WSU Five-Year Program Review
Self-Study
2007-2012

DEPARTMENT OF GEOSCIENCES
COLLEGE OF SCIENCE

Department/Program: GEOSCIENCES

Semester Submitted: FALL 2012

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1. Introduction

The Department of Geosciences is one of seven departments within the College of Science. It provides undergraduate education in geology and geospatial methodologies (remote sensing and geographic information science) for students wishing to complete the following degrees: Bachelor of Science in Geology; Bachelor of Arts in Geology; Bachelor of Science in Applied Environmental Geoscience; and Bachelor of Science in Earth Science Teaching. The department supports other degree programs on campus by providing minor programs of study in geology, Earth science teaching, and geospatial analysis, and geoscience emphasis areas for students pursuing a Bachelor of Integrated Studies (BIS). An institutional certificate in geomatics (applied mapping sciences) is also offered. The department also provides service courses for other majors and minors, including the Bachelor of Science in Construction Management Technology (CMT Department, College of Applied Sciences & Technology), Bachelor of Science in Geography (Geography Department, College of Social and Behavioral Sciences), Environmental Studies Minor (interdisciplinary), and the Urban and Regional Planning Emphasis (College of Social and Behavioral Sciences). Lastly, the Department of Geosciences supports the broader mission of the University by providing physical-science general-education courses for all students and by engaging the local community through geoscience-related outreach activities and responses to public inquiries.

Unique features of the department's programs include the integration of a traditional geology curriculum with course work in the emerging field of geospatial technologies at the undergraduate level, an emphasis on field-based learning, robust support for undergraduate research, and a cost-effective summer field camp for geology majors. We are particularly proud of our accomplishments in the area of undergraduate research. In the past five years, 26 students associated with the Department of Geosciences (majors and minors) participated in undergraduate research projects, resulting in 20 presentations at major scientific conferences (see Section 4.6 and Appendix G). Faculty members also encourage and support geoscience-related extracurricular activities and the department is the home to a very active Geosciences Club and Sigma Gamma Epsilon chapter (national honor society for geoscience students).

Students are the primary focus of our program. Total student credit hours (SCHs) taught by Geosciences ranged between 4,386 and 5,338 over the last 5 years (Appendix A). The variation in hours roughly correlates with overall university enrollment trends. In detail, SCHs from online classes have increased, with online classes consistently filling very quickly during registration. However, we cannot expand class size nor add more online sections without additional faculty. Based on data provided to the department by the Office of Institutional Research, the total number of majors in the department varied between a low of 54 (2009-2010) to a high of 78 last year (2011-2012, Appendix A), representing a 24% increase over the 5-year period. Based on data obtained during Fall Semester 2012, the department currently has 83 majors, up 6% from the previous year (2011-2012). The distribution of majors in our various degree and certificate programs is currently:

Geology (BS/BA):	37
Applied Environmental Geoscience (BS):	33
Earth Science Teaching (BS):	13
Geomatics (Institutional Certificate):	7

We had a total of 39 graduates over the last 5 years, averaging 7.8/yr (Appendix A). Although there were significant fluctuations between years, no clear trend is apparent. We are anticipating 14 graduates this academic year (2012-2013). We think the relative stability in the number of graduates and the increase in the number of majors over time is related to our emphasis on environmental and geospatial applications, where job opportunities continue to be strong. The number of Earth Science Teaching majors has roughly doubled since the early 2000s, as the demand for qualified science teachers has become very high. We also plan to make students aware of increasing opportunities in the petroleum and mining industries, which may lead to increased numbers of majors in the future. Of our 39 recent graduates (2007-2012), 16 are employed in geotechnical, geospatial, or other geologic areas, 3 continued on to pursue advanced degrees, and 8 are employed as Earth science teachers (Appendix J).

Lastly, the Department of Geosciences, along with the rest of the College of Science, is looking forward to moving to a new science building within the next 6 to 8 years. A new science building is the highest construction priority for the university and the administration has been working hard to make the case and to secure funding from the state legislature. It is hoped that approval will be granted during the next legislative session in early 2013. Planning for this much-needed improvement in space and facilities underlies many aspects of this report as the department looks to its future.

2. Mission Statement

Last update: 1/17/12

The mission of the Department of Geosciences is to provide quality undergraduate education in the sciences concerned with the Earth. We seek to provide an enriched learning environment through extensive interaction between faculty and students, with an emphasis on field studies and technology-enhanced data collection and analysis. The Department offers programs in geology, applied environmental geosciences, Earth science teaching, and geospatial analysis that provide students with the essential knowledge and skills needed to qualify them for employment or graduate education. The Department also contributes to the broader mission of the University by providing general education courses that enhance student awareness, appreciation, and understanding of the physical environment and the scientific process, as well as the relevance and role of the geosciences in the world today. In order to promote faculty vitality, increase scientific knowledge, and engage students in the scientific process, the Department encourages faculty to engage in basic and applied research. Faculty members also provide professional expertise in the geosciences to the community, local schools, and government agencies. We seek to continue building a solid base of personnel and facilities to maintain high quality, up-to-date programs that meet the educational needs of our various constituencies.

3. Curriculum

3.1 Types of Degrees Offered

The Department of Geosciences offers four degrees and one institutional certificate:

• Geology BS -- 44 credit hours of required geoscience courses, 25 credit hours of required support courses, 2 options (minor/no minor).

• Geology BA – 37 credit hours of required geoscience courses, 14 credit hours of required support courses, 2 options (minor/no minor).

• Applied Environmental Geosciences BS – 50 credit hours of required geoscience courses, 34 credit hours of required support courses, no minor required.

• Earth Science Teaching BS – 42 credit hours of required geoscience courses, 28 credit hours of required science support courses, 24 credit hours of required education courses, and 9 credit hours of required education support courses, no minor required.

• Geomatics (Applied Mapping Sciences) Institutional Certificate – 16 credit hours of required geoscience courses and 6 credit hours of required computer science courses.

3.2 Types of Minors Offered

The Department of Geosciences offers 3 minors:

• Geology Minor – 19 credit hours of required geoscience courses.

• Geospatial Analysis Minor – 20 credit hours of required geoscience courses.

• Earth Science Teaching Minor -- 20 credit hours of required geoscience courses.

The three minors listed above may also be used as one of the three required emphasis areas for students pursuing a Bachelor of Integrated Studies (BIS).

3.3 Number and Types of Courses Offered

The Department of Geosciences has 45 different courses listed in the university catalog, 14 at the lower-division level (freshman/sophomore) and 31 upper-division (junior/senior) courses. Approximately 38 of these are offered on a regular basis (Appendix H). Several courses allow different topics to be offered each time they are taught (i.e., GEO 4750 - Special Topics, GEO 2950/4950 – Geoscience Field trips, and GEO 2920/4920/5920 -Short Courses, Workshops, Institutes, & Special Programs). These more open-ended and flexible courses provide needed curricular flexibility, take advantage of faculty expertise and interest, and respond to student and campus/community demand. Several variable-credit

courses are used to support undergraduate research (GEO 4800 – Independent Research and GEO 4970 – Senior Thesis) or cooperative work/learning experiences (GEO 2890/4890 – Cooperative Work Experience).

The Department of Geosciences supports the **General Education** program at Weber State University by offering five (5) courses that may be used to satisfy the Physical Science (PS) breadth requirement for graduation:

GEO 1030 PS Earthquakes and Volcanoes
GEO 1060 PS Environmental Geoscience
GEO 1110 PS Dynamic Earth: Physical Geology
GEO 1130 PS Introduction to Meteorology
GEO 1350 PS Principles of Earth Science (geology and meteorology for Elementary Education majors)

Three of the department's general education classes are regularly offered in an **online** format through *WSUonline*, a comprehensive distance-learning program managed by the Continuing Education office on campus: GEO 1030 PS Earthquakes and Volcanoes**;** GEO 1060 PS Environmental Geoscience; and GEO 1110 PS Dynamic Earth: Physical Geology. Typically, our online offerings reach maximum enrollment early in the registration period.

Each degree program, with the exception of the Geology BA, has a designated **capstone** course in which the students are expected to apply the knowledge and methods learned in previous courses in applied, scenario-based projects or student teaching. The capstone course for geology (BS) majors is GEO 4510 – Geology Field Camp. Our field camp is different from traditional field camps in that we use a combination of local projects (students spend their evenings at home) and remote projects, where the students are camping during a multi-day assignment. This format has allowed us to keep the cost and duration (4 weeks) of summer field camp in check, which have greatly benefited our non-traditional majors (working, married, with children). We offer field camp every other summer, in a cooperative effort with the Department of Geology at Utah State University (Logan, UT). GEO 4060, Geoscience Field Methods, functions as the capstone course for the applied environmental geosciences (BS) majors. It emphasizes the collection and analysis of field data for a variety of geoscience applications and culminates with a group project that models a geologic hazards site assessment. The Earth Science Teaching majors typically spend their last semester prior to graduation student teaching in a local school, for which they receive academic credit (EDUC 4940 & 4950); this is a very authentic and demanding capstone experience.

3.4 Curricular Changes Since 2007

Two substantial curricular changes have been implemented since the 2007. First, all of the secondary education majors across campus were evaluated and revised during the 2006-2007 academic year, with new requirements taking effect Fall Semester 2007. Prior to the revision, secondary education majors were required to 31 credits hours of professional education courses, offered by the Department of Teacher Education, that were delivered in

course blocks over 3 semesters. This was in addition to the major requirements within their content field which were typically on the order 36-45 credit hours. The Department of Teacher Education, with substantial input from the content departments, changed the requirements for licensure to 24 credit hours delivered in course blocks over 2 semesters, substantially streamlining the secondary education degrees. During the second semester of the licensure program secondary education majors are off campus, student teaching in a local school. We think this change has been very beneficial to our Earth Science Teaching majors, allowing them an additional semester in the Geosciences learning community. In addition, the credit-hour reduction on the education side allowed the College of Science to develop two upper-division courses (GEO 3570 – Foundations of Science Education & GEO 4570 – Secondary School Science Teaching Methods) specifically focused on science pedagogies. These courses, cross listed by all the science departments, are taught by a faculty member in the Department of Physics whose research and teaching expertize is in the areas of science education and teacher preparation.

The second curricular changed involved all the Bachelor of Arts degrees across campus. Prior to the 2011-2012 academic year, the requirements for most BA degrees were basically the same as those for the corresponding Bachelor of Science degree, with the additional requirement of competency in a foreign language. Thus, the BS degree was seen as the "easier" degree and became the default degree selected by most students – even in disciplines such as English and Theatre Arts. A subcommittee of the university-level Curriculum Committee studied this issue and had every department reexamine its BA and BS degrees in comparison to national norms. The Department of Geosciences took this opportunity to revise its Bachelor of Arts in Geology, reducing the required credit hours in both required geoscience courses and required science support courses and providing more flexibility in the choice of electives. We think our new BA degree is an excellent "liberal arts & sciences degree for the 21st century" and would be excellent undergraduate preparation for pre-law, pre-business, and pre-military students. Currently, approximately 5 out of our 36 geology majors (14%) are pursuing the new BA degree, as opposed to the traditional BS degree.

Recognizing that a basic knowledge of GIS and computer mapping technologies has become expected of geoscience graduates by both employers of entry-level geoscientists and geoscience graduate school programs, the Department of Geosciences decided in fall 2012 to make its GEO 4210 (Introduction to Computer Mapping and GIS) a required class for both the geology BS and applied environmental geoscience BS degrees. This program revision was working through the Curriculum Committee process at the time this self-study report was being prepared.

4. Student Learning Outcomes and Assessment

4.1 Measureable Program-Level Learning Outcomes

At the end of their program of study in the Department of Geosciences, our graduates will have a set of basic intellectual skills that they can apply to a variety of situations and will have a knowledge and understanding of core concepts in the geosciences.

• BASIC SKILLS -- Graduates will:

1. be able to collect data, apply algebraic and graphical techniques to analyze data, and interpret results. **{Problem-Solving Skills}**

2. be able to clearly express geoscience concepts orally and in writing, present results from laboratory and field investigations, and effectively incorporate appropriate maps and graphs into presentations and reports. **{Communication Skills}**

3. be proficient in the use of appropriate technologies – including basic computer skills (word processing, spread sheets), geospatial skills (GPS, accessing geospatial databases), and information technology (search, compile, and evaluate information from scientific literature and web resources). **{Technology Skills}**

• GEOSCIENCE SKILLS – Graduates will:

4. be able to identify common minerals and rocks, describe rock characteristics, and interpret the environments/conditions (igneous, sedimentary, or metamorphic) in which rocks formed. **{Earth Materials}**

5. be able to identify major physical and biological events in Earth history and describe the methods used to interpret this history, including radiometric dating, fossil succession, and stratigraphic correlation. **{Earth History}**

6. be able to identify landforms from maps and imagery, construct topographic profiles, and interpret the development of landforms in terms of common surface processes. **{Surface Processes}**

7. be able to identify the different types of lithospheric plate boundaries based on types of activity, estimate rates of plate motion, describe the driving mechanisms for plate tectonics, and interpret geologic structures and construct cross sections from geologic map data. **{Tectonic Processes}**

8. be able to describe key geological cycles – including the hydrologic cycle, rock cycle, and carbon cycle. **{Earth Systems}**

9. have demonstrated an understanding of scientific methodology and the interdisciplinary nature of the geosciences, culminating in a capstone experience involving collection and analysis of multiple data sets to interpret Earth processes. **{Capstone Experience}**

4.2 Curriculum Map

Core Courses in the Geosciences Department	Department Learning Outcomes (DLOs)								
	LO 1: Problem-solving Skills	LO 2: Communication Skills	LO 3: Technology Skills	LO 4: Earth Materials	LO 5: Earth History	LO 6: Surface Processes	LO 7: Tectonic Processes	LO 8: Earth Systems	LO 9: Capstone
GEO 1110 Dynamic Earth: Physical Geology	I	I		I	I	I	I, A	I	
GEO 1115 Physical Geology Lab	I			E		I	I		
GEO 1220 Historical Geology	I	I	I		E, A		R	E, A	I
GEO 2050 Earth Materials		I	I	E, A					
GEO 3150 Geomorphology	R	E	I		R	E, A	R	R	I
GEO 3550 Sedimentology & Stratigraphy	E	E, A	R	E	R		R	R	I
GEO 4210 Computer Mapping & GIS	R	R	E, A						
GEO 4060 Geoscience Field Methods	E, A	R	R	R	R	R	E, A		E, A

Note: I = introduced; E = emphasized; R = reinforced; A = comprehensively assessed

4.3.1 Evidence of Learning: Courses within the Major: GEO 1110 PS

Evidence of Learning: Courses within the Major: GEO 1110 PS Dynamic Earth: Physical Geology					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 7: **Tectonic Processes**	Measure 1: A set of multiple-choice questions from Exam 2 related to the different types of tectonic plate boundaries	Measure 1: 70% of students will score at the 70% level	Measure 1: 72% of students scored 70% or better (Fall 2012, n=73)	Measure 1: Although the threshold was met, the results are bimodal	Measure 1: Improve review materials & develop an additional homework assignment that assess this outcome
	Measure 2: Homework assignment related to the theory of plate tectonics	Measure 2: 70% of students will score at the 70% level	Measure 2: To be developed and implemented in Fall 2012	Measure 2:	Measure 2:

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information: (1) This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Fall 2012 semester.

(2) This course is both a general education course and a required course for geoscience majors. Thus the interpretation of any assessment measure will be more complex than for the other courses within the major that generally do not include non-majors.

(3) In addition to comprehensively addressing and assessing department learning outcome #7, this course also addresses department learning outcomes 1, 2, 4, 5, 6, and 7 at an introductory level.

4.3.2 Evidence of Learning: Courses within the Major: GEO 1220

Evidence of Learning: Courses within the Major: GEO 1220 Historical Geology					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 5: **Earth History**	Measure 1: A set of laboratory exercises that have the students apply the basic principles of stratigraphic interpretation	Measure 1: 70% of students will score at the 70% level or better	Measure 1: 95% of the students scored 70% or better on the lab exercises (Spring 2012, n=26)	Measure 1: Students successfully demonstrated a working knowledge of the principles used to reconstruct the history of the Earth	Measure 1: No curricular or pedagogical changes needed at this time
	Measure 2: A set of multiple-choice and short answer questions related to specific events in Earth's history	Measure 2: 70% of students will score at the 70% level or better	Measure 2: 64% of students scored 70% or better on the exam questions (Spring 2012, n=26)	Measure 2: This particular class scored slightly below the threshold	Measure 2: Instructor will develop additional review exercises
Learning Outcome 8: **Earth Systems**	Measure 1: A set of laboratory exercises that analyze data related to key geological cycles	Measure 1: 70% of students will score at the 80% level or better	Measure 1: 80% of students scored 80% or better on the lab assignments (Spring 2012, n=26)	Measure 1: Students successfully demonstrated a working knowledge of the key geological cycles	Measure 1: No curricular or pedagogical changes needed at this time

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information:

(1) In addition to comprehensively addressing and assessing department learning outcomes 5 & 8, this course also addresses department learning outcomes 1, 2, 3, and 9 at an introductory level, and functions to reinforce learning outcome 7.

4.3.3 Evidence of Learning: Courses within the Major: GEO 2050

Evidence of Learning: Courses within the Major: GEO 2050 Earth Materials					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 4: **Earth Materials**	Measure 1: Students will observe and clearly describe in written form the physical properties and mineral content used to classify rocks	Measure 1: 60% of the class will correctly describe the properties seen in a group of igneous and metamorphic rocks at the 80% level or better	Measure 1:	Measure 1	Measure 1
	Measure 2: Students will recognize the properties of minerals and use those properties to correctly	Measure 2: 60% of students will correctly identify 40 unknown minerals such that they have a score of 80% or better	Measure 2:	Measure 2:	Measure 2:

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information: (1) This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Fall 2012 semester.

(2) In addition to comprehensively addressing and assessing department learning outcome 4, this course also addresses department learning outcomes 2 and 3 at an introductory level.

4.3.4 Evidence of Learning: Courses within the Major: GEO 3150

Evidence of Learning: Courses within the Major: GEO 3150 Geomorphology					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 6: **Surface Processes**	Measure 1: A set of 25 questions from the Lab Final Exam related to identifying landforms and dominant geomorphic processes	Measure 1: 70% of students will score at the 70% level or better	Measure 1: 89% of students scored at the 70% level or better (Fall 2011, n=9)	Measure 1: Students demonstrated competency with respect to surface processes.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: A set of problems from the Lab Final Exam related to basic map skills	Measure 2: 70% of students will score at the 70% level or better	Measure 2: This measure will be implemented Fall 2012	Measure 2:	Measure 2:

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information:

In addition to comprehensively addressing and assessing department learning outcome 6, this course also addresses department learning outcomes 3 and 9 at an introductory level, emphasizes learning outcome 2, and reinforces learning outcomes 1, 5, 7, and 8.

4.3.5 Evidence of Learning: Courses within the Major: GEO 3550

Evidence of Learning: Courses within the Major: GEO 3550 Sedimentology & Stratigraphy					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 2: **Communication Skills**	Measure 1: Students will effectively communicate geoscience concepts in written form (term paper)	Measure 1: 80% of students will score 70% or better on the term-paper grading criteria	Measure 1: 75% of students scored 80% or better On the term paper assignment	Measure 1: Class average was slightly below threshold (Spring 2012, n=11)	Measure 1: In the future the instructor will require students to prepare a preliminary outline for their paper
	Measure 2: Students will effectively communicate geoscience concepts in an oral presentation	Measure 2: 80% of students will score 70% or better on the oral-presentation grading criteria	Measure 2: Oral presentation will be assessed separately beginning Spring 2013	Measure 2:	Measure 2:

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information:

In addition to comprehensively addressing and assessing department learning outcome 2, this course also addresses department learning outcome 9 at an introductory level, emphasizes learning outcomes 1 and 4, and reinforces learning outcomes 3, 5, 7, and 8.

4.3.6 Evidence of Learning: Courses within the Major: GEO 4210

Evidence of Learning: Courses within the Major: GEO 4210 Intro to Computer Mapping & GIS					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 3; **Technology Skills**	Measure 1: Students will propose a research project that uses appropriate geospatial technologies (project proposal)	Measure 1: 80% of students will score 75% or better on the proposal grading criteria	Measure 1:	Measure 1:	Measure 1
	Measure 2: Students will demonstrate basic geospatial competencies by completing the research project and final report	Measure 2: 80% of students will score 75% or better on the final report grading criteria	Measure 2:	Measure 2:	Measure 2:

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information: (1) This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Fall 2012 semester.

(2) In addition to comprehensively addressing and assessing department learning outcome 3, this course also reinforces learning outcomes 1 and 2.

4.3.7 Evidence of Learning: Courses within the Major: GEO 4060

Evidence of Learning: Courses within the Major: GEO 4060 Geoscience Field Methods					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 1: **Problem-solving skills**	Measure 1: Students will prepare a field report that includes graphs and calculations	Measure 1: 90% of the students will score at the 70% level or better	Measure 1:	Measure 1:	Measure 1
Learning Outcome 7: **Tectonic processes**	Measure 1: Students will prepare a field report that includes the analysis of folded & faulted strata, a cross section, and simple structural analysis	Measure 1: 90% of the students will score at the 70% level or better	Measure 1:	Measure 1:	Measure 1
Learning Outcome 9: **Capstone Experience**	Measure 1: Working in groups, students will conduct a hazards assessment and prepare a final project that simulates a geotechnical consulting report	Measure1: 90% of the students will score at the 80% level or better	Measure 1:	Measure1:	Measure1:

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information: (1) This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Fall 2012 semester.

(2) In addition to comprehensively addressing and assessing department learning outcomes 1, 7, and 9; this course functions to reinforce learning outcomes 2, 3, 4, 5, and 6.

4.4 Measureable General-Education Learning Outcomes

All of the Physical Science breadth-area courses are designed to meet the following university-level, general-education learning outcomes. Students will demonstrate their understanding of the general principles of science:

1. Nature of science -- Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.

2. Integration of science -- All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.

3. Science and society -- The study of science provides explanations that have significant impact on society, including technological advancements, improvement of human life, and better understanding of human and other influences on the Earth's environment.

4. Problem solving and data analysis -- Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.

• Students will demonstrate their understanding of the following features of the physical world:

5. Organization of systems -- The universe is scientifically understandable in terms of interconnected systems. The systems evolve over time according to basic physical laws.

6. Matter -- Matter comprises an important component of the universe, and has physical properties that can be described over a range of scales.

7. Energy -- Interactions within the universe can be described in terms of energy exchange and conservation.

8. Forces -- Equilibrium and change are determined by forces acting at all organizational levels.

NOTE: Outcomes 1 through 4 are common to both the physical science (PS) and life science (LS) general education courses. Outcomes 5 through 8 are specific to physical science (PS) courses.

4.4.1 Evidence of Learning: General Education Courses: GEO 1030 PS

Evidence of Learning: General Education Courses: GEO 1030 PS Earthquakes & Volcanoes					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 1: **The nature of science.**	Measure 1: Homework assignment on the Theory of Plate Tectonics	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 2: **Integration of Science**	Measure 1: A set of multiple-choice questions related to Wegner's evidence for continental drift	Measure1: 60% of students will have the correct answer to each question			
Learning Outcome 3: **Science and society**	Measure 1: A set of multiple-choice questions related to hazard impacts and predictions	Measure1: 60% of students will have the correct answer to each question			
Learning Outcome 4: **Problem solving & data analysis**	Measure 1: Multiple homework assignments	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 5: **Organization of systems**	Measure 1: Pre-test; Post-test	Measure1: Class average on post-test will improve to 70% or higher			
Learning Outcome 6: **Matter**	Measure 1: Pre-test; Post-test	Measure1: Class average on post-test will improve to 70% or higher			
Learning Outcome 7: **Energy**	Measure 1: Pre-test; Post-test	Measure1: Class average on post-test will improve to 70% or higher			
Learning Outcome 8: **Forces**	Measure 1: Pre-test; Post-test	Measure1: Class average on post-test will improve to 70% or higher			

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information: (1) This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Fall 2012 semester.

4.4.2 Evidence of Learning: General Education Courses: GEO 1060 PS

Evidence of Learning: General Education Courses: GEO 1060 PS Environmental Geosciences					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 1: **The nature of science.**	Measure 1: Student paper requiring the use of the scientific method to interpret observed data	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 2: **Integration of Science**	Measure 1: Student paper requiring the use of multiple sciences to present scientific data and their interpretation	Measure 1: Discussed in class			
Learning Outcome 3: **Science and society**	Measure 1: A set of 8 multiple-choice questions from Exams 1 and 2	Measure1: 70% of students will score 70% or better on 8 questions			
Learning Outcome 4: **Problem solving & data analysis**	Measure 1: A quiz question requiring data analysis for flood frequency.	Measure 1: 70% of students will score at the 70% level			
	Measure 2: Measure 1: A quiz question requiring data analysis for groundwater flow.	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 5: **Organization of systems**	Measure 1: A set of 2 multiple-choice questions from Exam 1	Measure1: 70% of students will score 67% or better on 2 questions			
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Evidence of Learning: General Education Courses: GEO 1060 PS Environmental Geosciences					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 6: **Matter**	Measure 1: A set of 5 multiple-choice questions from Exams 1 & 2	Measure 1: 70% of students will score 70% or better on 5 questions			
Learning Outcome 7: **Energy**	Measure 1: A set of 5 multiple-choice questions from Exams 1 and 2	Measure 1: 70% of students will score 70% or better on 5 questions			
Learning Outcome 8: **Forces**	Measure 1: A set of 5 multiple-choice questions from Exams 1 and 2	Measure 1: 70% of students will score 70% or better on 5 questions			

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information:

This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Fall 2012 semester.

4.4.3 Evidence of Learning: General Education Courses: GEO 1110 PS

Evidence of Learning: General Education Courses: GEO 1110 PS Dynamic Earth: Physical Geology					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 1: **The nature of science.**	Measure 1: Student paper requiring the use of the scientific method to interpret an outcrop	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 2: **Integration of Science**	Measure 1: discussed in class; not assessed				
Learning Outcome 3: **Science and society**	Measure 1: A set of 10 multiple-choice questions from Final Exam	Measure1: 70% of students will score 70% or better on 10 questions			
Learning Outcome 4: **Problem solving & data analysis**	Measure 1: Homework assignment on faults and folds	Measure 1: 70% of students will score at the 70% level			
	Measure 2: Homework assignment on plate tectonics	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 5: **Organization of systems**	Measure 1: A set of 3 multiple-choice questions from Exam 1	Measure1: 70% of students will score 67% or better on 3 questions			

Evidence of Learning: General Education Courses: GEO 1110 PS Dynamic Earth: Physical Geology					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 6: **Matter**	Measure 1: A set of 5 multiple-choice questions from Exams 1 & 2	Measure 1: 70% of students will score 70% or better on 5 questions			
Learning Outcome 7: **Energy**	Measure 1: A set of 6 multiple-choice questions from Exam 1, 2, and Final Exam	Measure 1: 70% of students will score 70% or better on 6 questions			
Learning Outcome 8: **Forces**	Measure 1: A set of 8 multiple-choice questions from Exam 1, 2, and Final Exam	Measure 1: 70% of students will score 70% or better on 8 questions			

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information:

This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Fall 2012 semester.

4.4.4 Evidence of Learning: General Education Courses: GEO 1130 PS

Evidence of Learning: General Education Courses: GEO 1130 PS Introduction to Meteorology					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 1: **The nature of science**	Measure 1: A set of questions taken from Exams 1,2, 3, and Final	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 2: **Integration of Science**	Measure 1: A set of questions taken from Exams 1,2, 3, and Final	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 3: **Science and society**	Measure 1: A set of questions taken from Exams 1,2, 3, and Final	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 4: **Problem solving & data analysis**	Measure 1: A set of questions taken from Exams 1,2, 3, and Final	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 5: **Organization of systems**	Measure 1 Pre-test, post-test	Measure 1: Class average on post-test will improve to 70% or higher			
Learning Outcome 6: **Matter**	Measure 1: Pre-test, post-test	Measure 1: Class average on post-test will improve to 70% or higher			
Learning Outcome 7: **Energy**	Measure 1: Pre-test, post-test	Measure 1: Class average on post-test will improve to 70% or higher			
Learning Outcome 8: **Forces**	Measure 1: Pre-test, post-test	Measure 1: Class average on post-test will improve to 70% or higher			

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information:

This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Spring 2013 semester.

4.4.5 Evidence of Learning: General Education Courses: GEO 1350 PS

Evidence of Learning: General Education Courses: GEO 1350 PS Principles of Earth Science					
Measurable Learning Outcome **Students will…**	**Method of Measurement** **Direct and Indirect Measures***	**Threshold for Evidence of Student Learning**	**Findings Linked to Learning Outcomes**	**Interpretation of Findings**	**Action Plan/Use of Results**
Learning Outcome 1: **The nature of science.**	Measure 1: A set of questions taken from Exams 1,2, 3, and 4	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 2: **Integration of Science**	Measure 1: A set of questions taken from Exams 1,2, 3, and 4	Measure1: 60% of students will have the correct answer to each question			
Learning Outcome 3: **Science and society**	Measure 1: A set of questions taken from Exams 1,2, 3, and 4	Measure1: 60% of students will have the correct answer to each question			
Learning Outcome 4: **Problem solving & data analysis**	Measure 1: A set of questions taken from Exams 1,2, 3, and 4	Measure 1: 70% of students will score at the 70% level			
Learning Outcome 5: **Organization of systems**	Measure 1: Pre-test, post-test	Measure1: Class average on post-test will improve to 70% or higher			
Learning Outcome 6: **Matter**	Measure 1: Pre-test, post-test	Measure1: Class average on post-test will improve to 70% or higher			
Learning Outcome 7: **Energy**	Measure 1: Pre-test, post-test	Measure1: Class average on post-test will improve to 70% or higher			
Learning Outcome 8: **Forces**	Measure 1: Pre-test, post-test	Measure1: Class average on post-test will improve to 70% or higher			

*At least one measure per objective must be a direct measure. Indirect measures may be used to supplement evidence provided via the direct measures.

Summary Information:

This grid represents an assessment plan for this course going forward. Data/results for each learning outcome will be collected beginning with the Spring 2013 semester.

4.6 High-Impact Educational Practices

The Department of Geosciences offers its students a number of high-impact-learning opportunities, including undergraduate research, capstone courses and projects, collaborative assignments and projects, study abroad, and internships. Within the extracurricular realm, the department also encourages and supports our students' many service-learning and community-outreach projects. Foremost among these educational opportunities is undergraduate research. The Department of Geosciences has a long history of supporting undergraduate research, even before it received the institutional support and recognition that it now enjoys on our campus (Weber State University was selected to host the 2012 NCUR). Appendix G lists the 20 major presentations given by our undergraduate researchers at professional meetings during the past five years, including presentations at Geological Society of America national and regional meetings, NCUR meetings, and the Sigma Xi national conference on undergraduate research. Twenty-six (26) undergraduate students were involved in these projects, with five (5) different faculty members being involved as mentors or co-authors. Our students often report that participation in an undergraduate project and attendance at a national conference was the highlight of their undergraduate experience.

As mentioned in Section 3.3, three of our degree programs have designated capstone courses that require students to integrate and apply what they have learned in previous courses to "real-world" problems or scenarios. In addition, many of the projects in the Field Methods course (GEO 4060) and Summer Field Camp (GEO 4510) also require students to work collaboratively to complete a project. Faculty members appreciate and understand that potential employers are looking for well-trained geoscientists that work in a team environment.

Although not a regular part of our curriculum, during the summer of 2010 Dr. Matyjasik of our department organized a trip to Iceland. Six geoscience majors students participated in this intensive study-abroad experience, during which our students travelled and interacted with a group of geology students from Poland. The following summer Dr. Eaton facilitated a study-abroad opportunity in Peru in collaboration with the Anthropology program. The department also has had success in being able to offer internships with local companies or government agencies, especially in the field of geographic information systems/science (G.I.S.). Typically these internships last one semester and the students receive 1-3 academic credits (GEO 4890) for their experiential learning.

Lastly, although the department does not offer an formal community-based learning courses (CBL), the faculty encourages and supports our students as they engage in a wide variety of science-outreach projects and service to the geoscience profession, typically under the auspices of the department's chapter of Sigma Gamma Epsilon (geoscience honor society) and Geoscience Club. Most notable were two projects completed during the past year: Spring Semester 2012 geoscience students organized and held WSU's first-ever earthquake preparedness fair for the campus and local community; and Fall Semester 2012 geoscience students assembled 100 sets of local rock specimens that were donated to every 4th-grade classroom in the Weber School District. Both of these student projects were huge

successes and reported on by the local media. The WSU chapter of Sigma Gamma Epsilon has been recognized by the national organization as a "Quality Chapter", largely in recognition of its service-learning and community-outreach projects.

5. Academic Advising

5.1 Advising Strategy and Process

Students declaring a major in geosciences have an initial meeting with the department chair to discuss general goals and to go over the various degree programs offered by the department. A separate file is created for each major, minor, or BIS student, and is updated until graduation; these files are also maintained after graduation. {BIS= Bachelor of Integrated Studies, a program wherein students select 3 emphasis areas; a geology emphasis is an option.} The department secretary works with the chair to "declare" the student's major within CatTracks, the University's e-transcript and degree-evaluation platform. Students are also assigned to different advisors depending on their major/minor: Geology (BA/BS) -- Dr. Eaton or Dr. Yonkee; Earth Science Teaching -- Dr. Ford; Applied Environmental Geosciences -- Dr. Matyjasik or Dr. Wilson; and Geospatial Minor and Geomatics Institutional Certificate -- Dr. Hernandez. Most students meet with their advisor at least once a year to check progress and to develop a program of study for each semester or academic year until graduation. Planned future course offerings (3-year cycle) are posted for students to use in general planning. Students are also encouraged to meet with other faculty to discuss areas of interest and potential career paths. Advisors also work with students to obtain internships and admittance to graduate programs, and regularly write letters of recommendation. One faculty member gives an annual presentation to the Geosciences Club on undergraduate research opportunities, preparation for graduate school, and writing effective resumes. The department chair also sets up meetings with graduating seniors, either early in the semester of graduation or the semester before, to double check the student's graduation evaluation ("sign off") and to conduct an exit interview. Additionally, students may meet with the College of Science Academic Advisor for advice on general education courses and other university graduation requirements. Students also work with, and are on an email listserve from, the College of Science Career Services representative. Career and internship opportunities of particular interest to geoscience students are also listed on the weekly Geoscience Email Newsletter (beginning Fall semester 2012) and posted in our majors' room.

5.2 Effectiveness of Advising

We collect information about advising effectiveness by asking questions on the frequency and quality of advising during exit interviews with graduating seniors. These exit interviews indicate that graduates met regularly (at least annually) with a department advisor, and are very satisfied overall with the quality of the advising they received.

5.3 Past Changes and Future Recommendations

The department's advising system has been in place, basically unchanged, for some time and we have no plans to change it. We think having every regular faculty member involved in advising is a real plus – as the work load is shared and every geoscience major and minor has the opportunity to build a strong, one-on-one relationship with a faculty member. Geoscience students commonly list their advisor as a reference on job applications and/or ask them to write letters of recommendation. The department's advising systems was a notable strength of the program identified during its most recent program review (2007-2008).

6. Faculty

6.1 Faculty Demographic Information

The department currently has 6 full-time, tenure-track (regular) faculty, and 4 adjunct instructors that teach part time on a regular basis, with a combined full-time-equivalent faculty (FTE) that has varied from 7.8 to 8.6 over the last 5 years (Appendix A). The regular faculty members are a senior group, with a combined xx years of teaching experience (Appendix B). There likely will be two (2) retirements within the next 5 years. Vitae of the regular faculty are included in Appendix K.

6.2 Departmental Teaching Standards

Teaching standards are determined by three sources: (1) the University's Peer Review policies and procedures, (2) the Annual Review policies and procedures of the College of Science; and (3) the College and University Rank and Tenure policies and procedures. For additional details on these, see Section 6.4 below. These standards are communicated to the faculty by the Department Chair, Dean, and other key academic administrators of the university such as the Associate Provost and Provost. New faculty are also given orientations in the Fall Semester of their first two years through campus workshops provided for all faculty. New faculty members also undergo second-year reviews by the chair.

6.3 Faculty Qualifications

All full-time faculty members hold a PhD in the geosciences and have earned tenure within the College of Science (Appendix B). The sub-disciplinary expertise of the regular faculty covers most of the major areas of traditional geology and applied geoscience, including sedimentology, stratigraphy, paleontology, environmental geology, hydrogeology, Earth science education, geomorphology, GIS, remote sensing, geologic hazards, mineralogy, petrology, structural geology, and tectonics. All of the adjunct instructors have an advanced degree in the geosciences, along with extensive teaching and applied science (industry/regulatory) experience.

6.4 Evidence of Effective Instruction

6.4.1 Regular Faculty: There are several kinds of systematic evaluations of full-time, tenure-track faculty used in the department:

• Annual Reviews (year-end reports) conducted of all faculty by the department chair using data provided by faculty members pertaining to teaching, scholarship and service and evaluated according to established College of Science procedures with the results reported to the College Dean (see section 6.7);

• Second-Year Reviews of new tenure-track faculty made by the department chair according to university policy, with the results submitted to the faculty professional files;

• Peer Reviews of all faculty conducted by an elected departmental Peer Review Committee, which evaluate course-related materials submitted by the faculty member under review and include classroom and laboratory teaching observations. These reviews occur as part of the evaluation process for tenure and promotion, with the results submitted to the faculty professional files in the department and College;

• Ranking and Tenure Reviews, conducted by the appropriate committees as prescribed by University policy, that evaluate effectiveness in teaching, scholarship and service, with the results maintained in faculty professional files;

• Student Evaluations of faculty and classes conducted formally in accordance with College and institutional policies and procedures using a standardized instrument (see section 6.7); and

• Post-Tenure Review: The College of Science is presently working to develop a procedure for the periodic and systematic review of tenured faculty.

6.4.2 Adjunct Faculty: There are two kinds of systematic evaluations of part-time, adjunct faculty used in the department:

• Student Evaluations for every course taught, using formal instruments developed either by Continuing Education or by the College of Science, depending on the funding entity; and

• Classroom observations conducted by the chair every two years.

The data/results from these various reviews and evaluation of teaching effectiveness are to the individual faculty member and kept on file by the appropriate administrators. Often data obtained from one form of evaluation are used within other evaluations (e.g., Peer Review and Student Evaluation data are used for purposes of merit, tenure, and ranking reviews). This rigorous review process has kept faculty and administrators informed of institutional expectations and the caliber of their performance in comparison with these

expectations. Feedback from this array of evaluations has enabled faculty to improve their teaching, research and service over the years. This has also led to positive outcomes with respect to retention and tenure, promotion, and merit pay.

6.5 Mentoring Activities

Regular faculty members, in consultation with the department chair, set mission-related goals for the next academic year and evaluate goals from the previous year during a spring semester meeting. The department chair undergoes a similar mentoring/review process in consultation with the dean. Teaching assignments are made by consultation between the chair and faculty, with a normal teaching load of 24 TCH per academic year. The chair goes over the student teaching evaluations each semester with faculty and adjuncts to identify strengths and weaknesses. The department provides funds for professional development and travel (generally one conference or workshop per year), with additional funds available through the Research, Scholarship, and Professional Growth Committee (internal grants), and from external grants. Faculty can also apply for a sabbatical leave, subject to administrative approval. We have had a total of 5 semesters of sabbatical leave split between 5 faculty members over the last 5 years, with teaching assignments covered internally.

Although it has been a while since a new colleague joined the department, the department does recognize the importance of mentoring new faculty. The department chair has primary responsibility to make a new faculty member aware of the Policies and Procedures Manual, College of Science tenure expectations, opportunities for university-sponsored training and workshops, and external workshops related to pedagogy and early career planning. We are a small collegial group and new instructors, both regular faculty and adjuncts, are encouraged to exchange materials and ideas with more experienced instructors.

6.6 Diversity of Faculty

At present, all the tenure-track faculty are male; three (3) of the adjunct instructors are male, one (1) is female (Appendix B). All of the faculty, tenure-track and adjunct, are Euro-Americans (White), with one regular faculty also being Hispanic. Diversity has been a criterion for past hires, and efforts will be made to increase faculty diversity with future hires.

6.7 Ongoing Review and Professional Development

Regular faculty members are evaluated in teaching, research, and service each year by the department chair as part of a standardized, college-wide, annual review process. This process includes the setting of specific mission-related goals for the upcoming academic year. Results from these annual reports are then reviewed by the Dean, in consultation with the department chair. Annual faculty reviews indicate frequent lab improvements, course updates, use of new pedagogic techniques, attendance of workshops, and obtaining grants for instructional improvement.

Standardized student evaluations are given in at least two courses per year for each regular faculty member -- in practice almost all courses taught by regular faculty undergo student evaluation. Student evaluations are conducted in all courses taught by adjunct instructors. The department chair reviews and discusses the numerical results from the evaluations, and students' written comments, with each instructor. The faculty and adjunct instructors in turn use this feedback to help improve delivery methods, content, and assessment methods.

The department encourages faculty to attend workshops related to geoscience pedagogy and provides travel funds for those who participate. In the past five years geoscience faculty have participated in an Annual ESRI Education User Conference, the WSU Master Online Teacher Certification (MOTC) Program, an NAGT/NSF "Cutting Edge" workshop on Teaching Geomorphology in the 21st Century, and numerous short webinars related to GIS software updates, preparing NSF grant proposals, and developing online courses.

7. Support Staff, Administration, Facilities, Equipment, and Library

7.1 Adequacy of Staff

The department has adequate office-management support in the form of a three-quarter-time (0.75 FTE) secretary (Appendix C). The FTE level was increased from 0.60 when a new secretary was hired in August 2012. Both students and faculty have benefited from the increase in work hours for this position, as secretarial support is available for a longer period of the work day.

Since our last program review, the College of Science has hired a computing specialist to provide computer and IT support for all the departments in the college. This position has been a great benefit to the Department of Geosciences in that this person is able to assist Dr. Hernandez in maintaining computer hardware and software in the department's GIS/remote-sensing lab -- a very time-consuming task.

However, the department does not have a lab manager/ curator/instructor position, which requires faculty to spend substantial time preparing labs, for both lower- and upper-division courses, and dealing with field-trip logistics. The lack of a lab manager also results in a decrease over time in the organization and effectiveness of the department's teaching collections of rock/mineral specimens and maps. Increasing enrollments in introductory labs, particularly GEO 1115 (Physical Geology Lab) have reached the point where we need to offer additional sections (we have let in over 30 students in recent offerings of GEO 1115). However, without additional personnel, such as a lab manager/curator/instructor, we are facing difficult decisions on how to meet the instructional-support needs of our labs and field trips. This staffing inadequacy was also recognized by the external reviewers during our last program review (2007-2008). Looking forward, such a position would be very beneficial as we plan for a move to a new building for the College of Science. Such a

position could provide vital assistance in preparing the department's various teaching collections (minerals, rocks, fossils, maps, and air photos) for the move and helping to organize the collections in our new space.

We also see the need for a college-level lab technician, as the college continues to upgrade its analytical capabilities through the acquisition of high-end equipment, such as the SEM and AFM. This equipment is shared among the various departments and requires a substantial commitment to basic operations and maintenance. Such a position could act to support the analytical needs of all the departments in the college, and would be a key resource for students wishing to use the equipment for undergraduate research.

The Department of Geosciences is anticipating 2 faculty retirements within the next 5 years. At present, the 6 members of the regular faculty, plus staff support, are stretched very thin with respect to teaching loads, mentoring of undergraduate research, and university committee work – not to mention sustaining individual research programs and providing service to the community and our discipline. We think that it is imperative that the department be able to conduct national searches for new faculty members at the time our senior faculty formally announce their retirements. The retirements on the horizon will provide the department an opportunity to examine the possibility of new directions and disciplinary specialties, with the goal of improving our various degree programs and better preparing our graduates to live, work, and learn in the 21st century. As a department, we are just beginning to have discussions about potential future directions, but we know we must plan for a future that will be substantially different from our present circumstances.

The number of geoscience majors has increased 32% since 2007 (63 majors in 2007-2008; 83 majors in Fall 2012). If the growth in geoscience majors continues at this rate, an increase in the number of regular faculty may soon be warranted.

7.1.1 Ongoing Staff Development

The secretary, in consultation with the department chair, sets performance goals using the university's Performance Review and Enrichment program (PREP). The secretary is evaluated annually by the chair using PREP, which reviews performance of basic job functions and addresses how well goals from the previous year were met. Throughout the academic year, the secretary is encouraged to attend professional development classes/seminars given by the university. During just Fall 2012 alone, our new secretary has received formal training in the University's customer-service standards (Purple P.R.I.D.E.), civil rights issues in higher education, student transcripts and degree evaluation (CatTracks), purchasing card policies and reconciliation, class scheduling and registration (Registrar's Boot Camp), Lynx self-serve financial reports, Adobe Photoshop, and information security/GRAMA/FERPA.

7.2 Adequacy of Administrative Support

The department currently has an adequate annual budget to meet very basic needs. Over the last 5 years, the department annual budget, excluding faculty and staff salaries, has remained approximately $20,000, which has been used mostly to cover general operating expenses (e.g. phones, copying, office supplies), pay hourly wages, partly support travel (much of travel has been covered by grants), and partly support equipment/software purchase/maintenance. The Dean has provided additional one-time funds and matching funds for internal grants to purchase key equipment, including 6 new petrographic microscopes, enhancements to the SEM, and GeoWall system. Lastly, the department is very appreciative of the administration's support for sabbatical leaves of absence.

Private donations, exclusive of scholarships, have been used to help purchase equipment and defray student expenses associated with field trips. The department collects student fees totaling about $4000 per year for introductory labs (GEO 1065 and 1115) and for computer-intensive geospatial classes (GEO 4210, 4220, 3400, 4400). These funds are used to replace and improve lab supplies for the large-enrollment introductory labs, and to help cover computer/hardware expenses and software licensing in the geospatial classes. We reduce costs for GIS software licensing by being part of a cooperative program with other Utah institutions of higher education, and have received funds from other WSU constituencies that use the GIS software to help cover costs. However, covering on-going software licensing costs remains a challenge.

Weber State University supports a vigorous and well-funded Office of Undergraduate Research. Students apply on a competitive basis for research funding for the academic year and/or summers. Geosciences students have received over $10,000 in total funding from this source since 2007, with additional support coming from various faculty grants, the Dean's office, and the department. Undergraduate research is a highlight of our department (see Section 4.6 and Appendix G).

The College of Science has a liaison in the Development Office who we work with to obtain donations and cultivate ties with alumni and friends of the department (Appendix F). In 2011 the department received a very generous donation from Norman and Barbara Tanner which will provide two $5000 scholarships per year, for five years, to exemplary students majoring in the geosciences. The department also receives more than $10,000 annually from additional sources for other scholarships, which typically has allowed us to support five to ten majors during each academic year. We have also received support from the Utah Geological Association and the Golden Spike Gem and Mineral Club to support scholarships for the required summer field camp course for geology majors. Faculty work with the Office of Sponsored Projects (OSP) to obtain and help administer grants and contracts, with an OSP liaison specifically assigned to the College of Science.

Although many of the "wrinkles have been ironed" out since the initial implementation of the *CatTrack*s transcript and student-records system, a few problems still exist with student registration, prerequisites, and graduation evaluation. The Office of Continuing Education (*WSUonline*) provides support to evening and online classes, but technical problems with student access and the appearance/format of some online course materials

still occasionally arise. The College of Science now has a part-time IT person to help with computer and software applications.

7.3 Adequacy of Facilities and Equipment

The Department of Geosciences has access to a wide range of specialized facilities and equipment, as listed below:

• Environmental Scanning Electron Microscope (SEM) with energy dispersive analytical x-ray (EDS) and Peltier cooling stage, jointly administered with other departments in the College of Science.

• Atomic Force Microscope (AFM) with environmental cell for measurement of surfaces in fluids, obtained jointly with the Department of Physics from NSF Instrumentation grant.

• X-ray diffractometer with software for mineral identification.

• Geospatial & Environmental Applied Research (GEAR) laboratory with 15 computers (3 to 5 new computers obtained each year to replace older machines), server, laser printer, 42" large-format printer, ESRI campus site license for industry standard ArcGIS and ArcPad software, Excelis Envi and IDC remote sensing software (10 licenses shared with Physics), and GeoWall display system for 3-D visualization.

• Educational water-well field with 5 wells, water pump, piezometers, water sampling equipment, water chemistry equipment (probes, spectrophotometers, and chemicals), permeameters, and groundwater flow analog model.

• Multimedia classrooms (SL320, SL 328, SL 329, LL124) with projectors and computers for presentations.

• Surveying equipment- 1 Leica Geosystems total station, 2 leveling transits, 6 Trimble Juno GPS units with PDAs and ArcPad for recording and plotting data in the field, field laptop (ToughBook) computer.

• Other field equipment- soil auger, Brunton compasses, stereoscopes, and high resolution digital cameras.

• Microscopes- 10 newer petrographic microscopes and 10 older petrographic scopes, automated point counting system, 15 binocular scopes.

• Petrographic-display system for teaching, with high resolution color video camera, computer, high resolution display device, and software.

• Image-analysis system with research-grade petrographic microscope and software.

• Rock-preparation equipment- saws, grinding wheels, and crushing equipment.

• Grain-size analysis system with research-grade sieve set.

• Screen-washing facility for separating microfossils.

• Extensive rock, mineral, fossil, and thin section collections, including petro-tectonic suites.

• Topographic map, geologic map, and aerial photograph collections.

• Faculty and staff computing equipment- computers, scanners, color laser printer.

Significant equipment acquisitions and improvements have been made over the last 5 years, including acquisition of SEM and EDS (administered jointly within the college), XRD, 4 new petrographic microscopes, and new large format printer. Facilities are adequate to provide students with training in many computer, geospatial, and environmental applications. Strengths include the SEM and XRD that are also used in undergraduate research, educational water well field, GEAR lab, and extensive rock and thin section collections. We would like to develop a course in geophysics focused on environmental applications, which would require new equipment, such as ground-penetrating radar, shallow seismic survey system, micro-gravimeters, and appropriate software. Although we have made improvements, additional support is needed to purchase more analytical equipment (e.g. XRF) and to more effectively maintain existing equipment. A major challenge will be to provide space for additional equipment that supports increased faculty-student research in the new Science Lab Building.

7.4 Adequacy of Library Resources

Geoscience faculty and students have access to excellent central-library resources. Students use a variety of library materials for writing exercises, literature searches, labs in a number of classes, and research projects. The Stewart Library has a dedicated science librarian who routinely works with Geosciences faculty to update and add library resources. The department has made a major effort to improve coverage of library materials through the recommended purchase of new books and monographs and a faculty member is tasked to serve as library liaison to coordinate these purchases. Another significant improvement has been the licensing of several full-text article databases (ejournals), including *ScienceDirect* (92 geoscience titles), *WileyInterscience* (57 science titles), and *SpringerLink* (21 geoscience titles). Traditional (hard copy) journal subscriptions are decreasing due to high costs. The library currently supports approximately 25 print-based journal subscriptions in the geosciences. *GeoRef* and *Geobase* search engines are available and an excellent interlibrary loan system (*Illiad*) is in place. Students and faculty also have access to over 66,000 maps in the holdings of the Stewart Library.

8. Relationships with External Communities

8.1 Description of Role in External Communities

We have extensive contacts with governmental agencies, including the Utah Geological Survey, U.S. Geological Survey, National Forest Service, Weber Basin Water Conservancy District, county, and city planning groups. Faculty members have undertaken a number of collaborative projects with these agencies, and faculty serve on outside committees, such as the Weber County Health Department Advisory Committee and the Utah State Mapping Advisory Committee. One adjunct faculty works for the Utah Department of Environmental Quality. One faculty has a major grant from the National Park Service to conduct a paleontological survey of Bryce Canyon, which has employed many students. We have also developed contacts with geotechnical and mining-service firms who provide feedback on performance of graduates they hire. Many of these contacts have also resulted in student internships. Key contacts with external communities are listed in Appendix E.

We support GIS applications across the campus, including managing a site license for ArcGIS that is used by multiple academic programs, Stewart Library, and Facilities Management. One faculty heads the local GIS Users Group and provides training sessions on GIS to interested faculty.

The department supports K-12 education in the community. We have been closely involved with the Center for Science and Math Education (CSME) in the past, with one faculty serving on the steering committee for the center and specifically focused on Earth science teaching. However, CSME is currently without a director and maintaining a minimal level of activity due to lack of funding. One faculty member is currently serving on a college committee charged with improving STEM recruitment and retention. Faculty have been actively involved with the Utah Science Olympiad, the annual Ritchie Science & Engineering Fair hosted by WSU, MESA program, giving lectures in the public schools, and offering summer workshops for in-service teachers. One faculty member served as one of two representatives from higher education on a committee, sponsored by the Utah State Office of Education, that substantially revised the curriculum for Utah's 9th-grade Earth Science course. The department also provides an introductory Earth science course designed for elementary education majors, and has seen an increase in Earth Science Teaching majors (secondary education).

Geoscience faculty are actively involved in a number of professional organizations and service to the geoscience community. Faculty have chaired sessions and led field trips at professional meetings, served as judges for outstanding publication awards, and regularly serve as reviewers for a number of geoscience journals. One faculty served (2005-2010) as National President of Sigma Gamma Epsilon, the national honor society for students in the Earth sciences. Geoscience faculty are also called upon to review grants proposals and serve on thesis committees for graduate students at other colleges and universities.

8.2 Summary of External Advisory Committee Minutes

At this time the Department of Geosciences does not have an external advisory committee. However, the department chair has been tasked to work toward establishing such a group during the 2012-2013 academic year, with the goal of having a functioning advisory committee by December 2013.

9. Results of Previous Program Reviews

Problem Identified	Action Taken	Progress (since 2007-2008)
Issue 1—Staffing: The program would be greatly assisted by the hiring of a computer technician to address the needs of the GEAR Lab and to assist faculty w/computer-aided instruction.	Previous 5-Year Program Review:	
	Year 1 Action Taken:	No progress due to budget constraints
	Year 2 Action Taken:	same
	Year 3 Action Taken:	same
	Year 4 Action taken:	COS hires a part-time IT professional
Issue 2—Space: Any future growth in faculty or acquisition of new equipment will require additional space. Priority should be given to planning and funding a building for the College of Science.	Previous 5-Year Program Review:	
	Year 1 Action Taken:	No action
	Year 2 Action Taken:	SEM installed in remodeled room
	Year 3 Action Taken:	GEO faculty member serves on COS preliminary-planning committee for new building
	Year 4 Action taken:	WSU continues to make its case for new science building
Issue 3—Equipment & Maintenance: The routine and time-consuming duties related to laboratory instruction fall exclusively to the faculty. Priority should be given to hiring a lab manager.	Previous 5-Year Program Review:	
	Year 1 Action Taken:	No progress due to budget constraints
	Year 2 Action Taken:	same
	Year 3 Action Taken:	same
	Year 4 Action taken:	Same

Program Strengths Identified During the Previous Program Review (2007-2008):

1. **Faculty:** The program clearly has well qualified, dedicated, productive, and collegial faculty who ably balance teaching with research and service.
2. **Students & Advising:** The department's students enjoy success performing research, participating in internships, find employment, and in graduate programs. The advising of majors is a strength of the department and an important part of the close student-faculty interaction in the department.
3. **Curriculum:** The program successfully integrates traditional geology with geospatial analysis, environmental applications, close student-faculty interaction, numerous field experiences, modern technology, and laboratory work.

10. Action Plan for Ongoing Assessment Based on Current Self-Study Findings

10.1 Action Plan for Evidence of Learning Related Findings

Problem Identified	Action to Be Taken
Issue 1	Current 5 Year Program Review:
	Year 1 Action to Be Taken:
	Year 2 Action to Be Taken:
	Year 3 Action to Be Taken:
	Year 4 Action to Be Taken:
Issue 2	Current 5 Year Program Review:
	Year 1 Action to Be Taken:
	Year 2 Action to Be Taken:
	Year 3 Action to Be Taken:
	Year 4 Action to Be Taken:

Summary Information:

The Department of Geosciences developed its assessment plan during Spring Semester 2012 and began collecting data during Fall Semester 2012, thus we do not yet have findings to report in the table above. However, discussions during a department assessment meeting (November 2012) revealed two concerns with respect to the evidence of learning within our upper-division courses for majors: (1) many students struggle with 3-dimensional thinking and visualization (e.g. interpretation of topographic and geologic maps, construction of topographic profiles and geologic cross sections); and (2) many students need additional help mastering geoscience communication skills (e.g. writing for the geosciences, preparation of graphs and tables, oral presentations)

The faculty agreed at this meeting to re-double their efforts in upper-division courses to provide students with more opportunities to practice and develop their 3-D thinking and geoscience communication skills.

10.2 Action Plan for Staff, Administration, or Budgetary Findings

Problem Identified	Action to Be Taken
Issue 1—Staffing: The routine and time-consuming duties related to laboratory instruction and field-trip logistics fall exclusively to the faculty. Priority should be given to hiring a lab manager/curator.	Current 5 Year Program Review:
	Year 1 Action to Be Taken: Department will continue to make its case.
	Year 2 Action to Be Taken:
	Year 3 Action to Be Taken:
	Year 4 Action to Be Taken:
Issue 2—Staffing: The College of Science would benefit from hiring a college-level lab technician to oversee the use and maintenance of the college's shared analytical equipment.	Current 5 Year Program Review:
	Year 1 Action to Be Taken: Geosciences will work with the other departments of the college to make the case and help identify funding sources.
	Year 2 Action to Be Taken:
	Year 3 Action to Be Taken:
	Year 4 Action to Be Taken:
Issue 3—Budget: The Department is concerned about the ever-increasing cost associated with maintaining GIS software licenses and providing students with opportunities for field-based instruction. We would also like to see a commitment to providing start-up funds for new faculty.	Current 5 Year Program Review:
	Year 1 Action to Be Taken: Department will continue to work with the Dean and the Development Office to identify external funding sources.
	Year 2 Action to Be Taken:
	Year 3 Action to Be Taken:
	Year 4 Action to Be Taken:
Issue 4—Space: Not so much as a problem as an opportunity. The Department looks forward to planning, designing, and equipping its space within a new science building on campus.	Action to Be Taken
	Current 5 Year Program Review:
	Year 1 Action to Be Taken: Department must be actively involved in all aspects of the programming and planning for the new building.
	Year 2 Action to Be Taken:
	Year 3 Action to Be Taken:
	Year 4 Action to Be Taken:

11. Summary of Artifact Collection Procedure

Artifact	Learning Outcome Measured	When/How Collected?	Where Stored?
Sample field reports and calculations (GEO 4060)	DLO 1: Problem-solving	End of semester	Faculty's course files
Sample term papers (GEO 1220)	DLO 2: Communication	End of semester	Faculty's course files
Sample project proposals and final reports (GEO 4210)	DLO 3: Technology	End of semester	Faculty's digital course database
Mineral identification results & sample rock descriptions	DLO 4: Earth Materials	End of semester	Faculty's course files
Data from GEO 1220 exam questions	DLO 5: Earth History	2-3 times per semester	Faculty's course files
Data from GEO 3150 Lab Final Exam	DLO 6: Surface Processes	End of semester	Faculty's course files
Data from GEO 1110 exam questions	DLO 7: Tectonic Processes	2-3 times per semester	Faculty's course files
Sample cross sections and calculations (GEO 4060)	DLO 7: Tectonic Processes	End of semester	Faculty's course files
Data from GEO 1220 exam questions	DLO 8: Earth Systems	2-3 times per semester	Faculty's course files
Final Project rubric and samples (GEO 4060)	DLO 9: Capstone Experience	End of semester	Faculty's course files

DLO = Department Learning Outcome (see Sections 4.1 and 4.2)

APPENDICES

Appendix A: Student and Faculty Statistical Summary

	2007-08	2008-09	2009-10	2010-11	2011-12
Student Credit Hours Total	4,652	4,386	4,676	5,338	5,034
Student FTE Total	155.07	146.20	155.87	177.93	167.80
Student Majors					
Geosciences	63	57	54	74	78
Program Graduates					
Bachelor's Degrees	11	12	2	10	4
Institutional Certificates	1	1	4	1	1
Student Demographic Profile	**63**	**57**	**54**	**74**	**78**
Female	29	26	23	31	26
Male	34	31	31	43	52
Faculty FTE Total	**8.34**	**7.81**	**8.17**	**8.56**	**8.93**
Adjunct FTE	2.56	2.25	2.06	2.45	3.37
Contract FTE	5.78	5.56	6.11	6.11	5.56
Student/Faculty Ratio	**18.59**	**18.72**	**19.08**	**20.79**	**18.79**

Note: Data provided by Institutional Research

Appendix B: Contract/Adjunct Faculty Profile

Name	Gender	Ethnicity	Rank	Tenure Status	Highest Degree	Years of Teaching	Areas of Expertise
Jeffrey G. Eaton	M	Euro-American	Professor	tenured, 7/1/02	PhD	22	paleontology, stratigraphy, sedimentology
Richard L. Ford	M	Euro-American	Professor	tenured, 7/1/05	PhD	20	geomorphology, Earth science education
Michael W. Hernandez	M	Euro-American (Hispanic)	Associate Professor	tenured, 7/1/11	PhD	12	remote sensing, GIS, geologic hazards
Marek Matyjasik	M	Euro-American	Professor	tenured, 7/1/04	PhD	17	hydrogeology, environmental geology
James R. Wilson	M	Euro-American	Professor	tenured, 7/1/87	PhD	37	mineralogy, environmental geology
W. Adolph Yonkee	M	Euro-American	Professor	tenured, 7/1/97	PhD	22	structural geology, petrology, geochemistry
Helen K. Barker	F	Euro-American	Adjunct	NA	MS	25	general geology
Thomas R. Herret	M	Euro-American	Adjunct	NA	MS	18	meteorology
David C. Larsen	M	Euro-American	Adjunct	NA	MS	8	general geology
Gregory B. Nielsen	M	Euro-American	Adjunct	NA	PhD	13	general geology

Appendix C: Staff Profile

Name	Gender	Ethnicity	Job Title	Years of Employment	Areas of Expertise
Marianne Bischoff	Female	Euro-American	Secretary II	less than 1	office management

Appendix D: Financial Analysis Summary

Department: GEOSCIENCES	2007-08	2008-09	2009-10	2010-11	2011-12
Undergraduate					
Instructional Costs	$619,931	$654,917	$691,530	$663,926	$655,071
Support Costs					
Other Costs					
Total Expense	$619,931	$654,917	$691,530	$663,926	$655,071
Graduate					
Instructional Costs					
Support Costs					
Other Costs					
Total Expense					

Note: Data provided by Provost's Office

Appendix E: External Community Involvement Names and Organizations

Name	Organization
Resource Manager	National Park Service, Bryce Canyon National Park
Stephen McKay (alumnus)	North American Exploration
Robert Biek	Utah Geological Survey
Darlene Koerner	USDA, Forest Service, Ashley National Forest
James Kirkland	State Paleontologist, Utah Geological Survey
James Walters	The Society of Sigma Gamma Epsilon
Mitchell Power	Natural History Museum of Utah
Craig Morgan	Utah Geological Association
Sarah Young	Utah State Office of Education
Mary McKinley	Ogden Nature Center
President	Utah Friends of Paleontology
President	Golden Spike Gem & Mineral Club
Ranger/naturalist	Utah State Parks, Goblin Valley State Park
Director	Weber Basin Water Conservancy District

Appendix F: External Community Involvement Financial Contributions (2007-2012)

Organization	Amount	Type
National Park Service (CESU)	$210,000	Contract
USDA, Ashley National Forest	$61,400	Contract
Norman and Barbara Tanner	$50,000	Donation (scholarships)
Questar Corporation	$42,800	Donation (scholarships)
Czech-American Cooperation in Science Agreement	$20,400	Grant
Richard and Belva Moyle	$12,500	Donation (scholarships)
faculty & friends of Suzi Nicholson	$10,000	Donation (memorial scholarship)
faculty, alumni, & Department friends	$8,300	Donation
Harold Driver	$3,000	Donation
Utah Geological Association	$2,500	Donation
Golden Spike Gem & Mineral Society	$1,500	Donation

Appendix G.
Undergraduate Research (Presentations & Published Abstracts)
{student authors in bold}

1. **Day, S.L., Fellows, S.A.,** Hernandez, M.W., and Ford, R.L., 2007, Investigations into the morphology and spatial distribution of hoodoos at Goblin Valley State Park, Emery County, Utah: *Geological Society of America Abstracts with Programs*, v. 39, no. 5, p. 42.

A poster presented by Summer Day and Steve Fellows (WSU undergraduates) at the 2007 GSA Rocky Mountain Section Meeting, St. George, UT, May 2007. Also presented at

• WSU Undergraduate Research Symposium, March 2008, and published in *Ergo – Weber State University Undergraduate Research Journal*, v. 2, Spring 2008, p. 111-112.

2. **Emerson, R.I., Goodin, J.R., and Thompson, C.R.,** 2007, Petrology of the Cretaceous Straight Cliffs-Wahweap Formations transition, southern Utah: *Geological Society of America Abstracts with Programs*, v. 39, no. 5, p. 13.

A poster presented by Rich Emerson, Rusty Goodin and Cameron Thompson (WSU undergraduates) at the 2007 GSA Rocky Mountain Section Meeting, St. George, UT, May 2007. Also presented at

• WSU Undergraduate Research Symposium, March 2008, and published in *Ergo – Weber State University Undergraduate Research Journal*, v. 2, Spring 2008, p. 113.

3. **Barwick, C., Baker, J., Jenkins, J., Hawkins, K., and Waite, C.,** 2008, Faunal analysis of five nonmarine microvertebrate localities, Late Cretaceous, southern Utah: *Geological Society of America Abstracts with Programs*, v. 40, no. 1, p. 69.

A poster presented by WSU undergraduates at the 2008 joint GSA Cordilleran/Rocky Mountain Sections Meeting, Las Vegas, NV, March 2008.

4. **Jenkins, J.,** 2008, Petrology of sandstones from John Henry Member, Straight Cliffs Formation, Late Cretaceous, southern Utah: *Geological Society of America Abstracts with Programs*, v. 40, no. 1, p. 69.

A poster presented by Jed Jenkins (WSU undergraduate) at the 2008 joint GSA Cordilleran/Rocky Mountain Sections Meeting, Las Vegas, NV, March 2008.

5. **Summers, S.,** Matyjasik, M., Inglefield, C., and Manecki, M., 2008, AFM Arctic study of calcite surface.

A poster presented by Sara Summers (WSU undergraduate) at the national Sigma Xi Undergraduate Research Conference, November 20-23, 2008, Washington, D.C. Sara was awarded the **Gold Medal in the Geosciences Division** for this research. Also presented by Sara Summers:

• WSU Undergraduate Research Symposium, March 23, 2009, and published in *Ergo – Weber State University Undergraduate Research Journal*, v. 3, Spring 2009, p. 99.

6. **Summers, S.,** Plonka, A., **Paget, C., Park, C**., Matyjasik, M., Inglefield, C., and Manecki, M., 2008, AFM observations of weathering and microbiological alterations on the surface of calcite buried in Arctic soil (Spitbergen): *EOS, Transactions of the American Geophysical Union*, v. 89 (53), Fall Meeting Supplement.

This poster was presented by Sara Summers (WSU undergraduate) at the 2008 AGU Fall Meeting, San Francisco, CA, December 2008. Also presented at:

• WSU Undergraduate Research Symposium, March 23, 2009, and published in *Ergo – Weber State University Undergraduate Research Journal*, v. 3, Spring 2009, p. 100.

7. Matyjasik, M., Ford, R.L**.**, **Bartholomew, L.M., Welsh, S.B.,** Hernandez, M., Koerner, D., and Muir, M., 2008, Constructing a baseline model of alpine wetlands of the Uinta Mountains, Utah, USA: *EOS, Transactions of the American Geophysical Union*, v. 89 (53), Fall Meeting Supplement, Abstract H33F-1071.

This poster was presented by Sonya Welsh (WSU undergraduate) at the 2008 AGU Fall Meeting, San Francisco, CA, December 2008. This research was also presented at the:

• Utah Chapter – Association of Engineering Geologists, Student Night, February 12, 2009, Salt Lake City (Sonya Welsh and Kevin Severson).

• WSU Undergraduate Research Symposium, March 23, 2009, (Sonya Welsh) and published in *Ergo – Weber State University Undergraduate Research Journal*, v. 3, Spring 2009, p. 98.

• 5th Spring Runoff Conference (Climate Change and the Intermountain West), hosted by Utah State University, Logan, April 2, 2009 (Sonya Welsh).

8. **Pearce, S.R**., 2009, Paleontology and sedimentology of a Turonian (Late Cretaceous) lagoon, southwestern Utah: *Geological Society of America Abstracts with Programs*, v. 41, no. 6, p. 49.

A poster presented by Shayne Pearce (WSU undergraduate) at the 2009 GSA Rocky Mountain Section Meeting, Utah Valley University, Orem UT, May 2009.

9. **Summers, S.,** Matyjasik, M., Manecki, M., and Inglefield, C., 2009, Alteration of calcite samples in the Arctic environment (Spitsbergen) observed in atomic force microscopy: *Geological Society of America Abstracts with Programs*, v. 41, no. 6, p. 48.

A poster presented by Sara Summers (WSU undergraduate) at the 2009 GSA Rocky Mountain Section Meeting, Utah Valley University, Orem UT, May 2009.

10. **Welsh, S.B., Severson, K.S., Bartholomew, L.M.,** Hernandez, M.W., Matyjasik,. M., Ford, R.L., Koerner, K., and Muir, M.J., 2009, Mapping wetland plant communities using multispectral imagery: preliminary results from the Uinta Mountains: *Geological Society of America Abstracts with Programs*, v. 41 (6), p. 50.

A poster presented by Sonya Welsh and Kevin Severson (WSU undergraduates) at the 2009 GSA Rocky Mountain Section Meeting, Utah Valley University, Orem UT, May 2009.

11. Hernandez, M., **Welsh, S.,** Matyjasik, M., Ford, R., **Bartholomew, L., and Arnold, J.,** 2009, Preliminary comparison of alpine wetlands vegetation between the Reader Lakes and Dry Fork drainage basins, Uinta Mountains, Utah: *Association of American Geographers Great Plains-Rocky Mountain Division Annual Meeting, Program and Abstracts*, p. 15.

A poster presented by Michael Hernandez and James Arnold (WSU undergraduate) at the 2009 AAG Great Plains/Rocky Mountain Section Meeting, Utah State University, Logan, UT September 25-26.

12. **Arnold, J.,** Hernandez, M., **Welsh, S**., Matyjasik, M., Ford, R., and **Bartholomew, L.,** 2010, Classification of Vegetation Communities in High Alpine Wetlands Using Imagery, Uinta Mountains: *WSU Seventh Annual Undergraduate Research Symposium and Celebration, Program*, p. 50.

A poster presented by James Arnold (WSU undergraduate) at the WSU Undergraduate Research Symposium & Celebration, March 29, 2010. This research was also presented by the students at:

• Weber State University Day at the Capital, February 11, 2010, Utah State Capitol Rotunda.

• 2010 National Conference on Undergraduate Research (NCUR), April 15 – 17, 2010, University of Montana, Missoula, MT -- oral presentation by James Arnold.

13. **Hansen, B.R.,** and Hernandez, M. (mentor), Using GIS to analyze watershed-scale features to test the theory of island biogeography: *WSU Seventh Annual Undergraduate Research Symposium and Celebration, Program*, p. 57.

A poster presented by Bret Hansen (WSU undergraduate) at the WSU Undergraduate Research Symposium & Celebration, March 29, 2010.

14. **Summers, S.,** Matyjasik, M., Manecki, M., and Inglefield, C.E., 2010, New calcite dissolution features observed in tundra soils, Spitsbergen: *Geological Society of America Abstracts with Programs*, v. 42 (5), p. 454.

A poster presented by Sara Summers (WSU undergraduate) and Marek Matyjasik at the annual meeting of the Geological Society of America, November 2, 2010, Denver, CO.

15. Matyjasik, M., Hernandez, M.W., **Arnold, J.D., Welsh, S.B.,** Ford, R.L., **Batholomew, L.M., Sanders, M.L., Schurtz, A.J**., and Koerner, D., 2010, Observed relationships between water chemistry and plant communities in groundwater-dependent ecosystems, Ashley National Forest, Uinta Mountains, Utah: *Geological Society of America Abstracts with Programs*, v. 42 (5), p. 460.

A poster presented by Rick Ford and Michele Sanders (WSU undergraduate) at the annual meeting of the Geological Society of America, November 2, 2010, Denver, CO.

16. Hernandez, M., **Arnold, J., Welsh, S., Bartholomew, L**., Ford, R., Matyjasik, M., and Koerner, D., 2011, Developing a suitable classification scheme for plant communities in groundwater-dependent ecosystems, Ashley National Forest, Uinta Mountains, Utah.

A poster presented by Michael Hernandez and James Arnold (WSU undergraduate) at the 2011 annual meeting of the American Society for Photogrammetry & Remote Sensing, May 2011, Milwaukee, WI.

17. **Williamson, J.K.,** Eaton, J.G., Tibert, N.E., and Kirkland, J.I., 2011, The occurrence of the marine elasmobranch *Brachyrhizodus* sp. from a Satonian nonmarine locality, Bryce Canyon national Park, Utah: *Geological Society of America Abstracts with Programs*, v. 43, no. 4, p. 86.

A poster presented by Justin Williamson (WSU undergraduate) at the joint GSA Rocky Mountain/Cordilleran Sections Meeting, Utah State University, Logan, UT, May 2011.

18. Yonkee, A., **Pantone, S.,** and Czeck, D., 2011, Quantifying heterogeneous strain, fluid-rock interaction, and deformation mechanisms along the Willard thrust, Utah: *Geological Society of America Abstracts with Programs*, v. 43, no. 4, p. 53.

A poster presented by Adolph Yonkee and Spenser Pantone (WSU undergraduate) at the joint GSA Rocky Mountain/Cordilleran Sections Meeting, Utah State University, Logan, UT, May 2011.

19. **Gentry, A., Inghram, L.,** Eaton, J. (mentor), and Yonkee, A. (mentor), 2012, Characteristics of early-phase volcanism in the Marysvale volcanic field, south-central Utah.

A poster presented by Amanda Gentry and Leigh Inghram (WSU undergraduates) at the 2012 National Conference on Undergraduate Research (NCUR), March 29, 2012, Weber State University, Ogden, UT.

20. **Grether, C., Williamson, J**., and Matyjasik, M. (mentor), 2012, Field chemical weathering of calcite at nano-scale studied in SEM and AFM.

A poster presented by Cassie Grether and Justin Williamson (WSU undergraduates) at the 2012 National Conference on Undergraduate Research (NCUR), March 29, 2012, Weber State University, Ogden, UT.

APPENDIX H. PROVISIONAL COURSE SCHEDULE FOR 2013-2015

* offered every other year, [(a)] 4-week course offered in May-June. Updated 8/23/12

Required Courses for Geoscience Majors/Minors	**Cr Hr**	**Spring 2013**	**Fall 2013**	**Spring 2014**	**Fall 2014**	**Spring 2015**	**Fall 2015**
GEO 1110 Dynamic Earth: Physical Geology	3	X	X	X	X	X	X
GEO 1115 Physical Geology Lab	1	X	X	X	X	X	X
GEO 1220 Historical Geology	4	X		X		X	
GEO 1060 Environmental Geosciences	3	X	X	X	X	X	X
GEO 1065 Environmental Geosciences Lab	1	X	X	X	X	X	X
GEO 2050 Earth Materials	4		X		X		X
GEO 3010 Oceanography & Earth Systems *	3			X			
GEO 3060 Structural Geology *	4		X				X
GEO 3080 Water Resources	3		X		X		X
GEO 3150 Geomorphology	4		X		X		X
GEO 3400 Remote Sensing I	4		X		X		X
GEO 3550 Sedimentology & Stratigraphy	4	X		X		X	
GEO 3570 Foundations of Science Education	3	X		X		X	
GEO 4060 Geoscience Field Methods	3		X		X		X
GEO 4210 Intro to Computer Mapping & GIS	4		X		X		X
GEO 4220 Tech. & Applicational Issues in GIS	4	X		X		X	
GEO 4300 Igneous & Metamorphic Petrology *	4		X				
GEO 4400 Remote Sensing II	4	X		X		X	
GEO 4510 Summer Field Camp *	4			X [(a)]			
GEO 4570 Science Teaching Methods	3		X		X		X
Elective Courses							
GEO 1030 Earthquakes & Volcanoes	3	X	X	X	X	X	X
GEO 1130 Intro to Meteorology	3	X	X	X	X	X	X
GEO 2950/4950 Geoscience Field Trips	1-3	X	X	X	X	X	X
GEO 3180 Paleontology *	4						X
GEO 3210 Quaternary Environ. Change *	3	?				?	
GEO 3250 Geology of Utah *	3				X		
GEO 3753 Geomicrobiology *	3		X				?
GEO 3880 Groundwater	4	X		X		X	
GEO 4010 Ancient Environ. & Paleoecology *	3				X		
GEO 4100 Engineering Geology *	3	X				X	
GEO 4150 Environmental Assessment *	3			X			
GEO 4550 Geochemistry *	3	X				X	

APPENDIX J. DEPARTMENT OF GEOSCIENCES GRADUATES 2007-2012.

NAME	MAJOR	GRADUATION	POST GRADUATION
Graduate 1	EST	Fall 2007	Jr High Science Teacher, Davis School District, UT
Graduate 2	Geol	Fall 2007	unknown
Graduate 3	Geol	Fall 2007	Geologist, Schlumberger TerraTek, Salt Lake City, UT
Graduate 4	Geol	Spring 2008	MS in Geology, UNLV; currently in PhD program (stable-isotope geochemistry)
Graduate 5	Geol	Spring 2008	Contract negotiator, Hill Air Force Base, UT
Graduate 6	EST	Spring 2008	Middle School Science Teacher, Martin Kellog MS, Newington, CT
Graduate 7	Geol	Spring 2008	Geologist, Schlumberger TerraTek, Salt Lake City, UT
Graduate 8	AEG	Spring 2008	unknown
Graduate 9	AEG	Spring 2008	Environmental Scientist, IHI Environmental, Salt Lake City, UT
Graduate 10	EST	Spring 2008	Jr High Science Teacher, Legacy JHS, Davis School District, UT
Graduate 11	AEG	Spring 2008	Environmental Professional, Kleinfelder, Salt Lake City, UT
Graduate 12	AEG	Spring 2008	GIS Analyst, U.S. Forest Service, Ogden, UT
2007-2008 Total	**12**		
Graduate 13	Geol	Fall 2008	Office Automation Clerk, U.S. Geological Survey, Boise, ID
Graduate 14	Geol	Fall 2008	unknown
Graduate 15	AEG	Fall 2008	unknown
Graduate 16	Geol	Fall 2008	Well-site geologist/mud-logger, oil-field service co., Pinedale, WY
Graduate 17	EST	Fall 2008	Jr High Science Teacher, Centennial JHS, Davis School District, UT
Graduate 18	EST	Spring 2009	Secondary Science Teacher, Weber School District, UT
Graduate 19	EST	Spring 2009	Jr High Science Teacher, Centennial JHS, Davis School District, UT
Graduate 20	EST	Spring 2009	Jr High Science Teacher, Centennial JHS, Davis School District, UT
Graduate 21	AEG	Spring 2009	Geologist, geotechnical company, Salt Lake City
2008-2009 Total	**9**		
Graduate 22	EST	Fall 2009	Davis School District, UT
Graduate 23	AEG	Spring 2010	deceased
Graduate 24	AEG	Spring 2010	Fleet Services, Weber State University
Graduate 25	Geol	Spring 2010	Geologist, North American Mining Services, Copperton, UT
Graduate 26	AEG	Spring 2010	pursuing 2nd bachelor's degree in geography, Weber State University
2009-2010 Total	**5**		
Graduate 27	Geol	Summer 2010	MS in Geophysics, Utah State University; Geophysicist/Shell Oil -- Pittsburgh, PA
Graduate 28	Geol	Summer 2010	Geologist, North American Mining Services, Copperton, UT
Graduate 29	AEG	Summer 2010	Environmental Protection Specialist, Defense Logistics Agency, CA
Graduate 30	Geol	Summer 2010	MS in Geological Sciences, Notre Dame University, IN; Geologist, NAMS, UT
Graduate 31	EST	Fall 2010	Science Teacher, Ogden School District

Graduate 32	EST	Fall 2010	works at Dick's Market, Bountiful, UT
Graduate 33	Geol	Fall 2010	Geologist, North American Mining Services, Copperton, UT
Graduate 34	Geol	Fall 2010	Geologist, North American Mining Services, Copperton, UT
Graduate 35	EST	Fall 2010 (2nd bachelors)	substitute teacher, Weber School District
Graduate 36	AEG	Spring 2011	unknown
2010-2011 Total	**10**		
Graduate 37	AEG	Summer 2011	Davis School District, UT
Graduate 38	Geol	Fall 2011	Geologist, North American Mining Services, Copperton, UT
Graduate 39	EST	Spring 2012 (2nd bachelors)	Track Coach, Orion JHS, Weber School District
Graduate 40	AEG	Spring 2012	Customer Service Manager, Smith's Food & Drug, UT
2011-2012 Total	**4**		
Estimated graduates	4	Fall 2012	
Estimated graduates	10	Spring 2013	
2012-2013 Total	**est. 14**		

The department maintains a file that includes the graduate's name and contact information.