would select a PhD program that was specifically Environmental Engineering. USF does not expect that faculty workload would be compromised, as the Department currently has eight faculty members whose specialty is Environmental Engineering. However, the expectation of 40 doctoral student candidates within 5 years will place 5 students with each faculty advisor. The proposal estimates that the program will eventually produce 5-6 Ph.D. graduates per year. Review of Board data shows that currently, UCF and UF have similar programs with the same CIP of 14.1401. In 2010, the UCF program enrollment was 7 students, down from 18 in 2001, and the UF program had an enrollment of 59, up from 49 in 2001. USF's goal is to have 40 students at the end of year five.

With the need for more practicing Environmental Engineers in the coming decade, the external consultant who reviewed this proposal for USF, Dr. Amy Childress, emphasized that PhDs in Environmental Engineering will become highly sought after as faculty. She cites the U.S. Bureau of Labor Statistics that, "a total of 662,000 faculty jobs are expected to become available…from 2006-2016." She states that a 25-percent growth is expected for faculty in this field. Based on high expectations of employment growth mentioned above, graduates with a PhD in Environmental Engineering will be well suited to pursue employment as an academic faculty or with a public or private agency working in the field. The USF program will help to provide qualified PhDs in Environmental Engineering for these positions.

Addressing concerns over program duplication, the USF proposal provided evidence that communication was initiated by USF with each of five universities with similar programs (see Table, p. 8). USF reported no negative comments. According to the proposal, FAMU is interested in exploring an exchange of graduate level distance learning courses. The University of Florida offers a doctoral degree in Environmental and Engineering Sciences and the University of Central Florida offers a PhD in Environmental Engineering. Board staff confirmed both doctoral programs are CIP 14.1401. A letter of support from Dr. Tony Waldrop, Provost and Vice President for Academic Affairs at UCF suggested any impact on their

program would be minor. Letters of support provided by UF and UCF are attached at the end of the proposal.

C. Assessment of the University Review Process in accordance with BOG Regulation 8.011:

Due to the system of stair step accountability set in place by the Board of Governors in Regulation 8.011, it is now incumbent upon University Board of Trustees to verify that all doctoral programs coming before the Board of Governors have met the requirements of the regulation. The following is an assessment of the university review process to ensure that all criteria set forth have been considered by the university prior to submission to the Board of Governors office.

ACCOUNTABILITY

Check 'yes' or 'no' box, and make comments beneath criterion as appropriate.

1. *Overall –* *The proposal is in the correct format, includes all necessary signatures, and contains complete and accurate tables for enrollment projections, faculty effort, and the proposed budget.*

YES NO

☒ ☐ **The proposal has been approved by the university board of trustees and includes all required signatures.**

University of South Florida Board of Trustees approved the program on September 2, 2011.

☒ ☐ **The university has provided a proposal written in the standard SUS format which addresses new academic program approval criteria outlined in BOG Regulation 8.011.**

The Board of Governors new degree program proposal format was used, as expressed in Board of Governors Regulation 8.011.

☒ ☐ **The university has provided complete and accurate projected enrollment, faculty effort, and budget tables that are in alignment with each other.**

The proposal provides information on each of these areas. Detailed tables are provided on projected enrollment (Table 1-B); on faculty effort (Table 4); and on budget (Tables 2 & 3).

☒ ☐ **The university has included a statement in the proposal signed by the equity officer as to how this proposal will meet the goals of the university's equity accountability plan.**

The program plan for achieving diversity was reviewed and signed by the USF Equal Opportunity Officer on September 8, 2011.

2. Budget – *The proposal presents a complete and realistic budget for the program consistent with university and BOG policy, and shows that any redirection of funding will not have an unjustified negative impact on other needed programs.*

YES NO

☒ ☐ **The University Board of Trustees has approved the most recent budget for this proposal.**

The current budget proposal has been approved the USF Board of Trustees on September 2, 2011.

Projected costs of the program as provided in Table 2 are considerably lower than the average expenditures at other SUS institutions (see Estimated Costs on page 1.) The USF proposal and supporting documents (Table 2) do not include costs of administrative support staff or other departmental costs. If administrative activities will be provided by current staffing in the Department of Civil Engineering, the dual usage should be acknowledged and factored in. The goal of 30 students in the first year may also be an overestimation. If enrollment in the first year is less than 30 students, the costs will be appreciably higher as well.

According to the proposal, most funding for the new program (not including faculty salaries and benefits) will be supplied by external grants. It is not clear from the proposal, but can be assumed, that the faculty salaries and benefits are expected to be covered by the Civil Engineering Department. However, if this is the case, and if faculty serve two major program areas and supervise an increasing number of doctoral students, the program may need to hire more faculty by the 5th year.

The proposal explains that doctoral students will be supported as Department Teaching or Research Assistants. Funding and grants are available from state agencies, local municipalities, private industry, or federal funding (e.g. NSF, EPA). The proposal describes two grants currently awarded to faculty: 1) $750,000+ Department of Education Graduate Assistantships in Areas of National Need (GAANN) Grant, which provides stipends, tuition and supply funds for doctoral students working in fields or water, energy and materials with a focus on sustainability; and 2) a $600,000 National Science Foundation S-STEM Scholarship grant that provides funding for masters' and doctoral graduate students with interests in providing sustainable water and transportation infrastructure.

☒ ☐ **In the event that resources within the institution are redirected to support**

the new program, the university has identified this redirection and determined that it will not have a negative impact on undergraduate education, or the university has provided a reasonable explanation for any impact of this redirection.

According to the budget description and supporting tables and documentation, the proposed PhD program is not expected to have a negative impact on related programs or departments. All required courses are already offered at USF. Eight faculty members with Environmental Engineering specialties are already employed in the department at USF. As these faculty members have been teaching and advising in the Civil Engineering program, the proposal does not mention if they will continue in both programs or be assigned solely to Environmental Engineering. The proposal describes current and future collaboration and partnerships between the departments in the areas of shared courses and research.

According to the proposal there will be some short term decline in the PhD Civil Engineering enrollment as some students switch to the PhD Environmental Engineering program. The proposal explained that undergraduate students will benefit from the proposed program as it will enhance undergraduate education and research by serving as a mechanism for students in all engineering disciplines to continue their studies in Environmental Engineering at USF. Undergraduate engineering students will have opportunities to participate with the doctoral students in the proposed program in the development of undergraduate research or employment opportunities through professional ties developed between faculty members and external funding agencies.

READINESS

Check 'yes' or 'no' box, and make comments beneath criterion as appropriate.

3. Program Quality *– The proposal provides evidence that the university planning activities have been sufficient and responses to any recommendations to program reviews or accreditation activities in the discipline pertinent to the proposed program have been addressed.*

YES NO

☒ ☐ **The university has followed a collaborative planning process for the proposed program in accordance with policies and procedures adopted by the University Board of Trustees.**

As described in the proposal, the planning process began with planning and development in the fall of 2010 (see tables on pp. 16 & 17, *Chronology of Activities Leading to Developing the Proposal,* and *Events leading to Implementation of the Proposal*). A collaborative process is described, involving Dr. James R. Mihelcic and the Civil & Environmental Engineering Graduate Director (Dr. Sarina Ergas) in addition to

discussions and meetings with faculty members in the Department of Civil and Environmental Engineering, Department Chairs in Engineering, Associate Dean in Engineering, Dean of Engineering, Graduate School, and the Faculty Senate. According to the proposal, the environment and sustainability have been major strategic emphases of USF for several years and there has been administrative support through the hiring of eight environmental engineering faculty members over the past eight years.

☒ ☐ **An external consultant has reviewed the proposal and supports the department's capability of successfully implementing this new program.**

In response to a request from USF, Dr. Amy Childress, Professor and Chair of the Department of Civil and Environmental Engineering at the University of Nevada, Reno provided an external review of the proposal for the PhD in Environmental Engineering. Dr. Childress' findings and comments were very favorable for the establishment of the new program. She described research findings from the Bureau of Labor Statistics and from the Chronicle of Higher Education projecting increases in employment and research opportunities for Environmental Engineers. Many other programs offer environmental tracks, but she added that this type of program "would distinguish the USF program from the majority of other PhD programs that offer specialization in environmental engineering but not a PhD in environmental engineering specifically." She stated that providing this type of program would give greater identity to these students. She concluded by confirming that this program would have regional significance in terms of its location in Florida and the state's needs. A copy of her review letter can be found at the end of the proposal.

☒ ☐ **The university has found the level of progress that the department has made in implementing the recommendations from program reviews or accreditation activities in the discipline pertinent to the proposed program to be satisfactory.**

According to the proposal, the Civil & Engineering graduate programs were reviewed by two outside academic reviewers during a site visit on January 24, 2011. The reviewers were faculty members from Purdue University and Georgia Tech. A self study report was also prepared by the department in October, 2010.

The proposal summarizes two recommendations made by the reviewers that are relevant to the PhD program and describes USF's plans to implement those suggestions. The recommendations were: 1) the need to improve recruitment of graduate students through interaction with national and international communities. This has been addressed by USF in their proposal discussion on recruitment of students (Section II.E, pages 8-9); and 2) that the previous physical separation of graduate students created problems building a strong community of scholars. USF's response is addressed in Section X.C (page 35) in a discussion of the use of new

research laboratory space and offices.

☒ ☐ **The university has analyzed the feasibility of providing all or a portion of the proposed program through distance learning.**

As presented in the USF proposal, the program will primarily be delivered through traditional on-campus methods on the Tampa campus. Students may have the opportunity to take classes off-campus as several graduate courses are offered through distance learning by USF or other universities. Research may also be conducted off-campus.

☐ ☒ **If necessary, the university has made allowances for licensure and legislative approval to be obtained in a timely manner.**

Engineering is not licensed at the PhD level.

4. Curriculum *- The proposal provides evidence that the university has evaluated the proposed curriculum and found that it describes an appropriate and sequenced course of study, and that the university has evaluated the appropriateness of specialized accreditation for the program.*

YES NO

☒ ☐ **The university has reviewed the curriculum and found that the course of study presented is appropriate to meet specific learning outcomes and industry driven competencies discussed in the proposal.**

As presented in the proposal, the curriculum has been designed to allow students to perform specialized training and research resulting in the scholarly competence and ability to conduct and report original and significant environmental engineering research. It is also designed to prepare students to work in a variety of specialty areas of Environmental Engineering, e.g. Water Quality Engineering; Air Quality Engineering, Waste Management, etc.

As described in the proposal, the curriculum includes the four required core courses deemed as knowledge and core competencies important for the understanding and practice of environmental engineering by the Environmental Engineering Body of Knowledge, American Academy of Environmental Engineers.

To further align the curriculum with industry driven competencies, the proposal reports that the Department of Civil & Environmental Engineering has established an outside advisory board that consists of up to eight outside members from engineering practice, research, and academics. These individuals provide input on the undergraduate and graduate programs offered through the department. These

advisory board members are available to provide input to curriculum development and student assessment.

☒ ☐ **The university anticipates seeking accreditation for the proposed doctoral program, or provides a reasonable explanation as to why accreditation is not being sought.**

There is no specialized accreditation for doctoral programs in Engineering.

5. Faculty *– The proposal provides evidence that the university is prepared to ensure a critical mass of faculty will be available to initiate the program based on estimated enrollments, and that faculty in the aggregate have the necessary experience and research activity to sustain a doctoral program.*

YES NO

☒ ☐ **The university has reviewed the evidence provided and found that there is a critical mass of faculty available to initiate the program based on estimated enrollments.**

There are 8 current faculty members (see Table 4) who will take on primary responsibility for program delivery. There is no mention in the proposal about any need for further hires or use of adjuncts. As these faculty members are currently members of the Civil Engineering department, there is also no mention of need to replace faculty there.

☒ ☐ **The university has reviewed the evidence provided and found that the faculty in aggregate has the necessary experience and research activity to sustain the program.**

As described in Table 4, all of the current faculty members hold terminal degrees in their fields and have tenure. There is one full Professor, two Associate Professors, and 5 Assistant Professors. According to the proposal, this will provide ample faculty and resources for mentoring, research and teaching.

☒ ☐ **The university has reviewed the evidence provided and found the academic unit(s) associated with this new degree to be productive in teaching, research, and service.**

The proposal provides evidence that the eight faculty members have been productive in teaching, research and service, including publications and thesis and dissertation supervision (see Tables on pages 26-27). According to the proposal, in the past five years environmental engineering course enrollment has grown from under 20 students to 25-40 students per offering. The proposal reports that as of November 2010, the

number of graduate students advised by environmental engineering faculty had grown to 33 PhD and 42 MS thesis students.

According to the proposal, currently funded research within the environmental engineering faculty group exceeds $3.78 million. As evidenced in the proposal, the eight faculty members have participated in numerous national service opportunities (see Table on page 27).

☒ ☐ **If appropriate, the university has committed to hiring additional faculty in later years, based on estimated enrollments.**

The proposal provides no stated plan for future hiring of additional faculty.

6. Resources *– The proposal provides evidence that the university has ensured the available library volumes and serials; classroom, teaching laboratory, research laboratory, office space, equipment, clinical and internship sites, fellowships, scholarships, and graduate assistantships will be sufficient to initiate the program, and that if applicable, funding has been secured to make more resources available as students proceed through the program..*

YES NO

☒ ☐ **The university has provided a signed statement from the Library Director verifying that the library volumes and serials available are sufficient to initiate the program.**

The proposal provides evidence that sufficient library resources are available to implement the program and no additional resources are needed at this time. A statement was signed by the Dean of USF Libraries on September 6, 2011.

☒ ☐ **The university has ensured that the physical space necessary for the proposed program, including classrooms, laboratories and office space, is sufficient to initiate the program.**

The proposal describes adequate classrooms and laboratories to accommodate this program. Buildings throughout the USF campus are used for existing graduate classes. The Environmental Engineering program at USF maintains over 3,500 square feet of state-of-the-art research laboratory space, with another separate laboratory (approximately 500 square feet) dedicated for pilot plant research. The laboratories are equipped with hoods and bench space to accommodate approximately 30 research students. Development of additional laboratory space on the first floor of the IDR building will add another 5,300 square feet of space.

The proposal reports there is a plan to add 28 office spaces for doctoral students and postdoctoral research associates in the new Interdisciplinary Research Building (IDRB) space.

☒ ☐ **The university has ensured that necessary equipment is available to initiate the program.**

The proposal reports that USF currently has the specialized equipment needed for the program (see page 35).

☒ ☐ **The university has ensured that fellowships, scholarships, and graduate assistantships are sufficient to initiate the program.**

According to the proposal, there is no plan to allocate additional resources to the department or college to support doctoral students. All students enrolled in the program will have opportunities for a teaching or research assistant position. Graduate research assistantships and external funding support will be used. Faculty members conducting research normally support two or more research assistants. Thus, the Department typically supported 40-80 research assistants per year. A recent initiative to increase the number of PhD students in Engineering brought in 23 new doctoral students to the Department in fall 2010. The support for these new PhD students is $15,000/year.

☒ ☐ **If applicable, the university has ensured that the department has arranged a suitable number of clinical and internship sites.**

According to the proposal, opportunities are available for doctoral students to conduct research and be trained at many federal laboratories, such as: Environmental Protection Agency, Department of Energy, National Oceanic & Atmospheric Administration, and United States Geological Survey. The American Association for the Advance of Science provides opportunities for graduates of environmental engineering programs to be placed for fellowships with federal agencies in the Washington, D.C. area. In addition, some doctoral students will have their research occurring at local municipal water treatment, storm water management, and wastewater treatment facilities which provides students opportunities to interact with practitioners.

The proposal describes several international opportunities for USF's graduate students, including NSF funded travel to the UNESCO-IHE Water Laboratory in the Netherlands and travel to Bolivia to conduct research in sustainable development. As mentioned earlier, the department also has the only graduate partnership with the U.S. Peace Corps. Students spend 2+ years overseas working as a water sanitation engineer, while conducting field research with a developing world focus. The program is 2.5 years old

and has already attracted 33 domestic graduate students, who come from 31 universities representing 21 states.