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March 3, 2011

TO: Charles Roberts
CESCOS Curriculum Chair

FROM: Russ Ivy
Chair, Geosciences

RE: Proposal for M.S. in Geosciences

The Department of Geosciences would like to introduce a new Master of Science degree in Geosciences. Our Ph.D. in Geosciences is in its second year and we are pleased with its success (approximately 20 students). The Geosciences doctorate is a blend of geography and geology along with coursework from related fields and has been highly applauded by the local professional community. Since the inception of the doctoral program, the department has had a great deal of inquiry from prospective students about such a hybrid degree at the Masters level. Currently, we only have a traditional M.A. in Geography and M.S. in Geology, which often lead students to doctoral work. We propose to keep these degrees, but to add the M.S. in Geosciences as we think it serves a different market—those entering the workforce in governmental agencies, consulting firms, etc. to solve real world problems from a somewhat interdisciplinary geospatial perspective. Attached is the description of the program and its requirements. No new funding requests for faculty or teaching assistants will be tied to this degree program. This is simply a repackaging of existing courses into the hybrid program.

Approved by:

Department Chair: \_\_\_\_\_ Date: \_\_\_\_\_

College Curriculum Chair: \_\_\_\_\_ Date: \_\_\_\_\_

College Dean: \_\_\_\_\_ Date: \_\_\_\_\_

UGPC Chair \_\_\_\_\_ Date: \_\_\_\_\_

Dean of Graduate College: \_\_\_\_\_ Date: \_\_\_\_\_

## **M.S. in Geosciences Catalog Description**

The Department of Geosciences offers an interdisciplinary graduate degree allowing students to combine coursework in geography, geology and other related disciplines to prepare for careers that focus on problem solving utilizing a broad knowledge base in the geosciences. This degree would prepare students for certain careers related to water resources, hydrogeology, biogeography and environmental restoration, environmental consulting, urban sustainability, and various positions in geographic information systems and remote sensing. The degree is focused on technical training and problem solving skills. Students who successfully complete this degree program will earn a M.S. in Geosciences. The department will offer both a thesis and a non-thesis option for this degree. The requirements for both options are outlined below. Students must choose between the thesis/non-thesis option and concentration area by the end of their second semester of studies when they are required to file their plan of study.

### *Admission to the Program*

Students may apply for admission to the program for any academic term. Admission to the program is determined by the Department's Graduate Admissions Committee and is based on 1) the student having earned a baccalaureate degree in an appropriate discipline from an accredited college or university; 2) an acceptable GPA during the last 60 credit hours attempted (3.0 or higher preferred on a 4.0 scale); and 3) a combined quantitative and verbal GRE score of at least 1000. GRE scores more than 5 years old will not be accepted.

Applicants with undergraduate degrees outside of geography and geology may be admitted with academic deficiencies that must be completed in addition to the general degree requirements. The Graduate Admissions Committee will recommend any deficiencies to the Graduate Program Director as a condition of the admissions decision. The student should take the required course deficiencies at the first opportunity. Failure to do so may result in dismissal from the program.

Students who meet the admissions criteria and who have not already identified a consenting thesis advisor upon application are admitted on the non-thesis option. Students may move to thesis option after admission to the program if they have identified a consenting advisor by the end of their second semester in the program. Thesis students will be required to form a committee (advisor and two additional committee members) during the second semester of study. The advisor and at least one committee member should be from within the Geosciences Department. One committee member may be from an outside department within FAU or from another outside entity as long as the member satisfies the conditions established by the Charles E. Schmidt College of Science and the Graduate College.

### *Course requirements*

All students in the program must complete at least half of their coursework applied to the degree at the 6000 level. One 3 credit course at the 4000 level may be taken if needed to enhance the program of study based on the student's academic goals and background. No more than 3 credits of directed independent study (such as GEO 6908 or GLY 6908 or GEO 6918) may be used to fulfill the minimum credits of either degree option. A minimum of 24 credits should be taken

from the geosciences curriculum [courses offered by the Geosciences Department with the EVR, ESC, GEA, GEO, GLY and GIS prefixes]. This will include a 9 credit core that is required of both thesis and non-thesis students (Table 1).

*Core courses*

The core courses (9 credits) shown in Table 1 will be required for all students in the program. Note that *Geosciences Colloquium Series (GEO 6920)* is repeated 3 times during the program. Also note that both thesis and non-thesis students are required to take *Thesis Seminar (GLY 6931)* to develop writing skills that are demanded in professional careers.

Table 1. Core Requirements for the M.S. in Geosciences

Department Core Courses	Credits
GEO 6118 Research in the Geosciences	3
GLY 6931 Thesis Seminar	3
GEO 6920 Geosciences Colloquium	1 X 3
Total	9

*Electives and thesis credits*

Students will typically choose to focus their studies in an area of Geosciences that takes advantage of the broad yet specialized nature of the Department. Thesis and non-thesis students will take 18 and 27 elective credits, respectively from within their chosen focus study area in consultation with their academic advisor/advisory committee. The elective credits may include courses from related disciplines as approved by the advisor/advisory committee. For thesis students no more than 6 master’s thesis credits will be counted toward the degree.

The distribution of credits for the thesis and non-thesis options is presented in Table 2.

Table 2. Distribution of credits for non-thesis and thesis option

Distribution	Credits	
	Non-thesis option	Thesis option
Geosciences core	9	9
Approved Electives	27	18
Thesis	0	6
Total	36	33

Students must achieve a grade of at least “C+” in order for a course to be counted as part of the minimum credits toward the degree. Students must maintain a GPA of 3.0 or higher throughout their graduate program. Failure to do so will subject the student to dismissal from the program.

*Other requirements*

Additionally, students enrolled in the thesis-option must successfully defend their proposal and final thesis. In addition to the required coursework, non-thesis students will be required to

complete an essay (minimum 4000 words) related to one of the colloquia. It will be evaluated in the *Thesis Seminar (GLY 6931)* course, and it must include an oral presentation. This requirement is to ensure that all students (thesis and non-thesis) leave the program with sound writing and oral communication skills.

**TABLE 1-A  
PROJECTED HEADCOUNT FROM POTENTIAL SOURCES  
(Baccalaureate Degree Program)**

Source of Students (Non-duplicated headcount in any given year)*	Year 1		Year 2		Year 3		Year 4		Year 5	
	HC	FTE								
Upper-level students who are transferring from other majors within the university**	0	0	0	0	0	0	0	0	0	0
Students who initially entered the university as FTIC students and who are progressing from the lower to the upper level***	0	0	0	0	0	0	0	0	0	0
Florida community college transfers to the upper level***	0	0	0	0	0	0	0	0	0	0
Transfers to the upper level from other Florida colleges and universities***	0	0	0	0	0	0	0	0	0	0
Transfers from out of state colleges and universities***	0	0	0	0	0	0	0	0	0	0
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
<b>Totals</b>	<b>0</b>									

\* List projected annual headcount of enrolled students majoring in the program.

\*\* If numbers appear in this category, they should go DOWN in later years.

\*\*\* Do not include individuals counted in any PRIOR CATEGORY in a given COLUMN.

## Florida Board of Governors

### Request to Offer a New Degree Program

Florida Atlantic University  
University Submitting Proposal

August 2011  
Proposed Implementation Date

Charles E. Schmidt College of Science  
Name of College or School

Geosciences  
Name of Department(s)

Geography and Geology  
Academic Specialty or Field

M.S. in Geosciences  
Complete Name of Degree  
(CIP Code=45.0799)

**The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.**

\_\_\_\_\_  
Date Approved by the University Board of Trustees

\_\_\_\_\_  
President

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Chair, Board of Trustees

\_\_\_\_\_  
Date

\_\_\_\_\_  
Vice President for Academic Affairs

\_\_\_\_\_  
Date

Provide headcount (HC) and full-time equivalent (FTE) student estimates of majors for Years 1 through 5. HC and FTE estimates should be identical to those in Table 1. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Table 2. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 (Total E&G divided by FTE).

Implementation Timeframe	Projected Student Enrollment (From Table 1)		Projected Program Costs (From Table 2)		
	HC	FTE	Total E&G Funding	Contract & Grants Funding	E&G Cost per FTE
Year 1	16	9	84,757	0	9,417
Year 2	31	18			
Year 3	42	25			
Year 4	51	31.5			
Year 5	58	36.5	94,757	100,000	2,596

*Note: This outline and the questions pertaining to each section must be reproduced within the body of the proposal to ensure that all sections have been satisfactorily addressed.*

**INTRODUCTION**

**I. Program Description and Relationship to System-Level Goals**

- A. Briefly describe within a few paragraphs the degree program under consideration, including (a) level; (b) emphases, including concentrations, tracks, or specializations; (c) total number of credit hours; and (d) overall purpose, including examples of employment or education opportunities that may be available to program graduates.**

The Department of Geosciences at Florida Atlantic University (FAU), housed in the Charles E. Schmidt College of Science on the Boca Raton campus, proposes to offer graduate training in an on-campus program leading to the degree of Master (M.S.) in Geosciences. This program will merge department specialties in geography and geology. The program will build upon a successful undergraduate program in geography and geology at FAU. The master will be an integrated program, whereas existing master programs in the State of Florida related to this proposal are largely discrete (i.e. focused on either geography or geology) and are designed for the traditional academic career track. The proposed degree program will be a degree which answers the call from employers in the South Florida area and throughout the state, such as the Florida Department of Environmental Protection, the South Florida Water Management District (SFWMD), Broward County, Palm Beach County Planning Agencies, the Army Corp of Engineers, the U.S. Geological Survey, Coastal Planning and Engineering, Inc. and a variety of other local agencies and environmental consulting firms that have a growing need for trained individuals in technology and field applications in the geosciences. While the main focus of the degree in the long term will be on traditional, full-time students, the degree program will also welcome part-time students who wish to maintain their professional employment while earning their master degree. Thus, the degree program will also bring educational opportunities to professional geoscientists in the South Florida region who are interested in combining geography, geology and cognate areas at a graduate level and cannot abandon their current employment. With all the above in mind, this new M.S. program will thus meet all of the related goals set forth in both the SUS and FAU strategic plans, namely:

- 1.....Providing Increased Access to Higher Education,
- 2.....Meeting Statewide Professional and Workforce Needs,
- 3.....Building world-class academic programs and research capacity,
- 4.....Meeting Community Needs and Fulfilling Unique Institutional Responsibilities.

Geosciences examine the earth as a series of interrelated systems and processes involving analysis of natural and human phenomena within the earth system at various spatial and temporal scales. Since 2004, the Department has gone through the process of tightly integrating geosciences at FAU, successfully merging thus the teaching and research strengths of the Department in both geography and geology. In response to local needs the Department will

expand its course offerings, both undergraduate and graduate, and its research presence to the Davie campus of FAU in Broward County. The purpose is to create further synergism with the field/environmental biologists housed on that campus, and to be prepared to successfully interact with the US Geological Survey operations and to expand research on the Comprehensive Everglades Restoration Project (CERP).

A degree program combining facets of both geography and geology into a master degree in Geosciences will be especially tailored to the changing needs of the university's service region through an innovative curriculum that includes cross-disciplinary course work in the geosciences. The existing strengths of the Department, the College, the University and the local community, as highlighted below, combine to provide a dynamic program covering both regional and global aspects of the geosciences.

- .....State-of-the-art geospatial equipment in GIS, Remote Sensing and Hydro-Modeling
- ..... State-of-the-art field equipment including GPS units and surveying equipment
- .....Strong involvement of faculty and graduate students in local, national (i.e. NSF) and international grants addressing real-world problems
- .....Department-housed Center for Geo-Information Sciences
- .....Proposed Department Center for Hydrogeology and Water Resources
- ..... Excellent working relationships with other FAU research units such as the Center for Environmental Studies, Harbor Branch Oceanographic Institution, Department of Anthropology and Department of Urban and Regional Planning
- ..Excellent working relationships with local governmental units and agencies such as the SFWMD, USGS, Florida Department of Environmental Protection, South Florida Natural Resources Center, and the Broward and Palm Beach County Planning Offices
- .....Excellent working relationships with local environmental consulting and research agencies such as Coastal Planning and Engineering, CEPEMAR, and the Coastal Education and Research Foundation
- ..... Major environmental conservation areas including the world's largest, 30-year multi-billion dollar environmental restoration project (CERP) in our neighborhood
- .....Local job markets highly geared towards environmental analysis and planning in SE Florida.

The Department of Geosciences at FAU offers high-quality scientific education currently leading to undergraduate and master's degrees in geography and geology with emphasis in Earth Systems Science, Human-Environmental Systems Science, Geo-Information Science, and a doctoral degree in geosciences with emphasis in advanced research and technical training.

This Geosciences master program at FAU will provide technical training not currently possible within current master's programs and will be consistent with the revised mission of the Department of Geosciences. The program will emphasize the integration of conventional

subfields within geography, geology, and earth science with technical and field based subfields in the geosciences such as geographic information systems, remote sensing, geovisualization, geomatics, marine geology, geophysics, and coastal and environmental engineering to analyze terrestrial and aquatic subtropical environments.

The program will require students to complete 33 and 36 credit hours (thesis and non-thesis option respectively) beyond the baccalaureate degree with a cumulative GPA of at least 3.0. Students will choose to focus their studies in one area in Geosciences. Both thesis and non-thesis students will take 18 and 27 credits, respectively from within their chosen focus study area. Students may take some courses in other focus areas if needed. The M.S. in Geosciences study areas may be associated for example with: Urban Development and Sustainability, Cultural and Spatial Ecology Research, GIS Applications, Hydrology and Water Resources, and Hydrogeology. The exact courses taken are to be determined by the students and their advisory committees and/or graduate director. For thesis students no more than 6 master's thesis credits will be counted toward the degree.

**B. Describe how the proposed program is consistent with the current State University System (SUS) Strategic Planning Goals. Identify which goals the program will directly support and which goals the program will indirectly support. (See the SUS Strategic Plan at <http://www.flbog.org/StrategicResources/> )**

The proposed M.S. in Geosciences will complement and support the strategic goals of Florida Atlantic University (FAU) and the State University System (SUS), and where appropriate, this section will identify the specific SUS Goal met by this degree proposal. The four, broader goals set forth by the SUS include:

1. Access to and production of degrees,
2. Meeting statewide professional and workforce needs,
3. Building world-class academic programs and research capacity, and
4. Meeting community needs and fulfilling unique institutional responsibilities.

The M.S. in Geosciences will not find itself in direct competition with other more traditional geography and geology M.S. programs within the state which are focused largely on traditional academic career tracks, and use an approach that is very specialized. Traditionally, geographers, geologists and other environmental scientists have focused on narrower specialty areas such as groundwater, structural geology, near-shore environments, urban planning, and environmental mitigation. This means that multiple individuals with diverse academic backgrounds are always needed to tackle environmental problems, and often there are no common elements for a more holistic discussion or understanding of the problem. Environmental scientists today, particularly in the South Florida region where we are confronted with many human-environmental issues, need significant training in science, urban and regional planning, policy and geospatial technologies such as GIS, digital image analysis, GPS, computer mapping and remote sensing.

The proposed degree program will be a targeted applied degree (SUS Goal 2) which answers the call from state and federal employers in the area, as well as other local agencies and environmental consulting firms for better trained individuals in the geosciences. This graduate

program will focus on issues that are unique to this region and which should include coastal, wetland and aquifer protection. The M.S. will serve a growing need in the South Florida industry and government areas for students who have a degree of technical knowledge and skills in applied geologic and geographic science. As Geographic Information Systems becomes more common in South Florida and is integrated within the business processes, the demand for professionals with Geosciences skills will grow exponentially. In Florida there is a need for skilled graduates in water resources that are locally-grown. Familiarity with the water resources problems of Florida, the issues, and the agencies is pivotal. There is also a need for an expanded pool of educated geoscience professionals in Florida, not only in relation to growth-management issues, but also to geologic hazards and natural resource conservation/protection.

The continued development of computer modeling, spatial analysis and mapping has meant that students who took the traditional sequence of courses within the GIS/spatial analysis curriculum (typically 4 courses in the late 1980s and into the 1990s), now need at least an additional year and a half of training. The GIS/spatial analysis curriculum now approaches 15 integrated courses in our sequence, all of which are being demanded by the environmental and urban analysis professions. The program will thus emphasize higher level integration of conventional subfields in geography, geology, and earth sciences with technical and field based sciences, and will thus provide access to a new and different master degree program not currently available in the state of Florida (SUS Goals 1 and 2). Additionally, the program will welcome part-time students who can enroll in the M.S. program while maintaining their professional positions, thus opening graduate educational opportunities to a wider pool of geoscience professionals than in any other geography and geology master programs in the state.

Master students from the program will specialize in analytical training in hydrogeology/water resources, urban development and sustainability or cultural and spatial ecology. In addition, students will complete training in GIS/Remote Sensing and other field technologies to meet the demands of environmental professions. These areas emphasize skill sets that are required by local job markets, which address socio-economic concerns to scientific issues (e.g., weighing the costs and benefits of tourism development to environmental protection). Thus, the program will make an important contribution towards committing academic and fiscal resources to meeting Florida's need for trained professionals in areas that implement advanced technologies, and help prepare students for emerging trends in the labor force in general (SUS Goal 2). In this way, the department is demonstrating its commitment to recruiting and preparing students for professions vital to the sustainability of the state of Florida.

The M.S. in Geosciences will allow the Department, the Charles E. Schmidt College of Science and University to expand its graduate and overall presence in environmental conservation and sustainability, and in the work associated with one of the world's largest environmental restoration projects (i.e., Comprehensive Everglades Restoration Plan - CERP), thus adding to the greater visibility of the university in the area of environmental research. In doing so, the program will meet community needs and fulfill unique institutional responsibilities in the seven-county region serviced by FAU (SUS Goal 4) by offering specialty programs to address local geoscience issues, such as coastal processes and water resource planning and restoration, and applied modeling.

Local job markets are increasingly geared towards environmental analysis and planning due to the relative scarcity of water resources and water contamination; and the problem of unsustainable management of natural resources, which hinders human development and urbanization efforts. Pollution, the depletion of natural resources, and the disintegration of ecological functions are matters of local, national and global concern. The Comprehensive Everglades Restoration Project (CERP) will demand many trained professionals in order to fully address major water resources and biological issues such as the state of wetlands, invasive and indigenous species of flora and fauna and of course the quantity, quality, timing and distribution of the region's available water.

## **INSTITUTIONAL AND STATE LEVEL ACCOUNTABILITY**

### **II. Need and Demand**

- A. Need: Describe national, state, and/or local data that support the need for more people to be prepared in this program at this level. Reference national, state, and/or local plans or reports that support the need for this program and requests for the proposed program which have emanated from a perceived need by agencies or industries in your service area. Cite any specific need for research and service that the program would fulfill.**

#### **Broad Overview of Need:**

In his 2006 Presidential Address to the American Association for the Advancement of Science, Dr. Gilbert S. Omenn outlined scientific *grand challenges* for the future compiled from a variety of sources such as the National Science Foundation and the National Academies of Sciences. These grand challenges include (*Science*, 314, p1696ff, 15 December, 2006):

- Biogeochemical cycles (nutrient elements C, O, H, N, S, P and regulators K, Ca, Mb, Fe, Zn) and their perturbations;
- Biological diversity and ecosystem functioning;
- Climate variability—local and regional;
- Hydrologic forecasting—floods, droughts, contamination;
- Environmental changes as selection agents on pathogen virulence and host susceptibility to infections;
- Markets, treaties, and rules to govern resource extraction and waste disposal
- Land use and land cover dynamics.

All of these challenges involve integration of various earth science disciplines and further interdisciplinary connections to other fields of study. Additionally, they all bear strongly on issues facing the state of Florida, and especially Florida's Gold and Treasure Coasts.

Rising to these challenges requires training, a human resource base with education and skills in both the appropriate specialized disciplines and their synthesis. It will be this integration of specialized knowledge that will lead to the fundamental solutions required. In this context, it is

useful to note that Dr. Tim Killeen, president of the largest Earth Sciences professional society, the American Geophysical Union, and Director of the National Center for Atmospheric Research (which is the largest employer of geoscientists outside the federal government) has observed that

*... U.S. universities are currently educating an insufficient number of geoscience graduates for the jobs that are projected to open up in the next decade, let alone for those new jobs that will undoubtedly be created as the story of the 21<sup>st</sup> century unfolds. It is time to think more broadly about how to build the base of expertise. ("Challenges for the Geosciences", EOS: Transactions of the AGU, 87, 549, 5 December 2006.)*

The National Science Foundation (NSF), one of the main sources of funding of university-based basic research, has recognized the capital role of geo-scientific research. The Directorate for Geosciences (GEO) is one of six research arms within the National Science Foundation, with an annual budget of over \$700M, second only to the Directorate for Mathematical and Physical Sciences, which encompasses a broader scientific portfolio, in gross budget volume (see Figure 1). This level of funding is likely to continue, given the very close linkage of the geosciences with two of the areas of priority in NSF agency-wide funded research, Bio-complexity in the Environment and Polar Research.

### **Growth of Geosciences and Employment Trends:**

Looking at the growth trends in employment, clearly those educated in different facets of the geosciences will be more in demand. Employment projections for geography/geology professionals are growing faster than average, 12-35% and by 2014 the discipline will need 892,000 additional employees (Occupational Information Network, <http://online.onetcenter.org/find/quick?s=geography&g=Go>.) The same source identifies that in areas related to this proposal, for cartographers and photogrammatists there is an anticipated 10-20% growth, for mapping technicians a 10-20% growth, and for hydrologists, the growth will be faster than average with a 21-35% growth rate. Also, for urban and environmental areas in the geosciences, there will be a 10-20% increase in available positions. Given the multidisciplinary nature of the degree and the increasing job market for those with specific geoscience computer and analytical skills, jobs are particularly available for those with higher level skills in mapping, remote sensing, hydro modeling, geophysics, petrology and engineering geology that require advanced graduate training.

The National Science Foundation (NSF) indicates that science and engineering jobs are expected to increase by about 47%, or about 2.2 million jobs, a trend driven mainly by the computer-related sciences. Additionally, environmental science employment will increase by 21,000 jobs over the next decade. These trends are particularly pertinent for the geosciences, as the disciplines include science, computers and the environment, all areas in which NSF predicts a high increase in employment opportunities as indicated in a recent NSF report by Thurgood, Golladay and Hill in 2006 (<http://www.nsf.gov/statistics/nsf06319/pdf/nsf06319.pdf>).

TABLE 18. Federal research and development and research and development plant budget authority for general science and basic research (251): FY 2004–06

Funding category and agency	2004	2005	2006	2005–06
	actual	preliminary	proposed	
	\$ millions			% change
Total	7,352	7,391	7,354	-0.5
National Science Foundation (NSF)	4,123	4,057	4,170	2.8
Mathematical and physical sciences	1,092	1,070	1,086	1.5
Geosciences	713	694	709	2.2
Computer and information science and engineering	605	614	621	1.1
Biological sciences	587	577	582	0.9
Engineering	566	561	581	3.5
U.S. polar research programs	342	344	387	12.4
Major research equipment	156	174	250	44.0
Social, behavioral, and economic sciences	184	197	199	1.0
Integrative activities	164	130	135	3.8
Education and human resources	152	140	115	-17.9
Budget authority adjustment <sup>a</sup>	-438	-443	-494	11.5
Department of Energy (DOE)	3,229	3,334	3,184	-4.5
Basic energy sciences	991	1,105	1,146	3.7
High energy physics	716	736	714	-3.1
Biological and environmental research	574	582	456	-21.7
Human genome	64	65	64	-0.5
All other research	510	517	391	-24.3
Nuclear physics	380	405	371	-8.4
Fusion energy sciences	256	274	291	6.1
Advanced scientific computing research	197	232	207	-10.9
Small business innovation research <sup>b</sup>	115	0	0	na

na = not applicable.

<sup>a</sup> Budget authority adjustment subtracts costs for research facilities, major equipment support, and other non-R&D from total NSF budget authority.

<sup>b</sup> DOE treats this activity as a budget execution program (i.e., funds are collected from existing appropriations and are not allocated until three quarters into the fiscal year).

NOTES: Detail may not add to total because of rounding. Percent change derived from unrounded data. Not all federally sponsored basic research is categorized in subfunction 251.

Figure 1. Federal research and development and research and development plant budget authority for general science and basic research (Source: *Federal R&D by budget function: Fiscal Years 2004-2006*, NSF May 2006).

This report also cites a recent national survey in which 70% of graduating students (with undergraduate degrees in the geosciences) wanted to continue graduate work in the physical sciences/earth science arena. Thus, at the national level a continued demand for people with both geographic, geologic and computer/analytical skills obtained through Geosciences can be expected for the next decade and beyond. The NSF claims the ceiling on research and development activities is fixed only by the availability of trained personnel. Thus, the limiting resource for scientific, environmental development is currently an insufficient number of appropriately trained individuals.

*“For many young geoscientists now embarking on careers, the job outlook is very good. The current federal research funding situation means it's less rosy for those on an academic research track. But for those in industry, the number of geoscience jobs will grow by 22% from 2006 to 2016, much faster than the projected total of a 10% increase for all occupations, according to the U.S. [Bureau of Labor Statistics](#).*

The following excerpt from Coontz in *Science Careers*, August 8, 2008, particularly focuses on the need for advanced training for hydrogeologists.

*When hydrogeologists talk about their field, one word keeps coming up: "recession-proof." While geologists in the energy and mineral industries face roller-coaster hiring-and-firing cycles, those who study the movement and chemistry of water seeping through rocks and sediment find demand for their expertise almost as steady as the flow of groundwater itself. Environmental consulting companies, which employ about 80% of hydrogeologists in the United States, currently report four jobs for every qualified graduate, according to the [American Geological Institute](#) (AGI). Government regulatory agencies, national laboratories, and mining and oil companies also need them. New niches open regularly as hydrogeologists team up with scientists in other disciplines to grapple with huge environmental challenges, such as forecasting how changing climate will affect water resources and aquatic life. And signs are that the future will hold more of the same. As [Richelle Allen-King](#), a hydrogeology professor at the [University at Buffalo](#) in New York, puts it, "Water problems are not going away."*

[http://sciencecareers.sciencemag.org/career\\_magazine/previous\\_issues/articles/2008\\_08\\_08/career.a0800120](http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2008_08_08/career.a0800120)).

### **Florida's Contribution to MS Geoscience Training:**

The state of Florida's 1999-2009 annual M.S. production from the public institutions with M.S. programs in geography, Geographic Information Science, and geology averaged 56 Master's graduates (see Table 5 below, [http://www.flbog.org/resources/iud/degrees\\_search.php](http://www.flbog.org/resources/iud/degrees_search.php)). There are currently no M.S. programs that integrate the geosciences, as is being proposed here, that are offered by the State's public or private institutions. Given the need described in the previous paragraphs, it is safe to assume that while the demand for traditional, discrete degrees in geography or geology seems to be safely met in Florida, the need and demand for master training in geosciences is not being fulfilled in Florida (e.g. geospatial technologies). This M.S. program will fulfill that need. [NOTE: We have chosen the CIP code 45.0799 for this proposal.]

According to the Bureau of Economic and Business Research (BEBR), the population of Florida increased to 15,982,378 in the year 2000 (<http://www.bebr.ufl.edu>). This figure represents a growth of over 3 million people from the previous decennial census in 1990; a growth rate that lags behind only California and Texas. Florida's population is expected to keep expanding. In fact, the estimation of the Census Bureau's Population Estimates Program (PEP) was 18,537,969 people for the year 2009. The service area for FAU and the adjacent communities of Broward, Miami-Dade, and Palm Beach counties rank among the highest in total population increases. These three counties are ranked among the highest nationally in both, population number and rate of growth. However, collectively these counties do not host a single professionally oriented geoscience M.S. granting institution. Only M.S. in traditional geography and geology are granted, except for FSU (i.e. GIS). But again, this program is not similar to the one that is being proposed here.

According to a late 1990s comprehensive review of the situation in FAU's service area, undertaken by the Business Development Board of Palm Beach County, in terms of higher education, the county ranks at the bottom in the number of graduate students enrolled among the eight metropolitan areas included in the bench marking exercise ([www.bdb.org](http://www.bdb.org)). This reflects the small number of research universities located in the county with only three universities offering post-graduate studies. This puts Palm Beach at a significant disadvantage in meeting the

recruiting needs of high-tech sectors, which often require a rich talent pool of scientists, engineers, and specialists in other disciplines. This creates an employment problem in our service area which means that needs in the area cannot be met by professionals trained in South Florida schools. This program will help meet that need.

**Table 5 Master Degrees in Geosciences 1997-2009**

	Degree	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	Total	Avg/yr
FAU	Geography	7	6	10	4	11	8	7	5	6	5	69	6.9
	GIS	0	0	0	0	0	0	0	0	0	0	0	0
	Geology	5	6	8	5	4	7	7	5	3	7	57	5.7
	Total	12	12	18	9	15	15	14	10	9	12	126	12.6
FIU	Geography	0	0	0	0	0	0	0	0	0	0	0	0
	GIS	0	0	0	0	0	0	0	0	0	0	0	0
	Geology	4	6	5	1	2	2	6	4	3	5	38	3.8
	Total	4	6	5	1	2	2	6	4	3	5	38	3.8
FSU	Geography	1	4	5	9	7	13	5	18	14	9	85	8.5
	GIS	0	0	0	0	0	0	0	0	4	13	17	1.7
	Geology	1	6	4	2	0	0	2	2	1	8	26	2.6
	Total	2	10	9	11	7	13	7	20	19	30	128	12.8
UF	Geography	4	2	4	1	5	6	2	3	5	8	40	4
	GIS	0	0	0	0	0	0	0	0	0	0	0	0
	Geology	10	5	10	8	8	8	5	8	11	7	80	8
	Total	14	7	14	9	13	14	7	11	16	15	120	12
USF	Geography	5	8	4	4	4	10	8	7	11	8	69	6.9
	GIS	0	0	0	0	0	0	0	0	0	0	0	0
	Geology	11	11	5	6	5	13	8	7	9	8	83	8.3
	Total	16	19	9	10	9	23	16	14	20	16	152	15.2
State Total	Geography	17	20	23	18	27	37	22	33	36	30	263	26.3
	GIS	0	0	0	0	0	0	0	0	4	13	17	1.7
	Geology	31	34	32	22	19	30	28	26	27	35	284	28.4
	Total	48	54	55	40	46	67	50	59	67	78	564	56.4

FAU Florida Atlantic University  
 FIU Florida International University  
 FSU Florida State University  
 UF University of Florida  
 USF University of South Florida

**Source: Florida Board of Governors State University System**

**Impact of Florida’s Rapid Population Growth and the Need for Geoscience Research:**

The rapid population growth in the South Florida region has created a need to better understand the influence of human activities on environmental processes.

*“Together we can help all Floridians understand the importance of restoring and protecting our natural environment,” said Governor Crist. “We must educate our citizens, businesses and*

*policy makers on the importance of our mission to preserve Florida's natural beauty." Florida Governor, Charlie Crist <http://www.charliecrist.com/news.php?id=45>*

According to the U.S. Environmental Protection Agency (South Florida Geographic Initiative in EPA 841-S-95-001 Jan 1995), major environmental problems exist in the region, such as the following.

- Mercury contamination of Everglades fish and other biota
- Ecological degradation of Florida Bay and the Florida Keys National Marine Sanctuary
- Water supply conflicts among agricultural interests, natural resources, and an expanding urban population
- Nutrient enrichment of the Everglades by agricultural or urban drainage water
- Loss of historic hydropatterns, water gradients, and discharge
- Rapid regional population growth
- Spread of exotic plants and animals
- Loss of native populations and species of flora and fauna
- Extensive conversion of remaining wetlands and natural lands to other land uses

Florida's previous Governor, Charlie Crist, understands the seriousness of the environmental problems of Florida and has worked hard to create legislature and funding support to understand these environmental problems on a more holistic way. As his own website indicates, taking care of Florida's environment is one of his top agenda items.

*Governor Crist has made improving the health of the Florida Everglades, Lake Okeechobee and the Caloosahatchee and St. Lucie estuaries an environmental priority. Florida's economy and quality of life are connected to the health of Lake Okeechobee, the coastal estuaries and the long-term protection for the northern Everglades.*

**B. Demand: Describe data that support the assumption that students will enroll in the proposed program. Include descriptions of surveys or other communications with prospective students.**

The apparent demand on the M.S. in Geosciences was one of the main reasons the geoscience faculty at FAU began discussing the possibility of a M.S. in Geosciences, which seems only natural since the Ph.D. program is already approved (2009). Over the course of the compilation of the Ph.D. proposal and the present one, the Department Chair has been in contact with many professionals working in the field of geosciences who have been very supportive of the proposal and who have indicated that some of their current employees will be initial applicants into the program.

**C. If similar programs (either private or public) exist in the state, identify the institution(s) and geographic location(s). Summarize the outcome(s) of any communication with such programs with regard to the potential impact on their enrollment and opportunities for possible collaboration (instruction and research). Provide data that support the need for an additional program.**

No schools in Florida offer a degree similar to the proposed degree in Florida. The impact of the new program on other programs of the Department of Geosciences at FAU is expected to be quite minimal. This M.S. is significantly different than the other ones.

- D. Use Table 1 (A for undergraduate and B for graduate) to categorize projected student headcount (HC) and Full Time Equivalents (FTE) according to primary sources. Generally undergraduate FTE will be calculated as 40 credit hours per year and graduate FTE will be calculated as 32 credit hours per year. Describe the rationale underlying enrollment projections. If, initially, students within the institution are expected to change majors to enroll in the proposed program, describe the shifts from disciplines that will likely occur.**

We expect that all full-time students in the master program in Geosciences will be enrolled for 24 credit hours per year; 9 credit hours in each of the Fall and Spring semesters and 6 credit hours over the summer. Thus, assuming graduate FTE is calculated as 32 credit hours per year, then the FTE in Table 1B is calculated as 0.75 (24/32) of the headcount for full-time students, and for part-time students, the FTE is calculated as 0.5 of the headcount.

The majority of the first students will likely be past graduates of our own programs in the Department of Geosciences and currently employed within our service area, or other geosciences professionals working in South Florida desiring to acquire additional training. The number of full-time students enrolling in the program is expected to increase as statewide, national and international recruiting efforts prove to be effective. Additionally, it is anticipated that some shift may occur from students in related programs, such as Environmental Science, and Urban and Regional Planning (as happens periodically with our current graduate programs), but these numbers should be small and taper off rather quickly.

We expect the part-time applicants to remain significant throughout year 5 and beyond, as the nature of the degree being proposed is ideal for those already holding important professional positions in the geosciences within the service area of FAU. Therefore, Table 1B reflects a gradual shift from a highly local to an increasingly wider geographic base and from a predominantly part-time base to a greater representation of full-time students in the program. It should also be noted that it is expected that most of the initial students in the program will likely come into the program already having earned an undergraduate Bachelor's degree.

The final total headcount in Table 1B of 198 by the fifth year (114 part-time and 84 full-time) is more than reasonable considering (1) the perceived demand, and (2) the total number of participating faculty members. The projected student to faculty ratio compares favorably with programs in Geography or Geology around the state and country. The headcounts in Table 1B are fully justified based on the demand feedback discussed in section B above.

- E. Indicate what steps will be taken to achieve a diverse student body in this program, and identify any minority groups that will be favorably or unfavorably impacted. The university's Equal Opportunity Officer should read this section and then sign and date in the area below.**

The diversity of the local community was projected to achieve levels that will make it the first

region in the U.S. that does not have an ethnic or racial majority by the year 2005. The FAU student body in general is expected to continue to reflect the diversity of the region. The diversity of the graduate student body in Geosciences at FAU reflects that seen in the nation at large. The Geosciences program will target groups that are under-represented in the sciences so that its student body will more closely reflect that seen in the local region. The competition among graduate programs in the sciences for recruitment of qualified under-represented minority candidates is very keen. The proposed degree program in Geosciences will make recruitment of such students a high priority in its recruitment plan for new M.S. students. In particular, universities and colleges in the State of Florida will be targeted for student recruitment through brochures, contacts with specific departments in universities in the region, and visits by FAU/Geoscience recruitment teams. Such efforts can be made by faculty attending professional conferences as well. Additionally, faculty recruitment in the various units participating in this program will emphasize identification of qualified minority candidates. This effort is expected, in turn, to attract minority students through identification with faculty members as potential role models and mentors.

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Equal Opportunity Officer

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Date

### III. Budget

- A. Use Table 2 to display projected costs and associated funding sources for Year 1 and Year 5 of program operation. Use Table 3 to show how existing Education & General funds will be shifted to support the new program in Year 1. In narrative form, summarize the contents of both tables, identifying the source of both current and new resources to be devoted to the proposed program. (Data for Year 1 and Year 5 reflect snapshots in time rather than cumulative costs.)**

With the recent faculty hires in biogeography and geophysics for the 2010-2011 academic years, faculty staffing in the Department is adequate to initiate and maintain the proposed M.S. program. Thus, for year 1, the faculty salaries and benefits needed to support the Master program will come entirely from reallocated base E&G funds. This will include a total of \$78,790 reallocated from Geosciences faculty (fourteen faculty is paid from the home department, \$60,084, one of those faculty members is paid from College of Engineering and Computer Science budget, \$9,804, and one from the Center for Environmental Studies, \$8,902). See Table 4 for a complete listing of faculty involved with the program. These reallocated salaries and benefits extend into year 5 with the same % effort, and therefore the same amount reallocated.

A&P staff includes 2 part-time employees. Our department's budget coordinator currently is a (0.75) FTE position, and a computer support person is a (0.50) FTE position (a full-time employee currently shared with the Dean's office). Additionally, the department currently has 1 USPS employee (senior secretary). These would be enough to implement and sustain the additional program. Ample library resources are available to meet the initial needs of the

proposed program, as all of these courses are currently offered at FAU and current library resources adequately support them. Additional resources are not necessary to start the program.

Ample library resources are available to meet the initial needs of the proposed program. As all of courses in the proposed MS program are currently offered at FAU, and current library resources adequately support those courses, initial additional resources are not necessary. After a few years into the program, however, an additional investment in geoscience-related materials for the library will be necessary to support advanced research. The amount needed for the Library to increase the geoscience-related holdings by year 5 is estimated by the Wimberly Library staff to be \$10,000, as discussed more fully later in this document. This would add important research resources such as Global Biogeochemical Cycles, Ethnobotany Research and Applications, Journal of Ethnobiology, and the Geoscience World Database package, which includes several specialized geology research publications.

In the expense category on Table 2, we do not expect special needs for implementation of the program, however, by year 5 we estimate a need for computing, display and field technology equipment as described in section 10, part F of this document. This expense for year 5 would be approximately \$100,000 with approximately 100% of that total being funded from grants and contracts. No other special or capital outlay costs would be incurred for implementing and maintaining the program through year 5.

- B. If other programs will be impacted by a reallocation of resources for the proposed program, identify the program and provide a justification for reallocating resources. Specifically address the potential negative impacts that implementation of the proposed program will have on related undergraduate programs (i.e., shift in faculty effort, reallocation of instructional resources, reduced enrollment rates, greater use of adjunct faculty and teaching assistants). Explain what steps will be taken to mitigate any such impacts. Also, discuss the potential positive impacts that the proposed program might have on related undergraduate programs (i.e., increased undergraduate research opportunities, improved quality of instruction associated with cutting-edge research, improved labs and library resources).**

There are no plans to abandon the current master's programs in Geography and Geology, but to create a master's program that takes advantage of the interface of geography and geology towards developing specific job skills in geosciences. We will encourage non-thesis work at the master's level and will combine doctoral and master's students in many graduate courses. Thus the major adjustment for the master's programs will be largely additional students (FTE) in graduate classes. Provision of assistantships losses shifted to doctoral students in 2009, but we anticipate that due to the increased research activity in the Department that the doctoral program will bring, there will be increased funded research opportunities for master's students in all degree programs as well as doctoral students.

At the undergraduate level, as a result of redefining the department's mission recently, we have already streamlined course offerings in order to free up faculty time so that a higher level of participation can be devoted to the graduate program. Thus, we expect no negative impact on the undergraduate programs in the Department beyond a slightly higher rate of teaching by

instructors as faculty use grants to buyout some teaching. We will use the Master Teacher program of the Charles E. Schmidt College of Science diligently to maintain quality teaching among all faculty, including instructors.

**C. Describe other potential impacts on related programs or departments (e.g., increased need for general education or common prerequisite courses, or increased need for required or elective courses outside of the proposed major).**

There are no required courses to be taken in other departments, but the interdisciplinary nature of the proposed program will allow students to take courses from approved cognate courses in other departments appropriate to the student's research focus within the degree program. The departments like anthropology, biology, and urban and regional planning, (and to a lesser degree, chemistry, physics, and mathematics) may provide a few classes to some students whenever space would be available. It is not expected that student enrollment in any individual cognate course in the proposed program will strain resources of other departments, but will merely add to the graduate FTE production of the department by strengthening the enrollment of the courses.

**D. Describe what steps have been taken to obtain information regarding resources (financial and in-kind) available outside the institution (businesses, industrial organizations, governmental entities, etc.). Describe the external resources that appear to be available to support the proposed program.**

The Department Chair and some of the Geosciences faculty have had numerous meetings with representatives from a variety of agencies and consulting firms that work in the geosciences, such as the U.S. Geological Survey, the South Florida Water Management District, Coastal Planning and Engineering, Inc., and CEPEMAR. There has been strong support throughout the professional community for the graduate programs in geosciences.

Our strong relationship with Coastal Planning and Engineering, and Incorporated (CPE), a multidisciplinary coastal service firm, has yielded equipment-sharing, lab space-sharing, scholarships, student internships and joint grant opportunities with faculty and graduate students, and we expect that relationship to grow further with the addition of this MS program. CPE has been an important employer of recent graduates of our Department as the training and skills we provide fit nicely with the projects and overall goals of the firm as described on their webpage ([www.coastalplanning.net](http://www.coastalplanning.net)). Additionally, some agencies and private firms have expressed an interest in becoming directly involved in FAU's Geoscience graduate education. This time and expertise is another invaluable resource for graduate students. As Barry Rosen states:

*"The U.S. Geological Survey is looking forward to having new opportunities to work with Florida Atlantic University graduate students, collaborating both on a formal and informal basis, through classroom instruction, internships, and as representatives on dissertation committees... Cooperation with academia and other scientific organizations is an integral part of the U.S. Geological Survey's mission plan. The development of an integrated geosciences program at Florida Atlantic University will greatly facilitate this objective and allow the U.S. Geological Survey to continue its contribution to the Nation's science." Barry Rosen, Director, Florida Integrated Science Center, U.S. Geological Survey*

Our burgeoning relationship with USGS, will bring the opportunity to share equipment and

educational expertise. Additional funding sources include the Florida Department of Environmental Protection, the South Florida Water Management District and the various county and municipal planning agencies. The Department has a strong track record in securing such funding and expects the volume of funding to grow significantly as our new faculty will become more and more research active.

**IV. Projected Benefit of the Program to the University, Local Community, and State**  
**Use information from Table 1, Table 2, and the supporting narrative for “Need and Demand” to prepare a concise statement that describes the projected benefit to the university, local community, and the state if the program is implemented. The projected benefits can be both quantitative and qualitative in nature, but there needs to be a clear distinction made between the two in the narrative.**

The proposed degree program will be an *innovative applied degree* which answers the call from employers in the South Florida area and throughout the state, such as the Army Corp of Engineers, the U.S. Geological Survey, the Florida Department of Environmental Protection, the South Florida Water Management District, Broward County and Palm Beach County Planning Agencies, Coastal Planning and Engineering, Inc. and a variety of other local agencies and environmental consulting firms that have expressed a growing need for trained individuals in technology and field applications in the geosciences in order to study and solve various environmental problems in South Florida and beyond. The degree program is focused on both full-time and part-time students who can enroll in master work while maintaining their professional positions, thus opening graduate educational opportunities to a wider pool of geoscience professionals.

The M.S. in Geosciences will make an important contribution towards committing academic and fiscal resources to meeting Florida’s need for trained professionals in areas that implement technologies, and will help prepare students for emerging trends in the labor force in general, demonstrating the Department’s commitment to recruiting and preparing students for professions vital to the sustainability of Florida.

In the expense category, we do not expect special needs for implementation of the program. No other special or capital outlay costs would be incurred for implementing and maintaining the program. At the end the department will have an increase in FTE for the graduate courses. It is important to note that there is no additional cost at all of implementing the program, therefore providing an important educational opportunity for FAU’s service area in the long term at very small additional cost (see Table 2).

**V. Access and Articulation – Bachelor’s Degrees Only**

- A. If the total number of credit hours to earn a degree exceeds 120, provide a justification for an exception to the policy of a 120 maximum and submit a request to the BOG for an exception along with notification of the program’s approval. (See criteria in BOG Regulation 6C-8.014)**

This section does not apply to this degree proposal.

- B. List program prerequisites and provide assurance that they are the same as the approved common prerequisites for other such degree programs within the SUS (see Common Prerequisite Manual <http://www.facts.org>). The courses in the Common Prerequisite Counseling Manual are intended to be those that are required of both native and transfer students prior to entrance to the major program, not simply lower-level courses that are required prior to graduation. The common prerequisites and substitute courses are mandatory for all institution programs listed, and must be approved by the Articulation Coordinating Committee (ACC). This requirement includes those programs designated as “limited access.”**

**If the proposed prerequisites they are not listed in the Manual, provide a rationale for a request for exception to the policy of common prerequisites. NOTE: Typically, all lower-division courses required for admission into the major will be considered prerequisites. The curriculum can require lower-division courses that are not prerequisites for admission into the major, as long as those courses are built into the curriculum for the upper-level 60 credit hours. If there are already common prerequisites for other degree programs with the same proposed CIP, every effort must be made to utilize the previously approved prerequisites instead of recommending an additional “track” of prerequisites for that CIP. Additional tracks may not be approved by the ACC, thereby holding up the full approval of the degree program. Programs will not be entered into the State University System Inventory until any exceptions to the approved common prerequisites are approved by the ACC.**

This section does not apply to this degree proposal.

- C. If the university intends to seek formal Limited Access status for the proposed program, provide a rationale that includes an analysis of diversity issues with respect to such a designation. Explain how the university will ensure that community college transfer students are not disadvantaged by the Limited Access status. NOTE: The policy and criteria for Limited Access are identified in BOG Regulation 6C-8.013. Submit the Limited Access Program Request form along with this document.**

This section does not apply to this degree proposal.

- D. If the proposed program is an AS-to-BS capstone, ensure that it adheres to the guidelines approved by the Articulation Coordinating Committee for such programs, as set forth in Rule 6A-10.024 (see Statewide Articulation Manual <http://www.facts.org>). List the prerequisites, if any, including the specific AS degrees which may transfer into the program.**

This section does not apply to this degree proposal.

## **INSTITUTIONAL READINESS**

### **VI. Related Institutional Mission and Strength**

- A. Describe how the goals of the proposed program relate to the institutional mission statement**

**as contained in the SUS Strategic Plan and the University Strategic Plan.**

The proposed M.S. in Geosciences fits with the goals and mission statements of both the SUS (<http://www.flbog.org/StrategicResources/>) and Florida Atlantic University (<http://www.fau.edu/strategicplan/mission.php>; <http://www.fau.edu/strategicplan/goals.php>). The M.S. in Geosciences will complement and support the strategic goals of Florida Atlantic University (FAU) and the State University System (SUS), and where appropriate, this document will identify the specific SUS Goal and the corresponding FAU Goal met by this degree proposal. The four, broader goals set forth by the SUS include:

- GOAL 1: Access to and production of degrees,
- GOAL 2: Meeting statewide professional and workforce needs,
- GOAL 3: Building world-class academic programs and research capacity, and
- GOAL 4: Meeting community needs and fulfilling unique institutional responsibilities.

The 7 goals within the FAU Strategic Plan are:

- GOAL 1: Providing increased access to higher education,
- GOAL 2: Meeting statewide professional and workforce needs,
- GOAL 3: Building world-class academic programs and research capacity,
- GOAL 4: Meeting community needs and fulfilling unique institutional responsibilities,
- GOAL 5: Building a state-of-the-art-information technology environment,
- GOAL 6: Enhancing the physical environment, and
- GOAL 7: Increasing the university's visibility.

As already discussed in the introduction section of this proposal, the M.S. in Geosciences will not find itself in direct competition with other more traditional geography and geology M.S. programs in the state which are focused largely on traditional academic career tracks. The proposed degree program will be an applied degree (SUS Goal 2, FAU Goal 2) which answers the call from state and federal employers in the area, other local agencies and environmental consulting firms, for more trained individuals in the geosciences. These entities have a growing need for a workforce trained in technology and field applications in geosciences in order to study and solve various environmental problems in South Florida. The program will emphasize higher level *integration* of conventional disciplines such as geography, geology, and earth sciences with technical and field based sciences, and will thus provide access to a different type of M.S. degree program not currently available in the state of Florida (SUS Goal 1, FAU Goal 1). The program will welcome part-time applicants from the geoscience professional community in South Florida, making advanced educational opportunities available to a wider constituency in the FAU service region (SUS Goal 1, FAU Goal 1).

M.S. students from the program will specialize in hydrogeology/water resources, GIS/Remote Sensing technologies, or various areas within environmental analysis (such as coastal environments, biogeography, ethno botany, and urban land-use change and sustainability). These areas emphasize skill sets that are required by local job markets, which address socio-economic concerns to scientific issues (e.g., weighing the costs and benefits of tourism to environmental

protection). Thus, the program will make an important contribution towards FAU's strategic goal of committing academic and fiscal resources to meeting Florida's need for trained professionals in areas that implement advanced technologies, and help prepare students for emerging trends in the labor force in general (SUS Goals 2 and 4, FAU Goals 2 and 4).

Inclusion of a M.S. in Geosciences will allow the Department, College and University to expand its graduate presence in environmental conservation and sustainability, and in the work associated with one of the world's largest environmental restoration projects (i.e., Comprehensive Everglades Restoration Plan - CERP), thus adding to the greater visibility of the university in the area of environmental research (FAU Goal 7). The program will meet community needs and fulfill unique institutional responsibilities in the seven-county service region (SUS Goal 4 and FAU Goal 4) by offering specialty programs to address local geoscience issues, such as coastal processes and water resource planning and restoration, and applied modeling. Local job markets are highly geared towards environmental analysis, contamination and planning due to the relative scarcity of water resources and water contamination; and the problem of unsustainable management of natural resources, which hampers human development and urbanization efforts. The aim of the program is to provide professionals with the knowledge and skills necessary to contribute, directly or indirectly, to the conservation and prudent use of natural resources for the general benefit of society, as this will foster comprehensive assessments on major environmental issues.

**B. Describe how the proposed program specifically relates to existing institutional strengths, such as programs of emphasis, other academic programs, and/or institutes and centers.**

This M.S. degree program combines facets of both geography and geology into a master degree in geosciences. This program will be especially tailored to the changing needs of the university's service region through an innovative curriculum that includes cross-disciplinary course work in the geosciences. The Department of Geosciences already has a good relationship in terms of grant proposals and contracts with the Center for Environmental Studies at FAU, and the beginnings of such a relationship with the Harbor Branch Oceanographic Institution (HBOI). Additionally, the Department has begun a dialogue with the Center for Urban Redevelopment and Education in the College for Design and Social Inquiry at FAU. The mission statements, as obtained from their respective web pages and promotional material, of some of the partners in this program are consistent with the goals of FAU and the proposed program:

“The Florida Center for Environmental Studies represents the ten state universities and four major private universities. The center acts as a facilitator and coordinator of research and training related to the environment and as a locus for environmental information. Grounding its activities in the Florida sub-tropical environment, its mandate encompasses global tropical and sub-tropical environments especially the issues and problems of water dominated ecosystems.”

<http://www.ces.fau.edu/>

“Harbor Branch Oceanographic Institution (HBOI) is dedicated to exploring the world's oceans, integrating the science and technology of the sea with the needs of humankind. Our staff of over 250 includes scientists, engineers, mariners and support personnel. We are involved in research

and education in the marine sciences; biological, chemical, and environmental sciences; marine biomedical sciences; marine mammal conservation; aquaculture; and ocean engineering.”

[www.hboi.edu](http://www.hboi.edu)

- C. Provide a narrative of the planning process leading up to submission of this proposal. Include a chronology (table) of activities, listing both university personnel directly involved and external individuals who participated in planning. Provide a timetable of events necessary for the implementation of the proposed program.**

### **2004-2005 AY**

-Department Subcommittee formed to create new mission statement for the Department. This committee (Ivy, Oleinik, Restrepo and Tran) was charged by Nathan Dean, Dean of the Charles E. Schmidt College of Science, to more tightly integrate Geography and Geology within the Department through the mission statement. 9/04.

-Department approves new mission statement on 11/04/04.

### **Mission Statement**

The Mission of the Department is to provide students with a high-quality scientific education and expose them to professional research focused on the Geosciences through excellence in teaching, research and creative activities. Additionally, we will provide service to the university and local and regional communities by regularly offering courses that address a broad education in the Geosciences. Moreover, the department will strive for continued growth in our service mission through expansion in the distance-learning environment, through the continued offering of certificate programs in Geo-Information Science, and through the training of students to solve problems in their communities.

-Department votes to change its name from Department from ‘Geography and Geology’ to ‘Geosciences’ to reflect the new, integrated mission. 11/04/04. And University Provost, John Pritchett, approves the name change from Department of ‘Geography and Geology’ to the Department of ‘Geosciences’ on 12/07/04.

-Dr. Russell Ivy is appointed Interim Chair by Dean Nathan Dean to begin making the necessary changes in the Department to move towards implementing the ideas presented in the mission statement. 12/04.

-Interim Chair forms curriculum committees to begin looking at the undergraduate degree programs, degree requirements and course offerings in light of the new mission of the Department. Curriculum committees are formed in the areas of Earth Systems Science, Human-Environmental Systems Science and Geo-Information Science. Baccalaureate degree tracks were revised to fit the new mission and foci of the department. Several courses were eliminated from the course offerings that did not fit with the new foci and a few core courses were created to fill holes or strengthen offerings in the new areas of emphasis.

-Department identified basic hiring needs of tenure-track professors to implement the mission, and foci of the ‘new’ Department. These are not listed in any specific rank order:

- 1) Coastal Geologist-Environmental Geophysics and/or Shallow Seismic Geophysics;
- 2) Hydrogeologist/Hydrogeochemist;

- 3) GIS/Remote Sensing Technical-Spatial/Quantitative Analysis;
- 4) Human-Environmental Geographer-Hazards, Vulnerability, Biogeography, or Landscape Ecology.

-Department hires Dr. Maria Fadiman as a Human-Environmental Geographer to begin as a tenure-track Assistant Professor in Fall 2005.

### **2005-2006 AY**

-Department approves a formal set of Goals and Objectives that stem from the Mission Statement. 9/05.

-Department curriculum committees [*Earth Systems Science, Human-Environmental Systems Science and Geo-Information Science*] complete their assessment of the undergraduate degree programs and course offerings and finalize paperwork for changes. The committees then move to examine the Masters' degree programs, requirements and course offerings in the same fashion. Again, requirements are slightly changed, courses are deleted and some new courses are added to reflect the new mission/foci of the Department.

-A Ph.D. Planning Committee is formed in the Department that meets weekly (Ivy, Oleinik, Restrepo, Tran). Goal of the committee is a white paper that describes the intended focus of the Ph.D. proposal.

-Dr. Russell Ivy is appointed Chair of Geosciences by Dean Nathan Dean and is charged to move ahead with a formal full-scale proposal for the Ph.D. degree based in the Department. 12/05.

-Department hires Dr. Tara Root as hydrogeologist/hydrogeochemist to begin tenure-track Assistant Professor position during the 2006-2007 AY.

-Department hires an instructor James Gammack-Clark to replace Gallagher. The instructor will free up availability of some of the technical faculty for graduate course offerings by teaching some of the lower-level GIS courses.

### **2006-2007 AY**

-Department is visited by the new Dean of the Charles E. Schmidt College of Science, Dr. Gary Perry, who charges the Department to move forward with the planning of the Ph.D. degree in Geosciences. 9/06.

-Ph.D. Planning Committee resumes weekly meetings. Tran, who departed FAU during the Summer of 2006 for a position with the EPA, is replaced by Charles Roberts. Goal of Committee is to have the Ph.D. proposal draft ready by the end of the Spring 2007 term. All faculty are involved at this point either on the main committee or a subcommittee. Committee explores the official name for the degree—Ph.D. in Applied Geosciences becomes the working title for the proposal.

-Dr. Ivy begins meeting with leaders from the geosciences and environmental professional

community to gain interest in and support for the proposal as well as input for the shaping of the curriculum and other facets of the proposal. The end goal is a tight proposal that reflects the geoscience needs of the professional community, to gather letters of support for the proposal, and to select some of these professionals to serve on an advisory board to critique the final document, but also to monitor the degree program in the future.

-Department hires Dr. Scott Markwith as tenure-track assistant professor in the human/environmental interactions area. His specific area of expertise is Biogeography. Dr. Markwith began in the 2007-2008 AY.

-Department hires Dr. Xavier Comas as a tenure-track assistant professor in the geophysics area. He began in the 2007-2008 AY.

### **2007-2008 AY**

-Department approves proposal document and finalizes name for degree --Ph.D. in Geosciences as being a more flexible than other working titles during the planning process [ Ph.D. in Applied Geosciences was the working title]

-Seek approval for Ph.D. in Geosciences from College, University, BOT, BOG.

### **2008-2009 AY**

-Implementation of first Ph.D. in Geosciences in the state of Florida.

### **2009-2010 AY**

-Ph.D. in Geosciences started to function.

-A M.S. Planning Committee was formed in the Department and met several times (Hanson, Roberts, Warburton, Root, Restrepo). Goal of the committee: a white paper to describe the intended focus of the M.S. proposal.

-All faculty were involved in two Faculty meetings. Spring 2009.

-Department approves proposal document and finalizes name for degree --M.S. in Geosciences as being it a more natural extension. 4/09.

## **VII. Program Quality Indicators - Reviews and Accreditation**

**Identify program reviews, accreditation visits, or internal reviews for any university degree programs related to the proposed program, especially any within the same academic unit. List all recommendations and summarize the institution's progress in implementing the recommendations.**

The last program review was completed in 2001 and indicated that the Department was doing well in teaching, research and service, given its size. This review was of the former Department of Geography and Geology. Since the end of 2004, the Department has made major changes in its mission, goals and curriculum to streamline the program to be consistent with local, state and

national needs, and to prepare for the implementation of the Ph.D. in Geosciences in 2009. The changes made since 2004 have created a tighter focus for the Department that should make our program more competitive in attracting students, and our faculty more competitive in grant and other research arenas.

## **VIII. Curriculum**

### **A. Describe the specific expected student learning outcomes associated with the proposed program. If a bachelor's degree program, include a web link to the Academic Learning Compact or include the document itself as an appendix.**

The M.S. in Geosciences will have the following outcomes, modified from the outcomes for the M.A./M.S. programs in the Department to reflect training:

- 1) Students will be well prepared for professional positions in the geosciences workforce. The criterion for success will be that at least 80% of the graduates of the M.S. program will obtain and maintain a position in their chosen field of interest related to their degree. The Department will constantly update the curriculum of the program to ensure that our students are well prepared. The Department will maintain a database to monitor the success of this outcome.
- 2) Students will become engaged in appropriate professional activities in their area of specialization. This outcome will be measured by attendance and participation in the conferences, workshops and other meetings of professional societies.

### **B. Describe the admission standards and graduation requirements for the program.**

#### **Admission Requirements:**

Individuals to be admitted to the master program in Geosciences at Florida Atlantic University will submit applications to the Graduate Admissions Committee of the Department. In addition to meeting the University and College admission requirements for graduate study, applicants for master's degrees in the Department of Geosciences must meet the following requirements:

- 1) Hold a bachelor's degree in an appropriate discipline from an accredited college or university;
- 2) Have earned a minimum grade point average of 3.0 (on a 4.0 scale) in the last 60 credits of undergraduate work attempted;
- 3) Have obtained a quantitative-verbal combined score of 1000 or higher on the general portion of the Graduate Record Exam. GRE scores more than 5 years old will not be accepted;
- 4) Receive the recommendation of the department faculty.

#### **Administration of the Program:**

The proposed M.S. program will be administered by a director (who will be the Geosciences Department Chair) and the faculty of the Geosciences Department.

Graduate faculty status will be determined using the general criteria, policies and procedures

outlined for the university-wide graduate faculty at FAU. Those with graduate faculty status may teach courses in the program and may serve on master committees for a thesis option. Research professors and outside professionals, such as employees of USGS, etc, with appropriate graduate credentials may serve on a master committee at the discretion of the Geosciences Graduate Program Committee. The Geosciences Graduate Program Committee will also be responsible for admitting students into the program.

**Degree Requirements:**

Students who successfully complete this degree program will earn a M.S. in Geosciences. The department will offer both a thesis and a non-thesis option for this degree. The requirements for both options are outlined below. Students must choose between the thesis/non-thesis option and concentration area upon the end of their second semester of studies when they have to file their plan of study. Students must earn a grade of “C+” or higher in any course that is applied to the credit hours presented for the degree. The degree program should normally be completed within 2-3 years. As per university policy, the degree should be completed within seven years of maintained continuous enrollment. Students must maintain a GPA of 3.0 or higher throughout their graduate program. Failure to do so will subject the student to dismissal from the program. The specific degree requirements are discussed in detail below.

*Sponsor, Advisor and/or Committee*

Potential students must have a "sponsor" from within FAU, who will then, in the case of the thesis option, acts as the student’s advisor until a permanent advisor has been chosen. The sponsor should recommend the academic deficiencies to the graduate director. The student should take the required course deficiencies at the first opportunity. Thesis students will be required to form a committee (advisor and two additional committee members) during the second semester of study. The advisor and at least one committee member should be from within the Geosciences Department. One committee member may be from an outside department within FAU or from another outside entity as long as it satisfies the conditions established by the College of Science.

*Course requirements*

All students in the program must complete at least half of the graduate credits at the 6000 level (Table 6). One 3 credit course at the 4000 level may be taken. No more than 3 credits of directed independent study (such as GEO 6908 or GLY 6908) may be used to fulfill the minimum credits for either degree option. A minimum of 24 credits should be taken from the geosciences curriculum.

Table 6. Distribution of credits for non-thesis and thesis option beyond the bachelor’s degree

Distribution	Credits	
	Non-thesis option	Thesis option
Department core	9	9
Geosciences electives	27	18
Thesis	0	6
Total	36	33

*Core courses*

The core courses (9 credits) shown in Table 7 will be required for all students in the program.

Table 7. Distribution of Department core courses

	Department Core Courses	Credits
GEO 6118	Research in the Geosciences	3
GLY 6931	Thesis Seminar	3
GEO 6920*	Three Geosciences Colloquium Series	1 each
	Total	9

[\*This is a one-credit course. The content of the course varies from semester to semester as it is based on guest speakers discussing their research in the geosciences and related areas. Students will be asked to take the course for credit 3 semesters during their residency in the program to expose them to a wide variety of research in the geosciences and related areas.]

*Electives and thesis credits*

Students will choose to focus their studies in one area in Geosciences. Both thesis and non-thesis students will take 18 and 27 credits, respectively from within their chosen focus study area. Students may take some courses in other focus areas if needed. The M.S. in Geosciences study areas may be associated for example with: Urban Development and Sustainability, Cultural and Spatial Ecology Research, GIS Applications, Hydrology and Water Resources, and Hydrogeology. The exact courses taken are to be determined by the students and their advisory committees and/or graduate director. For thesis students no more than 6 master's thesis credits will be counted toward the degree.

*Other requirements*

Students enrolled in the thesis-option must successfully defend their proposal and final thesis. Non-thesis students will be required to complete an essay (minimum 4000 words) related to one of the colloquia. It will be evaluated at the Thesis Seminar course, and it must include a presentation. This requirement is to ensure that all students (thesis and non-thesis) leave the program with sound writing skills.

- C. Describe the curricular framework for the proposed program, including number of credit hours and composition of required core courses, restricted electives, unrestricted electives, thesis requirements, and dissertation requirements. Identify the total numbers of semester credit hours for the degree.**

*See section 'B' above for detailed information on the program requirements.*

- D. Provide a sequenced course of study for all majors, concentrations, or areas of emphasis within the proposed program.**

The course of study provided is for full-time students coming into the M.S. in Geosciences program directly from an undergraduate degree, entering in the fall semester of the academic year.

**YEAR 1****Fall Semester**

GEO 6118	Research in the Geosciences	3
GLY 6931	Thesis/Dissertation Seminar	3
GEO 6920	Geosciences Colloquium Series	1
	Coursework chosen in consultation with master committee	<u>3</u>
	TOTAL Hours	10

**Spring Semester**

GEO 6920	Geosciences Colloquium Series	1
	Coursework chosen in consultation with master committee	<u>9</u>
	TOTAL Hours	10

**Summer Session**

	Coursework chosen in consultation with master committee and/or Research/Thesis credits	<u>6</u>
	TOTAL Hours	6

**YEAR 2****Fall Semester**

GEO 6920	Geosciences Colloquium Series	1
	Coursework chosen in consultation with master committee /Thesis credits	<u>9/3</u>
	TOTAL Hours	10/4

**Spring Semester**

	Thesis Credits	<u>3</u>
	TOTAL Hours	3

**E. Provide a one- or two-sentence description of each required or elective course.**

**Curriculum for M.S. in Geosciences*****Geoscience Graduate-Level Courses***

- GEO 6277 Human-Environmental Interactions (3 credits).  
Methods and approaches to explore diverse aspects of human-environmental interactions.
- GEO 5435C Geographic Analysis of Population (3 credits).  
Theory and methods in geographic analysis of population and demography.
- GEO 6117 Seminar in Geographic Methodology Techniques (3 credits).  
Basic methodologies and techniques in geographic analysis.
- GEO 6118 Research in the Geosciences (3 credits).  
An introduction to the research in Geosciences that form the main foci in the Department.
- GEO 6318 Plants and People (3 credits).  
Cross-cultural examination of people's use of plants.
- GEO 6337 Culture, Conservation and Land Use (3 credits).  
The course looks at how people utilize resources with emphasis on conservation

- and cultural influences on land use practices.
- EVR 6334 Seminar in Urban Area Analysis (3 credits).  
Analysis of land-use, economic development and sustainability of the urban environment and its infrastructure.
- EVR 6334 Restoration Geoscience (3 credits)  
Advanced topics and research in biogeography.
- GEO 6908 Directed Independent Study (1-3 credits).  
Independent study in topic areas outside the regular department offerings.
- GEO 6918 Graduate Research in Geosciences (1-9 credits).  
Independent research prior to Master's candidacy.
- GEO 6920 Geosciences Colloquium Series (1 credit).  
Course for incoming graduate students to develop an awareness of various research perspectives in geosciences through a series of invited speakers.
- GEO 6938 Seminar in Special Topics in Regional/Systematic Geography (3 credits)  
Analysis and synthesis of special topics in geography.
- GEO 6971 Master's Thesis (1-6 credits).
- GIS 5033C Digital Image Analysis (3 credits).  
Introductory course for graduate students covering the analysis of digital satellite imagery of the earth.
- GIS 5038C Remote Sensing of the Environment (3 credits).  
Introductory course for graduate students covering principles of photographic and electromagnetic remote sensing systems.
- GIS 5051C Principles of Geographic Information Systems (3 credits)  
Introductory course for graduate students covering the basic concepts of geographic information systems.
- GIS 5100C Applications in Geographic Information Systems (3 credits).  
Project-oriented implementation and application issues in geographic information systems.
- GIS 5103C Programming in Geographic Information Systems (3 credits).  
Introductory course for graduate students covering basic programming concepts and methodologies in geographic information systems.
- GIS 6039 Advanced Remote Sensing (3 credits).  
Advanced study of remote sensing applications, project design, implementation and evaluation.
- GIS 6127 Hyperspectral Remote Sensing (3 credits).  
Processing and interpretation of hyper- and ultra-spectral data with a focus on thematic information extraction from airborne and satellite-based sensors.
- GIS 6114 Internet GIS (3 credits).  
Concepts and hands on techniques of how geographical information can be disseminated and processed in an Internet environment.
- GIS 6120 Topics in Geographic Information Science (3 credits).  
Technical, operational and management issues in geographic information systems.
- GLY 5243 Advanced Environmental Geochemistry (3 credits).  
A study of the hydrologic cycle and natural and man-made pollutants in the environment.

- GLY 5575C Shore Erosion and Protection (3 credits).  
Study of the geomorphology and usage of coasts including such topic as sediment budgets and dune-beach interaction.
- GLY 5736C Marine Geology (3 credits).  
Theoretical and applied earth science in the marine environment looking at the history of marine geology, structure and evolution of continental margins and the world's basins.
- GLY 5934 Advanced Topics in Applied, Coastal and Hydrogeology (3 credits).  
Advanced work in specialized topics in engineering geology, coastal geology and hydrogeology not covered in other regular course offerings in the department.
- GLY 6619C Paleomalacology (3 credits).  
Review of the systematics, evolution, and ecological interactions of the fossil mollusks.
- GLY 6661C Paleoecology (3 credits).  
Overview of the principles of ecology as applicable in the fossil record and implications in evolutionary theory.
- GLY 6707 Regolith Geology (3 credits).  
Surveys the occurrence and distribution of surficial materials.
- GLY 6737 Coastal Environments (3 credits).  
Examination of the biophysical framework and biogeography of coastal environments.
- GLY 6745 Ancient Marine Environments (3 credits).  
Focuses on methods used to recognize ancient marine environments from the stratigraphic record and investigates changes in deep-sea sedimentation and sedimentary overlap sequences on continental margins.
- GLY 6746 Global Environmental Change (3 credits).  
Study of the causes and impacts of global climatic change through time.
- GLY 6826 Optimization Applications in Groundwater (3 credits).  
Develops and applies groundwater optimization models for the control of groundwater flow and water quality.
- GLY 6827C Advanced Hydrogeology (3 credits).  
Advanced groundwater flow modeling.
- GLY 6828 Groundwater Solute Transport Modeling (3 credits).  
Studies the mechanisms that govern the movement of water and pollutants in aquifers.
- GLY 6836 Modeling Groundwater Movement (3 credits).  
Focuses on groundwater flow space and time scale, and surface groundwater interaction.
- GLY 6888 Coastal Hazards (3 credits).  
A global review of natural and human-induced hazards as they affect coastal zones.
- GLY 5457 Environmental Geophysics (3 credits).
- GLY 6908 Directed Independent Study (1-3 credits).  
Independent study in topic areas outside the regular department offerings.
- GLY 6931 Thesis Seminar (3 credits).

Methods, procedures and policies for preparing, presenting, defending, and completion of a thesis or dissertation.

- GLY 6934 Special Topics in Applied Geology (3 credits).  
Analysis and synthesis of special topics in geography.
- GLY 6971 Master's Thesis (1-6 credits).

**F. For degree programs in the science and technology disciplines, discuss how industry-driven competencies were identified and incorporated into the curriculum and identify if any industry advisory council exists to provide input for curriculum development and student assessment.**

Industry-driven competencies were gleaned by numerous discussions by the Chair of Geosciences with geoscience professionals in the South Florida area over the Ph.D. planning year period. This led to expand its graduate presence with the Ph.D. in geosciences which further fine-tuned the curriculum and the possibilities of creating the M.S. program in geosciences.

**G. For all programs, list the specialized accreditation agencies and learned societies that would be concerned with the proposed program. Will the university seek accreditation for the program if it is available? If not, why? Provide a brief timeline for seeking accreditation, if appropriate.**

As geography and geology are the main components of the proposed degree program, the learned societies that would be most concerned with this degree would be the major academic societies of these disciplines; the Association of American Geographers and the Geological Society of America. Other specialized associations, such as the American Water Resources Association, the American Society for Photogrammetry & Remote Sensing, and the International Association for Environmental Hydrology, among many others, would also have interest in the program. There are currently no formal accreditation boards for degree programs in geography and geology.

**H. For doctoral programs, list the accreditation agencies and learned societies that would be concerned with corresponding bachelor's or master's programs associated with the proposed program. Are the programs accredited? If not, why?**

See section G above.

**I. Briefly describe the anticipated delivery system for the proposed program (e.g., traditional delivery on main campus; traditional delivery at branch campuses or centers; or nontraditional delivery such as distance or distributed learning, self-paced instruction, or external degree programs). If the proposed delivery system will require specialized services or greater than normal financial support, include projected costs in Table 2. Provide a narrative describing the feasibility of delivering the proposed program through collaboration with other universities, both public and private. Cite specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.**

Most of the coursework for the proposed program will be traditional delivery courses on the Boca Raton campus. With the expansion of geosciences faculty on the Davie campus by 2012, as

has been proposed by the Dean as part of the formal growth plan for the Charles E. Schmidt College of Science, some graduate coursework will eventually be offered at that location to take full advantage of specialties of the new Davie geosciences faculty. As the program grows, eLearning options shared with other FAU campuses, centers, and other private and public universities in Florida. Also, our relationship with USGS is expected to grow along with the program, offering internship opportunities for both graduate and undergraduate students, as well as expanded teaching opportunities with USGS faculty as adjuncts or research faculty. As mentioned earlier, the Department fully expects our relationship with the Harbor Branch Oceanographic Institute to grow and flourish and can certainly envision HBOI faculty participating in eLearning education in the program as the proposed degree program grows.

## **IX. Faculty Participation**

- A. Use Table 4 to identify existing and anticipated ranked (not visiting or adjunct) faculty who will participate in the proposed program through Year 5. Include (a) faculty code associated with the source of funding for the position; (b) name; (c) highest degree held; (d) academic discipline or specialization; (e) contract status (tenure, tenure-earning, or multi-year annual [MYA]); (f) contract length in months; and (g) percent of annual effort that will be directed toward the proposed program (instruction, advising, supervising internships and practica, and supervising thesis or dissertation hours).**

As identified in Table 4, the faculty needed to sustain the program through year 5 is already in place at FAU. This list includes 16 faculty within the Geosciences Department at FAU. Two important notes on Table 4: 1) An instructor with only an M.A. is included in the Geosciences faculty list. The role of this person will be the offering of a 5000-level course in Geographic Information Systems for students admitted to the program with minimal skills in that area. 2) Two Research Professors in Geosciences are not included in the list of faculty in Table 4. Dr. Charles Finkl, and Dr. Myroslaw George Harasewych (affiliated with the Smithsonian Museum and Harbor Branch) are all appointed to such positions and actively contribute to graduate education in the department in terms of serving on thesis committees, offering research colloquiums and offering graduate level, adjunct courses in the Department. These services come at no salary and benefits cost to the university, except adjunct pay when they assume a teaching role. It should be noted that Dr. Finkl has research and teaching specialty in the coastal and marine science aspects of the geosciences, a popular area within geosciences, and therefore help to reduce upfront costs needed to implement and sustain that part of the program.

- B. Use Table 2 to display the costs and associated funding resources for existing and anticipated ranked faculty (as identified in Table 2). Costs for visiting and adjunct faculty should be included in the category of Other Personnel Services (OPS). Provide a narrative summarizing projected costs and funding sources.**

As discussed, the faculty salaries and benefits needed to support the master program will come entirely from current allocated funds. This will include one of those faculty members paid from Research Office budget and one from the Center for Environmental Studies). See Table 4 for a complete listing of faculty involved with the program.

**C. Provide the number of master's theses and/or doctoral dissertations directed, and the number and type of professional publications for each existing faculty member (do not include information for visiting or adjunct faculty).**

Faculty Name	Theses	Dissertations	Professional Publications
Berry, Leonard			221
Comas, Xavier	0	0	8
Fadiman, Maria	1	0	6
Finkl, Charles	13	0	146
Hanson, Howard	0	0	60
Ivy, Russell	16	1	32
Markwith, Scott	0	0	6
Oleinik, Anton	2	0	22
Petuch, Edward	0	0	67
Restrepo, Jorge	7	0	33
Roberts, Charles	15	0	10
Root, Tara	1	0	4
Warburton, David	1	0	5
Xie, Zhixiao	1	0	23
Zhang, Caiyun	0	0	7

NOTE: The table above only includes thesis and dissertation **supervision** as indicated in the directions. Also, the professional publications do NOT include published abstracts as not all faculty include these on their vitae. The professional publications include refereed journal articles, conference proceedings, technical reports and books and book chapters.

**D. Provide evidence that the academic unit(s) associated with this new degree have been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, as well as qualitative indicators of excellence.**

The Office of Institutional Effectiveness at FAU collects productivity on all academic units at the university. Below is a summary of information about the Department of Geosciences over the past 3 academic years. The entire document can be found on the Institutional Effectiveness pages of the FAU website at [http://www.fau.edu/iea/deptreview.php/PR\\_2008-2009\\_Geosciences.rtf](http://www.fau.edu/iea/deptreview.php/PR_2008-2009_Geosciences.rtf). The first table found below (Table B3 from the link above) shows the teaching productivity of the Department since the 2006-2007 academic year. This is followed by two tables illustrating the number of degrees awarded in geography and geology (Tables C3—one chart for each CIP code—from the link above), and a research summary table for the Department. This is followed by two tables illustrating the number of degrees awarded in geography and geology (Tables C3—one chart for each CIP code—from the link above).

**B 3 Average Course Section Size and Percent of Sections Taught By Faculty, Geosciences**

Course Level	Type			Geosciences			College Total	University Total
				2006-2007	2007-2008	2008-2009	2008-2009	2008-2009
Undergraduate	Lecture/Seminar	Sections Offered	#	56	55	48	612	5,109
			# Enrolled	3,005	3,360	3,198	35,266	162,098
			Avg Section Enrollment	<b>53.7</b>	<b>61.1</b>	<b>66.6</b>	<b>57.6</b>	<b>31.7</b>
		Sections Faculty-Taught	#	47	48	43	457	3,267
			%	<b>83.9</b>	<b>87.3</b>	<b>89.6</b>	<b>74.7</b>	<b>63.9</b>
	Lab	Sections Offered	#	21	22	19	562	842
			# Enrolled	351	357	333	10,031	15,101
			Avg Section Enrollment	<b>16.7</b>	<b>16.2</b>	<b>17.5</b>	<b>17.8</b>	<b>17.9</b>
		Sections Faculty-Taught	#	1			251	356
			%	<b>4.8</b>			<b>44.7</b>	<b>42.3</b>
	Discussion	Sections Offered	#	61	61	41	100	186
			# Enrolled	1,120	1,286	1,249	2,902	4,994
			Avg Section Enrollment	<b>18.4</b>	<b>21.1</b>	<b>30.5</b>	<b>29.0</b>	<b>26.8</b>
		Sections Faculty-Taught	#				14	14
			%				<b>14.0</b>	<b>7.5</b>
Other Course Types	Sections Offered	#	18	10	16	306	1,329	
		# Enrolled	22	12	30	643	9,028	
		Avg Section Enrollment	<b>1.2</b>	<b>1.2</b>	<b>1.9</b>	<b>2.1</b>	<b>6.8</b>	
	Sections Faculty-Taught	#	18	10	16	270	965	
		%	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>88.2</b>	<b>72.6</b>	
Graduate	Lecture/Seminar	Sections Offered	#	21	24	23	183	1,708
			# Enrolled	139	117	130	1,289	21,393
			Avg Section Enrollment	<b>6.6</b>	<b>4.9</b>	<b>5.7</b>	<b>7.0</b>	<b>12.5</b>
		Sections Faculty-Taught	#	17	22	20	174	1,405
			%	<b>81.0</b>	<b>91.7</b>	<b>87.0</b>	<b>95.1</b>	<b>82.3</b>
	Lab	Sections Offered	#				1	34
			# Enrolled				2	294
			Avg Section Enrollment				<b>2.0</b>	<b>8.6</b>
		Sections Faculty-Taught	#				1	17
			%				<b>100.0</b>	<b>50.0</b>
	Other Course Types	Sections Offered	#	45	38	30	648	1,915
			# Enrolled	50	43	33	960	3,577
			Avg Section Enrollment	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>1.5</b>	<b>1.9</b>
		Sections Faculty-Taught	#	45	38	29	594	1,805
			%	<b>100.0</b>	<b>100.0</b>	<b>96.7</b>	<b>91.7</b>	<b>94.3</b>

Source: Instruction and Research File and Student Data Course File

'Other Course Types' includes DIS, Thesis/Dissertation Research, Individual Performance Instruction, Internships, etc. Sections taught by tenured, tenure-earning and non-tenure-earning faculty are counted as 'faculty-taught'

**C 3 Degrees Awarded  
Geography (Program CIP: 450701)**

		Geography			College Total	University Total
		2006-2007	2007-2008	2008-2009	2008-2009	2008-2009
Associates	Degrees awarded with a:					
	Single major					157.0
	All					157.0
Bachelors	Degrees awarded with a:					
	Single major	9.0	8.0	11.0	581.0	4,050.0
	Double or triple major				5.5	418.0
	All	9.0	8.0	11.0	586.5	4,468.0
Masters	Degrees awarded with a:					
	Single major	5.0	6.0	5.0	65.0	1,091.0
	Double or triple major				2.0	11.0
	All	5.0	6.0	5.0	67.0	1,102.0
Specialist	Degrees awarded with a:					
	Single major					43.0
	Double or triple major					1.0
	All					44.0
Doctorate	Degrees awarded with a:					
	Single major				25.0	89.0
	Double or triple major					1.0
	All				25.0	90.0
Total	Degrees awarded with a:					
	Single major	14.0	14.0	16.0	671.0	5,430.0
	Double or triple major				7.5	431.0
	All	14.0	14.0	16.0	678.5	5,861.0

Source: Student Data Course File

Note: Degrees awarded with multiple majors may result in fractional degree totals for some groups. A degree awarded with a single major contributes 1 degree, a double major contributes 1/2 degree in each major, and a triple major contributes 1/3 degree in each major to the degree totals.

**C 3 Degrees Awarded  
Geology (Program CIP: 400601)**

		Geology			College Total	University Total
		2006-2007	2007-2008	2008-2009	2008-2009	2008-2009
Associates	Degrees awarded with a:					
	Single major					157.0
	All					157.0
Bachelors	Degrees awarded with a:					
	Single major	9.0	8.0	14.0	581.0	4,050.0
	Double or triple major				5.5	418.0
	All	9.0	8.0	14.0	586.5	4,468.0
Masters	Degrees awarded with a:					
	Single major	5.0	3.0	7.0	65.0	1,091.0
	Double or triple major				2.0	11.0
	All	5.0	3.0	7.0	67.0	1,102.0
Specialist	Degrees awarded with a:					
	Single major					43.0
	Double or triple major					1.0
	All					44.0

		Geology			College Total	University Total
		2006-2007	2007-2008	2008-2009	2008-2009	2008-2009
Doctorate	Degrees awarded with a:					
	Single major				25.0	89.0
	Double or triple major					1.0
	All				25.0	90.0
Total	Degrees awarded with a:					
	Single major	14.0	11.0	21.0	671.0	5,430.0
	Double or triple major				7.5	431.0
	All	14.0	11.0	21.0	678.5	5,861.0

Source: Student Data Course File

Note: Degrees awarded with multiple majors may result in fractional degree totals for some groups.

A degree awarded with a single major contributes 1 degree, a double major contributes 1/2 degree in each major, and a triple major contributes 1/3 degree in each major to the degree totals.

## Research, Creative & Scholarly Activities

A Assessment Goals and Outcomes for Research (reported separately)

B 1 Faculty Person Years and FTE Devoted to Research

Geosciences

				Geosciences			College Total	University Total
				2006-2007	2007-2008	2008-2009	2008-2009	2008-2009
Departmental Research	Tenured & tenure-earning faculty	Professor, Assoc Professor, Asst Professor	Person-Years	1.7	2.3	1.9	22.0	104.4
			FTE	2.2	3.1	2.5	29.3	139.3
	Non-tenure-earning faculty	Instructors, Lecturers, Visiting Faculty	Person-Years				1.8	6.5
			FTE				2.4	8.7
	Other personnel paid on faculty pay plan	--	Person-Years				1.4	12.2
			FTE				1.8	16.2
	Total		Person-Years	1.7	2.3	1.9	25.1	123.2
			FTE	2.2	3.1	2.5	33.5	164.2
Sponsored Research	Tenured & tenure-earning faculty	Professor, Assoc Professor, Asst Professor	Person-Years	0.5	0.7	0.7	8.2	31.9
			FTE	0.7	1.0	0.9	10.9	42.5
	Non-tenure-earning faculty	Instructors, Lecturers, Visiting Faculty	Person-Years			0.1	0.1	3.3
			FTE			0.2	0.2	4.4
	Other personnel paid on faculty pay plan	--	Person-Years		0.3	0.1	6.7	46.6
			FTE		0.4	0.2	9.0	62.1
	Total		Person-Years	0.5	1.0	0.9	15.0	81.7
			FTE	0.7	1.4	1.3	20.0	109.0

Source: Instruction and Research File

'Other personnel paid on faculty pay plan' includes Scholar/Scientist/Engineer (all ranks), Research Assoc, Assoc In, Asst In, Postdoctoral Assoc

Includes summer, fall and spring semester data

Person-year= 1 person working full time for one year

1.0 FTE = .75 person-years

## X. Non-Faculty Resources

- A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5. Provide the total number of volumes and serials available in this discipline and related fields. List major journals that are available to the university's students. Include a signed statement from the Library Director that this subsection and subsection B have been reviewed and approved for all doctoral level proposals.

Library holdings for titles in the Geosciences at FAU number 14,079 volumes. Serial holdings at FAU in geoscience and related fields include 92 print journals, and 260 electronic journals in fields ranging from geosphere to atmosphere to hydrosphere. Additionally, 37 electronic databases in geosciences and related scientific disciplines are available at FAU. These include noncommercial databases such as Florida Environments Online (FEOL), and Florida Geological Survey Publications (FGS), and commercial databases such as GEOREF, GEOBASE, Web of Science and Compendex. Leading journals available through the FAU library in diverse geoscience disciplines include Nature, Science, AAPG Bulletin, American Mineralogist, Annals of the Association of American Geographers, Annals of Tourism Research, Applied Geochemistry, Bioscience, Bulletin of the AMS, Bulletins of American Paleontology, Cartography and Geographic Information Science, Chemical Geology, Climatic Change, Climate Dynamics, Computers and Geosciences, Computers Environment and Urban Systems, Conservation Biology, Deep Sea Research, Earth and Planetary Science Letters, Ecological Applications, Ecology, Ecology and Society, Economic Geography, Environment and Planning Section A, Environmental Conservation, Environmental Ethics, Environmental Science & Policy, Environmental Science and Technology, Geochimica et Cosmochimica Acta, Geographical Analysis, Geographical Review, Geological Society of America Bulletin, Geology, Geophysical and Astrophysical Fluid Dynamics, Global Biogeochemical Cycles, Ground Water, Hydrogeology Journal, International Journal of Geographical Information Science, ISPRS Journal of Photogrammetry and Remote Sensing, Journal of Applied Meteorology and Climatology, Journal of Atmospheric and Oceanic Technology, Journal of the Atmospheric Sciences, Journal of Climate, Journal of Contaminant Hydrogeology, Journal of Geology, Journal of Geophysical Research, Journal of Historical Geography, Journal of Hydrology, Journal of Hydrometeorology, Journal of Paleontology, Journal of Petrology, Journal of Physical Oceanography, Journal of Quaternary Research, Journal of Regional Science, Journal of Transport Geography, Journal of Travel Research, Landscape Ecology, Marine Geology, Mathematical Geology, Monthly Weather Review, Oceanography, Paleobiology, Palaeoecology, Palaeogeography, Palaeoclimatology, Palaeoecology, Palaeontology, PALAIOS, Photogrammetric Engineering and Remote Sensing, Professional Geographer, Progress in Physical Geography, Remote Sensing of the Environment, Restoration Ecology, Transactions in GIS, Urban Geography, Water Resources Research, Weather and Forecasting, to name just a few.

## **DATABASES RELEVANT TO GEOSCIENCES**

### **Chemistry**

**SciFinder Scholar** - complete coverage of chemistry and the life sciences including biochemistry, biology, pharmacology, medicine, and related disciplines.

### **Engineering**

**Compendex** - 1884- present - The broad subject areas of engineering and applied science are comprehensively represented. Coverage includes nuclear technology, bioengineering, transportation, chemical and process engineering, light and optical technology,

agricultural engineering and food technology, computers and data processing, applied physics, electronics and communications, control, civil, mechanical, materials, petroleum, aerospace and automotive engineering as well as narrower subtopics within all these and other major engineering fields, including **Geological Engineering, Geophysics, Geosciences.**

**Computing Reviews** - A comprehensive source for technical literature in the field of computer science. Includes reviews of both articles and books.

**CSA / ASCE Civil Engineering Abstracts Database** - 1966-present - provides citations, abstracts, and indexing of the serials literature in civil engineering and its complementary fields. Geoscience related subjects covered include: geotechnical engineering; seismic engineering; surface & groundwater hydrology; land development, irrigation & drainage; and more.

**CSA Engineering Research Database** - 1966-present - Covers the international serial and non-serial literature pertaining to civil, earthquake, environmental, mechanical, and transportation engineering including their complementary fields.

**Earthquake Engineering Abstracts** - 1971-present - Coverage of earthquake engineering and earthquake hazard mitigation, including geotechnical earthquake engineering, performance-based seismic engineering, disaster planning, earthquake resistant design and analysis, engineering seismology, risk and reliability seismic engineering, soil dynamics, and structural dynamics.

**Environmental Engineering Abstracts** - 1990-present - Covers the world literature pertaining to technological and engineering aspects of air and water quality, environmental safety, and energy production.

## **Environmental Sciences**

**ASFA 3: Aquatic Pollution and Environmental Quality** - 1990-present - Devoted exclusively to research and policy on the contamination of oceans, seas, lakes, rivers, and estuaries. Some geoscience titles indexed include; Acta geographica sinica, Africa geoscience review, Applied Geochemistry, Aquatic Geochemistry, Bulletin of the Geobotanical Institute ETH, Comptes rendus: Geoscience, Environmental Geology, and more.

**Ecology Abstracts** - 1982-present - Focuses on how organisms of all kinds - microbes, plants, and animals - interact with their environments and with other organisms. Included are relevant papers on evolutionary biology, economics, and systems analysis as they relate to ecosystems or the environment. Some geoscience titles indexed include; Australian Geographical Studies, Geographical Journal, Geographical Research, Global Ecology and Biogeography, Journal of Biogeography, and more.

**EIS: Digests of Environmental Impact Statements** - 1985-present - Provides detailed abstracts of environmental impact statements issued by the federal government. Major areas of coverage include: Air Transportation; Defense Programs; Energy; Hazardous Substances; Land Use; Parks, Refuges, and Forests; Research and Development; Roads and Railroads; Urban and Social Programs; and Water.

**Environmental Sciences and Pollution Management** - 1981-present - Multidisciplinary database, provides comprehensive coverage of the environmental sciences. Some Geoscience titles indexed include; Africa geoscience review, Annals of the Association of American Geographers, Applied Geography, Aquatic Geochemistry, Biogeochemistry, Cartography and Geoinformation, Journal of Geographical Sciences, and more.

**Florida Environments Online (FEOL)** - The core of Florida Environments Online database consists of eight merged research bibliographies including 1) Florida Ecosystems 2) Florida Ornithology, 3) Fishes of Florida, 4) Florida Herpetology, 5) Florida Geology, 6) Bibliography of Literature Useful to the Study of Florida Plants - and the Herbarium Library of Books and Reprints, 7) Florida FreshWater Bibliography, and 8) Florida Agricultural History.

**Pollution Abstracts** - 1981-present - Pollution Abstracts combines information on scientific research and government policies in a single resource. Topics of growing concern are extensively covered from the standpoints of atmosphere, emissions, mathematical models, effects on people and animals, and environmental action in response to global pollution issues. Major areas of coverage include: Air Pollution, Marine Pollution, Freshwater Pollution, Sewage and Wastewater Treatment, Waste Management, Land Pollution, Toxicology and Health, Noise, Radiation, and Environmental Action.

**Toxicology Abstracts** - 1981-present - Toxicology Abstracts covers issues from social poisons and substance abuse to natural toxins, from legislation and recommended standards to environmental issues. Major areas of coverage include: Pharmaceuticals; Food, Additives, and Contaminants; Agro-chemicals; Cosmetics, Toiletries, and Household Products; Industrial Chemicals; Metals; Toxins and Other Natural Substances; Social Poisons and Drug Abuse; Polycyclic Hydrocarbons; Nitrosamines and Related Compounds; Radiation and Radioactive Materials; Methodology; and Legislation and Recommended Standards.

**TOXLINE (CSA)** - 1994-present - This database, produced by the U.S. National Library of Medicine, provides bibliographic citations and abstracts from the core journal literature in toxicology. This version of TOXLINE does not contain information from Chemical Abstracts Service, BIOSIS, or International Pharmaceutical Abstracts.

**Water Resources Abstracts** - 1967-present - Water Resources Abstracts provides summaries of the world's technical and scientific literature on water-related topics covering the characteristics, conservation, control, pollution, treatment, use and

management of water resources. Major areas of coverage include: Groundwater; Lakes; Estuaries; Erosion and sedimentation; Water supply and conservation; Desalination; Water yield improvement; Water quantity management and control; Watershed protection; Water quality management; Water resources planning; Water law; Engineering works and hydraulics.

## **General Science**

**Applied Science and Technology Full Text** - 1983-present – Covers leading trade and industrial publications, professional and technical society journals, specialized subject periodicals, plus buyers' guides, directories, and conference proceedings in the applied sciences. Includes such subjects as Atmospheric Sciences, Chemistry, Civil Engineering, Communication & Information Technology, Computer Databases & Software, Energy Resources & Research, Environmental Engineering, Geology, Metallurgy, Mineralogy, Oceanography, Petroleum & Gas, Transportation, and more.

**General Science Full Text** - 1984-present - Covers a **broad range of fields** in general interest periodicals—including The New York Times Science section—and specialized journals as well. Subjects covered include: Astronomy, Atmospheric Science, Biology, Botany, Chemistry, Conservation, Earth Science, Environment, Food, Genetics, Health, Mathematics, Medicine, Microbiology, Nutrition, Oceanography, Physics, Physiology, Zoology.

## **GeoSciences**

**GeoRef** - 1785-present - The GeoRef database covers the geology of North America from 1693 to the present and the geology of the rest of the world from 1933 to the present. The database includes references to all publications of the U.S. Geological Survey.

**Florida Geological Survey Publications (FGS)** - This collection consists of publications of the Florida Geologic Survey, including Bulletins, Reports and Maps.

**GEOBASE** - 1980-present – Covers worldwide literature on geography, geology, and ecology. Major subject areas include cartography, climatology, energy, environment, geochemistry, geomorphology, geophysics, hydrology, meteorology, paleontology, petrology, photogrammetry, sedimentology, and volcanology. Also included are remote sensing, GIS, aerial photography and satellite observations.

## **Oceanography**

**ASFA 2: Ocean Technology, Policy and Non-Living Resources** - 1978-present - Coverage spans the wide-ranging fields of oceanography: physical, descriptive, dynamical, chemical, geological, and biological aspects, as well as limnology, ocean engineering, and specific resources from international policy and legislation to meteorology and climatology to technology and engineering.

**Oceanic Abstracts** – 1981-present - The database focuses on marine biology and physical oceanography, fisheries, aquaculture, non-living resources, meteorology and geology, plus environmental, technological, and legislative topics. This database is totally comprehensive in its coverage of living and non-living resources, meteorology and geology, plus environmental, technological, and legislative topics.

## Physics

**INSPEC** – 1970-present - providing access to the world's scientific and technical literature in physics, electrical engineering, electronics, communications, control engineering, computers, computing, information technology, manufacturing, production and mechanical engineering. It also has significant coverage in areas such as materials science, oceanography, nuclear engineering, geophysics, biomedical engineering and biophysics.

## Social Sciences

**Human Population & Natural Resource Management** - 1995-present - Covers human population and demography topics, as well as societal issues involving natural resource management. Major areas of coverage include: Human population dynamics, Demography, Population - Environment Relations, Population Statistics, Population Policy, Ecotourism, Sustainable Living, Sustainable Consumption , Environmental Awareness, and Environmental Education.

**Humanities & Social Sciences Retrospective** - 1907-1984 - This database offers the ability to search a wide range of important journals in the humanities and social sciences as far back as 1907. Coverage also includes content from H.W. Wilson's International Index. Subject coverage includes geography and a ample of journal titles covered include: Annales de Geographie, Economic Geography, Geographical Review, Journal of Geology, Journal of Historical Geography, and The Professional Geographer.

**SocINDEX with Full Text** - 1895-present - Indexes and abstracts of articles from English-language periodicals published in the United States and elsewhere plus the full text of selected periodicals. Coverage includes a wide range of interdisciplinary fields covered in a broad array of social sciences journals including those in the database above and more.

**Sociological Abstracts** - 1952-present - Abstracts and indexes the international literature in sociology and related disciplines in the social and behavioral sciences. Some geoscience titles indexed include; Cultural Geographies, Geoforum, Geografiska Annaler, Series B: Human Geography, Geographical Bulletin, Geographical Research, Political Geography, Progress in Human Geography, Social & Cultural Geography, and Tourism Geographies.

## General

**ArticleFirst** - 1990-present - Contains bibliographic citations with some full text from more than 13,000 journals in science, technology, medicine, social science, business, the humanities, and popular culture. Incorporates OCLC's ContentsFirst as of 10/15/01. Some geoscience titles indexed include Acta Geophysica, Advances in geophysics, Advances in physical geochemistry, Aquatic Geochemistry, Cartography and geographic information science, Chemical geology, Computational Geosciences, Cultural Geographies, Developments in economic geology, Economic geography, Environmental geochemistry and health, Environmental geology and water sciences, Exploration geophysics, Journal of geography Photogrammetric engineering and remote sensing, Remote sensing of environment, Remote sensing reviews, Weather and Forecasting, Theoretical and applied climatology, Tourism Geographies and more.

**Current Contents Connect** - 1998-present -Current Contents Connect provides access to current awareness research from seven broad disciplines. Those of relevance to the geosciences are: Agriculture, Biology & Environmental Sciences; Engineering, Computing & Technology; Life Sciences; Physical, Chemical & Earth Sciences; and Social & Behavioral Sciences.

**PapersFirst** – 1993-present - Provides access to individual papers presented at conferences, congresses, symposia, expositions, workshops and meetings.

**ProceedingsFirst** -1993-present - Indexes the contents of papers presented at conferences worldwide.

**ProQuest Dissertations and Theses** - 1861-present

**Web of Science** - 1945-present - Contains information gathered from thousands of scholarly journals in all areas of research. Geosciences would be covered in the *Science Citation Index* and *Social Sciences Citation Index* portion of this database.

**WorldCat** - The world's most comprehensive bibliography, with over 48 million bibliographic records representing over 400 languages and covering all the records cataloged by OCLC member libraries worldwide.

**WorldCat Dissertations and Theses** – Contains records for dissertations and theses from OCLC member libraries. This is an excellent source for documents that may not have been submitted to ProQuest for publication.

**B. Describe additional library resources that are needed to implement and/or sustain the program through Year 5. Include projected costs of additional library resources in Table 2.**

Ample library resources are available to meet the needs of the proposed program. As many of

these courses are currently offered at FAU, and instructors feel the current library resources adequately support those courses, additional resources are not required.

After a few years into the program, however, the Department feels that additional investment in geoscience-related materials for the library will be necessary to support the department as whole and this proposed master program in geosciences. The department feel that the amount needed for the Library to increase the geoscience-related holdings for this master program is estimated to be \$10,000 in the next 4 years (see Table 2 with the budget). This would add important research resources such as Global Biogeochemical Cycles, *Ethnobotany Research and Applications*, *Journal of Ethnobiology*, and the *Geoscience World* Database package, which includes several specialized geology research publications.

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Library Director

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Date

**C. Describe classroom, teaching laboratory, research laboratory, office, and other types of space that are necessary and currently available to implement the proposed program through Year 5.**

The Department is currently housed in the east wing of the Physical Sciences building with additional overflow space in the Social Science Building and T5 and T6. The total office and related storage space of the Department is currently 4, 600 square feet, the research lab space is 4, 560 square feet, teaching lab and related equipment storage space is 9,496 square feet, and miscellaneous storage. This does not include the boat and large equipment storage space and dirty lab space in T5. In 2011 the department is schedule to move to a space vacated by engineering in the SE building. The available space will grow. This space should be able adequately to serve the proposed master program.

**Geosciences Current Space**

Dept. Office	300 sq. ft.
Chair Office	180 sq. ft.
Budget Coordinator Office	100 sq. ft.
Supplies	120 sq. ft.
Mail/breakroom	320 sq. ft.
Conference Room	324 sq. ft.
Computer Teaching Lab (Undergraduate)	1260 sq. ft.
Computer Teaching Lab (Graduate)	640 sq. ft.
Server Room	320sq. ft.
Teaching Lab (Large)	1024 sq. ft.
Prep Room for Above	320 sq. ft.
Teaching Lab (Large <b>with sink</b> )	1024 sq. ft.

Prep Room for Above	320 sq. ft
Teaching Lab (Small <b>with sink/and fume hood</b> )	640 sq. ft.
Prep Room for Above	320 sq. ft
Map Library	320 sq. ft.
Mineral Collection (now housed in T buildings)	1260 sq. ft.
Mineral Curator Office	100 sq. ft.
Hydro Modeling Lab	320 sq. ft.
Water Sampling Lab ( <b>with sink</b> ) and Rock/Fossil/Mineral Processing Lab ( <b>Sink with sediment trap</b> )	320 sq ft.
Equipment Storage	320 sq. ft.
TA Office Space	1260 sq. ft.
Adjunct/Emeritus Space	1260 sq. ft.
GIS Research Lab	360 sq. ft.
Remote Sensing Lab	360 sq. ft.
Office Space/Corcoran	100 sq. ft.
Office Space/Fadiman	100 sq. ft.
Office Space/Gammack-Clark	100 sq. ft.
Office Space/ Zhang	100 sq. ft.
Lab Space/ Zhang,	320 sq. ft.
Office Space/Hindle	100 sq. ft.
Office Space/Petuch	100 sq. ft.
Lab Space/Petuch ( <b>with sink</b> )	320 sq. ft
Office Space/Oleinik	100 sq. ft.
Lab Space/Oleinik ( <b>with sink</b> )	320 sq. ft.
Office Space/Restrepo	100 sq. ft.
Lab Space/Restrepo	320 sq. ft.
Office Space/Roberts	100 sq. ft.
Lab Space/Roberts	320 sq. ft.
Office Space/Root	100 sq. ft.
Lab Space/Root ( <b>with sink</b> )	320 sq. ft.
Office Space/Warburton	100 sq. ft.
Lab Space/Warburton	320 sq. ft.
Office Space/Xie	100 sq. ft.
Office Space/Comas	100 sq. ft.
Lab Space/Comas ( <b>with sink</b> )	320 sq. ft.
Office Space/Markwith	100 sq. ft.
Lab Space/Markwith ( <b>with sink</b> )	320 sq. ft.
Teaching/Lab Classroom (first dibs scheduling in SO 300)	1024 sq. ft
Computer Teaching Lab for World Geography (first dibs in SO 200)	1024 sq. ft

Note this list does not include the indoor and outdoor storage places for boats and larger equipment as well as the dirty lab space in T5.

**D. Describe additional classroom, teaching laboratory, research laboratory, office, and other space needed to implement and/or maintain the proposed program through Year 5. Include any projected Instruction and Research (I&R) costs of additional space in Table 2.**

**Do not include costs for new construction because that information should be provided in response to X (J) below.**

No new space is required to implement the M.S. program, or to sustain the program through year 5.

**E. Describe specialized equipment that is currently available to implement the proposed program through Year 5. Focus primarily on instructional and research requirements.**

\*Parenthetical numbers indicate quantity of items

### **Computer hardware**

- a. Dell Poweredge T610 server (2)
- b. Dell Poweredge T410 server
- c. Dell Poweredge 2900 server (2)
- d. Dell Poweredge 2600 server (2)
- e. Dell Poweredge 700 server
- f. Dell Poweredge 830 server
- g. Dell T3500/T1500 Stereo 3D workstations (17)
- h. Dell T3400 Teaching Assistant workstations (15)
- i. Dell Optiplex desktop lab PC's (50)
- j. Dell Optiplex desktop staff PC's (20)
- k. Smart Technologies SmartBoard (2)
- l. LCD computer projectors (5)
- m. Panasonic Toughbook field laptop
- n. Dell Latitude laptops (6)
- o. IBM Tablet Netbooks (5)
- p. Dell 5100 color laser printer
- q. HP DesignJet T610 Plotter

### **Survey/Mapping/GPS**

- r. Leica TC307 electronic total station
- s. Spectra physics laser plane 520 laser level, lenker rod, 3 receivers
- t. Transits and Philadelphia rods (12 sets) – shared with Electrical Engineering
- u. Trimble ProXH decimeter DGPS
- v. Trimble Pro XR (2)
- w. Trimble GeoXT
- x. Trimble Juno SB (4)
- y. Trimble GeoExplorer 3 (5)
- z. Trimble PathFinder Office and Terrasync software
- aa. Bruntons (12)
- bb. Nikon hypsometer (2)

### **GIS/Remote Sensing/Computer Modeling**

- cc. Field Portable Spectroradiometer. Model: ASP FieldSpec3 JR. Full spectral range (400 – 2500 nm), rapid integration time (.1 s), high SNR. Controlling IBM Thinkpad laptop and software
- dd. 10 in x 10 in. calibrated Spectralon® plate: Reflectance standard for spectral research.
- ee. ESRI educational site license (unlimited licenses)
  - i. ArcInfo
  - ii. ArcEditor
  - iii. ArcView
  - iv. ArcGIS extensions: ArcGIS Spatial Analyst, ArcGIS 3D Analyst, ArcGIS Geostatistical Analyst, ArcGIS Publisher, ArcGIS Schematics, ArcGIS Survey Analyst, ArcScan for ArcGIS, ArcGIS Military Analyst, Maplex for ArcGIS, and ArcGIS Network Analyst
  - v. ArcSDE
  - vi. ArcIMS
  - vii. ArcIMS Route Server
  - viii. ArcGIS Server License with ArcGIS Server Spatial Analyst extension, ArcGIS Server 3D Analyst extension, and ArcGIS Server Network Analyst extension options
  - ix. ArcGIS Engine Developer Kit
  - x. Mobile GIS
  - xi. ArcPad Application Builder including ArcPad
  - xii. Business GIS
  - xiii. BusinessMAP 4
  - xiv. ArcLogistics Route
  - xv. MapObjects—Windows Edition
  - xvi. MapObjects—Java Edition
  - xvii. NetEngine for Windows and UNIX
  - xviii. Production Line Tool Set (PLTS) for ArcGIS—Mapping Agency Solution
  - xix. ArcView 3.x Products
    - xx. ArcView 3.x (for Windows)
    - xxi. ArcView 3.0a (for Macintosh)
    - xxii. ArcView 3.x extensions: ArcView Spatial Analyst, ArcView Network Analyst, ArcView 3D Analyst, ArcPress for ArcView, and StreetMap 1.1
    - xxiii. Virtual Campus—Unlimited seat
- ff. ENVI Hyperspectral software (5 licenses)
- gg. Leica Erdas Imagine (14 licenses)
- hh. Rockworks geologic software (5 licenses)
- ii. Adobe Photoshop CS5 extended (17 licenses)
- jj. Arc Hydro toolset for ArcGIS
- kk. Groundwater Vistas
- ll. SMT seismic analysis (5 licenses)

**Field vehicles**

- mm. 2000 Dodge Ram 4x4
- nn. 17' Carolina Skiff boat

- oo. 13' Carolina Skiff boat
- pp. 10' Jon boat
- qq. 8' inflatable boat

**Environmental sampling/analytical equipment**

- rr. Sieve shakers (2)
- ss. Standard testing sieves (multiple sets)
- tt. Vibracore with trailer
- uu. Unconfined compression test machine
- vv. Hand geoprobe sediment corer
- ww. Solomat 803 DS water quality probe
- xx. Solinst MS5 water quality probe
  - i. LDO probe
  - ii. pH probe
  - iii. Nitrate ion selective electrode
  - iv. Graphite conductivity probe
- yy. Surveyor 4a handheld interface for the MS5
- zz. pH probes and meters (2)
- aaa. Conductivity probe/meter
- bbb. DO probe/meter
- ccc. Hach water chemistry analysis kits
  - i. Distillation apparatus
  - ii. Digital reactor block
  - iii. Digital titrator
  - iv. Portable spectrophotometer
  - v. Cold vapor mercury apparatus
  - vi. Related glassware and reagents
- ddd. Weather station
- eee. Laboratory centrifuge
- fff. Fume hood
- ggg. Solinst water level meters (2)
- hhh. Solinst pressure transducers (2)
- iii. Solinst leveloader control for pressure transducers
- jjj. Solinst WaTerra hand pump
- kkk. Laboratory ovens (3)
- lll. Grinders (4)
- mmm. Laboratory press
- nnn. Rock saws (2)
- ooo. Teaching stereographic microscopes (10)
- ppp. Teaching petrographic microscopes (15)
- qqq. Research microscopes
  - i. Leica DMLS transmittant light microscope with mounted Sony CCD-IRIS high resolution digital camera
  - ii. Leica MZ8 reflected light binocular microscope with drawing attachment

- iii. Olympus SZX12 binocular transmittant/reflected light binocular microscope with drawing attachment, multiple lenses, and digital camera attachment
- iv. Olympus petrographic microscopes (4)
- rrr. Ohaus explorer digital precision lab scale
- sss. Optronics Magna Fire firewire digital camera
- ttt. Professional setup for macro- and micro-digital photography

Additionally, research and technical equipment within the Charles E. Schmidt College of Science will be available for Geosciences faculty and graduate students. These include two core facilities for proteomics and nucleic acids, as well as a machine shop with attendant machinist and part-time electronics technician. In addition, the College supports a computer information technology group that provides IT and computer support. In particular, this group maintains a “near” supercomputer, called Boca 5, which consists of 64 Dell CPU’s on a Beowolff cluster platform.

Boca 5" is a cluster computer for the College of Science. Boca 5 runs Red Hat Linux and consists of 64 Dell 1850 servers. Each 1850 has two dual-core processors running at 2.8GHz. This gives Boca 5 roughly the equivalent processing power of a cluster that uses 256 single-core processors. The backbone of Boca 5 consists of two gigabit Ethernet switches, and its storage array is connected through fiber optic cables for optimum transfer rates.

**F. Describe additional specialized equipment that will be needed to implement and/or sustain the proposed program through Year 5. Include projected costs of additional equipment in Table 2.**

The Geosciences rely a great deal on cutting-edge computing, display and field technologies. Particularly as this program will be heavily tied to the professional community, it is vital that we stay on top of the latest technologies and expand the quantity and quality of these instruments in the Department. With more students in the program, expansion to the Davie campus and expected changes in technology, we estimate the need for the geosciences technology equipment by year 5 to be \$100,000 (see Table 2), specifically tied to the proposed M.S. program. This includes approximately 70 lab computers for 2 labs on the Boca Raton campus, replacing older computers and expanding the size of the labs to accommodate growth in the program. This amount would also include growth and expansion of GPS units for field work. We anticipate that the funding would come from equipment money from grants.

**G. Describe any additional special categories of resources needed to implement the program through Year 5 (access to proprietary research facilities, specialized services, extended travel, etc.). Include projected costs of special resources in Table 2.**

There are no special categories of expenses specifically tied to the proposal for the M.S. in Geosciences.

**H. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5. Include the projected costs in Table 2.**

The current MA./M.S. graduate stipends were *reallocated* to doctoral stipends. We currently

have two scholarships in the Department awarded annually to graduate students to help support their research expenses. Both are in the amount of \$1,000 each from the Coastal Education and Research Foundation and from Coastal Planning and Engineering, Inc. We will seek more scholarships. In addition, it is expected that a number of research assistantships will be available as faculty, especially the new junior faculty, become more successful at obtaining extramural grants.

**I. Describe currently available sites for internship and practicum experiences, if appropriate to the program. Describe plans to seek additional sites in Years 1 through 5.**

Geosciences undergraduate and graduate students regularly receive internships from CUES and the Center for Environmental Studies at FAU, Broward County Planning, Palm Beach County Planning, Coastal Planning and Engineering, CEPEMAR, the Coastal Education and Research Foundation, the U.S. Geological Survey, and the South Florida Water Management District. We have also placed students in internships in a variety of smaller environmental consulting firms and various municipalities in South Florida. As part of our new relationship with the U.S. Geological Survey (USGS), we expect our graduate students to be even more successful in securing internships at that agency in the near future. Discussions with USGS have yielded opportunities in their STEP program (Student Temporary Employment Program), SCEP (Student Career Employment Program), Water Resources Research Institute Internship Program and post-doc programs through Mendenhall and the NRC.

**J. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Table 2 includes only Instruction and Research (I&R) costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs in particular would necessitate increased costs in non-I&R activities.**

No new capital expenditure is directly related to the proposed program. Geosciences is expected to benefit from space expansions at both the Boca Raton campus and the Davie campus that are already planned, but neither of these are specifically tied to the proposed M.S. program.