MEMORANDUM

TO: Chuck Gee  
Chair, Academic Affairs Committee  
Board of Regents

VIA: M.R.C. Greenwood  
President

VIA: Tom Apple  
Chancellor

FROM: Reed Dasenbrock  
Vice Chancellor for Academic Affairs

SUBJECT: Approve Establishment of Provisional Master of Geoscience (MGeo), Department of Geology & Geophysics, School of Ocean & Earth Science & Technology, University of Hawai‘i at Mānoa

SPECIFIC ACTION REQUESTED:
It is requested that the Board of Regents approve as provisional the Master of Geoscience (MGeo) to be administered by the Department of Geology and Geophysics in the School of Ocean and Earth Science and Technology at the University of Hawai‘i at Mānoa.

RECOMMENDED EFFECTIVE DATE:
September 2013.

ADDITIONAL COST:
No additional funds required. Existing faculty and facilities are sufficient to run the program.

PURPOSE:
The Master of Geoscience degree (MGeo) is designed for students who seek careers in geoscience-related industries. Unlike the M.S. degree, the MGeo will emphasize coursework in applied geology and geophysics, with options in business, economics, and management, and requires a capstone work project with a local company or agency.

BACKGROUND:
Pursuant to Board of Regents Policy 5-1, the Board of Regents has the authority to approve new degree programs upon the recommendation of the President.
Geology has a long history within the University of Hawai‘i at Mānoa, having been taught since 1920, organized into a department in 1955, and then given the name Geology and Geophysics in 1959. The graduate degree program began in 1962. The department currently offers four degrees: B.A and B.S. in Geology & Geophysics; M.S. in Geology and Geophysics; and the Ph.D. in Geology and Geophysics.

The Department has an internationally recognized strength in basic research. The expertise of its 26 full time faculty members is broadly categorized into the three main divisions: Geophysics and Tectonics, Marine and Environmental Geology, and Volcanology, Geochemistry, and Petrology. On average, each faculty member produces 3-4 peer-reviewed scientific journal publications per year, and the department collectively has raised on average about $3M/year in extramural research funds in the past decade. Correspondingly, the current graduate program emphasizes basic research with the M.S. Plan A requiring a research thesis and the Ph.D., a research dissertation.

Evidence shows that there is a population of students and working professionals on Oahu who would benefit from many Geology and Geophysics course offerings, but who do not enroll because our current graduate degrees cater almost exclusively to students seeking training in basic research and who are supported by research grants. Unlike the M.S. degree, the proposed MGeo will emphasize coursework in applied geology and geophysics and provide options for training in business, economics, and management. Rather than a research thesis, MGeo students will do a work project as a volunteer, intern, or as an employee of a local company or agency, followed by a written report and oral presentation. For individuals with a bachelor’s degree in geology and geophysics, the MGeo will be an efficient path to a Master’s degree as it can be completed with only one additional year of study. For students with other science backgrounds, such as in civil engineering, environmental engineering, and agriculture and resource management, the MGeo will provide advanced training for pursuit of geoscience related careers. Courses will be scheduled appropriately or given online to make the MGeo available to working professionals.

The demand for geoscientists in the U.S. workforce is projected by the BSL Occupational Outlook Handbook (2011) to grow between the years 2008-2018 by 18%, substantially more than the average of all occupations. In Hawai‘i, geoscience job growth from 2008-2018 is projected to be 10%. This growth is nearly twice the average growth percentage of all jobs in the State of Hawai‘i in that time frame (Dept. of Labor and Industrial Relations, Long-term Projections, Sept. 2011). This growth of geoscience professions is expected to be spurred by the needs for energy, environmental protection, hazards mitigation, as well as land and water management. The MGeo degree will support the University of Hawai‘i’s mission of fostering a skilled workforce in areas of growing importance to Hawai‘i and the global economy.

The proposed program has the support of the faculty and the Dean of the School of Ocean and Earth Science and Technology, and the Dean of the Graduate Division. The program was reviewed and recommended for approval by the UH Mānoa Faculty Senate, and reviewed by the Systemwide Council of Chief Academic Officers.
Board of Regents Policy 5-1(a) provides that all new academic programs, once approved, shall have provisional status until a review is conducted. As a master’s degree program, the required review would be scheduled to take place during the 2016-2017 academic year.

**ACTION RECOMMENDED:**
It is recommended that the Board of Regents approve as provisional the Master of Geoscience to be administered by the Department of Geology and Geophysics in the School of Ocean and Earth Science and Technology at the University of Hawai‘i at Mānoa, to be effective September 2013.

Attachments

cc: Executive Vice President and Provost Johnsrud
    Interim Vice Chancellor and Dean Brian Taylor
    Chair Moore
Summary for BOR Academic Affairs Committee Review
(limit to 3 pages)

Campus: MĀNOA

Actions requested: Approval of
  X New program proposal: Masters of Geoscience "MGeo" (degree)

Significance/Contribution of this degree:
Evidence shows that there is a population of students and working professionals in Hawai‘i who would benefit from many Geology and Geophysics course offerings, but who do not enroll because our current graduate degree tracks (M.S., Ph.D.) cater almost exclusively to students seeking training in basic research and who are supported by extramural research grants. The Department of Geology and Geophysics, therefore proposes the Masters of Geoscience degree, or "MGeo": a program for students who are seeking or already pursuing careers in geoscience-related industries.
For individuals with a B.S. in geology and geophysics, the MGeo will provide an efficient path to a Master’s degree as it can be completed with only one additional year of study. For students with other science backgrounds, the MGeo will provide advanced training for pursuit of geoscience related careers.

Cost and resource allocation/reallocation implications:
The MGeo will be marketed as a professional program that is distinct from the current M.S. degree. Students will pay tuition to obtain the MGeo degree and not be eligible for Teaching or Research Assistantships. The existing master’s program will benefit because the MGeo students will augment the sizes of graduate classes, add diversity to the graduate student population, and support more regular interaction between the department and local industries. The MGeo program will leverage existing Department/SOEST resources: no new faculty members are needed; only two new courses will be developed; and few additional offerings of existing classes will be required. The program will be self-sustaining in that the added work required of faculty or added lectureships by local professionals will be funded by the tuition raised.

Demand projections:
We conservatively anticipate the program eventually enrolling approximately half as many students as our M.S. program (or 10-15 students each year). We anticipate this enrollment meeting the demands of the growing job market in the more specialized field of geoscience within Hawai‘i and the other U.S. states and countries served by UHM.

Accreditation impact (if any): None.
Examples (2-3) of similar models from peer institutions:

- **Rice University, Department of Earth Science, Professional Master’s Degree in Subsurface Geoscience** ([http://sloan-pmp.rice.edu/](http://sloan-pmp.rice.edu/)).
  Rice University's Department of Earth Science is comparable in size and in its emphasis on research to UHM's Department of Geology and Geophysics. The Department of Earth Science houses Rice's very successful Professional Master's Degree in Subsurface Geophysics. Since it was created in 2001, Rice's PSM program has grown steadily to >15 students in 2010. It is also interesting to note that while the enrollment in the PSM program has grown, their traditional M.S. enrollment has decreased. One interpretation of this trend is that many of the Rice's would-be M.S. students now favor the professional degree. Rice University also boasts a 100% job placement for 2001-2010. Rice has taken advantage of their location in Houston, home to many companies in the petroleum industry. GG has placed some prior M.S. students in the petroleum industry but will likely supply a more diverse market with the MGEO program.

- **University of Houston, Department of Earth and Atmospheric Science, Professional Master’s Degree with Emphasis in Petroleum Geoscience** [http://www.geosc uh.edu/graduate/professional-masters/index.php](http://www.geosc uh.edu/graduate/professional-masters/index.php). This program is designed as an “accelerated degree program” especially for working professionals seeking a higher degree in petroleum geoscience.

- **University of Pennsylvania, College of Liberal and Professional Studies, Master of Science in Applied Geoscience** ([http://www.sas.upenn.edu/lps/graduate/msag](http://www.sas.upenn.edu/lps/graduate/msag)). “A master of applied geosciences isn’t just a master of geology degree; it combines expertise in the theoretical areas of geology with technical expertise in geochemistry, geophysics, hydrogeology, and engineering geology. Getting an advanced degree in applied geosciences rather than just a geology masters degree prepares you to tackle a wide range of practical and pressing environmental problems in fields where you can make a real, practical difference.”

- **Boise State University, Dept. of Geosciences, Master of Earth Science (MESCi, [http://earth.boisestate.edu/degrees/graduate/master-of-earth-science/](http://earth.boisestate.edu/degrees/graduate/master-of-earth-science/))** “The Master of Earth Science (MESCi) is a professional science degree program without a thesis requirement designed for students who are in the workforce or considering a career path where a thesis would not be a requirement. The curriculum in the MESCi is built around proven course strengths in our MS Geology, Geophysics, and Hydrologic Sciences programs... This provides the MESCi student with similar core skills,
knowledge base, and focus as in the thesis based programs, skills which have proved vital to a broad range of fields, including policy, regulation, or management, in the areas of environment, natural resources, and urban planning. ...The Master of Earth Science is a graduate degree platform that will provide its graduates with a rigorous degree that will enhance their competitive edge in the job marketplace.”

Similar programs at other UH campuses (if there is duplication, why is this program necessary)
We are not aware of any other Masters programs in geoscience-related fields at the other UH campuses.

Statement from campus administration of new program's strategic value within the UH priorities
The MGGeo degree will support the University of Hawai‘i’s mission of fostering a skilled workforce in areas of growing importance to Hawai‘i and the global economy. These areas include environment (e.g., consulting, remediation, water resources, beach erosion, and climate change); natural hazards (mitigation and adaptation due to floods, tsunamis, earthquakes, landslides, volcanic eruptions), energy and natural resources (petroleum and gas exploration and development, renewable energy, metal and mineral resources), and K-12 education. While other degree programs at UHM may also feed into some of the above employment sectors (e.g., M.S. in Civil Engineering, M.S. in Natural Resources and Environmental Management), the MGGeo degree is distinct in its specialization in geological and geophysical applications, and in emphasizing a work project. MGGeo will directly support UHM’s goals of “increasing the experiential learning opportunities”, “increasing student success”, of “promoting scholarly work that informs policies and practices that benefit communities”, to “expand internships, practica, mentoring”, and to “increase partnerships and sharing of expertise with community organizations”.

Draft 7/3/13
Proposal for a New Degree Program:
"MGeo" Professional Master of Geoscience

Department of Geology and Geophysics
School of Ocean and Earth Science and Technology

University of Hawai‘i at Mānoa

August 2013
Proposal for a Master of Geoscience (MGeo)

Administrative Locus

School of Ocean and Earth Science and Technology (SOEST)

Planning Committee

Garrett Apuzen-Ito  
Neil Frazer  
Gregory Ravizza  
Stephen J. Martel  
Aly El Kadi  
Gregory Moore  

Department of Geology and Geophysics  
Department of Geology and Geophysics  
Department of Geology and Geophysics  
Department of Geology and Geophysics  
Department Chair and Graduate Chair of  
Geology and Geophysics

Degree Proposed

MGeo, Professional Master of Geoscience

Proposed Date of Implementation

Spring 2014
# Proposal for a Master of Geoscience (MGeo)

## Table of Contents

1. Executive Summary ................................................................. 1
2. Background .................................................................................. 2
3. Program Need and Justification ..................................................... 3
   3.1 What Geoscientists Do ................................................................. 3
   3.2 Projected Growing Demand for Geoscientists in the U.S. and Hawaiʻi .... 4
   3.3 Growth in Professional Master's Degrees in Science ....................... 7
   3.4 Feedback from GG Alumni from Informal Market Survey ................. 7
   3.5 Summary of Results of Survey of Current GG Undergraduate Majors .... 8
4. Statement of Program Objectives .................................................... 10
5. MGeo Program Description ............................................................. 10
   5.1 Target Market ............................................................................ 10
   5.2 Distinguishing Features .............................................................. 11
   5.3 Admissions Requirements ......................................................... 11
   5.4 Course Requirements ................................................................. 11
   5.5 Writing Course Requirement ...................................................... 13
   5.6 MGeo Professional Project: The Culminating Experience ................. 13
   5.7 Program Administration ........................................................... 14
   5.8 Student Advising ...................................................................... 14
6. Relationship to Board of Regents Criteria ......................................... 14
7. Relationship to Other Programs at UHM ........................................... 15
8. Similar Programs at Comparable Institutions ..................................... 16
9. Resources Required and Resources Available .................................... 17
10. Financial Projections (anticipated enrollment and costs) .................... 19
11. Assessment of Student Performance and Program Effectiveness ............ 21
12. Web link to supporting documentation .......................................... 22
Proposal for a Master of Geoscience (MGeo)

1. Executive Summary

The Department of Geology and Geophysics (GG) proposes to create the “MGeo”, Masters of Geoscience, a professional Master’s degree program for students who seek careers in geoscience-related industries. Evidence shows that there is a population of students at UH and working professionals on Oahu who would benefit from many GG course offerings, but who do not enroll because our current graduate degree tracks (M.S., Ph.D.) cater almost exclusively to students seeking training in basic research and who are supported by faculty research grants. Unlike the M.S. degree, the MGeo will emphasize coursework in applied geology and geophysics and provide options for training in business, economics, and management. Rather than a research thesis, MGeo students will do a work project as a volunteer, intern, or as an employee of a local company or agency, followed by a written report and oral presentation. For individuals with a B.S. in geology and geophysics, the MGeo will be an efficient path to a Master’s degree as it can be completed with only one additional year of study. For students with other science backgrounds, such as in civil engineering, environmental engineering, and agriculture and resource management, the MGeo will provide advanced training for pursuit of geoscience related careers. In addition, courses will be scheduled appropriately or given online to make the MGeo available to working professionals.

The MGeo degree will support the University of Hawai‘i’s mission of fostering a skilled workforce in areas of growing importance to Hawai‘i and the global economy. These areas include environment (e.g., consulting, remediation, water resources, beach erosion, and climate change); natural hazards (mitigation and adaptation due to floods, tsunamis, earthquakes, landslides, volcanic eruptions), energy and natural resources (petroleum and gas exploration and development, renewable energy, metal and mineral resources), and K-12 education. While other degree programs at UHM may also feed into some of the above employment sectors (e.g., M.S. in Civil Engineering, M.S. in Natural Resources and Environmental Management), the MGeo degree is distinct in its specialization in geological and geophysical applications, and in emphasizing a work project. MGeo will directly support UHM’s goals of “increasing the experiential learning opportunities”, “increasing student success”, of “promoting scholarly work that informs policies and practices that benefit communities”, to “expand internships, practica, mentoring”, and to “increase partnerships and sharing of expertise with community organizations”.

The MGeo will be marketed as a professional degree program that is distinct from the current M.S. degree. Students will pay tuition to obtain the MGeo degree; therefore the enrollment of the program will not be limited by extramural funding as it is in our M.S. program. GG’s graduate program will benefit because the MGeo students will augment the sizes of graduate classes, add diversity to the graduate student population, and support more regular interaction between GG and local industries. The MGeo program will leverage existing GG/SOEST resources: no new faculty members are needed; only two new courses will be developed; and few additional offerings of existing classes will be required. The program will be self-sustaining in that the added work required of GG faculty or added lectureships by local professionals will be funded by the tuition raised.

-1-
2. Background

Geology has a long history within the University of Hawai‘i at Manoa (UHM), having been taught since 1920, organized into a department in 1955, and then given the name Geology and Geophysics in 1959. The graduate degree program began in 1962. The department currently offers four degrees:

- B.S. in Geology & Geophysics (for students planning to be professionals)
- B.A. in Geology (for students not planning to become professional geoscientists)
- M.S. in Geology and Geophysics (Plan A requires a research thesis and Plan B is the non-thesis option)
- Ph.D. in Geology and Geophysics

The Department of Geology and Geophysics (GG) has an internationally recognized strength in basic research. The expertise of its 26 full time faculty members is broadly categorized by the names of the three main divisions: Geophysics and Tectonics (GT), Marine and Environmental Geology (MEG), and Volcanology, Geochemistry, and Petrology (VGP). On average, each faculty member typically produces 3-4 peer-reviewed scientific journal publications per year, and the department collectively has raised an average of about $3M per year in extramural research funds in the past decade. Correspondingly, the current graduate program has emphasized basic research with the M.S. Plan A requiring a research thesis and the Ph.D., a research dissertation.

Recent enrollment of GG’s degree program is shown above. While the numbers are smaller than those of many programs at UHM, the size of GG’s program is appropriate when considering the broader U.S. market: the percentage of all UHM students in GG of 0.4% is larger than the percentage of all U.S. undergraduate and graduate students in the geosciences of 0.15% (i.e., 30,000 graduate and undergraduate geoscience majors in the past decade [AGI, Geoscience Currents, No. 31, 27 April 2010] compared to ~200,000 total U.S. students [http://www.census.gov/hhes/school/data/cps/2010/tables.html]). In terms of GG’s graduate program, the size is primarily controlled by the fact that essentially all graduate students are supported by research assistantships (RAs). The RAs are funded from
extramural grants and tied to specific projects of individual faculty members who are the primary advisors of the students. This practice is standard in the geosciences across the country as it is in other scientific fields supported by national funding agencies.

The system of limiting enrollment based on extramurally funding works well for GG’s research program and for students interested in pursuing research as a career; however, the system is a disadvantage to GG’s broader mission of serving a range of education needs both in and outside of research. GG’s existing course program has the capacity to train more students. In addition, the time needed for a student to conduct a successful M.S. research project is the primary controlling factor on the duration of the degree and it has led to most M.S. degrees taking two or more years. The MGEO is aimed to improve GG’s graduate program by overcoming the above limitations. An important requirement is that the MGEO students pay tuition and be ineligible for research and teaching assistantships. This practice is common among many professional degree programs and is one reason the MGEO will be identified and marketed as entirely separate degree program. Ultimately, the MGEO will augment GG’s graduate program with a more diverse student body, serve a broader sector of Hawai‘i’s workforce, provide additional tuition income, and help meet a rising number of geoscience-related occupations locally and nationally.

3. Program Need and Justification

3.1 What Geoscientists Do

Geoscientists—as described by the U.S. Bureau of Labor Statistics (BSL, http://www.bls.gov/oco/ocos312.htm)—"study and work in one of several closely related geoscience fields, including geology, geophysics, and hydrology". Geology and geophysics involves the study of the composition, structure, dynamic processes and history of the Earth. Geologists traditionally characterize and map rock formations to determine their origin and evolution. Subspecialties include petroleum geologists who specialize in petroleum exploration; engineering geologists who “apply geological principles to the fields of civil and environmental engineering, offering advice on major construction projects and assisting in environmental remediation and natural hazard-reduction projects”; mineralogists who specialize in mineral analysis, classification, and exploration; sedimentologists who “study the nature, origin, distribution, and alteration of sediments” as well as sedimentary rocks, which contain oil, gas, coal, and other mineral deposits; and geochemists who study the origin and evolution of rocks and water based on their chemical composition. Geophysicists apply physics, math, and techniques involving seismology, gravity, magnetics, and electromagnetics to studying the surficial and internal structure of the Earth. "Hydrologists study the quantity, distribution, circulation, and physical" (and chemical) "properties of water and the water cycle".

Hence geoscientists play major roles in the interaction of society with the Earth, whether it be in construction, natural hazard mitigation, preserving fertile soil for agriculture, the search for ever diminishing mineral and petroleum resources, securing clean water supplies, or developing new technologies for renewable energy. These activities address some of the biggest challenges the U.S. and the world face in the near to distant future.

3.2 Projected Growing Demand for Geoscientists in the U.S. and Hawai‘i

The demand for geoscientists in the U.S. workforce is projected by the BSL Occupational Outlook Handbook (2011) to grow between the years 2008-2018 by 18%, substantially more than the average of all occupations (http://www.bls.gov/oco/ocos312.htm).
growth of geoscience professions is expected to be spurred by the needs for energy, environmental protection, hazards mitigation, as well as land and water management. For example, an increasing number of geoscientists are working in environmental management. Geoscientists and hydrologists are needed to monitor the human impact on coastal environments and on soil and water contamination. More engineering geologists are expected to be needed for large construction and infrastructure projects such as highway building. In the specialties of oil, gas, and coal exploration, the employment of geoscientists has fluctuated considerably with the prices of these commodities; however, a long-term trend of rising oil prices is expected to maintain a high demand for geoscientists. In addition, as much of the U.S. population occupies more environmentally sensitive locations such as coastal regions, more hydrologists and geoscientists are expected to be needed to assess building sites for potential geologic hazards and to mitigate the effects of hazards such as landslides, floods, and tsunamis.

The projected national growth by industry sector is given in the two diagrams above.

In Hawai‘i, geoscience job growth from 2008-2018 is projected to be 10%. This growth is nearly twice the average growth percentage of all jobs in the State of Hawai‘i in that time frame (Hawai‘i, Dept. of Labor and Industrial Relations, Long-term Projections, Sept. 2011. www.hiwi.org).
Proposal for a Professional Master of Geoscience (MGeo)

In addition to the demand expected from growth of industry sectors, the demand for geoscientists in the U.S. will be further bolstered by the need to replace those who will move to senior management positions as well as those who will retire. The American Geological Institute’s (AGI) Geoscience Workforce Report 2009 (http://www.agi-web.org/workforce/data.html) shows that the majority of geologists and geophysicists are within 15 years of retirement age.

Thus, even with “approximately 1,500 geoscience graduate students transitioning into the professional workplace each year, the supply of newly trained geoscientists falls short of geoscience workforce demand and replacement needs” (http://www.agiweb.org/workforce/data.html).

In the gas and oil industry, AGI shows that the projected enrollment of students in geosciences is expected to fall short of demand for the next 20 years.

*Even with an optimistic 3 percent increase in graduate geoscience students entering the petroleum industry and a conservative estimate of 2 percent growth in annual demand for
geoscientists after 2011, by 2030, the unmet demand for geoscientists in the petroleum industry will be approximately 30,000" (http://www.agiweb.org/workforce/data.html). Adding the anticipated supply of geoscience graduates from non-U.S. degree programs does not appreciably narrow the gap.

In public education, a growing number of geosciences departments nationwide are taking larger roles in supporting K-12 education [Nyman and Ellmein, EOS, Trans. AGU, 89(50), 2008]. Hawai‘i is expected to need 90 additional math and science teachers at the post-secondary level, a growth of 9% (Hawai‘i, Dept. of Labor and Industrial Relations, Long-term Projections, Sept. 2011. www.hiwi.org). Professional degrees in science will help strengthen the quality of educators to meet this expected demand. Geoscience is one of a few areas of study that involves integrating a number of fundamental disciplines (chemistry, mathematics, physics, and biology); therefore an educator with a Master’s degree in geoscience will be well equipped to teach a variety of science courses in addition to those in earth and environmental science.

Also reflecting the strong demand and positive job outlook is the steady rise in salaries for geoscientists. Over the past decade, the average salary of geoscience-related occupations has increased more than those of physicists, chemists, and biological scientists (see diagram to the right). In the year 2010, the average annual salaries for geoscience-related occupations ranged from $60K-$130K.
3.3 Growth in Professional Master's Degrees in Science

Geoscientists with Master's degrees are highly desired by employers, sometimes more so than individuals with bachelor's or Ph.D. degrees. Compared to individuals with bachelor's degrees, graduates of geoscience Master's degrees are able to do projects requiring more technical knowledge and take on leadership roles in the design and oversight of projects. Compared to Ph.D. graduates, Master's graduates are not as able to specialize in cutting-edge research activities, but are often more suited for more applied activities and in management.

The need for stronger Master's degree programs is supported by the BLS's 2008-18 projections for employer demand. Employment of those with Master's degrees in general, is projected to grow by about 18%, which is comparable to or slightly exceeds the demand for bachelor's and doctoral degrees (17% each). This balance is not reflected in GG's past enrollment which has seen fewer Master's students than bachelor or Ph.D. students. The BLS report highlights geoscientists with Master's degrees as having excellent job prospects (http://www.bls.gov/oco/ocos312.htm).

In the past decade or so an innovative Master's degree program has arisen to support a growing career path for students interested in science but who do not want to pursue a Ph.D. or professional research [e.g., Teitelbaum and Cox, Nature 445, 2007]. The Professional Science Masters (PSM) initiative first began in 1997 when the Alfred P. Sloan Foundation provided grants to a select group of research universities to developed programs that integrated science and mathematics with training in management, law, and other professions. In 2001, the U.S. Council of Graduate Schools (CGS) extended the PSM to Master's focused institutions. In 2006, CGS assumed primary responsibility from the Sloan Foundation for supporting and promoting the PSM initiative more broadly. Today, the PSM initiative recognizes 246 programs and 114 affiliate institutions throughout the U.S., Canada, Australia, and the UK (www.sciencemasters.com). The numbers have doubled since 2007. Hawai'i is among 18 remaining states without such a program, but GG is well positioned to offer one.

3.4 Feedback from GG Alumni from Informal Market Survey

An informal market survey of our alumni revealed wide interest in the proposed MGeo program from individuals representing various companies, government agencies, and schools in Hawai'i and other states. The complete email responses are given in the Appendix 1 but some of the responses are given below:
Proposal for a Professional Master of Geoscience (MGeo)

"I would say 90% of all non-academic geology jobs here in Hawai‘i are in the environmental field, yet UH doesn’t prepare their graduates with courses for this field of work. It makes no sense to me. Maybe this masters program will allow geology grads to focus more in this area to prepare them for the job market in Hawai‘i." - Dave Davis ESN Pacific, Honolulu, HI

"As someone who pursued and received my MS in Geology & Geophysics there while working full-time as an Active Duty Army Officer, I say it sounds like a great plan! The late night research and hours in the labs killed me when I put on my uniform early every morning. If you need more than encouragement, let me know!" - LTC Joseph L. Insignoli, Commander, 7th Squadron, 6th Cavalry (ATK HEL), Conroe, TX

"A Masters of Geoscience degree program would definitely draw interest from our firms staff. I can think of several people (4+) that would probably be interested in this program, including myself. Thanks for the opportunity to comment." - Scott Moncrief, Project Manager, CH2M

"The program sounds quite good- particularly in that the 'culminating experience' final project will be derived from the work place, tying together the practical and academic parts of the degree in a way that should benefit both the student and employer. I think if the program had been available at the time of my graduation I might have taken a job with a local firm and gone for it." - Eden Jael Feirstein, Dept. Hydrology & Water Resources, University of Arizona

"Currently, I work for the U.S. Geological Survey Water Resources Division in Honolulu. I have been an employee here since May 2005 under their Student Career Employment Program. The USGS and the university have a joining contract to employ me as a student until 2010. I would like to earn a professional degree with a focus on what I do here at the USGS, but do not know how to go about it or what the grand details are..." - Tracy Ibarra, USGS

"...When I returned three years ago I was disappointed in knowing that my only chance to do a Masters in Geology was to quit my job and go through a traditional MS program I dismissed the idea of going back to school." "...I am a middle school teacher but would love to take courses to keep current in my field to be a better teacher." Mahalo nui loa - Tina M. Mueller

"I think the MGeo (Master's degree in geosciences) is an excellent idea. There is a huge demand for people with various specialties and skills that also have backgrounds in earth science / geosciences. Typically companies find earth science people that they then train as analysis, CAD, GIS, Survey, env assessment, sampling & monitoring, businesses, law, etc..... I think a MGeo degree would be a marketable degree and very desirable for professionals. Offering night courses opens the avenue to professional from many walks of life." - Greg Kurras, Seafloor Investigations LLC

3.5 Summary of Results of Survey of Current GG Undergraduate Majors

A package was sent to our current undergraduate majors containing information about salary and career trends in the geosciences, a summary of the MGeo program, as well as a short questionnaire (See Appendix 2). The five questions were designed to assess their future career interests and their potential interest in the MGeo degree:

1) Why did you decide to become a GG major, & how important was career consideration in your decision?

2) Yes or no: Are you seriously considering pursuing a career in the geosciences? If "no", how (if at all) has your experience as a GG major influenced your career interest. If "yes", what type of career in geosciences most interests you?

3) Before reading the above information were you already seriously considering applying to graduate school for a M.S. or Ph.D. degree? If so, in what field?

-8-
Proposal for a Professional Master of Geoscience (MGeo)

4) After reading the above information, which one phrase below best describes your interest level in applying to the MGeo program. a) Not at all interested; b) Moderate-to-low interest; c) Moderate-to high interest; d) Really, really interested. Please give a brief explanation for your choice:

5) What recommendations might you have for making the MGeo degree more relevant to its intended purpose: serve students interested in geoscience related careers in industry but not research."

Out of 45 packages sent, we received 27 responses (60%). The breakdown of responses to question (4), about their interest in applying to the MGeo program are as follows:

•d) Not at all interested. All 3 who responded with this answer intend to pursue careers related to geoscience and all three intend to apply to a M.S. or Ph.D. program to do research. Hence the MGeo is not well suited for them.

•c) Moderate-to-low interest. Of the 7 who responded with this answer 5 intend to pursue careers related to geoscience and 1 was undecided. 4 were already considering applying to an M.S. or Ph. D. program to do research and 3 were not. 1 is interested in teaching but felt the degree emphasized “engineering” too much; 1 questioned the comparative quality of a MGeo; 1 expressed a lack of money.

•d) Moderate-to-high interest. Of the 12 who responded with this answer 11 intend to pursue careers in geosciences and 1 is undecided. 6 were already considering doing a M.S. or Ph.D. and 6 were not. 2 are attracted by the short degree time of the MGeo; 1 expressed concern about lack of money; 2 expressed concern that the value of the MGeo would not be recognized by employers as being comparable in quality to an M.S.

•c) Really, really interested. All 5 who responded with this answer intend to pursue careers in geosciences. 4 were already considering apply to an M.S. or Ph.D. program and 1 was not.

Here are a few excerpts from the comments received (complete survey results given in Appendix II).

“This program is exactly what I have been looking for, and I hope it gets put into place soon.”

“Really, really interested, with a caviat. In in my current situation I am moving back to the mainland for family reasons, so I wouldn't be able to stay in the area to attend. However, with that said, I wish that wasn't the case because this would fit perfectly with my career goals I think. As I am not looking to pursue an academic career, the integration of the practical work experience into a program of study is invaluable and highly attractive to me. Also the inclusion of engineering into the program is attractive given the job outlook figures for environmental engineering.”

“The degree interests me because it will only take 1 additional year after getting a B.S. in GG. Also, I like that it is geared towards applications of geoscience and doesn't require a research thesis.”

“I am really interested, however, I have been 5 years in college and I would like to take a break from schooling and try to pursue a career. It would have really helped if this was
available and I knew about it a few years ago.... I really believe that this program should have been available a long time ago.

4. Statement of Program Objectives

The Master's of Geoscience (MGeo) program will provide a rigorous post-baccalaureate education in the geosciences (meaning geology, geophysics, and hydrology) for individuals who wish to pursue or are working in careers related to geoscience, but not necessarily in scientific research. In addition to coursework that emphasizes societally relevant applications, the program will provide practical work experience for students and bolster connections between GG and employers in Hawai'i as well as in the U.S. mainland. The program will be an efficient path for those with a B.S. in geology and geophysics (including GG B.S. majors) to obtain a Master's degree because the MGeo can be completed with only one year of study. It also will be open for students with bachelor degrees from other fields such as UH's CEE and CTAHR or similar disciplines. Through a combination of appropriate course scheduling and providing online content, the program will also serve working professionals.

Student learning objectives:

1. MGeo graduates are proficient in applying technical knowledge of relevant theory, computer applications, laboratory methods, field methods, and the supporting disciplines (math, physics, chemistry, biology) in solving real-world problems in the geology, geophysics, and/or hydrology.

2. MGeo graduates are able to define and successfully complete a body of work or research that has practical benefit to industry and/or society. In addition, they are able to effectively communicate their work in a written report as well as in an oral presentation at a professional level as evaluated by scientists and other professionals.

3. MGeo graduates have acquired the knowledge and skills needed to pursue employment or other activities that contribute to the advancement of the Earth sciences and/or strengthen the benefit of their application to societal problems.

5. MGeo Program Description

5.1 Target Market

The MGeo is for recent baccalaureates who desire an advanced degree and professional experience needed to enter the job market with minimal additional time in school. It is also for working professionals who seek a Master's credential and practical training for specialization in geoscience. The MGeo is appropriate for career pursuits in fields such as:
- Environmental consulting, environmental engineering, environmental geology
- Engineering geology, geotechnical engineering, and offshore surveying
- Hydrology and water resources
- Natural hazards mitigation and adaptation
- Climate change adaptation
- Petroleum and gas exploration, including offshore exploration
- Economic geology and mining
- Renewable energy
- Intermediate or high school teaching
The name "MGeo, Masters of Geoscience" was carefully chosen so it can be marketed as a program that is clearly distinct from our existing, research-based degree tracks. The MGeo program is designed with considerable breadth, allowing students—with advice from faculty mentors—to design a set of courses to meet their specific professional needs. Our long-term goal is that the MGeo name will be recognized throughout Hawaii as well as nationally.

5.2 Distinguishing Features

- Five-year masters: The MGeo can be completed in one year beyond a B.S. degree in geology and geophysics. It is therefore possible for an entering undergraduate freshman to earn a B.S. in the Department of Geology and Geophysics in four years, followed by an MGeo degree in one more year.

- The MGeo degree differs from the M.S. degree by requiring slightly (6 hrs) more coursework, by emphasizing courses in applied geoscience, by providing students with the opportunity to gain experience in business, economics, or management, and by providing practical work experience. The current M.S. degree is for students who wish to pursue scientific research through a completed research project and thesis (Plan A) or a literature study (Plan B). The MGeo requires a work project with a local company or agency, followed by a written report and oral presentation.

- MGeo students will pay tuition. Unlike M.S. students, MGeo students will not be eligible for research assistantships (RAs), teaching assistantships (TAs), or tuition waivers. Teaching experience, if desired, can be gained by enrolling in GG609 Graduate Teaching in Geology or courses in the College of Education. The MGeo must therefore be marketed as being clearly distinct from GG's other degree tracks. A related, proposed distinction is that 85% of the tuition revenue be returned back to GG analogous to the practiced of the other professional degree programs at UH (e.g., MBA, Nursing).

- Key courses will be taught during the early mornings, evenings or possibly weekends, and include online content (e.g., lectures or recordings of lectures posted online) so they will be more available to working professionals.

5.3 Admissions Requirements

A Bachelor's degree in natural science from an accredited university is required by the time a student begins the MGeo. Like GG's current M.S. degree, the application materials will include a statement of objectives, GG's supplemental information form, three letters of recommendation, official transcript from each institution attended, official GRE scores, and official TOEFL scores for international applicants. Other requirements are specified by the University of Hawaii Graduate Division Admissions.

5.4 Course Requirements

The MGeo requires a minimum of 30 credit hours at the 300 level and above. This requirement is above and beyond any prior coursework done, for example, in completing a GG bachelor's degree. A minimum of 12 credits must be in GG graduate courses (GG600-798, excluding GG750). A total of 6 credits must be taken in GG750 MGeo Professional Project, for the culminating work project; and GG740 MGeo Seminar (1 credit hr) must be taken once a year up to three times. Thus, GG750 and GG740 are the only courses specifically required for the degree. Students must enroll for letter grades (A, B, C) in at least 18 credits (excluding GG750 MGeo Professional Project), and must obtain a GPA of 2.0 or higher.
Proposal for a Professional Master of Geosience (MGeo)

MGeo students can choose from a wide selection of courses to fulfill the degree requirements and meet their specific professional needs. Any of GG’s 38 graduate (GG600-798) course offerings can be taken. MGeo students may opt to take no more than 12 credits of the following upper-level undergraduate courses, provided they were not previously taken to fulfill a bachelor’s degree. The GG courses listed below are commonly taken by GG M.S. and Ph.D. students. Consultation with departments offering the following non-GG courses, confirms that they too are appropriate for graduate students not specializing in the relevant fields.

<table>
<thead>
<tr>
<th>Elective Undergraduate Courses</th>
<th>credit hrs</th>
<th>Average Ranking*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volcanology (GG300)</td>
<td>3</td>
<td>3.83</td>
</tr>
<tr>
<td>Hawaiian Geology (GG402)</td>
<td>3</td>
<td>4.52</td>
</tr>
<tr>
<td>Natural Disasters: Geothics and the Layman (GG406)</td>
<td>3</td>
<td>n/a</td>
</tr>
<tr>
<td>Geological Data Analysis (GG413)</td>
<td>3</td>
<td>3.75</td>
</tr>
<tr>
<td>Coastal Geology (GG420)</td>
<td>3</td>
<td>3.52</td>
</tr>
<tr>
<td>Marine Geology (GG423)</td>
<td>3</td>
<td>3.80</td>
</tr>
<tr>
<td>Environmental Geochemistry (GG425)</td>
<td>3</td>
<td>3.92</td>
</tr>
<tr>
<td>Geophysical Methods (GG450)</td>
<td>4</td>
<td>3.52</td>
</tr>
<tr>
<td>Hydrogeology (GG 455)</td>
<td>4</td>
<td>4.96</td>
</tr>
<tr>
<td>Engineering Geology (GG454)</td>
<td>3</td>
<td>4.32</td>
</tr>
<tr>
<td>Geological Remote Sensing (GG460)</td>
<td>4</td>
<td>3.36</td>
</tr>
<tr>
<td>Geospatial Information (GG461)</td>
<td>3</td>
<td>n/a</td>
</tr>
<tr>
<td>Fluid Mechanics (CEE 320)</td>
<td>4</td>
<td>n/a</td>
</tr>
<tr>
<td>Geotechnical Engineering (CEE 355)</td>
<td>4</td>
<td>n/a</td>
</tr>
<tr>
<td>Statistical Analysis for Business Decision (BUS 310)§</td>
<td>3</td>
<td>n/a</td>
</tr>
<tr>
<td>Engineering Management (ENGR 401)§</td>
<td>3</td>
<td>n/a</td>
</tr>
<tr>
<td>Engineering Economics (CEE 405)§</td>
<td>3</td>
<td>n/a</td>
</tr>
<tr>
<td>Environmental Impact Assessment (GEOG 412)§</td>
<td>3</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*An employer survey was conducted in 2001 as part of a series of surveys done to meet the WASC accreditation requirements. Fifty-one companies and employer organizations were contacted; 25 replied with complete responses (~50% return rate). The employers were asked to rank each GG course in terms of relevance to their work. The numbers above are the average rankings (http://www.soest.hawaii.edu/GG/resources/gg_documents.html). n/a refers to a course that was either created after the survey was done or is in another department.

§Students who do not already have experience in business, economics, or management are encouraged to select from these courses.

The coursework may be further tailored to meet the specific interests of the students by substituting other courses in other departments (e.g., CEE, CTAHR, Shidler College of Business), subject to approval of the MGeo Faculty Oversight Committee (MGOC).

The curriculum is designed to meet a diversity of professional needs. For example, MGeo students with a B.S. in Geology and Geophysics, will benefit by taking some of the above business and management classes; whereas many working professionals may already have experience in these areas and wish to take only GG courses. GG740 MGeo Seminar will provide professional training and exposure through lectures by GG professors and professionals in local businesses and state offices. Students will also write and learn how to give professional talks in preparation for their final report. GG750 MGeo Professional Project will be taken to complete the culminating work experience (see Section 5.6 below). The rest of the curriculum will be designed by the student and faculty mentor to
most appropriately build from the student's background and best address their future career objectives.

5.5 Writing course requirement

At least 3 credits in a writing class must be taken within the total of 30 credits required. Eligible classes include any GG course designated as writing intensive (W) as well as ENG308, Technical Writing, and TPSS 657 Grant Writing for Graduate Students.

Hypothetical Schedule for a 2-year MGeo Taken Part Time (working professionals)

<table>
<thead>
<tr>
<th>Year 1 Fall Courses</th>
<th>Credits</th>
<th>Year 1 Spring Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GG604 Disaster Management: Understanding the Nature of Hazards</td>
<td>3</td>
<td>GG640 Coastal Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>GG420 Coastal Geology (W)</td>
<td>3</td>
<td>GG655 Ground Water Modeling</td>
<td>3</td>
</tr>
<tr>
<td>GG455 Hydrogeology</td>
<td>3</td>
<td>GG740 MGeo Seminar</td>
<td>1</td>
</tr>
<tr>
<td><strong>Cumulative Total:</strong></td>
<td><strong>9</strong></td>
<td><strong>Work project as a volunteer or intern done in summer, or as an employee throughout the 2 years</strong></td>
<td></td>
</tr>
<tr>
<td>Year 2 Fall Courses</td>
<td>Credits</td>
<td>Year 2 Spring Courses</td>
<td>Credits</td>
</tr>
<tr>
<td>GG600 Equations in Geophysics</td>
<td>3</td>
<td>GG740 MGeo Seminar</td>
<td>1</td>
</tr>
<tr>
<td>GG650 Seismology</td>
<td>3</td>
<td>GG652 Gravity, Magnetics, &amp; Heatflow</td>
<td>3</td>
</tr>
<tr>
<td>GG750 MGeo Professional Project</td>
<td>3</td>
<td>GG750 MGeo Professional Project</td>
<td>3</td>
</tr>
<tr>
<td><strong>Cumulative Total:</strong></td>
<td><strong>25</strong></td>
<td><strong>Cumulative Total</strong></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>

Hypothetical Schedule for 1-year MGeo Taken Full Time (e.g. for 5-yr Master's*)

<table>
<thead>
<tr>
<th>Year 5 Fall Courses</th>
<th>Credits</th>
<th>Year 5 Spring Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GG604 Disaster Management: Understanding the Nature of Hazards</td>
<td>3</td>
<td>GG640 Coastal Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>GG420 Coastal Geology (W)</td>
<td>3</td>
<td>GG655 Ground Water Modeling</td>
<td>3</td>
</tr>
<tr>
<td>GG600 Equations in Geophysics</td>
<td>3</td>
<td>GG740 MGeo Seminar</td>
<td>1</td>
</tr>
<tr>
<td>GG455 Hydrogeology</td>
<td>3</td>
<td>GG652 Gravity, Magnetics, &amp; Heatflow</td>
<td>3</td>
</tr>
<tr>
<td>GG650 Seismology</td>
<td>3</td>
<td>GG750 MGeo Professional Project</td>
<td>6</td>
</tr>
<tr>
<td><strong>Cumulative Total:</strong></td>
<td><strong>15</strong></td>
<td><strong>Work project as a volunteer or intern done in the summer</strong></td>
<td><strong>31</strong></td>
</tr>
</tbody>
</table>

*Graduates of GG's undergraduate program who enter the MGeo program cannot apply any of their prior undergraduate coursework towards the MGeo and cannot repeat a course for their MGeo credit.

5.6 MGeo Professional Project: The Culminating Experience

Students are required to do a work-related project either as an intern, volunteer, or employee of a local company or agency. The culminating experience includes a written report or technical paper as well as an oral presentation on their work. The oral presentation can be made at UH or at the location of the sponsoring organization. A total of 6 credit hours
must be taken in GG750 (MGeo Professional Project) for this project. GG740 will help students prepare for the oral presentation.

5.7 Program Administration

The Dean of SOEST and the Associate Dean of Academic Affairs provide ultimate oversight of the MGeo degree as with the other degree programs in SOEST. Graduation policies will be handled by the office of the Director of Student Services. The primary oversight of the MGeo will be performed by the MGeo Faculty Oversight Committee (MGOC) and GG's Department Chair who is also the Graduate Chair. The MGOC will be composed of GG members of the Graduate Faculty who will be appointed by and report to the GG Department Chair. To assure sufficient continuity of the program, each MGOC member will serve a three-year term with one third of the committee rotating off and being newly appointed each year. The chair of the MGOC will instruct the MGeo Intern Seminar (GG740). The MGOC will oversee the advertising of the degree and assist in building relationships with local companies and agencies for internships, members of the MGeo Advisory Board (see Section 11), and for job placement efforts.

5.8 Student Advising

SOEST's Director of Student Services will advise students on issues related to graduation policies, procedures, and milestones. A faculty advisor will be designated for each student who will help the student plan the course work and serve as the primary GG advisor on the student's work-related project. As such, the faculty advisor will be the instructor for the student's 6 credits of GG750 MGeo Professional Project.

The MGeo Faculty Oversight Committee (MGOC) will meet with each MGeo student during the Fall semester of each year. The MGOC will serve as a third-party resource for general advice to the student, will facilitate communication between the student and the faculty advisor, and collaborate with the faculty advisor to assess the student's proposed work project. The written report and oral presentation of the work project will be formally evaluated by the faculty advisor, one member of the MGOC (not the faculty advisor), and the project mentor at the sponsoring company or agency where the work was done.

6. Relationship to Board of Regents Criteria

The MGeo will directly support the following strategic goals of the UHM 2011-2015 Strategic Plan:

**Goal 1: Transformative Teaching and Learning Environment:** The focus on societally relevant applications and the inclusion of the practical work experience will "increase the experiential learning opportunities". These aspects will also strengthen the emphasis of teaching for faculty hiring, tenure and promotion, whereas research at GG is already highly emphasized. Providing a more efficient route to a Master's degree will address the objective to "increase student success".

**Goal 3: An Engaged University:** The MGeo's emphasis on applied geoscience, its design to serve those seeking or already involved in professions outside of basic research, the intern program, and the coordination with local leaders in industry, agencies, and schools will all enhance GG's impact in "promoting scholarly work that informs policies and practices that benefit communities”, in expanding “internships” and “practica”, and in increasing “partnerships and sharing of expertise with community organizations”.
7. Relationship to Other Programs at UHM

The MGeo program will be distinct from any other Master's degree program at UH. Those degrees that are most closely related to the MGeo are discussed below.

The Department of Civil Engineering's (CE) M.S. degree has the option of concentrating in construction management and environmental engineering. The latter concentration includes study and research in hydrology, which is a point of similarity with the Department of Geology and Geophysics's M.S. degree as well as the proposed MGeo degree. A student interested in hydrology would enter the MGeo program rather than CE to gain knowledge in the origin, properties, and distributions of different rock formations, the natural water cycle, as well as the use of geophysical methods (e.g., seismology, electrical resistivity, electrical-magnetic methods) in hydrologic applications. In fact, the MGeo would be an ideal degree for a student with a B.S. in Civil Engineering and a desire to pursue work in hydrology to gain a rigorous education in geology and geophysics. Hydrology is only one area of specialization, and the MGeo offers many other areas of specialization related to geology and geophysics.

Civil Engineering also offers a dual Master's degree in Civil Engineering and Business Administration. This degree is similar to many degrees recognized by the Professional Science Master's degree initiative (www.sciencemasters.com) in that it combines a science-related discipline with business. The MGeo degree does not require coursework in business or law, but does allow enough flexibility for such coursework.

Related to hydrology, The Water Resources Research Center (WRRC) is composed of faculty and researchers from a number of different UH departments, including GG. WRRC is not a degree-granting unit, but faculty members with joint appointments with other units supervise students that work on projects administrated by WRRC. Many of these projects are directed towards solving State water problems and can serve as options for students' culminating experience required for this program. Hence WRRC and the MGeo program are complementary and students in the MGeo degree could take full advantage of the faculty expertise and activities of the WRRC.

The College of Tropical Agriculture and Human Resources (CTAHR) offers M.S. degrees in Natural Resources and Environmental Management (NREM). The NREM M.S. involves studies in geospatial analysis and modeling, natural resources economics and environmental planning, land and water resource management, and terrestrial ecology. The points of similarity with geology and geophysics are in the use of GIS and remote sensing technology as well as in hydrology. Again, a student with a B.S. from CTAHR would enter the MGeo to gain a solid background in geology and geophysics.

The Department of Geography offers an M.A. degree, a Ph.D. degree and a Graduate Ocean Policy Certificate. Topics of research include: “Climate, Disturbance and Land Carbon”; “Climate and Ecohydrology”; “Vegetation, Environmental Change, and LiDAR Remote Sensing”; “Community-Based Natural Resource Management”. Geography emphasizes the social sciences and how people interact with the land, water, or climate; whereas geosciences emphasizes the natural sciences and Earth’s natural processes. Geographers and geoscientists can, in some cases, use common tools including satellite imagery, high-resolution radar, LiDAR, and Geographic Information Systems (GIS) technology.
8. Similar Programs at Comparable Institutions

As described in Section 3.3 of this proposal the Professional Science Master’s (PSM) initiative recognizes 246 PSM programs and 114 affiliate institutions; most are in the U.S. but a few are in other countries. Fifty-two programs are classified as Environmental Science. Two programs that are most similar to the proposed MGeo are

• California State University San Bernardino’s Master of Science in Earth and Environmental Science (http://msees.csusb.edu), and

• Rice University’s Professional Master’s Degree in Subsurface Geoscience (http://sloan-pmp.rice.edu/)

Rice University’s Department of Earth Science is comparable in size and in its emphasis on research to UHM’s Department of Geology and Geophysics. This department houses Rice’s very successful Professional Master’s Degree in Subsurface Geophysics. Since it was created in 2001, Rice’s PSM program has grown steadily to >15 students in 2010. It is also interesting to note that while the enrollment in the PSM program has grown, their traditional M.S. enrollment has decreased. One interpretation of this trend is that many of the Rice’s would-be M.S. students now favor the professional degree. Rice University also boasts a 100% job placement for 2001-2010. Rice has taken advantage of their location in Houston, home to many companies in the petroleum industry. GG has placed some prior M.S. students in the petroleum industry but will likely supply a more diverse market with the MGeo program.

Other degree programs, not formally recognized by the PSM initiative include:

• University of Houston, Department of Earth and Atmospheric Science, Professional Master’s Degree with Emphasis in Petroleum Geoscience (http://www.geosc.uh.edu/graduate/professional-masters/index.php). This program is designed as an “accelerated degree program” especially for working professionals seeking a higher degree in petroleum geoscience.

• University of Pennsylvania, College of Liberal and Professional Studies, Master of Science in Applied Geoscience (http://www.sas.upenn.edu/lps/graduate/msag). “A master of applied geosciences isn’t just a master of geology degree; it combines expertise in the theoretical areas of geology with technical expertise in geochemistry, geophysics, hydrogeology, and engineering geology. Getting an advanced degree in applied geosciences rather than just a geology masters degree prepares you to tackle a wide range of practical and pressing environmental problems in fields where you can make a real, practical difference.”
Proposal for a Professional Master of Geoscience (MGeo)

- Western Virginia University, Department of Geology and Geogeography, Option II Professional Studies (http://www.geo.wvu.edu/geology/graduate/ma_requirements), "Goal: To prepare students for future Ph.D. studies or employment in geological research. The Thesis option is an intensive experience, involving more focused coursework and a relatively open-ended, and challenging project."

- Colorado School of Mines, Professional Master's (P.M.) in Geochemistry, P.M. in Mineral Exploration and Mining Geoscience, and P.M. in Petroleum Reservoir Systems (http://geology.mines.edu/pmaster.html). These are non-thesis degrees designed so they can be completed in a relatively short time by working professionals or in 5-years by new undergraduates.

- University of Washington, College of the Environment, Earth and Space Sciences, Masters in Applied Geosciences (http://www.ess.washington.edu/ess/education/grad/appliedms.html). "The Masters in Earth and Space Sciences, Applied Geosciences (MESAge) is designed for students who are seeking to go into the private sector and wish to have a lead role in geology, geophysics, environmental geology or engineering geology. The program offers a unique blend of classroom and field experiences to build fundamental knowledge and practical skills that employers in the private sector are seeking. Earn your Masters in an intensive 12-month program, or complete the degree part time while you work. Nine-day field seminars offer hands-on experience, without extended time away. Late afternoon and early evening class meetings accommodate work schedules. Some instructors offer the option to participate remotely, with video streaming and interaction via the internet."

- Boise State University, Dept. of Geosciences, Master of Earth Science (MESci, http://earth.boisestate.edu/degrees/graduate/master-of-earth-science/) "The Master of Earth Science (MESci) is a professional science degree program without a thesis requirement designed for students who are in the workforce or considering a career path where a thesis would not be a requirement. The curriculum in the MESci is built around proven course strengths in our MS Geology, Geophysics, and Hydrologic Sciences programs... This provides the MESci student with similar core skills, knowledge base, and focus as in the thesis based programs, skills which have proved vital to a broad range of fields, including policy, regulation, or management, in the areas of environment, natural resources, and urban planning. ...The Master of Earth Science is a graduate degree platform that will provide its graduates with a rigorous degree that will enhance their competitive edge in the job marketplace."

Almost all universities with graduate degrees in geoscience have M.S. degrees, which, like GG, offer a research thesis and a non-thesis option. The examples above are relatively new, separate degree programs geared for non-research careers and/or for currently working professionals. Some do not require a culminating experience, whereas the MGeo will require a work-related project, written report, and oral presentation. Feedback from GG’s alumni and local employer’s have reiterated the importance of writing and oral communication. The MGeo will be sure to emphasize these skills.

9. Resources Required and Resources Available

As discussed in Section 2, because the size of GG’s graduate program is limited primarily by extramurally funded research projects, many of GG’s graduate courses are under
enrolled. Consequently, GG’s resources in terms of the number of class rooms, faculty, as well as course offerings are already sufficient to meet the expected demands of the program. GG estimates a negligible additional cost (about $1000/yr) needed for supplies, advertising, and hosting visits by local business leaders for annual meetings of the MGeo Advisory Board (see Section 11 below). The larger monetary cost will be for lectureships needed for GG740 (MGeo seminar) and to partly cover introductory undergraduate course so faculty can provide more offerings of the relevant MGeo courses; and the partial FTE needed for GG740, GG750 (MGeo Professional Project) and for the MGeo Advisory Committee (see Section 11 below). All added costs will be supported by the tuition dollars returned to GG or will be absorbed by SOEST.

The potentially larger challenge on resources will be on time. Courses will need to be offered at times that will accommodate the schedules of both working professionals as well as traditional, full-time (B.S., M.S., and Ph.D.) students. Initially, when the program is first created, but when the MGeo enrollment is likely to be minimal, the most essential courses will be scheduled at the beginning (e.g., 8:00 and 9:00 a.m.) or end of the day (e.g., 4:00 and 5:00 p.m.). As the program grows—potentially reaching numbers that are comparable to our current M.S. program—we will progressively shift our course offerings so that the bulk of the upper-level undergraduate and graduate courses are taught in the early mornings and late afternoons: e.g., upper-level undergrad courses taught early mornings (MWF) and graduate classes taught late afternoons or early evenings (TR). Some courses have lab sessions that meet once a week for 3 hours (e.g., GG450 Geophysical Methods; GG455 Hydrogeology). It may be necessary to teach more of these lab sessions during the weekend than is currently done. With time and with increasing MGeo enrollment, we will gain more knowledge of what courses are best rescheduled during the week, which should be taught during the weekends, which can be taught at night, and which courses can be effectively taught by posting videos of lectures on the internet.
10. Financial Projections (anticipated enrollment and costs)

Table 1. Academic Cost & Revenue. Template for New Program from the OVCAA

<table>
<thead>
<tr>
<th>Academic Cost and Revenue Template - New Program (adjust template for appropriate number of years) (Updated 10/31/12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAMPUS/Program</td>
</tr>
<tr>
<td>ENTR ACADEMIC YEAR (La., 2011-2012)</td>
</tr>
<tr>
<td>Students &amp; SSH</td>
</tr>
<tr>
<td>A. Headcount enrollment (Fall)</td>
</tr>
<tr>
<td>B. Annual SSH</td>
</tr>
<tr>
<td>Direct and Incremental Program Costs Without Fringe</td>
</tr>
<tr>
<td>C. Instructional Cost without Fringe</td>
</tr>
<tr>
<td>C1. Number (FTF) of FT Faculty/Lecturers</td>
</tr>
<tr>
<td>C2. Number (FTF) of PT Lecturers</td>
</tr>
<tr>
<td>D. Other Personnel Costs</td>
</tr>
<tr>
<td>E. Unique Program Costs</td>
</tr>
<tr>
<td>F. Total Direct and Incremental Costs</td>
</tr>
<tr>
<td>Revenue</td>
</tr>
<tr>
<td>G. Tuition</td>
</tr>
<tr>
<td>H. Tuition rate per credit</td>
</tr>
<tr>
<td>I. Total Revenue</td>
</tr>
<tr>
<td>J. Net Cost (Revenue)</td>
</tr>
<tr>
<td>Program Cost per SSH With Fringe</td>
</tr>
<tr>
<td>K. Instructional Cost with Fringe/SSH</td>
</tr>
<tr>
<td>K1. Total Salary FT Faculty/Lecturers</td>
</tr>
<tr>
<td>K2. Cost Including Fringe of K1</td>
</tr>
<tr>
<td>K3. Total Salary PT Lecturers</td>
</tr>
<tr>
<td>K4. Cost Including Fringe of K3</td>
</tr>
<tr>
<td>L. Support Costs/SSH</td>
</tr>
<tr>
<td>Non-Instructional Exp/SSH</td>
</tr>
<tr>
<td>System-wide Support/SSH</td>
</tr>
<tr>
<td>Organized Research/SSH</td>
</tr>
<tr>
<td>M. Total Program Costs/SSH</td>
</tr>
<tr>
<td>N. Total Campus Expenditure/SSH</td>
</tr>
<tr>
<td>Instruction Cost with Fringe per SSH</td>
</tr>
<tr>
<td>O. Comparable Cost/SSH</td>
</tr>
</tbody>
</table>

The following rows of Table 1 were taken from Table 2 (below) using the following methods.

A. Headcount Enrollment is a function of the “projected number of entering students” (Table 2, row 8). Half of these students are assumed to be full time and thus finish the degree in one year; the other half are assumed to be half-time students taking two years to finish the degree (See Table 2, rows 8-11).

B. Annual SSH assumes the half-time students take 15 hrs/yr and full-time students take 30 hrs/yr (Table 2, row 11)
### Proposal for a Professional Master of Geoscience (MGeo)

#### Table 2. Cost-Revenue Worksheet

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Expenses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Faculty FTE</td>
<td>0.51</td>
<td>0.80</td>
<td>0.92</td>
<td>1.07</td>
<td>1.07</td>
<td>1.07</td>
</tr>
<tr>
<td>2) FTE COST</td>
<td>$50,490</td>
<td>$79,200</td>
<td>$91,080</td>
<td>$105,930</td>
<td>$105,930</td>
<td>$105,930</td>
</tr>
<tr>
<td>3) Other personnel</td>
<td>$3,679</td>
<td>$6,565</td>
<td>$7,676</td>
<td>$9,300</td>
<td>$9,300</td>
<td>$9,300</td>
</tr>
<tr>
<td>4) Lecturers PT</td>
<td>$16,857</td>
<td>$16,857</td>
<td>$16,857</td>
<td>$16,857</td>
<td>$16,857</td>
<td>$16,857</td>
</tr>
<tr>
<td>5) Supplies (including advertising, hosting business leaders)</td>
<td>$1,000</td>
<td>$1,000</td>
<td>$1,000</td>
<td>$1,000</td>
<td>$1,000</td>
<td>$1,000</td>
</tr>
<tr>
<td>6) Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Total Expenses for All 30 Credit hrs</td>
<td>$72,026</td>
<td>$103,622</td>
<td>$116,613</td>
<td>$133,087</td>
<td>$133,087</td>
<td>$133,087</td>
</tr>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) Projected No. of Entering Students</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>9) Projected No. of Full-Time Students</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>10) Proj. No. Half-Time Students</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>11) Projected Enrollment</td>
<td>4</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>12) No. of Credit Hrs Taught</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>13) Student Semester Hrs (full-time students take 30 hr/yr; half-time students take 15)</td>
<td>90</td>
<td>165</td>
<td>195</td>
<td>240</td>
<td>240</td>
<td>240</td>
</tr>
<tr>
<td>14) % of all students in courses numbered 300 and above</td>
<td>7.0%</td>
<td>12.2%</td>
<td>14.1%</td>
<td>16.8%</td>
<td>16.8%</td>
<td>16.8%</td>
</tr>
<tr>
<td>15) % of all students served by staff</td>
<td>3.3%</td>
<td>5.9%</td>
<td>6.9%</td>
<td>8.3%</td>
<td>8.3%</td>
<td>8.3%</td>
</tr>
<tr>
<td>16) Tuition Rate per cred. Hr. (In-State)</td>
<td>$514</td>
<td>$552</td>
<td>$593</td>
<td>$637</td>
<td>$637</td>
<td>$637</td>
</tr>
<tr>
<td>17) Revenue from Tuition (In-State)</td>
<td>$46,260</td>
<td>$91,080</td>
<td>$115,635</td>
<td>$152,880</td>
<td>$152,880</td>
<td>$152,880</td>
</tr>
<tr>
<td>18) Other Sources of Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19) Total Revenue</td>
<td>$46,260</td>
<td>$91,080</td>
<td>$115,635</td>
<td>$152,880</td>
<td>$152,880</td>
<td>$152,880</td>
</tr>
<tr>
<td>20) Net Cost to UH (Expenses minus Revenue)</td>
<td>$25,766</td>
<td>$12,542</td>
<td>$978</td>
<td>-$19,793</td>
<td>-$19,793</td>
<td>-$19,793</td>
</tr>
</tbody>
</table>

C1 Number of faculty FTE is based on 0.2 FTE per semester hour. The amount of new FTE is 0.1. This is needed to support GG740 MGeo Seminar (2 hrs), GG750 MGeo Professional Project and the MGeo Oversight Committee. The remaining FTE is based on the MGeo percentage of all students taking courses number 300 and above (Table 2, row 14). This percentage assumes 20 M.S. students (average enrollment from 2000-2010), 15 Ph.D. students (50% of average enrollment 2000-2010), and 4.75 undergraduate students (half of fourth-year students out of the average of 38 during 2000-2010, or 0.5 x 0.25 x 38 = 4.75) also enrolled in the same courses as the MGeo students. Thus, for year 1, the fraction of 29 credits being taken by MGeo students is 2 full-time plus 2 half-time = 3 MGeo students, divided by 4.75+20+15+3=42.5, or 3/42.75=0.07. The estimated FTE for 29 hrs is 29 x 0.07 x 0.2=0.41. For year 1, the total FTE is 0.1 (new)+ 0.41 (for courses already being taught)=0.51. This number grows with the enrollment because the MGeo becomes a larger percentage of the total student population taking the relevant courses.

C2 Lecturers PT: GG anticipates providing part-time lectureships for one or two professionals who contribute to GG740 MGeo Seminar as well as to cover a few introductory...
undergraduate courses so faculty are able to provide more offerings of the appropriate MGeo courses. A total of only 1.0 FTE of a part-time lecturer is needed per year.

D. Other Personnel Costs are based on the annual salaries of two administrative assistants ($48,400+$44,00) and 30% of that for the Director of Student Services ($64,000*0.3=$19,200) for a total of $111,600. This total is multiplied by the MGeo percentage of all students serviced by these staff members. For year 1, this percentage is 2 full time plus 2 half-time = 3 MGeo students, divided by 38 (undergrads) + 20 (M.S.) +30 (Ph.D.) +3 (MGeo) total students = 3/(38+20+30+3)=0.033 (Table 2, row 15. 2012-13). The other personnel cost for year 1 is thus $111,600*0.033=$3,679.

K1. Total Salary FT Faculty is the product of the average 9-month salary of GG instructors ($99,000) and the number of FTE (Table 2, row 1)

The “Net Cost” estimates of Table 1 includes faculty FTE that are already being used to teach the same classes. The additional cost of the program is far less. GG proposes that 85% of the tuition revenues be returned to GG analogous to the practice with other professional degree programs at UHM (e.g., MBA, Nursing). These revenues will be sufficient to support a growing MGeo program and will benefit GG overall.

11. Assessment of Student Performance and Program Effectiveness

Student performance will be assessed in much the same way as is done for GG’s M.S. program: grades in coursework, reviews of overall student progress during annual meetings with the MGeo Faculty Oversight Committee (MGOC), and evaluations of the written report and oral presentation by the faculty advisor, a representative from MGOC, and the mentor at the company or agency where the work was done.

The MGeo program effectiveness will be assessed based on its ability to address the student learning objective (listed again as they are in Section 4):

1. MGeo graduates are proficient in applying technical knowledge of relevant theory, computer applications, laboratory methods, field methods, and the supporting disciplines (math, physics, chemistry, biology) in solving real-world problems in the geology, geophysics, and/or hydrology.

2. MGeo graduates are able to define and successfully complete a body of work or research that has practical benefit to industry and/or society. In addition, they are able to effectively communicate their work in a written report as well as in an oral presentation at a professional level as evaluated by scientists and other professionals.

3. MGeo graduates have acquired the knowledge and skills needed to pursue employment or other activities that contribute to the advancement of the Earth sciences and/or strengthen the benefit of their application to societal problems.

One set of assessments will involve reviews of student grades in classes, performance measures of the final work project, as well as job placement success rates. These will be done by the MGOC and reported to the Department and Graduate Chair. A second assessment activity will be done in collaboration with the MGeo Advisory Board. The MGeo Advisory Board will be leaders in businesses, agencies, and schools in Hawai’i who will provide advice and assistance with the overall MGeo program development, student re-
Proposed for a Professional Master of Geoscience (MGeo)

cruitment, internships, and job placement. They will be invited annually to spend an afternoon in the department, where they will see presentations by current students near graduation, and meet with the chair of the MGOC, the Department Chair, the Associate Dean of Academic Affairs, as well as the Dean of SOEST. This will be an opportunity for the Advisory Board to provide feedback about the quality of work the students are performing, make curriculum suggestions, help GG identify companies who may be interested in interns, and to help keep GG aware of current trends in the workplace.

12. Supporting Documentation

Appendix 1: Course Proposals for GG740 MGeo Seminar and GG750 MGeo Professional Project

Appendix 2: Feedback from Alumni

Appendix 3: Survey of Current Undergraduate Majors

Appendix 4: Executed ATP

The above supporting documentation can be accessed at the following web link:

www.soest.hawaii.edu/GG/FACULTY/ITO/Proposal_MGEO_Appendices.pdf