Introduction

UWRF has a rich history of providing geology education with course offerings as far back as 1875. Although the courses and program offerings have changed over the years, our mission, to provide students with a strong geological foundation by providing rich classroom, field, laboratory, and research experiences that emphasize a multidisciplinary understanding of the Earth system, has remained central to our program. As the science of geology has advanced, the discipline has become increasingly more multidisciplinary. For much of its history, the Geology program at UWRF has been part of the College of Agriculture, which was later renamed the College of Agriculture, Food, and Environmental Sciences (CAFES). This connection to agriculture gives our geology program a distinctive and unique identity compared to other geology programs in Wisconsin and nationwide. To our knowledge we are one of the only geology programs in the nation associated with a college of agriculture.

The proposed program revision seeks to
1. enhance our strong group of core geology courses and 2. expand and strengthen our multidisciplinary connections within the Department of Plant and Earth Science and the College of Agriculture, Food, and Environmental Science, in addition to other programs on campus. These changes will help make our students even more successful in their careers and will help align our curriculum and program to existing faculty expertise. This program revision is the culmination of several years of strategic planning discussions and represents an important step towards enhancing our Geology program at UWRF.

As part of our strategic planning process, we established five student learning goals for our program:

**Goal One:** Students will develop as lifelong learners to become productive, creative, ethical, and engaged citizens and leaders with an informed global perspective through a foundation of diverse and interdisciplinary academic experiences.

**Goal Two:** Students will demonstrate a broad knowledge of the physical and natural sciences including the nature, structure, and cycling of matter and energy and the understanding of the Earth as a system.

**Goal Three:** Students will demonstrate a comprehensive core knowledge of earth history, materials, structures, and processes occurring on the surface and within the Earth over geological time.

**Goal Four:** Students will be able to utilize geologic maps, field and laboratory equipment and instrumentation, software, mathematics, and statistics, and other technologies to investigate Earth’s systems.

**Goal Five:** Students will develop professionally, as geologists, through a combination of academic, field, international, and research experiences.

Current course requirements were evaluated against each of the established goals and new courses were added to enhance curriculum in areas where it was needed.
Program Goals and Curriculum

**Goal One:** Students will develop as lifelong learners to become productive, creative, ethical, and engaged citizens and leaders with an informed global perspective through a foundation of diverse and interdisciplinary academic experiences.

Students will complete the UWRF General Education and University requirements with the following courses designated for specific categories:

S (Sciences): GEOL 101 (Introduction to Geology)
SL (Sciences Laboratory): CHEM 120/121 (General Chemistry I)
EC (Ethical Citizenship): ESM 105 (Introduction to Environmental Science) OR GEOL 269 (Environmental Geology)

**GEOL 350 (Geological Destinies of Nations) will be strongly recommended for MD (Multidisciplinary) and GP (Global Perspectives).

**Goal Two:** Students will demonstrate a broad knowledge of the physical and natural sciences including the nature, structure, and cycling of matter and energy and the understanding of the Earth as a system.

Students will complete the following courses:

GEOL 101 (Introduction to Geology)-3*
CHEM 120 (General Chemistry I)-6* OR CHEM 121 (General Chemistry I)-5*
PHYS 121 (General Algebra-based Physics I)-5 OR PHYS 131 (General Calculus-based Physics I)-5
ESM 105 (Introduction to Environmental Science)-3* OR GEOL 269 (Environmental Geology)-3*
SOIL 120 (Introductory Soil Science)-3

*counts towards general education (credits not counted in goal total)

**Goal Three:** Students will demonstrate a comprehensive core knowledge of earth history, materials, structures, and processes occurring on the surface and within the Earth over geological time.

Students will complete the following courses:

GEOL 150 (Geological Perspectives of Global Change)-3
GEOL 230 (Mineralogy)-4
GEOL 231 (Petrology)-4
GEOL 326 (Structural Geology)-4
GEOL 327 (Geomorphology)-4
GEOL 328 (Geochemistry)-3
GEOL 362 (Stratigraphy and Sedimentation)-4
GEOL 441 (Geophysics)-4
GEOL 445 (Hydrogeology)-3
GEOL 450 (Paleontology)-4
**Goal Four:** Students will be able to utilize geologic maps, field and laboratory equipment and instrumentation, software, mathematics, and statistics, and other technologies to investigate Earth’s systems.

Students will complete the following courses:

GEOL 102 (Introduction to Geology Laboratory)-1  
MATH 166 (Calculus I)-4  
GEOG 250 (Introduction to Geographic Information Science)-3

**Goal Five:** Students will develop professionally, as geologists, through a combination of academic, field, international, and research experiences.

Students will complete the following:

GEOL 285 (Sophomore Seminar)- 1  
GEOL 371-377 (Regional Geology Field Course)- 1

Capstone experience- choose one of the following  
(3-6 credits – three credits counted as capstone and the remaining credits  
– if any- counting towards directed electives):

1.) GEOL 270/370: (Summer Internship)  
2.) GEOL 490: (Independent Study- Undergraduate Research Experience)  
3.) GEOL 489: (Special Topics- Field Camp)  
4.) GEOL 378: (Study Abroad Experience)  
5.) GEOL 489: (Research Experiences for Undergraduates (NSF) projects)

Professional Development Plan- required of all students prior to graduation

**Other**

Directed Electives- 19-20 credits. We have developed a list of appropriate classes selected mainly from other areas of science and Math/Computer science, but also including selected others such as ART 307 (computer graphics) and ENGL 367 (Technical writing)

<table>
<thead>
<tr>
<th>Credit summary</th>
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<tbody>
<tr>
<td>General Education</td>
<td>40 cr</td>
</tr>
<tr>
<td>Required Geology Classes</td>
<td>45 cr</td>
</tr>
<tr>
<td>Required Supporting Classes</td>
<td>15-16 cr</td>
</tr>
<tr>
<td>Directed elective Classes</td>
<td>19-20 cr</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>120 cr</td>
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</tbody>
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*n.b. University requirement (d) adds three credits to this program.*  
*University requirement (g) double counts with recommended MD classes*
Program Revision Narrative

**Goal One:** No significant changes for general education except to formally require GEOL 350 (Geological Destinies) for MD/GP and either ESM 105 (Introduction to Environmental Science) or GEOL 269 (Environmental Geology) for EC. All of these courses provide students with a broad perspective on the importance of geological resources, environmental issues, and the impact of humans on the Earth system. These courses are already being taken by a significant percentage of current geology majors.

**Goal Two:** There are several significant changes in supporting physical/natural science courses. In our present program both Chemistry II and Physics II are required. In the proposed program only Chemistry I and Physics I will be required. We have done an extensive analysis of concepts addressed in these courses and feel that this will not reduce the quality of or negatively impact our program. For students intending to pursue graduate school, we will advise them to research course requirements and evaluate whether Chemistry II or Physics II would be beneficial to them as elective coursework. In addition, we are proposing to add SOIL 120 (Introductory Soil Science). Many of our students gain employment in the environmental sector where soil science knowledge is often very beneficial. Many students are already taking SOIL 120 as an elective.

**Goal Three:** The geology faculty remain strongly committed to providing students a broad but comprehensive geology degree. Rather than specializing in a certain sub discipline, we offer a wide range of technical geology courses. This has served our students and employers well. There are several significant changes to certain geology courses:

1. **GEOL 150 (Geological Perspective of Global Change)**- This course is actively going through a course change from its previous title of Historical Geology. Historical Geology has long been a central course for geology majors nationwide and focuses on examining the geological events in earth's history, and specifically life, chronologically over time. As the discipline and knowledge-base have rapidly expanded, there is a need for students to have an integrated perspective of how life, climate, and large-scale processes (such as tectonics) have concurrently affected the planet over time. Instead of a chronological approach, this course will focus on key 'extraordinary' events (such as the development of life, rise of oxygen in the atmosphere, mass extinctions, etc.), the magnitude and rate of change and how they have altered and shaped the planet. We expect that this course will be applicable not just to Geology but also Environmental Science, Soil Science, Geography, Biology, and other majors. Course development is currently supported by strategic initiative funding.

2. **GEOL 328 (Geochemistry)**-This is a new course that is actively going through the course proposal process. Geochemistry is a fundamental component of a broad Earth Science education. Nearly all Earth Science fields involve geochemistry at some level. It is a common requirement of most Geology programs across the nation, and the lack of a Geochemistry course at UWRF has been a notable limitation of the program. By learning basic geochemical principles, students will be equipped to carry out research and projects in fields as diverse as hydrogeology, soil science, atmospheric science or mineralogy and volcanology. An understanding of geochemistry is a valuable tool that can be applied to a variety of topics. We expect that this course will be
applicable to Environmental Science, Chemistry, and Soil Science majors in addition Geology majors. Course development is currently supported by strategic initiative funding.

3. GEOL 230/231- These courses will be modified to include chemistry concepts presently not covered in CHEM 120/121. Course concepts will also shift with the addition of GEOL 328 (Geochemistry).

4. GEOL 326/441- These courses will be modified to include physics concepts presently not covered in PHYS 151/161.

**Goal Four:** One section of GEOL 102 (Introduction to Geology Laboratory) will be taught for Geology, Environmental Science, Soil Science, Education, and other majors/minors that currently require the course. This course will ultimately be re-designed as a more applied laboratory and field methods course. GEOG 250 (Introduction to Geographic Information Science) is also being added to the major. Knowledge of geographic information systems and software packages such as ArcGIS is the standard for analysis of spatial data and essential for geologists.

**Goal Five:** The significant change in this goal is the revision to the capstone experience. Our current program requires all students to conduct an undergraduate research project. Our current staffing and commitments do not allow us to continue to provide this experience in the future. Furthermore, less than 30% of our students go on to graduate school and many could have equal or greater benefits from other high impact practices. We are proposing to give students the choice among several options and will work with their faculty advisor to choose the one most beneficial for them.

1. GEOL 270/370: (Summer Internship)- We will leverage the expertise and resources of the CAFES Internship office to facilitate this option. We currently have one faculty member designated as the program liaison and the faculty will collectively work to network with employers and develop high-quality internship opportunities.

2. GEOL 490: (Independent Study- Undergraduate Research Experience)- This option will consist of a significant (8-12 week) undergraduate research program with either a UWRF geology faculty member or participation in a research experience such as the National Science Foundation-Research Experience Undergraduate (REU) program.

3. GEOL 489: (Special Topics- Field Camp)- Field camp is a multi-week applied field experience for geology students hosted by a variety of institutions. Many field camps focus on a specific subdiscipline and are ideally suited for students going on to private industry, government, or graduate school. Many employers and graduate schools require or expect field camp experience. UWRF does not currently host a field camp; however there are several offered in the Midwest. There is currently a CAFES Scholarship to financially support students enrolling in field camp.

4. GEOL 489: (Special Topics- Study Abroad Experience)- One of the unique aspects of geology compared to other STEM disciplines is that geologic environments are vastly different from place to place. Several of our faculty have served as program leaders, instructors, or mentors within various UWRF study abroad programs such as Study Abroad: Europe, International Travelling Classroom, and Wisconsin in Scotland.