Department of Geological Sciences
California State University, Fullerton

Geological Sciences Program Performance Review Self- Study
2013-2014

CONTENTS OF THE SELF-STUDY

APPENDIX LIST

I. *Department Mission, Goals and Environment*

A. Mission and Goals since previous PPR

In preparation for our 2006 Program Performance Review, the Department elected to hold a series of retreats in 2005 to craft a comprehensive strategic vision for the Department, with associated goals. In preparation for the current Program Performance Review and in response to the College strategic planning process, the Department reviewed and updated its mission, vision, and goals in a series of meetings and retreats in 2011 and 2012. The Vision Statements crafted by the Department in 2005 were specifically designed to provide broad strategic direction to the Department; as such they have not changed in the short time since our last review. However, the Department's specific goals have evolved significantly in response to the changing environment in the university and our own progress towards meeting our goals.

Department Mission Statement
The Department of Geological Sciences is an interdisciplinary education and research community whose members are active mentors and role models. We provide a student-centered educational and research experience that emphasizes critical thinking, communication, and scientific citizenship.

This mission statement is unchanged from the one that was adopted in 2005.

Vision statements are grouped into those related to curriculum and teaching; to student-faculty research; and to the Department community, service and outreach. The vision statements are unchanged from the ones drafted in 2005. The vision statements below are summarized from the actual, detailed vision statement in Appendix VIII.

Vision: Curriculum and Teaching
The Department of Geological Sciences strives to:

1. Provide a high quality, field intensive research-based curriculum
2. Encourage faculty to in all aspects of teaching

Vision: Student-Faculty Research
The Department of Geological Sciences strives to:

3. Maintain and strengthen faculty expertise
4. Enhance interdisciplinary research with colleagues outside of our Department.
5. Maintain high-level Scholarly and Creative Activity (SCA) in each faculty member's discipline
6. Provide a high quality, competitive, and nationally recognized graduate program
7. Provide undergraduate research opportunities

Vision: Department Community, Service and Outreach
The Department of Geological Sciences strives to:

8. Provide a collegial and collaborative Department environment
9. Provide service to the Department, university and community
10. Increase Earth science awareness in the local community

Department Goals - The Department reviewed and approved revised Goals in a series of faculty meetings in Spring, 2011. The revised goals of the Department (and the relevant CSUF goals) are:

1. Support effective curricular and teaching strategies that continue to enhance student learning, retention, and time-to-degree. (CSUF Goals 1, 2)
2. Improve community outreach and undergraduate student recruitment (CSUF Goals 1, 2, 4)
3. Strengthen the graduate program (CSUF Goals 1, 2)
4. Encourage High Quality Scholarly and Creative Activity (CSUF Goals 1, 4)
5. Recruit and retain high-quality faculty and staff (CSUF Goals 2,3)

These goals are similar to the goals in our 2006 PPR:

1. Improve Teaching and Learning
2. Student Recruitment and Outreach

3. Promote Student Visibility and Development of Effective Communicators
4. Seek Department Grants for support of students, teaching excellence and outreach
5. Faculty/Staff Recruitment
6. Increase teaching/research space
7. Encourage High Quality Scholarly and Creative Activity
8. O.C. Archeology-Paleontology Curation/Research project
9. Increase University Representation and Professional Visibility
10. Establish a Department Advisory Board

To more closely mirror the university strategic planning process, we have consolidated many of the earlier objectives under larger goals. The Department's integrated goals, strategies, and outcomes are mapped to NSM and University goals in Appendix VI.

B. Changes in the Discipline and Department Response

1. Employment Prospects for Students

The geosciences are experiencing a period of high student demand nationwide. This is driven by a number of factors, including the increasing public awareness of global climate change and its impacts, a growing need to discover and exploit new energy sources and mineral resources, the increasing national and regional strain on water resources, and ongoing and expanding environmental remediation efforts driven by both public demand and tighter regulation.

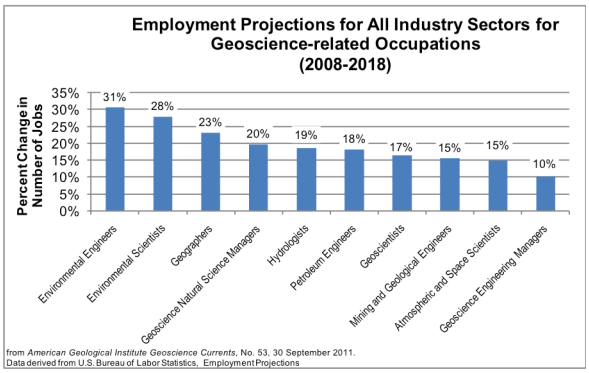

Figure 1. Geoscience employment projections. From 2011 Geoscience Workforce Report (*American Geological Institute, 2011*).

Geoscience employers are also experiencing a demographic crisis as the "baby-boom" generation approaches retirement age. Nationwide, the American Geological Institute has forecast a 10-31% growth (depending on field) in geoscience-related employment from 2008-2018, independent of replacement needs due to attrition (Figure 1). Despite the forecast growth in geoscience career opportunities, most active geoscientists are over 50 years old (American Geological Institute 2011 Geoscience Workforce Report). When attrition due to retirement is included in the employment projections, geoscience job growth is forecast to be 35% between 2008 and 2018. In terms of actual positions, the US Bureau of Labor Statistics projects that the US economy will add approximately 60,000 geoscience jobs between 2008 and 2018, but nationwide only 15,000 geoscience students will enter the workforce during that period (AGI 2011 Geoscience Workforce Report). These statistics suggest historically high demand for geoscience graduates in the coming decade. The high demand for geoscience graduates is also being recognized within the popular press; *Forbes Magazine* recently listed "Geology" as the 7th most valuable college major (http://www.forbes.com/pictures/lmj45jgfi/no-7-geology/).

In a recent survey (January 2014), we polled 263 alumni regarding employment history, with 62 responses. Since graduating, 87% of the respondents indicated that they were employed in a geology related field and 88% of those were able to find a geology job within one year of graduating. 75% of the respondents currently work in geology; we interpret the decrease in numbers currently working (from 87 to 75%) as due to external factors such as starting a family or going back to school. The majority of the graduates work in environmental, education, and geotechnical fields. In summary, the overwhelming majority of our students get geology related jobs if they want them.

2. Preparation and recruitment of prospective students

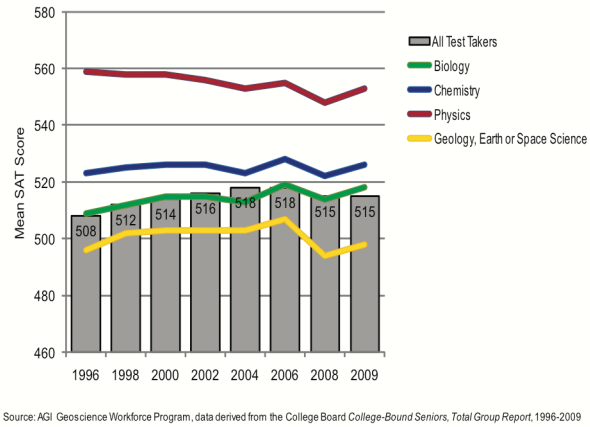

Figure 2. Mean SAT scores for high school students who have taken selected science classes. From 2011 Geoscience Workforce Report (*American Geological Institute, 2011*).

Despite strong growth in well-paying jobs, the geosciences remain a low-visibility field for most students. Surveys of student attitudes suggest that students perceive the geosciences as a low-prestige science (see AGI Geoscience Currents No. 36, June 2010), even though most of the students surveyed have never taken a geology course. This perception likely is rooted in the lack of meaningful exposure to the geosciences in K-12 education, where the percentage of high school students enrolled in an Earth science class has never exceeded 25% (*Van Norden, Palaios*,*17*, 2002); even when students take an Earth science course, it is generally only for one semester. In the state of California, Earth Science courses are not accepted as meeting the "Science" high school graduation requirement (http://www.cde.ca.gov/ci/gs/hs/hsgrtable.asp).

Indirect evidence also suggests that high-achieving students are not taking high school Earth science courses. Data from the SAT college entrance exam show that less than half of students that take the SAT have ever taken an Earth science class (from AGI Geoscience Workforce Program evaluation of the College Board College-Bound Seniors, Total Group Report, 1996-2009). Furthermore, students who have taken a high school Earth science class have lower SAT math scores than students who have taken other high school science courses.

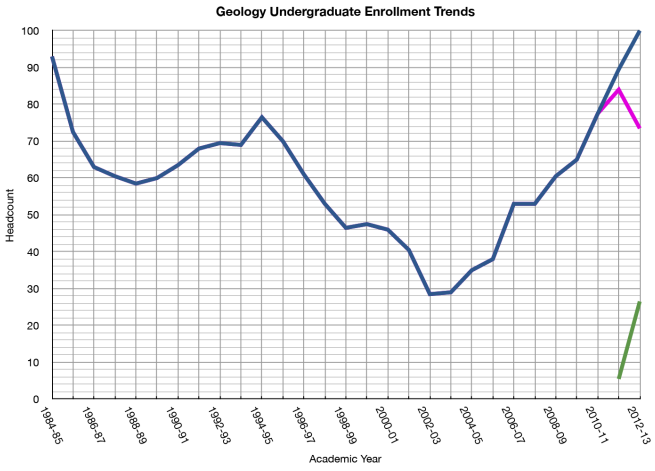

Figure 3. Enrollment trends for Geology B.S. and Earth Science B.A. students at CSUF.

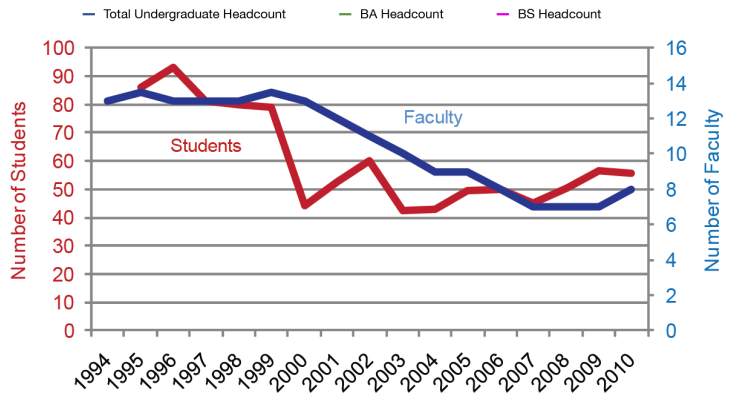

Figure 4. Median size of US geoscience Departments based on number of majors and number of faculty. From 2011 Geoscience Workforce Report (*American Geological Institute, 2011*).

These trends present a significant challenge for the recruitment of students into either the B.S. in Geology or B.A. in Earth Science. Data from the CSUF Office of Institutional Studies indicates that less than 10% of geology majors since 2000 entered Cal State Fullerton as a 1st-time freshman Geology Major. Students overwhelmingly discover geosciences after taking a general education class; 64% of geology majors had completed more than 60 units before declaring the major. At the end of Fall 2013, 59 of 128 Geology (B.S. and B.A.) majors had changed from another major after arriving at CSUF. Given that the B.S. in Geology requires 48 units in the major and 30 units in related fields, it is almost impossible for these students (who represent the majority of Geology majors) to graduate in four years.

Despite the significant barriers that exist for recruiting geoscience students, the Department has seen robust growth of new majors since 2003 (Figure 3). Nationwide there has been a modest increase in geoscience enrollments over the last four years (Figure 4). Furthermore, geology and Earth science majors at CSUF are significantly more diverse than the national average. According to Huntoon and Lane (*Jour. Geosci. Ed., 55, p.447, 2007*), ethnicities that are underrepresented in STEM fields (defined as Black, Hispanic, and Native American) comprised 6.3% of geoscience students in the US from 1995-2001. In comparison, underrepresented minorities make up 26% of CSUF geoscience majors.

3. Changes in the discipline

The geosciences are undergoing a nationwide shift to place greater emphasis on what the Department has traditionally described as "applied geology." According to the 2011 Geoscience Workforce Report (*American Geological Institute, 2011*), the top three publication topics since 2000 are environmental geology, economic geology, and Quaternary geology (Figure 5). Environmental fields also receive the highest support from federal research agencies (Figure 6). The Department has a strong Quaternary geology group, however our historically significant presence in environmental and economic geology has been diminished in recent years due to retirements and resignation. A key element of our hiring plan (see Section **IV**) is to hire new faculty in fields related to these topics. These hires will ensure that the Department remains relevant as the field continues to evolve.

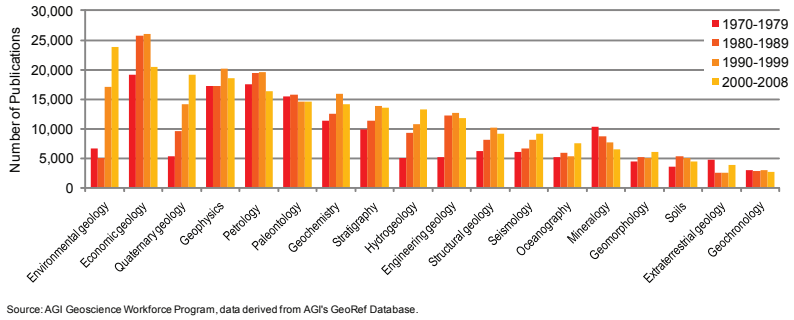

Figure 5. Trends in geoscience publications. From 2011 Geoscience Workforce Report (*American Geological Institute, 2011*).

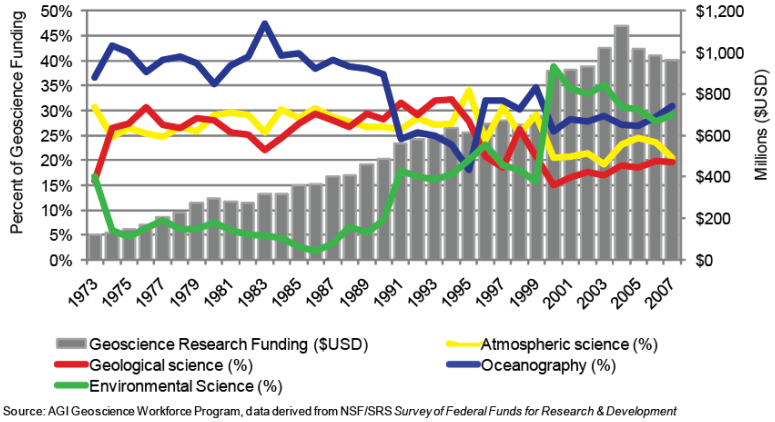

Figure 6. Trends in federal funding of the geosciences. From 2011 Geoscience Workforce Report (*American Geological Institute, 2011*).

C. Priorities for the future.

The Department's priorities are identified below. The strategies and outcomes for the general goals are described in Appendix VI. Details of the priorities for each goal, along with metrics of accomplishment are in section VII.

Goal 1. Support effective curricular and teaching strategies that continue to enhance student learning, retention, and time-to-degree.

Priority 1 – Maintain High-Impact Practices through student-faculty research and field/lab experiences for students
Priority 2 – Evaluation of B.A. in Earth Sciences program
Priority 3 – Assessment of programs
Priority 4 – Expand online course offerings

Goal 2. Improve community outreach and undergraduate student recruitment

Priority 1 - Recruitment of new majors
Priority 2 – Alumni outreach
Priority 3 - Leverage the Cooper Center to expand outreach activities

Goal 3. Strengthen M.S. Program

Priority 1 – Increase the Teaching Assistant support for Masters students
Priority 2 – Increase Graduate Assistant – Teaching Asssitant office space

Goal 4. Encourage High Quality Scholarly and Creative Activities

Priority 1 – Maintain student-faculty research capabilities
Priority 2 – Enhance faculty research space
Priority 3 – Enhance funding opportunities

Goal 5. Recruit and retain faculty and staff

Priority 1 – Faculty recruitment
Priority 2 - Support staff excellence

D. Special session and self-support courses.

The Department offers up to seven course sections in self-support summer and intersession sessions. These courses generally are GE courses (GEOL101, 101L, 310T) and are mostly in-person. We offer one section of online GEOL310T during the winter intersession. Our B.S. in Geology capstone course GEOL481A (Geology Field Camp) is offered under self-support in summer. Dr. Rhodes is teaching a special course – GEOL371: Earth Science Issues in the Tropics – for the first time this summer in Thailand. The goal is to turn this course into a permanent course that is taught abroad but with different topics. The course is a spin-off from the successful Environmental Science Research in Thailand (ESRT) program; this study-abroad program is now called Science and Math Research in Thailand (SMRT) and is run independent from the GEOL371 course.

II. Department Description and Analysis

A. Curricular Changes and New Degree Program

Since the last PPR in 2006, we have added two new courses to our undergraduate curriculum:

- GEOL408 Volcanology
- GEOL440 Paleoclimatology

These courses are upper-division elective courses for either the B.A. or B.S. degrees. These can be part of the 9-unit (max) 400-level course collection for graduate study plans. The new courses were developed to complement faculty strengths in those subject fields and fill high-profile holes in our elective curriculum.

In addition, one of our faculty members proposed a special course GEOL371 – Earth science issues in the tropics. This is a study abroad course that will be taught, at least initially, in Thailand. It is linked to CSUF strategic plan goals 1 and 2. Our plan is to convert this special course into a geology abroad topics course (which could be taught anywhere abroad, but with different regional focus) for consideration as a regular electives course.

We discontinued the night rotation of our core geology courses for the following reasons: (a) student demand for a night schedule was low, with more students complaining about the night scheduling than were benefitting from it; (b) the nocturnal times made class-time field trips difficult to impossible, which resulted in a loss of experiential learning.

In Fall 2013, we combined GEOL500 (Advanced Concepts in Geology -3 units) and GEOL501 (Research Methods - 1 unit) into one course GEOL500 (Advanced Concepts and Research Methods in Geology – 4 units). This new GEOL500 will discuss current advances in geologic concepts and introduce students to research planning, design, bibliographic search, and proposal writing. The GEOL501 course typically was much more effort for students and faculty than the 1-unit it received. Also, faculty often covered much of the GEOL501 content in GEOL500. Thus, combining the courses streamlines our core graduate course offerings for both students and faculty.

In February 2009, we proposed a new degree – B.A. in Earth Sciences. The degree was approved in Spring 2011 and officially started in Fall 2011. The B.A. in Earth science was developed to (1) increase the number of majors in our geology undergraduate degree programs and (2) provide pathways for students interested in non-traditional Earth science-related careers. See below for structure of the B.A. in Earth Science program.

B. Structure of Degree Programs

Undergraduate Program

Our undergraduate program has two majors: (1) B.S. in Geology and (2) B.A. in Earth Science along with a Minor in Geology. The B.S. Geology degree is a traditional program that trains students to become professional geologists or graduate students in geology. Our B.A. in Earth Science is much more flexible than the B.S. in Geology and is aimed at students who plan to pursue careers other than careers as professional geologists. The general differences in geology core and electives courses for the two majors are shown in Table 1 and a more detailed comparison of the degrees are given in Appendix IX.

TABLE 1 – General geology course comparison B.S in Geology and B.A. in Earth Science.

	B.S. Geology		B.A. Earth Sciences	
	Optional	Required	Optional	Required
GEOL 101 – Physical Geology (or 110T, 140)		X		X (Can choose 102)
GEOL 201 – Earth History		X		X
GEOL 303A – Earth Materials		X	X	
GEOL 303B – Ig Met Petrology		X	X	
GEOL 321 – Sed & Strat		X	X	
GEOL 333 – General Oceanography	X			X
GEOL 335 – Surface Process & Hydrology		X		X
GEOL 360 – Structural Geology		X	X	
GEOL 380 – Geological Field Techniques		X		X
GEOL 406 – Geochemistry		must choose 406 or 456	X	
GEOL 456 – Geophysics		must choose 406 or 456	X	
GEOL 420 – Earth Sci for Teachers	X			must choose 420 or 470
GEOL 470 – Env Geol & Planning	X			must choose 420 or 470
GEOL 481A – Summer Field Camp		X	X	
GEOL 498 – Undergraduate Thesis		X	X	

B.S. in Geology: The primary goal of the B.S. in Geology curriculum design is to prepare students for a career as a professional geologist or for further education in graduate school. Thus, the curriculum is a traditional geology curriculum that is heavily field based. The degree requires a total of 120 units, of which 48 are geology core or elective courses. The core geology courses cover the spectrum of fundamental geology topics that form the building blocks of geologic knowledge, as given in the following general categories (and the corresponding courses):

Courses that focus on general geology
- GEOL101 Physical Geology (or GEOL140-Earth's Atmosphere and Oceans; or GEOL110T-Topics in Earth Science)
- GEOL101L Physical Geology Lab

Courses that focus on geologic history
- GEOL201 Earth History

Courses that focus on rocks and minerals, and processes that form them
- GEOL303A Earth Materials
- GEOL303B Igneous and Metamorphic Petrology
- GEOL321 Sedimentation and Stratigraphy

Courses that focus on the redistribution of materials at the surface
- GEOL335 Hydrology and Surface Processes

Courses that focus on how rocks are deformed
- GEOL360 Structural Geology

Courses that focus on the understanding field relations of geologic materials
- GEOL380 Geologic Field Techniques
- GEOL481A Geology Field Camp (a capstone course for B.S. in Geology)

The core of the major also includes a more quantitative course in either GEOL456 (Geophysics) or GEOL406 (Geochemistry).

One of the hallmarks of our B.S. in Geology degree is the required undergraduate thesis. B.S. students are required to take 3 units of GEOL498 (Undergraduate Thesis), which can be taken as three 1-unit courses over a three-semester time span. The undergraduate thesis is a capstone experience where majors work one-on-one with a faculty adviser to do original research. This experience generally begins during the junior year. The undergraduate thesis course satisfies the university's upper-division writing requirement. Thus the B.S. major has two capstone experiences – a required field camp course (GEOL481A) and required undergraduate thesis (GEOL498).

Students are required to take 9 units as geology electives. These electives provide breadth in the geology curriculum and selection of courses depends on the interests and career goals of the student.

For related fields science courses, students are required to take at least 30 units, with one semester of college biology and two semesters each of college level chemistry and physics. Two semesters of mathematics are required and students can choose either (1) two semesters of college calculus (MATH 150A and 150B) or (2) a semester of college calculus (MATH130) and semester of statistics (MATH337).

The Student Learning Outcomes (SLOs) for the B.S. in Geology are given in Table 2 and the SLOs are mapped onto the B.S. curriculum in Table 3. The SLOs are developed (D) in most of the core and elective courses and practiced at a high level (P) in at least one course. It is important to note that P level is obtained for all SLOs in the capstone undergraduate thesis (GEOL498); hence, we use the undergraduate thesis as the assessment vehicle for assessing our B.S. in Geology program.

TABLE 2. Student Learning Outcomes for B.S. in Geology.

Skills, concepts, and processes

- Describe, integrate, and interpret data;
- Read, interpret, and construct graphical or spatial representation of data;
- Apply concepts of geologic time.

Integrative approach to Earth Science problems

- Apply and/or integrate aspects of math and/or other related fields;
- Relate Earth science to its broader impacts on society;
- Integrate Earth systems and cycles.

Scientific method and communication

- Perform research by applying the scientific method;
- Effectively communicate research results and interpretations.

TABLE 3. B.S. in Geology Curriculum Map.

Courses	Skills, concepts, and processes			Integrative approach to Earth Science problems			Scientific Method	
	Describe, integrate, and interpret data	Read, interpret, and construct graphical or spatial representation of data	Apply concepts of geologic time	Apply and/or integrate aspects of math and/or other related fields	Relate Earth science to its broader impacts on society	Integrate Earth systems and cycles	Perform research by applying the scientific method	Effectively communicate research results and interpretations
Related Fields	I	I		D			I	
101/110T/ 140	I	I	I	I	I	I	I	
201	I	I	P	D		D	D	D
303A	D	D		D	D	D	D	D
303B	D	D	D	D	D	D	D	D
321	D	D	D	D	D	D	D	D
335	D	D	D	D	P	P	D	D
360	D	D	D	D	D	D	D	D
380	D	D	D		D	I	D	D
406/456	D	P	D	P	D	D	D	D
Geol electives	D	D	D	P	D	D	D	D
481A	P	P	D		D	D	P	P
498	P	P	P	P	P	P	P	P

I=Introduced D=Developed P=Practiced at a high level

B.A. in Earth Science: The B.A. in Earth science is aimed at the need for (1) K-12 science teachers; (2) a society of Earth-educated professionals (policy makers/politicians, business leaders, lawyers, and journalists) that will need to understand Earth resource, pollution, and other environmental issues; and (3) a general citizenry that is equipped to manage future changes in Earth systems related to natural and anthropogenic causes. The degree requires a total of 120 units, of which 32 are geology or geography core or elective courses. We believe the multiple pathways and abundant flexibility in electives choices for the B.A. are its hallmark and consider the degree a "liberal science" degree. The 20-unit core of the degree is designed to give students sufficient Earth science knowledge and breadth as given in the following general categories (and the corresponding courses):

Courses that focus on general geology
- GEOL101 Physical Geology (or GEOL140-Earth's Atmosphere and Oceans; or GEOL110T-Topics in Earth Science or GEOL102-Earth and Astronomical Science for Future Elementary Teachers)
- GEOL101L Physical Geology Lab

Courses that focus on geologic history
- GEOL201 Earth History

Courses that focus on surface process and water interactions
- GEOL335 Hydrology and Surface Processes
- GEOL333 General Oceanography

Course that focus on the understanding field relations of geologic materials
- GEOL380 Geologic Field Techniques

Courses that form a capstone for the student's chosen pathway
- GEOL420 Earth Science for Science Teachers (for students in the teaching pathway)
  OR
- GEOL470 Environmental Geology and Planning (for students in non-teaching pathway)

Students are required to take 12 units as electives in geology and geography. These electives provide some breadth in the Earth Science curriculum and selection of courses depends on the interests and career goals of the student. For related fields science courses, students are required to take 16-22 units, with one semester each of biology, chemistry, physics, and math. The related fields courses can be at lower levels than the related fields courses required for the B.S. in Geology, but still offer sufficient scientific and mathematical background and breadth for the degree learning outcomes. In addition to the related field core, students take 8 units of related field electives that are adviser approved and tailored to the student's track. The remaining 22 units are undesignated electives, which are chosen with adviser approval to allow maximum flexibility in the student's chosen field. Students must also take a 3-unit writing course (English 301 or 360) or do an undergraduate thesis (GEOL498) to satisfy the university's upper-division writing requirement.

The Student Learning Outcomes (SLOs) for the B.A. in Earth science are given in Table 4 and the SLOs are mapped onto the B.A. curriculum in Table 5. The SLOs are introduced (I), developed (D), and/or practiced at a high level (P) in most of the core and elective courses. Note that the SLOs are practiced at a high level mostly in the 420/470 courses and in the geology electives, but that the P-level depends on which set of electives courses are taken. Thus some students may achieve most of the program learning outcomes, but some may not. In terms of the SLOs, we feel this is a weakness of our two-year-old B.A. in Earth science degree; therefore, one of the curricular changes we plan to make in the short-term is to design an appropriate capstone course for the B.A. program. This new course will practice the SLOs at a high level and will be used as an assessment vehicle for the program, as well as satisfy the upper-division writing requirement. This new course is discussed in the following section.

TABLE 4. Student Learning Outcomes for B.A. in Earth Science.

Broad foundation in basic science

- Evaluate and apply basic mathematical/statistical methods;
- Apply basic biological, physical, and chemical methods;
- Apply the scientific method.

Earth Science skills

- Read, interpret, and construct graphical or spatial representation of data;
- Apply concepts of geologic time;
- Identify and locate existing Earth science information;
- Effectively communicate Earth science information and concepts using appropriate technology.

Integrative approach to Earth Science problems

- Evaluate the roles of Earth materials and processes in everyday life;
- Evaluate Earth science and its relationships with societal issues; for example, the extent of human impact on Earth systems and issues related to natural hazards;
- Apply and/or integrate fundamental concepts of math and/or other related fields with Earth systems and cycles.

TABLE 5. B.A. in Earth Science Curriculum Map.

	Broad foundation in basic science			Earth science skills				Integrative approach to Earth science		
Courses	Evaluate and apply basic mathematical/statistical methods	Apply basic biological, physical, and chemical methods	Apply the scientific method	Read, interpret, and construct graphical or spatial representation of data	Apply concepts of geologic time	Identify and locate existing Earth science information	Effectively communicate Earth science information and concepts using appropriate technology	Evaluate the roles of Earth materials and processes in everyday life	Evaluate Earth science and its relationships with societal issues	Apply and/or integrate fundamental concepts of math and/or other related fields with Earth systems and cycles
Rel Fields Electives	I	I	I	D*			I*	I*	I*	I*
Undesig. Electives	D*	D*	I*	D*			I*	I*	I*	I*
101/110T/ 140/102	D*	D*	I	I	I	I	I	I	I	D
101L	I	I	I	I	I		I	I	I	D
201		D	D	D	P	I	D	D		D
333	D	I	D	D	D	D	D	D	D	D
335	D	D	D	D	D	D	D	D	D	D
380			D	P	D	D	D			D
420/470	P	P	P	P	D	D	P	P*	P*	P
Geology electives	P*	P*	P*	P*	P*	P*	P*	P*	P*	P*

I=Introduced D=Developed P=Practiced at a high level

* = Learning outcome may be Introduced, Developed, or Practiced at high level depending on which courses taken.

Minor in Geology: A minimum of 20 units in geological sciences courses is required for the minor, of which at least 12 units must be upper division and at least 6 of these 12 must be taken in residence. Up to 3 units of GEOL 310T may be applied. Prospective minors make an appointment with a Department adviser in order to select courses that most closely match their educational goals.

Graduate Program

We offer a Master of Science in Geology, which began in Fall 2000. It is based on the assumption that every geologist must have a thorough knowledge of fundamental geologic principles and that this knowledge must be rooted in field- and/or laboratory-based experiences. The M.S. degree requires 30 units of which 21 must be at graduate level (500 level). The 9-12 core units include general advanced concepts and research methods (GEOL500 – 4 units), graduate seminar (GEOL590 – 2 units), and thesis research (GEOL598 – 3-6 units). Students must take 18-21 elective geology and/or related fields "focus" courses, which are approved on the required study plans prior to completing 9 total graduate units. A public, oral defense of the thesis is required. The Student Learning Outcomes (SLOs) for the M.S. in Geology are given in Table 6. All of the SLOs are practiced at a high level, as evidenced by students:

- Completing advanced courses within their discipline;
- Attending and interacting in research seminars at CSUF and other local institutions and societies;
- Presenting research at regional and international professional conferences;
- Conducting independent research that includes:
  a) writing of a research proposal;
  b) production of a written thesis that describes the problem, methodology, and results of the student's research;
  c) dissemination of the results through publication in peer-reviewed journals and/or presentations at regional and/or international conferences;
  d) a public oral defense of the thesis.

TABLE 6. Student Learning Outcomes for M.S. in Geology.

Students receiving an MS in Geological Sciences will be able to:

Advanced knowledge of Earth Science skills, concepts, and processes

• *Compile, analyze, assess, and interpret* published research relevant to graduate-level research in the Earth sciences.
• *Create* and *implement* an experimental design to solve a research problem in the Earth sciences and *interpret* data collected through these experiments.

Conduct original scientific research

• *Design* a research plan to solve fundamental scientific problems in the Earth sciences and *formulate* this plan in a clearly expressed written research proposal.
• Prepare written and oral presentations that clearly express the results of their research plan, including a clear *statement* of hypothesis and research methods, *summary* and *interpretation* of data, and critical *evaluation* of the hypothesis.

C. Student Demand

The Geology Department has strived to increase numbers of majors by active recruiting in lower division GE courses (GEOL101, 101L) at CSUF and at local community colleges and by community engagement (career day, NSM day, job fair, geology club exposure, etc). Since 2005, the number of first time freshman applying to our B.S. program has varied between 11 to 33 students and generally increased 2-3 fold. The percent admitted has fluctuated between 33 and 64% (Appendix I Table 1-A). Over this time, generally less than about 30% of the total admitted (<7, but generally <3, students) enrolled in our program. The number of upper-division transfer students applying to our B.S. program are 18-60 students, with an increase of 3-fold since 2005. Of those applying, 40-60% were admitted and 50-85% of those actually enrolled in our program. Thus, since 2005 we have admitted more than three times as many students as upper division transfers than we have as first time freshman.

It is important to note that many of our students become geology majors after coming to CSUF, mostly through exposure to lower division GE courses. According to CSUF Institutional Research data, at the end of Fall 2013 59 out of our the total 128 majors (B.S. and B.A.) changed majors to geology or Earth Sciences from a previous or undeclared major; so nearly half choose a geology major late in their academic careers, which causes them to have longer time-to-graduation periods.

Our B.A. in Earth Science program had its first cohort of admits in 2012-2013 (Appendix I Table 1-B). A total of 30 first time freshman applied, 13 were admitted but zero enrolled in the program. For the upper-division transfer students,

16 applied, 9 were admitted, and 2 enrolled. At the end AY2112-2013, our B.A. headcount was 27, which indicates that 25 students (27 minus the 2 enrolled UD transfer students) entered the B.A. from other majors at CSUF.

For our graduate MS program, the numbers of applicants has doubled (from 12 to 28 applicants) on an annual basis since 2005 (Appendix II Table 5), thus reflecting the growing reputation of our program. The percent admitted has decreased from ~50-67% to about 30%, reflecting greater selectivity to our program. We consistently admit 5-6 new students into our graduate program – the number is limited by numbers of faculty able to advise and mentor the students and resources available to support them (TA position, GA positions with grant money).

Typically 50-80% of our new upper-division transfer B.S. students graduate in 6 years or less for cohort students staring since 2001 (Appendix 1 Table 3-A). This range is quite variable and reflects the relative low numbers of students in the initial cohorts (5-8 students). First-time freshman enrollments were too low during this time for statistically relevant analysis. In terms of retention in the major, nearly all of the first-time freshman and upper-division transfer students graduate in the major (Geology) and not in other majors. We interpret this to mean that students are happy in geology and very few geology students change to other majors.

Ideally, we would like to see graduate MS students graduating in 3 years or less. However, less than 50% of our graduate students graduate in <3 years for cohorts starting between 2000 and 2009 (Appendix II Table 7). In fact, <75% (but variable) of the cohort MS students (2000-2006) graduated in 6 years. This reflects the quality of student and the fact that nearly all of those early cohort students worked full time and were in nighttime graduate program; thus, their potential to graduate in a timely manner was low. In 2007-2008 our Department made efforts to increase the TA financial support and attract more high quality, full-time graduate students into our program. We expect to see the graduation rates increase substantially over the next five years.

D. Enrollment Trends

The Geology Department total FTES (Full Time Equivalent Students = number of students if all were taking 15 units) have increased from 355 in 2005-2006 to 431 in 2012-2013 (note that no more than 7.7 FTES were from graduate students) (Appendix I Table 2-A). Over the same time period our total undergraduate majors have grown from 39 to 100 (73.5 B.S., 26.5 B.A. in 2012-13). However, since the end of 2012-13 AY our total undergraduate headcount has increased further to 131 at Fall 2013 census (Appendix I Table 2-A) and still farther to approximately 163 at this writing [our count]. Thus our total FTES and our undergraduate headcount has grown substantially. Importantly, our total FTES seems to have leveled off or decreased in the current 2013-14 AY, but our numbers of majors continue to increase rapidly.

Between 2005-06 and 2009-10, our full time faculty numbers increased from 11 to 15 as our FTEF (Full Time Equivalent Faculty = number of faculty each teaching 15 weighted teaching units [WTU]) allocation increased from 19.9 to 21.7 (Appendix IV Table 9). However, since 2009-10, FTEF decreased to 18.3 and the full time faculty numbers have effectively decreased to 11 (at this writing). Overall, our overall FTEF allocation has decreased from 19.9 to 18.3 despite an increase in FTES from 355 in 2005-2006 to 432 in 2012-2013 (22% increase) (Appendix IV Table 9) and a four-fold growth in numbers of majors. Over the 2005 to 2013 time period the Geology Student:Faculty ratio (SFR = FTES/FTEF) has increased from 17.8 to 23.6. The college of NSM SFR and CSUF SFR have been consistent at 20-21 and 21-22, respectively. Thus Geology has migrated to SFR values that are higher than the college or university averages as it gained FTES and lost FTEF. Assuming FTES values remain the same this year, or are slightly lower, we should be at 20-21 FTEF for a SFR equivalent to the college average of 20.4.

The total headcount for MS in Geology graduate students increased to a maximum of 18 in 2009-2010, but has since decreased to 15 at Fall 2013 census (Appendix II Table 6). Typically, our graduate courses have 4 to 8 graduate students enrolled, and some graduate students take 400-level courses for which they can receive up to 9 units toward their study plans. Though the number of students in the graduate courses is not high, it is sufficient to maintain a community of scholars in the program; in fact, in some cases it is ideal for discussion, seminar, and field-based graduate courses. Because of our efforts to support our graduate students both financially and with office/desk space, the students tend to maintain a community spirit and rapport that promotes intellectual thought and generates ideas. The number of graduate students we maintain (12 to 16) also works well with the relatively low numbers of full-time faculty and time-intensive and financial efforts required to support more graduate students per faculty member. Part of our long-term goals is to find ways to support more graduate students in our program while maintaining the same levels of collegiality and professional growth.

Since 2005-2006 the number of bachelor's degrees awarded increased from 3 to 23 (Appendix I Table 4), commensurate with the growth in numbers of majors. Over the last five years we have graduated five to eight MS students per year (Appendix II Table 8).

E. Plans for Curricular Changes

Short-term Curriculum Plans

In the short term (next 1-3 years), we plan to add or modify four undergraduate courses. We also plan to revise the catalog requirements for the B.A. in Earth Sciences. The undergraduate course additions and/or modifications are mostly in response to our "Revisit and Revise" strategy for the 2.5-year old B.A. in Earth Science. The new courses or modifications and rationale for each are listed below.

B.A. Revision (Goal 1, priority 2 in section IC)
Our most significant programmatic change will be to remove the 22 units of "Undesignated electives" from the B.A. in Earth Sciences. Our original intention of these undesignated units was to allow students to create a personalized study plan under the guidance of the Geology Faculty. One anticipated use of these undesignated units would be for students to pursue a minor in a related field. Because most minors at Cal State Fullerton require 18-24 units, the 22 undesignated units in the B.A. should provide ample opportunities for students to pursue this option.

According to university policy, a minimum of 12 units for any minor must be completely distinct from the units required for the major. Unfortunately, because the 22 Undesignated Electives for the B.A. are included in the catalog description for the degree, they cannot also be applied to a minor. The Department was unaware of this rule when the degree was proposed, and plans to request a change of program to remedy the problem. The simplest solution will be to change the degree requirements as follows:

Current (Catalog 2013-15) Requirements for the B.A. in Earth Sciences		Proposed (Catalog 2015-17) Requirements for the B.A. in Earth Sciences	
Earth Science Courses	32 units	Earth Science Courses	32 units
Geology Core	• 20-21 units	Geology Core	• 20-21 units
Earth Science Electives	• 12-15 units	Earth Science Electives	• 12-15 units
Related Fields Courses	24 units	Related Fields Courses	24 units
Related Fields Core	• 16-22 units	Related Fields Core	• 16-22 units
Related Fields Electives	• 8 units	Related Fields Electives	• 8 units
Upper-Division Writing	3 units	Upper-Division Writing	3 units
General Education	39 units	General Education	39 units
Undesignated Electives	22 units	Undesignated Electives	0 units
Total Units for Major	**120 units**	**Total Units for Major**	**98 units**
Units required to graduate	120 units	*Units required to graduate*	120 units
Open units available for minor	*0 units*	*Open units available for minor*	*22 units*

GEOL4XX – Capstone experience in Earth Science (Title TBD). This 3-unit capstone course will be project-based with a large independent research and writing component. Discussions/activities will encompass issues related to the student learning outcomes for the degree. This course will satisfy the university's upper division writing requirement.

Rationale: Our original plan in the B.A. degree was for GEOL420 or GEOL470 to be the capstone course for the major - 420 for students in the teaching pathway and 470 for those not in the teaching pathway. Though the content of these courses is extremely relevant to the degree pathways, we now feel that there needs to be a broader capstone course. This course potentially will allow new assessment strategies for B.A. student learning outcomes (see section II.B.). The 3 additional units will not add units to the major because students will not need to take English 301 (now required to satisfy upper division writing requirement). Another option is to convert the current GEOL470 into a broader capstone for ALL B.A. students.

GEOL280 –Research Methods in Earth Science (?). This 3-unit research methods course will cover basic methodologies for fieldwork, lab work, field/lab note taking, and report writing. Will include lab/discussion time and local (1/2 to 1-day field trips).

Rationale: Currently, B.A. in Earth science students are required to take GEOL380 (Geological Field Techniques). The course content in GEOL380 is intended more for B.S. in Geology students, with extensive field mapping and interpretation, and is more appropriate for students wishing to pursue careers as geologists. This new 200-level course will articulate with some community college field courses, which is not the case for GEOL380.

GEOL133 – Introduction to Oceanography. This 3-unit lecture/discussion course will cover general chemical, physical, geologic aspects of oceans.

Rationale: Our curriculum currently includes GEOL333 (General Oceanography), which is required for B.A. students and is an elective course for B.S. students. This course needs to be at a lower-division level to allow articulation for community college transfer students. The new course (GEOL133) will be required for B.A. students, rather than GEOL333. GEOL133 will articulate via the statewide course identification numbering system descriptors for California community colleges. The new course will be eligible for General Education category B.1. (Scientific Inquiry and Quantitative Reasoning in Physical Science). GEOL333 will be changed to GEOL433, its title will be changed to "Coastal and Marine Geology" after we hire a coastal sedimentologist in Fall 2014, and its content will be changed accordingly.

GEOL299 – Research Experience for Undergraduate Students. This 1-3 unit supervisory course will allow freshman- and sophomore-level students to gain research experience under the guidance of a faculty mentor.

Rationale: We currently have no mechanism for involving freshman and sophomore level students in research experiences; GEOL499L requires junior/senior level status. This research experience course will help promote new research activities, student involvement, and outreach at the Cooper Center.

GEOL433 – Coastal and Marine Geology. This 3-unit elective lecture/discussion course will focus on understanding coastal and near shore marine processes.

Rationale: We plan to hire a coastal sedimentation/processes faculty member to start in Fall 2014. This new faculty member will develop the course. The course should be designed to build on basic material taught in Oceanography (new GEOL133) and Hydrology and Surface Processes (GEOL335). It will be able to take advantage of nearby coastal access for field trips and class projects.

Long-term Curriculum Plans

Our long-term curricular plans revolve around Department growth and subject deficiencies in our curriculum. Additionally, our "revisit and revise" strategy for the new B.A. in Earth science program (discussed above in short-term plans) will likely continue beyond three years.

Two of our faculty retired at end of AY2013 (Drs. Foster and Carlson). Their expertise is in environmental/engineering geology and geoscience education. Both of these fields are prominent in our growing B.A. in Earth science program. We expect to hire new faculty in some or all these fields and the new faculty will bring new ideas for these areas of our curriculum. So we expect that there will be substantial changes in course and course sequencing in the next seven years based on the new hires.

Our Department growth plan (Goal 2-priority 1 and Goal 5-priority 1 in section I.C and Appendix VI) is based on subject deficiencies in the Earth science fields and faculty retirements as discussed in section IV. Current subject/course deficiencies include:

- Resource/Economic geology – this includes courses related to economic (mineral resource) geology exploration and management. New hire should be in place in Fall 2014;
- Coastal/marine processes – this includes courses related modern coastal and shallow marine sedimentation and processes, oceanography, and/or marine geology. New hire should be in place in Fall 2014;
- Engineering geology – we currently have a 300-level engineering geology course (GEOL376), but new undergraduate elective and MS courses will potentially be developed by new hire or existing faculty – see section IV;
- Resource/Petroleum geology – this includes much needed courses in petroleum geology at undergraduate and graduate levels;
- Geoscience Education – There will probably not be any new courses. We may hire new tenure-track or full-time lecturer – see section IV. This new hire would be tasked with evaluating and potentially changing/modernizing our existing geoscience education courses (GEOL102, 410, 420);
- Environmental geophysics and remote sensing – this includes courses that teach students about geophysical, satellite, and GIS methods of evaluating environmental, and applied Earth science issues.

III. Documentation of Student Academic Achievement and Assessment of Student Learning Outcomes

Table 7 below illustrates a plan for assessing our two bachelor's programs. We have initiated and performed a pilot project for assessment of the B.S. in Geology as described below.

***Table 7. Bachelor of Science in Geology* and *Bachelor of Arts in Earth Sciences* Program Assessment Plan**

CSUF SLO	***Bachelor of Science in Geological Sciences***		***Bachelor of Arts in Earth Sciences***	
	SLO	Where Assessed	SLO	Where Assessed
Demonstrate intellectual literacy through the acquisition of knowledge and development of competence in disciplinary perspectives and interdisciplinary points of view.	Describe, integrate, and interpret data	GEOL 498 – Thesis GEOL 481A – Field Camp Alumni surv.	Evaluate and apply basic mathematical/statistical methods	TBD - Embedded assessment in math electives
	Read, interpret, and construct graphical or spatial representation of data	GEOL 498 – Thesis GEOL 481A – Field Camp Alumni surv.	Apply basic biological, physical, and chemical methods	TBD - Embedded assessment in science electives
	Apply concepts of geologic time	GEOL 498 – Thesis GEOL 481A – Field Camp Alumni surv.	Read, interpret, and construct graphical or spatial representation of data	Embedded assessment in GEOL 380 – Field Techniques
			Apply concepts of geologic time	Embedded assessment in GEOL 201 – Earth History & GEOL 380 – Field Techniques
Think critically, using analytical and quantitative reasoning, to apply previously- learned concepts to new situations, complex challenges and everyday problems.	Apply and/or integrate aspects of math and/or other related fields	GEOL 498 – Thesis GEOL 481A – Field Camp Alumni surv.	Understand the scientific method and roles of scientists in society	Embedded assessment in GEOL 470 and/or GEOL 420
	Relate Earth science to its broader impacts on society	GEOL 498 – Thesis GEOL 481A – Field Camp Alumni surv.	Apply and/or integrate fundamental concepts of math and/or other related fields with Earth systems and cycles	Embedded in GEOL 470 and/or GEOL 420
			Evaluate the roles of Earth materials and processes in everyday life	Embedded in GEOL 470 and/or GEOL 420
Communicate orally and in writing clearly, effectively, and persuasively.	Perform research by applying the scientific method. Effectively communicate research results and interpretations	GEOL 498 – Thesis GEOL 481A – Field Camp Alumni surv.	Identify and locate existing Earth science information; Effectively communicate Earth science information and concepts using appropriate technology	Embedded in GEOL 380
Work effectively as a team member or leader to achieve a broad variety of goals.		GEOL 498 – Thesis		
Evaluate the significance of how differing perspectives and trends affect their local communities.		GE Assessment	Evaluate the roles of Earth materials and processes in everyday life;	Embedded in GEOL 470 and/or GEOL 420

Recognize their roles in an interdependent global community.		GE Assessment	Evaluate Earth science and its relationships with societal issues; for example, the extent of human impact on Earth systems and issues related to natural hazards	

A. Assessment of B.S. in Geology

The Department has focused assessment efforts on the student learning outcomes for the B.S. in Geology. We have focused on this degree for several reasons, including 1) most of our majors are pursuing the B.S.; 2) it is a well-established degree with a large alumni base and excellent reputation; and 3) the structure of the degree program provides two capstone experiences that should be excellent vehicles for assessment of the established student learning outcomes.

At present, the B.S. in Geology is assessed by via the undergraduate thesis (GEOL 498) using the rubric in Appendix X, which rates each of the Student Learning Outcomes on a scale of 1 (insufficient) to 5 (Excellent). The Department plans to use this rubric annually, or every other year, during the spring semester to assess all undergrad theses produced over the previous year. At present this will yield 15-25 theses per year to be assessed. Each faculty member reviews 2-4 theses, depending on the number of students in the year(s), with each thesis being reviewed by two different faculty members. Theses are provided in electronic format and redacted to maintain confidentiality. Theses to review are assigned randomly to each faculty member by the Department Coordinator, with the only caveat being that no faculty member shall review the theses of his/her own students.

Following the rubric, theses are assigned a score of 1 if they document insufficient mastery of the learning outcome, a score of 3 if they demonstrate sufficient mastery, and a score of 5 if the demonstrate excellent mastery. Theses that do not address the specified learning outcome are assigned a score of 0. Note that a score of 0 does not indicate that the student did not master the learning objective in question; it indicates only that the thesis did not contain any evidence that would allow the outcome to be assessed. The Department believes that this is an important distinction, since not all theses will necessarily use all of the geologic tools specified in the B.S. Student Learning Outcomes.

This procedure was first used to assess student learning during the 2012-13 academic year. Eleven theses were assessed in this initial exercise. The results are summarized below.

Student Learning Outcome	Number of theses that address the outcome	Average score (only including theses that address the outcome)	Number of theses that score sufficient or higher
1. Skills, concepts, and processes			
a. Describe, integrate, and interpret data	11	3.64	10
b. Read, interpret, and construct spatial representation of data	11	3.73	10
c. Apply concepts of geologic time.	10	3.2	8
2. Integrative approach to Earth science problems			
a. Apply and/or integrate aspects of math and/or other related fields.	11	3.18	8
b. Integrate Earth systems and cycles.	11	2.45	7
c. Demonstrate and/or relate the role of Earth sciences in everyday life.	4	1.5	1
3. Scientific method			
a. Perform research by applying the scientific method	11	3	7

This assessment suggests that students are achieving most of the desired learning outcomes for the B.S. degree. Students performed particularly well on the SLOs related to the collection, description, and analysis of data (SLOs 1.a, 1.b, and 1.c). Students also demonstrated a sufficient mastery the scientific method (SLO 3.a) and were sufficiently able to apply and/or integrate concepts and principles of math, chemistry, physics, and biology into their work (SLO 2.a).

The primary area of concern found during the assessment was students' ability to integrate Earth system and cycles (SLO 2.b), and demonstrate the role of the Earth sciences in everyday life (SLO 2.c). We believe these deficiencies are not necessarily indicative of students' actual mastery of the learning outcomes, but in flaws in both the assessment rubric and the way the thesis assessment is administered.

Both SLO 2.b and 2.c reflect learning outcomes that relate to the "broader impacts" of both the Earth sciences and the specific project described in the thesis. In reviewing the theses, the faculty overwhelmingly agreed that most of the theses under review did not adequately address these points simply because the students were not instructed to do so. The faculty agreed to place greater emphasis on these topics when advising students in the final writing stages of their theses. We also plan to make the evaluation rubric available to students so that they understand their expectations in advance. We believe that this will dramatically improve student's ability to express their mastery of these important learning outcomes.

B. Other Assessment Strategies for the B.S. in Geology

In addition to the formal assessment of the undergraduate thesis as descried above, the Department plans to develop a process for assessing student learning in GEOL 481A – Geology Field Camp. This course is also a capstone requirement for the B.S. degree, and will present a good complement to the thesis assessment. GEOL 481A is an intensive field-based course held every summer in southwest Montana. The course is a true capstone experience that requires students to integrate all of the skills they have learned through their geology training in an authentic project-based experience. The final project in GEOL 481A is a weeklong mapping project with a comprehensive final report. This project will provide an excellent opportunity to perform an assessment exercise similar to the one we have designed for the undergraduate thesis. Dr. Brady Rhodes will be teaching GEOL 481A in summer 2014, and will be piloting an assessment rubric for use in this class.

The Department can derive additional evaluation of student learning though the Association of State Boards of Geology (ASBOG) exam, a nationwide licensure exam for professional geologists. Many geology alumni enter the consulting geology industry directly after graduation, and the ASBOG exam is a standard licensure that they will take after a specified period of time in the profession (typically 3 years). Although this is an indirect assessment that occurs after our students have been out of school for several years, it also provides insight into the quality of our programs. The performance on the ASBOG exam by CSUF Geology alumni with a terminal B.A./B.S. is shown in Figure 7. These results are broken down into cohorts based on the year they received their degree, and reveal several important trends for the Department. First and foremost the data show that CSUF Geology majors successfully complete the ASBOG exam at a rate equal to or greater than the national average; over the history of the exam, the national pass rate has been 52%, whereas the CSUF pass rate is 54%. The performance of CSUF alumni improves when considering only the most recent alumni. 68% of alumni who graduate CSUF from 2001-2005 passed the ASBOG (compared to 60% nationally). Alumni who graduated from 2006-2012 had a 59% passing rate compared to a national average of 50%.

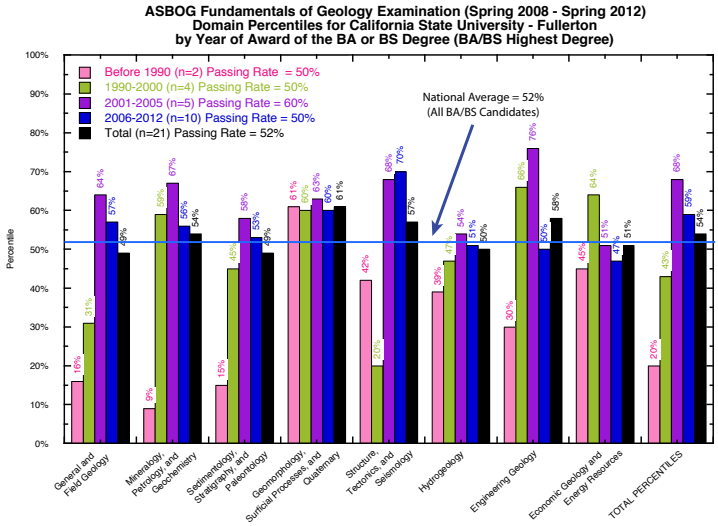

Figure 7. CSUF geology alumni performance on ASBOG Fundamentals of Geology Examination (data provided by Association of State Boards of Geology [ASBOG])

Finally, we can indirectly assess student learning of our students using alumni surveys. In January 2014, we did a survey of 263 our alumni where we asked them to rank how well their academic program in geology prepared them to address the B.S. student learning outcomes (listed in table 2). Respondents were asked to score from 1 (Poor preparation) to 5 (Excellent preparation). The results are listed in Figure 8 below. Respondents graded the eight general SLOs with scores of 4 or better. The strongest scores (>4.4/5.0) are in reading/interpreting data, effective communication, and performing research. It is interesting that these categories are very general categories and not specific to geology. However, the

weakest score (but still 4.0 out of 5.0) is in applying/integrating related fields (math, chemistry, physics). This indirect assessment survey indicates that our B.S. in Geology graduates believe that they have achieved the B.S. Student Learning Outcomes.

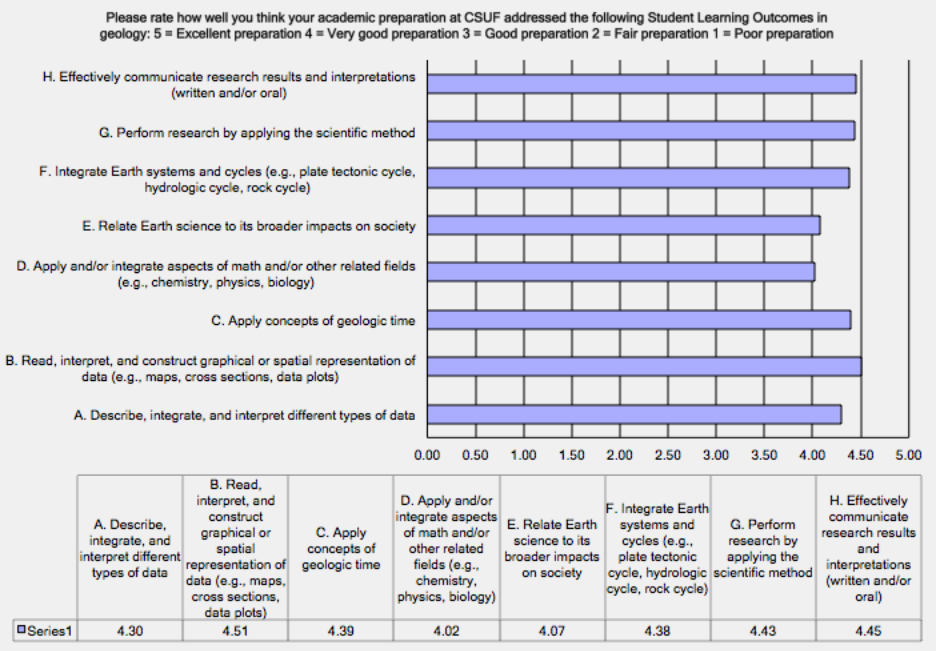

Figure 8. Results from alumni survey rating academic preparation with respect to the B.S. in Geology student learning outcomes.

C. Assessment of B.A. in Earth Sciences

We are delaying the institution of a formal assessment program on the B.A. in Earth Sciences for 2-3 years both to allow us to focus on the B.S. and to give us time to resolve any obvious administrative or structural problems with the relatively new B.A. before doing an assessment of student learning. Furthermore, the recent turnover in tenure-track faculty within the Department provides an opportunity to redesign some of the key classes in the B.A. to accommodate embedded assessment. The B.A. has 3-4 courses where assessment can naturally be done via embedded assignments (GEOL 201, GEOL 380, GEOL 420, and GEOL 470, see Table 7). With the recent retirement of Dr. Galen Carlson (who taught GEOL 420) and the hire of Dr. Sean Loyd (who teaches GEOL 470), we have an opportunity to revamp these courses with assessment in mind as new faculty are brought in to teach the classes.

IV. *Faculty*

A. Changes in FTEF since last PPR

Since the last PPR in 2006 our FTEF allocation has decreased from 19.9 to 18.3 despite an increase in FTES from 355 to 432 (22% increase) (see Table 9 in appendix IV). Undergraduate majors increased from 39 to 100 between 2006 and 2012-13 (Figure 3 and Appendix I Table 2), and to 163 [our count] at the time of this writing. We currently have eight tenured faculty (5 Full Professors; 3 Associate Professors), three tenure-track faculty (Assistant Professors), and one full time lecturer, for a total of 12 full-time faculty (including the new Interim Dean).

As discussed in section II.D., our full-time faculty numbers decreased from a high of 15 in 2009-2010 to 12 at this writing. The decrease in FT faculty is due to two retirements (Drs. Carlson and Foster) at end of Spring 2013, the death of one FT lecturer (Mr. Warham), the resignations of two other faculty in 2011 (Dr. Kneeshaw) and 2013 (Dr. Browne), and the recent appointment of one faculty member as Interim Dean (Dr. Bowman). These losses have been partially offset by two new hires in 2012 (Dr. Parham) and 2013 (Dr. Loyd). **The effective net loss is 4 full-time faculty members since 2010**.

The losses of full time faculty have considerably affected our academic offerings. The impacts of the individual losses include:

- Dr. Browne taught our core Earth Materials course (GEOL303A), Geologic Field Techniques (GEOL380), Geology Field Camp (GEOL481), and Geochemistry (GEOL406). Dr. Browne also taught several popular geology electives such as volcanology (GEOL406) and optical mineralogy (GEOL404). His loss has put substantial strain on staffing the core courses. We hope to replace Dr. Browne with a Resource Geology search by Fall 2014.
- Dr. Carlson taught and directed our geoscience education courses (i.e., GEOL410 and 420). Presently, exclusively part-time faculty members are teaching the geoscience education program. One of our goals is to assess the impact and need for the geoscience education program and courses in our Department and perhaps hire a new FT faculty (either tenure track, or lecturer) to lead that program.
- Dr. Foster taught mainly electives courses, particularly geological engineering (GEOL376). His loss has lead to having another full time faculty member take over the popular GEOL376 course, which ripples through our staffing because now that faculty must be replaced for elective or core courses he normally teaches.
- Dr. Kneeshaw taught Environmental Geology and Planning (GEOL470), which is a capstone course for our B.A. in Earth science major. She also taught our core Geochemistry course (GEOL406). Fortunately, we were able to hire Dr. Loyd (2013) to replace the expertise and course staffing in 470 and 406.
- Mr. Warham – taught exclusively in GE courses, but part-time lecturers now teach his full time teaching load.
- Dr. Bowman was recently selected as Interim Dean for NSM and it is unclear whether he will return to the Department as a teaching faculty member. If he does not return, we will have a discipline gap in the field of geophysics and will need to rely on part-time lecturers to teach our core and elective geophysics courses.

Additionally, the loss of these full-time tenure/tenure track faculty members has lead to the following:

- Fewer faculty members to mentor/advise the required undergraduate theses for B.S. in geology students. At a time when our majors are growing like never before (Figure 3), the loss of faculty members stresses the ability of fewer faculty to effectively engage in meaningful faculty-student research, which is a main goal in the university's strategic plan.
- Hiring part-time faculty to teach in our upper-division core courses. This year, we will need to hire at least two part-time lecturers to fill key courses in our core curriculum (GEOL303A, 303B, 333 and 456).
- Teaching a higher percentage of our course offerings with part-time lecturers. This year (AY2013-14) we will need to offer 70 WTU (Weighted Teaching Units) per semester to PT lecturers; this is more than twice the WTU's taught by PT lecturers last year and will constitute 30% of our non-supervisory weighted teaching load. TA's will teach a total of 48 WTU in 24 sections of GEOL101L, which is 21% of the total weighted teaching load.
- Difficulty in staffing important committees, such as advising, curriculum, and personnel.

B. Priorities for additional hires

At our 2012 retreat we outlined a hiring plan, but that was prior to the resignation of Dr. Browne and the appointment of Dr. Bowman as Interim Dean. Figure 9 highlights the general hiring plan, modified since our retreat. Over the next 4 years, we hope to hire 6 faculty members (to reach total of 17 FT TT faculty) with specialties that both fill gaps in our curriculum gaps as discussed above and disciplines that are important for training our students for the work force.

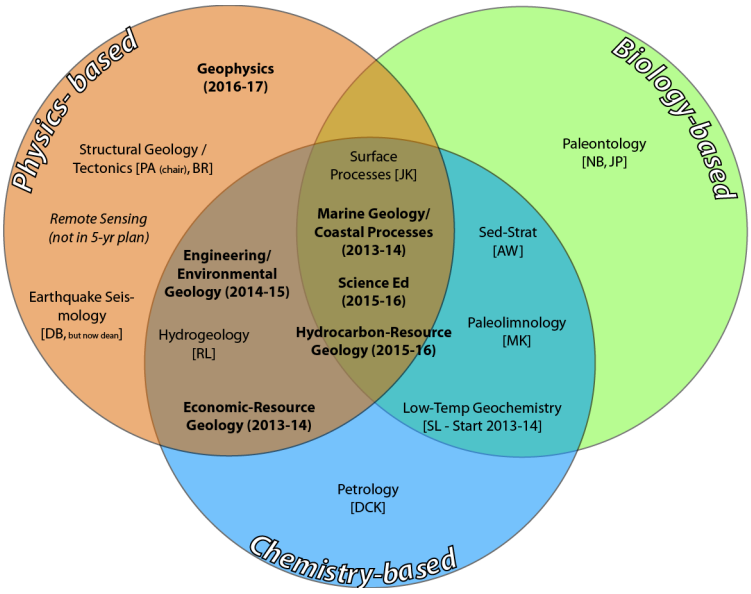

Figure 9. Existing and new (bold) faculty specialties within the Department. Initials refer to individual faculty. Dates indicate the academic year of planned search.

2013-2014: (1) Resource/economic geologist and (2) Coastal Sedimentologist. The Resource geologist will help cover needs for teaching our core Earth Materials course (GEOL303A) and potentially teach our field courses (GEOL380 and 481A) and provide valuable resource-economic geology experience for our students hoping to go into mineral exploration or resource management positions. The coastal sedimentologist will teach the B.A.-core Oceanography (GEOL333) and electives in Coastal and Marine geology (new GEOL433), as well as rotate into the field courses. This hire will be able to take advantage of our abundant coastal geology in CA and provide course work relevant to coastal environmental issues and/or training on coastal sedimentological systems that make up petroleum reservoirs studied by oil companies. At the time of this writing, we are searching for both of these positions.

2014-15: Engineering/Environmental Geologist. An engineering/environmental geologist will help replace the retired Dr. Foster and will cover our needs for teaching Engineering Geology (GEOL376) and Environmental Geology and Planning (GEOL470). Both environmental and engineering geology fields are growing (Figure 5) and many of our students find jobs in these fields. However, Dr. Jeff Knott has a professional background in engineering geology and taught GEOL376 in Fall 2013. He plans to use part of his sabbatical time in AY2014/15 to revamp and modernize GEOL376, which may allow him to teach this course on a regular basis in the future. This would allow us to not search for an engineering geologist in 2014-15 and instead move-up the geophysics search (see below) and fill much needed discipline and teaching weaknesses, especially with Dr. Bowman's promotion to Interim Dean.

2015-16: (1) Geoscience Education and (2) Hydrocarbon Resource Geologist. The Geoscience Education hire will fill the position vacated by retired Dr. Carlson (in 2013). Dr. Carlson coordinated and managed the geoscience education curriculum, which includes three courses including: Earth and Astronomical Science for Future Elementary Teachers (GEOL102); Physical Earth/Space Systems (GEOL410 – for elementary teachers); and Earth Science for Science Teachers (GEOL420). Our 2.5-yr old B.A. in Earth Science degree is directed at training STEM teachers at K-12 levels for which there is a growing need. Though we recognize that we have a disciplinary need for a geoscience education faculty member, we are unsure how to proceed because we do not know the direction the college of NSM wants to take with regard to science education. Additionally, a geoscience education specialty does not fit well into our teaching and research model for faculty. One option is to hire a full-time lecturer to teach some of the geoscience ed courses, to coordinate instructors, and manage curriculum for the entire geoscience education program. Release time would need to be offered for the coordination and management portions.

The second position is for a hydrocarbon resource geologist. At present, our Department lacks expertise in hydrocarbon geology. However, issues of petroleum geology are growing and will continue to grow - we anticipate that more of our graduates will be hired into petroleum exploration, extraction (hydrofracturing), site remediation, and petroleum-related environmental fields over the next decade or more. At present, our students receive very little training in hydrocarbon related geology. This hire would contribute to the NSM vision of a center for the environment, resources, and sustainability.

2016-17: Geophysics. Remotely evaluating environmental issues, shallow crustal structures, and aquifers, as well as evaluating Earthquakes, using geophysics is a growing field. Although we offer a general geophysics course, we do not have courses or faculty expertise in using geophysics (ground penetrating radar, seismic reflection, electromagnetic) necessary to train our students for this growing field. Students taking geophysics courses and doing geophysics research would learn to use the sophisticated equipment and software packages required of graduates working in the field. This hire would contribute to the new NSM Center for Computational and Applied Math (CCAM).

Caveat: Given the status of Dr. Bowman as Interim Dean of NSM, we may have to move our geophysics search up to 2014-15. In addition, the NSM is in a state of change, with a new Interim Dean and the potential to redirect emphases for the College. For example, the past dean was focused on centers for which our Department needed to focus new hires. The new Dean may ask us to consider different centers or opportunities such as with the CSU Ocean Studies Institute (OSI) and its potential research/outreach center in the Port of Los Angeles. In the case of the OSI opportunities, we may want to focus some hiring efforts on marine geology and oceanography.

Our hiring plan will be a major topic of discussion at our next retreat – tentatively planned for August, 2014.

C. Role of full-time and part-time faculty and student teaching assistants

Generally, tenure-track faculty teach our upper division core courses, electives courses, and graduate courses; part-time faculty teach lower division general education courses; and student teaching assistants teach our GEOL101 labs as instructors of record. Figure 10 shows that the number of sections taught by PT faculty decreased from 67 in 2007-08 to a low of 24 sections in 2010-11. This decrease in sections taught by PT faculty was offset primarily with GEOL101L sections taught by TAs as the Department made a conscious effort to bolster our TA support and build our graduate program. Currently we offer 24 sections of GEOL101L. Since 2010-11, the numbers of sections taught by PT faculty have grown as we've effectively lost tenure-track faculty as discussed above; in 2013-14 we estimate that 75% of our total class sections will be taught by PT faculty or graduate TAs.

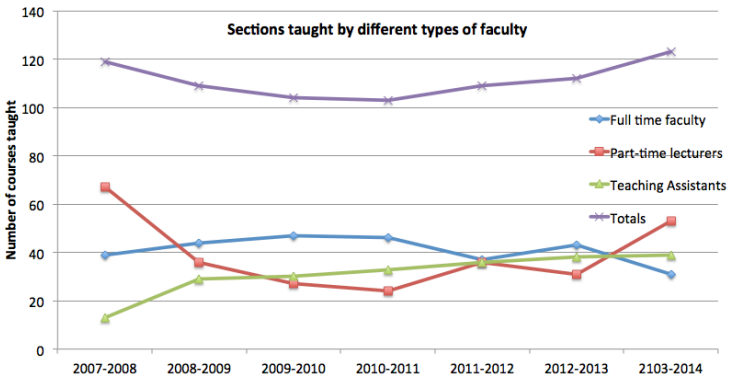

Figure 10. Number of sections taught.

Figure 11 shows the FTES/year taught by tenure-track faculty and lecturers (includes TAs). Starting in 2007-08, tenure-track faculty started to teach more of the large-enrollment general education courses (GEOL101 and 310T) as a way of recruiting majors. In 2010-11, 40% of the total FTES were taught by lecturers, but since then the total FTES taught by tenure-track faculty has decreased as the numbers of FTES taught by lecturers has increased – again this is due to loss of tenure-track faculty since 2010-11. In 2013-14, we estimate that 60% of the total FTES will be taught by lecturers or TAs.

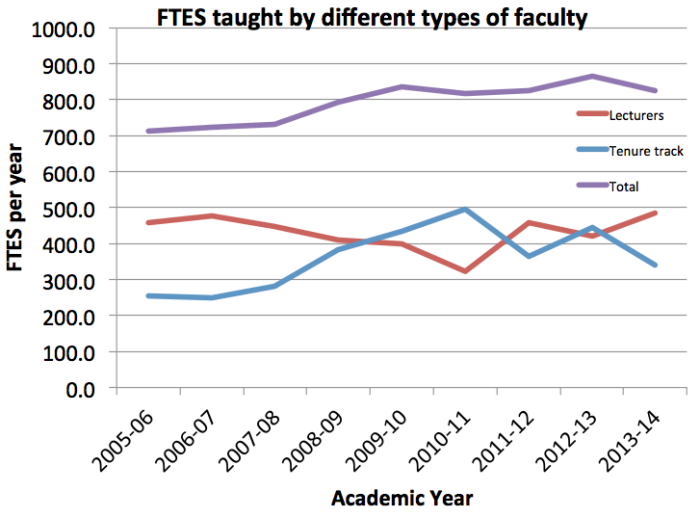

Figure 11. Number of Full-time equivalent students (FTES) taught.

V. *Student Support and Advising*

A. Describe how Department advises its majors, minors, and graduate students

Undergraduate Student Advising

Our undergraduate B.S. and B.A. majors must be advised upon declaring the major and have mandatory advising every semester thereafter. Mandatory advising usually takes place in a two-week window at about mid-semester and just after the next semester's schedule is released. Advising is scheduled for one hour for new majors and half hour for continuing majors with a faculty member undergrad adviser; generally about 6 of our FT faculty advise students each semester. The general goals and structure of our undergrad advising are given below. A detailed outline of the goals and structure of our undergraduate advising, and the role of the undergraduate adviser, are given in Appendix XI.

The general goals of undergrad advising in for B.S. and B.A. students include:

- Chart a pathway through the B.S. & B.A. major requirements;
- Ensure students are making timely progress towards graduation;
- Enable students to meet faculty who do not teach in Geology Core;
- Help faculty develop better understanding of our own curriculum;
- Provide information on student numbers in next semester courses for scheduling purposes.

The administrative structure of undergraduate advising includes:

- Undergraduate Committee of six tenure-tenure track faculty has responsibility for undergrad advising;
- Main Undergraduate advisor (committee chair) has responsibility of coordinating advising activities, training new faculty advisers, conducting all grad checks, and conducting all new student advising during summer or intersession.

Graduate Student Advising

Summary: The Department of Geological Sciences uses a three-tier advising system for graduate students: **Graduate Advisor**, **General Education contact**, and the student's specific **Project Advisor**.

Graduate Advisor: (All graduate students) Upon admittance, all new graduate students are contacted by the Department Graduate Advisor with a list of important sites/links/handbooks. This information includes the Department Graduate Handbook, the University Graduate Studies webpage, and the Department webpage, where they can access important forms required to begin their journey. Within the first month of their arrival, new graduate students are required to attend an advising session with the Department Graduate Advisor where they are provided with information about important deadlines, protocols for success, and how to manage their study guide. The Graduate Advisor's role includes also study plan management, graduate checks, and other issues that require the Graduate Advisor's signature. Finally, the Graduate Advisor

acts as the liason between the Department of Graduate Studies and the Department of Geological Sciences for issues that pertain to the graduate student.

General Education contact: (Teaching Assistants only) Graduate students offered a TA attend a mandatory advisement with the Department of Geological Sciences General Education contact during the first week before classes. This TA orientation focuses on the TA's responsibilities, teaching advice, and other pedagogical material aimed at preparing the TA for their teaching responsibilities. Each TA is then required to take 1 unit of GEOL593 for two semesters where they are regularly mentored and reviewed for their TA position. Within the first few weeks of the semester, new TA's are also required to attend a campus session on Unit 11 (union) compliance where they learn about their TA rights and privileges. Upon completion of the Unit 11 advisement, the TA's report the date and time of their attendance to the Department administrative support assistant to insure Unit 11 compliance.

Project Advisor: (All graduate students) All Department graduate students are also assigned a Project Advisor. The Project Advisor is the student's mentor with whom the student should have the most contact. The Project Advisor is expected to help the graduate student succeed in the program by providing the project direction, study plan, goals, resources, and timeline. Although not required, the Project Advisor is encouraged to meet with their graduate students regularly as commensurate with student's needs and the project's development.

B. Student access to research opportunities, internships, outreach, and student assistant teaching opportunities.

Student research opportunities: All B.S. Geology and MS Geology students must complete a mandatory thesis in collaboration with a faculty advisor. B.S. students must take 3 units of GEOL498 – Undergraduate Thesis. All tenure track faculty participate in student-faculty research and lecturers also have the opportunity to involve undergraduates in research. B.A. in Earth Science students are not required to do a thesis, but they have the opportunity to do a thesis and/or other independent research if they choose. B.A. students often do GEOL499 Independent study projects to fulfill upper division elective unit requirements. Thesis work is supported through a combination of state support of faculty research labs, external research grants by faculty, and philanthropic funds raised by the Department. Students doing research and presenting their results at meetings generally pursue travel funding from the Associated Students Interclub Council. Our students strive to be involved with the AS-ICC.
Internships: For the last two years we have had an internship program that has supported 2-3 students per year. This program has two financial components: (1) a paid summer internship with hourly wage set by employer and (2) a $1000 scholarship paid by the employer as a donation to the Department. We hope to grow this program, but are constrained by university and employer regulations on donations. The Cooper Center also plans to offer internships opportunities. Students also are able to take GEOL495 – Geological Sciences Internship for electives credit.
Student assistant teaching: Our students are able to take Geological Sciences Tutorial (GEOL496L) as part of their electives courses – GEOL496L typically enrolls 1-7 students per semester for last five years. These student tutors assist faculty with setting up and administering labs, running field trips, and general tutoring of students. They do not grade student work.
Geology club: Our Department has a very active student-run club and is part of the Associated Students Interclub Council. Officers are elected annually and there are typically 30+ students active in the club. The club sponsors student events that foster social interactions and promotes student research. Student club is very involved in outreach efforts such as interacting with potential geology majors visiting our Department.
Seminar series: We have a bi-weekly seminar series whereby professionals are invited to give talks and interact with students and faculty. Following the seminar, we (speaker, students, faculty and staff) convene at local pizza restaurant for continued seminar discussions in a less formal setting (typically 10-15 students).
Participation in professional meetings: Our students regularly attend and participate in national and regional professional society meetings (GSA, AGU, AAPG, NGWA) and in local professional organizations such as the South Coast Geological Society. Students at these organization meetings are engaged in geology discussions and have opportunities to network with potential graduate schools and with geology company employers – many make graduate school or job connections at these meetings.

VI. *Resources and Facilities*

A. State and non-state resources

Appendix V shows the breakdown of state and non-state resources received since 2007-08.

Our state-support resources generally are broken down into two categories: Part-time faculty blanket (PTF) and operating expense-student worker (OE-SA). The PTF blanket has been covered by Dean and VPAA funds to meet required course needs and includes salary for all part-time lecturers, state-funded graduate assistants, teaching assistants (TA), and Instructional Support Assistants (ISA). The decrease in PTF blanket expenses between 2007-08 and 2009-10 reflects the decrease in number of sections taught by PT faculty. PTF blanket has generally increased since 2010 as our numbers of FT faculty decreased as described in section IV. Even with the increases in PTF blanket, our allocated PTF$$/FTES are typically $450-620/FTES (Appendix V) – the NSM average is about $1000/FTES over this time period; our Department has been efficient in its PTF blanket expenditures by using full-time faculty to teach many of its large lower-division GE courses.

The OE-SA has varied between about $150,000 and $250,000 – the bulk of the operating expenses include equipment and supplies/services. Variations in these expenses depend dominantly on (1) start-up costs for new faculty, which is included in equipment and supplies/services categories, and (2) purchase of a vehicle (2009-10, 2011-12) for teaching and student-faculty research. The summer special course fee under state support is a special fee paid by students enrolling in our Geology Field Camp (GEOL481A). We use this money to support our vehicle maintenance/repairs.

Our faculty have been successful in obtaining grants and contracts. The external grant amounts include large grants from Orange County for the Cooper Center (years 2009-10 to 2011-12) and master service agreement contracts from the Mojave Water Agency. Many of the grants and contracts provide resources as release time and indirect cost (IDC) money. Our faculty obtained intramural grants at a rate of $15,000 to $35,000 per year in total. All of these grants provide valuable resources for allowing faculty to work with students on research projects that are expensive due to travel, field, lab, and/or analytical costs inherent in our discipline. One of our priorities (section VII) is to increase grant submittals.

Our donations to the Department vary from about $7,000 to about $34,000 per year over the last 6 years. The 2011-12 donations total is skewed by one gift of $25,000 to set up the David L. Willoughby Endowed Scholarship. Most of the rest of the donations are as gifts of up to $2200. One of our long-term goals is to work with University Advancement to increase donor giving.

B. Identify any special facilities/equipment used by the program/Department such as laboratories, computers, large classrooms, or performance spaces. Identify changes over last five years and prioritize needs for the future.

The Department of Geological Sciences includes classrooms, offices, and research labs that are located in the basement, 2nd, 3rd, 4th, 5th, and 6th floors of McCarthy Hall (MH) as well as the 1st and 2nd floors of Dan Black Hall (DBH).

Geology-controlled instructional classrooms:

- MH-341 – General classroom, seminars, faculty and club meetings
- MH-255 – Sed/strat, paleontology, Earth history courses
- MH-212 – Surface processes, hydrology, and Physical Geology lab courses
- MH-208 – Physical Geology lab (GEOL101L) courses
- MH-263 – Classroom with 28 Windows based computers. Utilized by courses that require heavy computer use – Geophysics, geochemistry, and other courses with computer applications on a regular basis (tectonics, hydrology, surface processes, and petrology courses)
- DBH203 – Earth Materials and Petrology courses

Special facilities include:

- DBH-205 - Rock Preparation Lab
- DBH-240 - ICP lab
- MH-333 - Mineral Separation Lab
- MH-259 - Department Technician Office
- MH-264F - Department Information Technology Office
- MH-6 - Field Supply Storeroom
- MH-3 - Rock crushing room
- MH-53 - Rock Storage Room
- MH-45 and 577 - Part-Time Faculty Offices and cubicles
- MH264F - Teaching Assistant Offices
- Faculty Research Labs – not listed separately, but these faculty research labs are essential to achieving the Retention, Tenure, and Promotion standards that require success in SCA (research).

Changes over the last five years: Over the past 5 years, the Department of Geological Sciences has focused its space changes on three major objectives: 1. the centralization of physical geology laboratory and core course classrooms; 2. the

improvement of faculty research lab space; and 3. the development of community office space for our MS teaching assistants.

1. **Centralization of Physical Geology Laboratory and Core Course Classrooms**. Until two years ago, all introductory Physical Geology laboratory (GEOL101L) classes were held in DBH-201. The DBH-201 lab was occupying two functioning fume hoods. As appropriate research lab space is difficult to find and expensive to renovate in McCarthy Hall, the Department realized that its best option for expanding their faculty research space was to reconfigure DBH-201 into two faculty research spaces (see next section).

Equally important, the faculty felt that the distance between the GEOL101L classes in DBH-201 and the Department's core facilities was not conducive to recruitment of its second largest population of potential geology majors (i.e., GEOL 101L; note: GEOL 101 is the largest population of potential geology majors). Thus we migrated the GEOL 101L classes into MH-208 and MH-212. Drs. Laton and Foster had previously used MH-208 as a shared research space. GEOL101 lab materials were moved to MH-208C for easy access to GEOL 101L classrooms. The transfer of GEOL 101L labs and materials to MH permitted the Department to expand the number of GEOL 101L course offerings by offering extra sections in MH-212 and MH-255 (Figure 12).

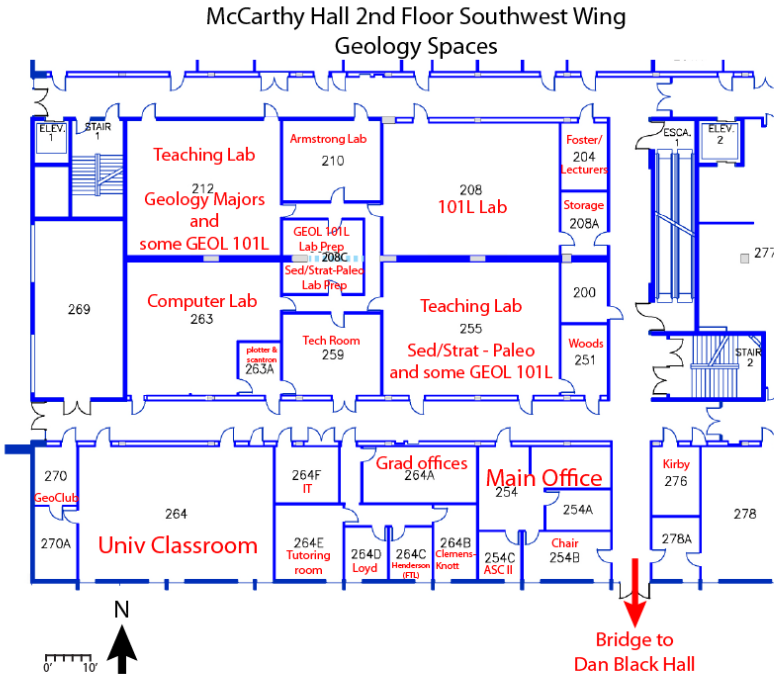

Figure 12. McCarthy Hall 2nd floor plan with geology rooms identified.

2. **Improve Faculty Research Laboratory Space**. The Department has managed to reconfigure and improve existing lab space and acquire new lab space.

- Dr. Woods moved his research lab into DBH-211, thus providing space for a mineral separation lab in MH-333.
- In 2007, the Department exchanged its old seminar room in MH-327 for a new room in MH-341. This change was done to accommodate the construction of a new teaching lab for Biology, but had the fortuitous consequences of creating an additional small room adjacent to MH-341. This new room, MH-341D, was given to Dr. Rhodes to serve as a field preparation lab. Dr. Rhodes had no research lab space previously, but still has very little usable lab space.
- Drs. Laton and Foster had previously used MH-208 as a shared research space; they vacated this space to accommodate the migration of GEOL 101L into McCarthy Hall. After Dr. Foster's retirement, Dr. Laton moved to a new office/lab complex for him in MH-452C/460/461.
- A new research lab space was acquired in DBH (175) for Dr. Kirby. This was a significant achievement for the Department, as it is the first geology research lab that is comparable in size and capability to the research labs available to faculty in other science Departments on campus. Dr. Kirby's old office/lab complex (MH-556) is now occupied by Dr. Parham.
- In summer 2013, DBH-201 (previous GEOL101L classroom) was remodeled into two research lab spaces for Dr. Knott and new faculty member Dr. Loyd. Dr. Knott's lab (DBH-201b) has an interior office that he now uses

as his faculty office. The remodel of 201 freed up Dr. Knott's research lab (MH-337) and his office (MH-327B), which will provide lab/office options for one of our 2014 new hires.

3. **Development of Community Office Space for our MS Teaching Assistants**. Through a combination of acquired space and vacated space (Dr. Carlson), the Department was able to provide permanent desk space in a shared office for our eight Department MS teaching assistants in MH-264A, and a joint tutoring space in MH-264E. TAs use their office cubicles in MH-264A to prepare course material, grade, and hold office hours. MH-264E is used to hold group office hours and tutorial sessions. A key focus in our long-term plans is to increase our number of TAs on a competitive basis and we anticipate needing additional space for our teaching graduate students.

Future priorities:

1. Move Dr. Woods research space from DBH-211 to DBH-241. Dr. Woods will utilize research lab (DBH-241) adjacent to the ICP lab (DBH-240), for which he is the primary user. He will also move his office from MH-251 to DBH-241A, which will free up office and lab space for one of our 2014 hires.

2. **Modify existing lab space and acquire additional lab space with requisite facilities** (e.g., fume hoods, deionized water, lab benches, workspaces, and up-to-date electrical options). We hope to hire at least four new faculty over the next 4 years (six if the 2014 hires are included). Critical to the success of these searches is the ability to offer new faculty appropriate research lab space. After the addition of our 2014 hires, the Department of Geological Sciences will be at research lab capacity. Therefore, a future priority must entail the acquisition of new research lab space. Priorities are:

- Remodel/modify MH-337, 333, 327B and DBH-211 for our two new hires in 2014. This may require minor modification of the wall between MH327B and 333 to include a door and more effective use of this lab cluster (summer, 2014).
- Acquisition and remodeling of space on the MH 3rd floor (Figure 13). As part of the current remodel of MH 6th floor for four new biology labs, the past dean (Koch) indicated that biology will give up space on the MH 3rd floor (MH-338, 340) for remodel to one or two geology labs. As part of this overall remodel, we also propose to modify the cluster of offices and labs including MH341A-D, 327A-D, 333, 337 into a two larger and more efficient research lab/office spaces. This would effectively displace two faculty offices and some part-time office space, but would generate much more usable student/faculty research space (Summer, 2015).
- Remodel MH-264E and 264F for research lab. Will need to find other location for IT staff, perhaps in MH-208A, and space accommodations for a joint tutoring space for our TAs (replace current MH264E). Will require removing the wall between the rooms and this space will not include fume hood. (Summer, 2015)
- Acquisition of additional lab space to accommodate at least one additional new hire. Space yet to be determined.
- Develop and utilize shared lab space for analytic equipment. Part of the long-term plan is to share space for new acquired analytic equipment, such as an ICPMS-LA instrument, in MH-77. Additional shared space with other NSM Departments should be discussed and planned.

Figure 13. Portion of 3rd floor of MH to be potentially modified.

VII. *Long-term Plans*

A. Summary of long-term plan, priorities, and outcomes metrics

The Department's goals, strategies, and potential outcomes and how they relate to CSUF and NSM goals are shown in detail in Appendix VI. Below, we further develop the goals with priorities and general metrics.

Goal 1. Support effective curricular and teaching strategies that continue to enhance student learning, retention, and time-to-degree.

Priority 1 – Maintain High-Impact Practices (HIP) through student-faculty research and field/lab experiences for students: Our Department historically has a strong commitment to HIP through student-faculty research and offering field and lab experiences to our students in most majors courses. We must support our teaching and research labs and field vehicle fleet. We have outgrown our mineralogy-petrology lab classroom, which currently holds 24 students. In the past, physical plant absorbed the cost of gas for vehicles, but starting 2013-14 those costs (up to $25,000/yr) will be transferred to Academic Affairs, the college, and the Department. The Department budget cannot handle these new costs. We also need to replace and add to our field and lab teaching equipment including microscopes, Brunton compasses, and GPS units. Our one computer teaching lab (MH263) has 31 ten-year-old Windows computers. These computers are heavily used by our students for class and research projects and will need to be replaced or upgraded (if even possible) over the next 2-3 years.

Metrics – Maintenance of well-stocked and supported teaching and student-used research labs. Increase student seating capacity for DBH-203 to 30 students. Maintenance of field vehicles. Purchase of at least one new field vehicle capable of transporting students and gear to class and research-related field sites. Acquisition of money to cover gas costs for course and research travel through state funds and grants. Inclusion of vehicle mileage fees at state rate for all grant and contract proposals. Purchase new microscopes, Brunton compasses, and GPS units to keep up with attrition and/or enrollment increases. Upgrade or replace all of the computers in our computer lab.

Priority 2 – Evaluation of B.A. in Earth Sciences program: We plan to assess the impact of the B.A. on the Department, including student recruitment and retention, faculty workload, and resource utilization. We are particularly focused on three aspects of the curriculum: 1) assessment of the appropriateness of GEOL 380 in the B.A. curriculum, and if necessary developing an alternative; 2) revision and modernization of the B.A. capstone courses (GEOL 470 – Environmental Geology and Planning, and GEOL 420 – Earth Science for Science Teachers), including the development of an effective B.A. program assessment instrument for those courses; and 3) restructuring of the Oceanography curriculum, perhaps including the division of the existing class (GEOL 333) into a lower-division GE course and an upper-division majors' course. This will depend on new faculty hires; the Department currently does not have a faculty member with expertise in Marine Geology/Oceanography. We are searching for a Coastal geologist in Spring 2014.

Metrics – Edits/changes to B.A. program that reflect assessment, advising, and curricular issues identified in last 3 years. Hire of at least one faculty member that teaches in the core of the B.A. program.

Priority 3 – Assessment of programs: We developed a pilot program to assess our B.S. in Geology program using the capstone thesis as the assessment tool (described earlier in section III). We also plan to utilize an additional capstone experience (GEOL481A – Geology Field Camp) as another assessment tool. For the B.A. program, our priority is to develop assessment strategies in the capstone courses (GEOL470 and 420 discussed above) or a new capstone course GEOL4XX. For the MS program, we will assess the thesis in a similar fashion to the B.S. assessment.

Metrics – Formation of Assessment Committee. Implementation of assessment program for all programs. Development of assessment plan with revamping of capstone courses to allow effective program assessment.

Priority 4 – Expand online course offerings: We currently offer one class completely online – GEOL310T – currently taught in Fall semesters and through UEE in summer and intersession. The most obvious area for growth is to develop an online version of GEOL 101 – Physical Geology. However, the Department has reservations about the impact this course would have on our ability to recruit students into our majors. Since 2000, less than 10% of geology majors entered the university as a declared geology major in their freshman year; geology majors overwhelmingly discover the degree through an engaging experience in lower division geology courses (GEOL 101, 110T, 140). The Department is concerned that a move to online teaching in the introductory courses would pose a serious risk to our ability to recruit new students.

Metric – Offer one online GEOL101 course per year.

Goal 2. Improve community outreach and undergraduate student recruitment

Priority 1 - Recruitment of new majors: Even though we've seen substantial growth in majors since last PPR, a top priority is to attract new majors (B.A., B.S.). In addition to continuing and strengthening our relationships with key offices within CSUF (notably Academic Advising and Freshman Programs), we plan to expand our reach through more effective use of social media and utilization of course pathways (clustering of courses around a theme, such as sustainability). Growth comes at considerable expense as we outgrow the capacity of our major's course class/lab rooms and full-time faculty workloads.

Metric – Increase number of majors (B.S.+B.A.) by 25% over end of Fall 2013 numbers.

Priority 2 – Alumni outreach: The Department plans to foster interactions with our alumni to increase philanthropic fund raising, enhance employment opportunities for students, and foster community relations. Earlier attempts to create a Geology Advisory Board were not successful; although there was interest among alumni and friends of the Department in creating a support structure, the nature of an Advisory board was too narrowly focused to accomplish our goals. As an alternative, we plan to explore the development of an Alumni Club that would provide alumni with an opportunity to network with other alumni, faculty, and students in a less formal setting. We plan to introduce an Annual Alumni Reception, Alum-of-the-year award, and expand on and grow the influence and scope of our Department newsletter.

Metrics – Develop Alumni Club, hold Annual Alumni Reception each year, and give annual Alum-of-the-year award. Increase alumni giving by a minimum 10% so that annual average giving over 7 year period is $20,000 per year.

Priority 3 - Leverage the Cooper Center to continue and expand outreach activities: We will expand the CC activities to local K-12 schools and community colleges. The Department received an NSF Opportunities for Enhancing Diversity in the Geosciences (OEDG) planning grant in 2012 to support the creation of an intern program in paleontology for high school and community college students in local schools to participate in research activates at the Cooper Center. This program, called Building Opportunities for New Experiences in Science – Project BONES, would have represented a significant opportunity to both recruit new majors and expand the number of underrepresented and underserved students in the geosciences at CSUF. Project BONES has generated strong interest from local high school and community colleges. Unfortunately, NSF announced in late 2012 that it has suspended the OEDG program. An important goal for the Department will be to search for alternate funding sources for Project BONES, either through NSF or private sources. Given the visibility of the Cooper Center in Orange County and within the university's Philanthropic Foundation, we believe Project BONES could be an outstanding candidate for significant philanthropic support.

Metrics – Funding for Project BONES or similar project. Hold at least two collaborative events with Cooper Center per year. Increase Cooper Center research opportunities for students.

Goal 3. Strengthen M.S. Program

Priority 1 – Increase the TA support for MS students: In the last 5 years the Department has strengthened its nationwide recruiting efforts by enhancing existing TA packages so that the salary we can offer to the our top candidates is competitive to other top graduate programs in southern California. This has had an impact on the quality of our graduate applicants, and has attracted students from across the country. However, the number of GEOL 101L lab sections limits the number of TA packages we can offer. At present we only have one lab room dedicated to GEOL 101L, limiting us to 18 three-hour sections per week. This in turn limits us to supporting only six fully funded TAs at a time. One way to increase the number of 101L sections is to use our existing space more effectively. However, given the number of available lab rooms, this can at most 2-4 additional sections per semester. A more satisfactory solution would be to obtain another lab room dedicated to GEOL 101L. The Department currently serves about 1100 students per semester in GEOL 101, but have an average of 550 seats available in GEOL 101L; nearly all the 101L sections fill and have wait lists. In addition, our growth in majors is putting increasing pressure on teaching our lab-intensive core courses; we plan to start including graduate TAs in the lab and field portions of these courses. Thus, we believe there will be sufficient demand to justify the expansion and its attendant growth in TA positions.

Securing a stable long term funding model for our TA students is also a priority for the Department. The success of our recruiting has been predicated on a significant increase on the funding rate for the TAs. As financial resources of the Department continue to decline, obtaining an alternative source of funding for the TA program is increasingly important. One strategy may be to partner with local community colleges to identify teaching opportunities for students. We are also seeking ways to fund additional students for work associated with the Cooper Center.

Metrics – Obtain and develop another lab space for GEOL101 labs. Fund at least two additional (for total of 8) graduate students through TA offers. Develop new models to fund our MS students, probably through combined TA/GA packages, as we start to include them more effectively in our majors' courses. Increase 3-year graduation rate.

Priority 2 – Increase TA office space: Increased numbers of TAs require space for course prep work and for office hours. We currently have one "bullpen" office for our TA's and a common instructional room, but the bullpen room is at capacity.

Metric – Open one new "bullpen" office for graduate students.

Goal 4. Encourage High Quality Scholarly and Creative Activities

Priority 1 – Maintain student-faculty research capabilities: One of the Department's greatest strengths has been a strong emphasis on student-faculty research; our B.S. in Geology is distinctive as one of the only undergraduate programs in the university to require all majors to complete a full undergraduate thesis based on original research. However, increasing numbers of majors and decreasing FT faculty places significant time and resource constraints on our faculty. A main part of the CSUF strategic plan is to enhance HIPs such as undergraduate research.

Metric – All B.S. and MS students complete thesis project. Develop incentives to spread the thesis advising loads so that some faculty are not advising too many.

Priority 2 – Enhance faculty research space: A significant obstacle to maintaining or increasing SCA output has to do with research lab space. The combination of (1) retiring faculty who did not need research space who will be replaced by exciting, energetic new faculty who do need significant research space; (2) higher research expectations than in the past per our revised Department personnel standards; and (3) increased numbers of students involved in HIP research projects leads to substantially increased research space needs; this is especially true as our Department competes against other institutions for excellent faculty candidates.

Metrics – Sufficient space (size and capabilities) for all new faculty. Increased function and size of research lab space for at least one existing faculty member who can demonstrate the need.

Priority 3 – Enhance funding opportunities: Funding levels for traditional external funds (mostly NSF) are lower than ever. We will strive to provide opportunities for our faculty to apply for as many grants as possible via grant writing release time and Department/college/university incentive funds. We also plan to enhance our philanthropic fund raising efforts to augment student-faculty research money.

Metric – 25% increase (over 2013) in numbers of grants submitted. At least one institutional grant (i.e., NSF-CREST) submitted.

Goal 5. Recruit and retain faculty and staff

Priority 1 – faculty recruitment: A critical issue for the Department in the next six years will be faculty recruitment. Strong growth in geology majors and overall FTES during the review period has coincided with an overall decrease in the number of faculty – see sections II.D. and IV.A. The decline in tenure-track is particularly significant as the Department has lost expertise in volcanology, engineering geology, geophysics, and science education. In addition, each year at least one faculty member will be on sabbatical or difference in pay leave. Not only does this negatively impact our ability to offer key courses for our undergraduate majors and staff important committees, the reduced number of faculty available to supervise theses puts strain on the remaining faculty. When combined with the increase in geology majors, there has been a near doubling in the annual number of theses per faculty needed to keep up with undergraduate student demand. The demand for research mentoring has overburdened not only faculty workload, but also the capacity of our physical lab facilities. The Department should increase to 17 tenure-track faculty (plus 1 full-time lecturer) to fill the academic and discipline needs. Assuming the Department allocates 75% of its FTEF to tenure-track faculty, this would require the Department increasing to 22.6 FTEF. This can be accomplished by expanding to 535 FTES (very unlikely given that we have saturated the service needs of our GE courses across the University) under the 2012-13 Student Faculty Ratio (SFR) of 23.6, or by holding the 2013-14 FTES target constant at 430 and reducing the SFR to 19.0 (similar to the Department's SFR in 2009 and that of CNSM).

Faculty recruitment will be targeted to strengthen the Department's presence in existing and planned interdisciplinary research centers within the college and university. The Department already plays a leadership role in the John D. Cooper Center for Archaeology and Paleontology, with one recent hire (Dr. Parham) dedicating 1/3 of his time to work involving the CC. The Department will participate in the new Center for Computational and Applied Mathematics through planned future hire in geophysics. Finally, we anticipate that the planned Center for Environment, Resources and Sustainability and potentially the CSU Ocean Science Institute planned AltaSea project will have strong participation by faculty from the Department.

Metric – Hire six new faculty members as outlined in section IV.

Priority 2 - Support staff excellence: Our four full-time staff members are a major Departmental strength. A priority is to promote our excellent staff in order to retain them and therefore maintain Department cohesiveness. In particular, we

need to promote our current Administrative Support Assistant (from ASA-I to ASA-II) and support promotions within rank of other staff members. We also want to maintain the ability of staff to teach as part-time lecturers in our Department – we currently have one staff member teaching a GEOL101L.

Metrics – Promotion of two out of four Department staff members. Work with Dean and HR to allow at least one staff member to teach one section per semester.

B. Long-term budget in support of long-term plan and priorities.

Below we outline the expected cost estimates for new "budget" items in our long-term priority list. Decreased budgets due to limited state, University, and College resources over the last 6 years has severely limited general operating expenses (excluding equipment and service expenses for new faculty start-up packages) and has led to the decline of maintenance and/or replacement of Department teaching equipment such as microscopes and field equipment. Likewise, staff have not been promoted or given raises. New CSUF strategic plan-driven mandates will mean that considerable time be given to assessment and advising duties. The cost estimates below are fiscally modest but reflect some of the needs to meet our priorities – however as our Department grows in terms of majors, our basic operating expenses will likewise increase, especially in terms of meeting part-time faculty blanket for TAs to assist in pedagogically sound lab courses and maintain safe and effective field instruction.

Goal 1. Support effective curricular and teaching strategies that continue to enhance student learning, retention, and time-to-degree.

Priority 1 – Maintain HIP through student-faculty research and field/lab experiences for students:

Renovate DBH-203: $25,000. Remove front pedestal and side cabinets to make space for additional table seating for students in Earth Materials and petrology courses.

Vehicles: $100,000. We will need to purchase two new vehicles ($50,000 each) over the next 7 years as our program grows and with vehicle attrition.

Microscopes: $75,000. We require 10 new scopes ($7500 ea) to replace broken scopes and keep up with student growth in mineralogy, petrology, and sed/strat courses.

Field equipment (Compasses, GPS): $9,750. We require at least 15 new Brunton compasses ($450 ea) and GPS units ($200 ea) to replace lost/broken units and to keep up with growth.

Computers: $40,000. Replace 31 Windows computers and monitors ($1300 ea).

Computer tables in computer lab: $20,000. Retractable computer tables/desks.

Vehicle gas: $25,000/yr base funding. If gas purchases will be coming from Department budgets, then a base allocation will be required in order to continue our field-based HIPs.

Priority 2 – Evaluation of B.A. in Earth Sciences program:

No anticipated extra costs

Priority 3 – Assessment of programs:

Assigned time: 3 WTU/year = $4800/year. One faculty member will be given release time each year to initially evaluate and institutionalize assessment of our programs, then organize/perform annual assessments.

Priority 4 – Expand online course offerings:

Assigned time: 3 WTU = $4800. Prior to spending Department allocations, we would encourage interested faculty to apply to other funding sources such as CSUF's eFellows program for release time.

Goal 2. Improve community outreach and undergraduate student recruitment

Priority 1 - Recruitment of new majors:

No anticipated direct costs to Department for recruitment efforts. We will utilize IDC and philanthropic funds for outreach efforts (seminars, posters, etc). There will be costs associated with potential growth, such as need for equipment and vehicle expenses outlined in Goal 1-Priority 1 above. Continued growth will require additional part-time faculty support (for part-time faculty and teaching assistants) to cover additional sections and/or larger lab sizes.

Priority 2 – Alumni outreach:

No anticipated costs to Department. We will utilize philanthropic and IDC funds for alumni outreach efforts.

Priority 3 - Leverage the Cooper Center to expand outreach activities:
No anticipated costs to Department. We will utilize philanthropic and IDC funds for alumni outreach efforts.

Goal 3. Strengthen M.S. Program
Priority 1 – Increase the TA support for MS students:
Obtain and renovate new GEOL101L room: cost unknown.
Increase number of competitive TA packages per year by two: $42,000/yr. We plan to offer two additional competitive TA packages (up from 6 currently). These TAs will teach GEOL101L sections and labs/field experiences in major's courses as we grow. This will increase our part-time faculty blanket expense. We will investigate TA salary packages that are in line with TA salaries in other NSM lab classes.

Priority 2 – Increase GA-TA office space:
Set up of TA office: $40,000 (at typical current university costs). General reconfiguring and equipping with office desks and other needs. Assumes Department can acquire additional space or convert existing space.

Goal 4. Encourage High Quality Scholarly and Creative Activities
Priority 1 – Maintain student-faculty research capabilities:
No anticipated direct costs to Department other than those mentioned in Goal 1-Priority 1 and Priority 2 below.

Priority 2 – Enhance faculty research space:
Lab space for new faculty: costs unknown. The costs are unknown at this time and will depend on new faculty needs and be part of faculty start-up packages. As we continue to have higher SCA expectations from existing faculty and continue to hire new faculty, there should be an active dialogue within the college about space sharing and distribution. Projects we envision include the remodel of MH 3rd floor space and the conversion of MH264E/F to usable lab space as discussed in section VI.B above.

Priority 3 – Enhance funding opportunities:
No anticipated direct costs to Department. However, we expect our faculty to explore release time funding possibilities through the University and College. Faculty should work with the University and College funded Scientific Writing and Grant Support Specialist (currently Dr. Chandra Srinivasan) to more effectively pursue funding opportunities.

Goal 5. Recruit and retain faculty and staff
Priority 1 – faculty recruitment:
Start-up, new faculty release time: costs vary. We plan to hire six new faculty over the next six years. Each of these will have associated start-up costs depending on discipline. Current start-up costs are about $100,000 per new faculty in Geology, excluding lab remodel costs.
Faculty search costs: $5000/search. Includes advertising and interview costs.

Priority 2 - Support staff excellence:
Promotion of Instructional and Administrative Support staff: $4000/yr. We hope to give 5% minimum base pay raises to two staff members.

VIII. *Appendices Connected to the Self-study*

Attached PDF files