

# : ENVIRONMENTAL GEOLOGY, MS

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## In Workflow

1. U Program Review (dforgacs@illinois.edu; eastuby@illinois.edu; aledward@illinois.edu)
2. 1655 Head (altaner@illinois.edu)
3. SESE Head (tomkin@illinois.edu)
4. KV Dean (las-catalog@illinois.edu)
5. University Librarian (jpwilkin@illinois.edu)
6. Grad\_College (agrindly@illinois.edu; jch@illinois.edu; lowry@illinois.edu)
7. Provost (kmartens@illinois.edu)
8. Senate EPC (bjlehman@illinois.edu; moorhouz@illinois.edu; kmartens@illinois.edu)
9. Senate (jtempel@illinois.edu)
10. U Senate Conf (none)
11. Board of Trustees (none)
12. IBHE (none)
13. DMI (eastuby@illinois.edu; aledward@illinois.edu; dforgacs@illinois.edu)

## Approval Path

1. Thu, 04 Feb 2021 17:08:22 GMT  
Deb Forgacs (dforgacs): Approved for U Program Review
2. Thu, 04 Feb 2021 19:10:37 GMT  
Stephen Altaner (altaner): Approved for 1655 Head
3. Thu, 04 Feb 2021 19:14:24 GMT  
Jonathan Tomkin (tomkin): Approved for SESE Head
4. Thu, 04 Feb 2021 20:38:44 GMT  
Amy Elli (amyelli): Approved for KV Dean
5. Thu, 04 Feb 2021 20:39:38 GMT  
John Wilkin (jpwilkin): Approved for University Librarian
6. Wed, 10 Mar 2021 16:15:56 GMT  
Allison McKinney (agrindly): Approved for Grad\_College
7. Mon, 15 Mar 2021 21:00:21 GMT  
Teresa Spence (tcspence): Approved for Provost

## New Proposal

Date Submitted: Tue, 02 Feb 2021 22:41:07 GMT

## Viewing:: Environmental Geology, MS

Changes proposed by: Beth McKown

## Proposal Type

### Proposal Type:

Major (ex. Special Education)

Proposal Title:

**If this proposal is one piece of a multi-element change please include the other impacted programs here. *example: A BS revision with multiple concentration revisions***

Establish a non-thesis Master of Science degree in Environmental Geology in the Department of Geology within the College of Liberal Arts and Sciences

**EP Control Number**

EP:21.098

**Official Program Name**

Environmental Geology, MS

**Effective Catalog Term**

Fall 2022

**Sponsor College**

Liberal Arts & Sciences

**Sponsor Department**

Geology

**Sponsor Name**

Tom Johnson, Head of Geology

**Sponsor Email**

tmjohnson@illinois.edu

**College Contact**

Kelly Ritter

**College Contact Email**

ritterk@illinois.edu

## Program Description and Justification

**Provide *abrief* description and justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.**

The Department of Geology (GEOL) proposes a new online, non-thesis Master of Science (M.S.) degree in Environmental Geology to accommodate remotely-located learners and working professionals. As outlined below, the proposed non-thesis M.S. degree option is designed to meet the high demand for advanced Geology expertise used in applied industry sectors, including groundwater modeling and contaminant migration characterization, geophysics, and "big data" analysis. This new degree will be able to satisfy demand from non-traditional students seeking to obtain an advanced degree in applied Geology, and from working professionals whose employers may pay some or all of the tuition. As such, the new Environmental Geology M.S. degree program satisfies an under-served educational community while not detracting from on-campus undergraduate and graduate-level GEOL programs. The new Environmental Geology M.S. will accommodate remotely-located students, particularly those located in the greater Chicago area, and builds upon existing GEOL faculty expertise in innovative online pedagogy. The requested new program will enable this expansion without drawing resources from other Geology graduate programs; to the contrary, it will increase course offerings.

The existing on-campus Geology, MS, "applied geology" (or non-thesis) option, in its current form, is not able to serve the intended student demographic. Only 2 students have completed this option over the past ten years, because of geographic and capacity limitations. Many prospective

students are working professionals in urban areas far from Champaign-Urbana, and the current Geology graduate program emphasizes basic research rather than applied training. It does not have the capacity to serve applied geology students. The department seeks to 1) expand the geographic reach of the department's teaching mission to serve students in Chicago, other cities, and globally, and 2) expand course offerings to provide optimal training in advanced topics. Both of these goals can be met through the creation of a new, fully-online M.S. degree in Environmental Geology funded through tuition revenue return to the department and the college. This revenue stream will allow the department to offer a series of online courses to optimally serve these new Environmental Geology online M.S. students living far from Champaign-Urbana, without diverting resources from the existing Geology graduate program.

GEOL's Environmental Geology online M.S. program is designed to meet high demand for advanced Geology expertise and would be the nation's first M.S. degree option in a Geology subdiscipline that can be completed fully online. The new M.S. degree is designed to accommodate a demographic comprised of nontraditional and working learners by offering online coursework, advising, and capstone research. The primary target is the environmental consulting sector, which is the most productive sector for employment of geologists and will remain a consistent area of employment for decades. According to the American Geoscience Institute, nearly 30% of Geology B.S. degree graduates were hired by environmental consulting firms in 2017. Another large fraction of Geology B.S. degree graduates have entered similar environment-related federal government jobs. As such, these Environmental Geology positions represent the largest sector of employment for recent Geology graduates nationwide. The department has observed that UIUC B.S. degree recipients, after a few years employed by organizations in this sector, discover that advanced skills and certification obtained through a M.S. degree in Geology are required to migrate into project management and leadership positions. However, taking time out of industry to complete a graduate degree can pose a high risk for individuals (particularly those supporting families) wishing to re-enter the work force after completing their graduate degree, making online graduate studies highly attractive, particularly with employer sponsorship.

Further, as State-based Professional Geology (P.G.) certification programs often credit advanced degree time toward the minimum time required for P.G. certification and licensing, the value of our proposed, online Environmental Geology M.S. is amplified to entry-level employees seeking graduate degrees remotely, especially with employer tuition support.

GEOL anticipates that a large fraction of students participating in our online Environmental Geology M.S. program will reside in the State of Illinois, especially in the Chicago metro. area, and will complete capstone projects and/or internships with environmental consulting firms in Illinois. Further, because the Illinois State Water Survey (ISWS) and the Illinois State Geologic Survey (ISGS) have ongoing practical projects in need of student and GEOL departmental involvement, significant potential exists in partnering with Illinois-based students in the online M.S. through the required capstone projects. As such, the new Environmental Geology online M.S. program allows the Department of Geology, which currently has a very small Urbana-based, face-to-face M.S. program, to meet demand for a practical, flexible M.S. accessible to Illinois-based students and, in particular, Chicago metro. residents. Finally, the overall Chicago-focused nexus of research by the ISWS and ISGS, connections to private-sector Environmental Consulting firms, and student involvement and focus on applied Geology will be ideally aligned with the Discovery Partners Institute (DPI).

The new online M.S. in Environmental Geology degree program offers the opportunity to learn advanced topics in geology through online coursework and capstone collaborations with GEOL and other UIUC faculty, all of whom have strong international reputations in their respective Geology subdisciplines. Specifically, GEOL has four faculty members with research and teaching programs focusing on groundwater, water chemistry, and contaminant characterization and migration. The Illinois State Water Survey (ISWS) and the Illinois State Geological Survey (ISGS) have Senior Scientists specializing in subsurface contamination at a variety of Illinois-based project sites. One of these scientists is already developing an online version of their Python-based hydrogeology modeling course that would be offered as part of the expanded M.S. degree program. The Covid-19 pandemic has rapidly accelerated faculty online teaching and learning expertise, particularly with the Summer 2020's first fully-online Geology field course. Our proposed Environmental Geology online M.S. program will build on these strengths as faculty teach in a variety of modalities and serve a more diverse cross-section of students.

The proposed Environmental Geology online M.S. degree program is part of three connected, synergistic M.S. programs in development with funding from an Office of the Provost's "Investment for Growth" (IFG) Program Grant (<https://provost.illinois.edu/about/initiatives/investment-for-growth-program/>), housed in the School for Earth, Society, and the Environment (SESE). The proposed "Weather and Climate Risk and Analytics" (Dept. of Atmospheric Sciences) and "CyberGIS and Geospatial Data Science" (Dept. of Geography and GIS) online M.S. degree programs will both enhance Geology's proposed Environmental Geology online M.S. program by providing shared courses, specialized courses in certain key areas (see below), and a larger group of faculty and staff collaborating to achieve overall program success, both on-campus and online.

In summary, GEOL's new online M.S. degree program will provide a high-quality, cutting-edge M.S. degree while targeting a more diverse cross-section of learners previously unable to complete this degree program on campus. As stated above, the initial, expanded target market will focus on the environmental consulting industry. GEOL notes that the UIUC 2018-2023 strategic plan articulates the goal of making UIUC "the go-to place for professional and continuing education programs" through "the creation of workforce-development strategies and related partnerships across the public and private sectors...using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers." The proposed Environmental Geology online M.S. degree program will align GEOL's graduate programs with this campus-wide goal while simultaneously benefitting both on-campus and remotely placed GEOL graduate students and programs.

Worldwide, industries and governments face the challenge of assimilating and analyzing enormous streams of data. SESE faculty are experts in working with large geophysical and geospatial datasets, advanced scientific programming, and cyberGIS (that is, new-generation geographic information science and systems based on advanced computing and cyberinfrastructure). Recognizing these building "Big Geodata" challenges facing professionals, students in the Environmental Geology online M.S. program are required to enroll in a minimum of two core courses focusing on geodata science and analysis (6 min. hrs.), building upon data science synergies with GGIS and ATMS through IFG funding, as illustrated in Fig. 1 attached.

Fig. 1 illustrates the relationships between the new or existing 400 and 500-level online courses developed and offered by each of the three departments within SESE through IFG funding, providing educational advancement for SESE online, non-thesis graduate students while taking advantage of the strengths of each department's expertise in computational and data sciences as well as geospatial analysis. Courses related to common core learning objectives, specifically Principles of GIS, and Geocomputation and Data Science with Python and R, can be taken by students in the Environmental Geology online M.S. as part of their core course requirements (see Academic Catalog Entry section below for details).

In addition to the core courses in geodata science and analysis, students have the opportunity to select, with the aid of their Program Advisor Dr. Pettijohn, 400 and 500 level course work focusing on advanced subjects and case studies. As such, students will work closely with the advisor to select advanced courses that provide the theoretical foundation and knowledge to successfully complete the capstone research project.

**Corresponding Degree**

MS Master of Science

**Is this program interdisciplinary?**

No

**Academic Level**

Graduate

**Will you admit to the concentration directly?**

No

**Is a concentration required for graduation?**

No

**CIP Code**

304101 - Environmental Geosciences.

**Is This a Teacher Certification Program?**

No

**Will specialized accreditation be sought for this program?**

No

**Institutional Context**

University of Illinois at Urbana-Champaign

Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built.

**Explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).**

The proposed program is designed to attain a long-standing goal of the Department of Geology: To prepare students for careers in applied geology using the unique strengths of faculty in Geology and elsewhere on campus. This goal has not been attained for many years, for several reasons:

- The Geology graduate program, with its emphasis on externally funded, leading-edge research, enrolls mostly Ph.D. students. Most applied geology jobs are done by M.S. degree holders, but the department has had little capacity to serve M.S. degree seekers.
- M.S. theses in the Department of Geology emphasize advanced research which is not ideally aligned with applied geology careers.
- Most B.S. degree holders in industry cannot afford to stop working for two years to pursue an M.S. degree on our campus.
- Most careers in applied geology are located far from Champaign-Urbana; pursuing a UIUC Geology M.S. degree while continuing to work is not feasible.
- The department's budget and staffing have not allowed it to offer a suite of courses that would provide excellent, targeted training for applied geology students.

The proposed program overcomes all of these barriers by providing an industry-focused M.S. degree that is accessible to students around the globe (but most importantly in the Chicago area) and which generates revenue to support the offering of industry-focused courses.

An existing non-thesis Geology M.S. degree exists, but only two students have completed this degree in the past ten years. For the reasons listed above, it has not been in great demand. It has been used mostly in cases where Ph.D. students exited that program but have completed enough coursework to warrant awarding an M.S. degree. The department plans to modify the face-to-face, non-thesis M.S. program description to reflect that reality.

The proposed program overlaps synergistically, and to small extent, with two new online M.S. programs being developed by sister departments ATMS and GGIS (see above). Roughly 15% of the new Geology degree consists of shared courses serving all three degree programs. The proposed program will also make use of a few advanced online courses previously developed for the existing, SESE-level, online B.S. in Earth, Society, and Environmental Sustainability (ESES). Although the new Geology program will include some courses developed for these other SESE programs, the Geology program has very distinct goals.

The Geology program has some content overlap with M.S. degrees in the Department of Civil and Environmental Engineering (CEE) and the Department of Natural Resources and Environmental Sciences (NRES). However, the CEE degree only overlaps in the area of groundwater flow and remediation and has a very different overall emphasis. Similarly, the NRES program is a broad environmental program with an emphasis on biological aspects, without the emphasis on geological skills required for jobs in the environmental geology field.

Overall, there are no conflicts with existing programs at UIUC. The coursework as part of the proposed Geology online M.S. degree program will not detract from on-campus offerings of the face-to-face courses serving on-campus students. The new program will increase the variety of advanced coursework offered by the department. On-campus students will benefit from this expanded choice, as on-campus students will be able to enroll in the new online courses.

University of Illinois

**Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.**

The proposed Environmental Geology online M.S. degree program will advance, in part, the careers of professionals working improve the environment as regulated by federal and state environmental legislatures. As such, our program supports the University's mission and priorities by broadening the reach of GEOL's environmental and societal impacts domestically and internationally. Through state-of-the-art knowledge and skills provided such as groundwater contamination plume characterization and remediation, big data analysis and communication, and other central public and environmental health issues, our proposed online M.S. program will provide advanced skills and knowledge to professionals working in the environmental geology public and private sectors. As such, the proposed degree program directly supports the University's mission through its underlying goal to reduce human vulnerability to environmental degradation. As noted above, this basic goal intersects with the following UIUC strategic initiatives:

- "Innovate in graduate, professional, and continuing education, with new degree programs and certificates at the intersection of disciplines, and support recruitment and retention of graduate students" [Goal 2.F].

The new and innovative Geology online M.S. degree program will help achieve UIUC Strategic Initiative Goal 2.F through synergies with the two additional proposed SESE online M.S. programs. Specifically, shared online courses and cross-discipline teaching and learning environments as part of the three new SESE online M.S. programs will increase graduate student enrollment while not detracting from on-campus programs.

- "Accelerate the growth of the Illinois entrepreneurial ecosystem to establish Champaign-Urbana as the best university-based entrepreneurship and innovation hub in the Midwest" [Goal 3.F].

The capstone course required as part of Geology's proposed online M.S. degree program will build heavily upon partnerships with both Research Park affiliates and Discovery Partners Institute (DPI) members. Such partnerships through the online M.S. program will also benefit on-campus undergraduates and graduates through faculty and student research projects and internships. The increased partnerships will therefore benefit the local, State, and national economy through shared connections between UIUC, DPI, and Research Park.

- "Reach out to all community stakeholders and partner with them to make our university and its surrounding region the leading innovation center and testbed for the technologies and services that will enable the safe, healthy, and sustainable communities of the future" [Goal 3.G].

Because Geology's proposed online M.S. degree program is initially geared heavily toward the environmental consulting industry, students participating in the new program will learn about innovative numerical modeling and geomicrobiological-based remediation strategies and technologies used in the environmental consulting industry. An online M.S. course such as "GEOL 572: Hydrogeology with Python," taught in collaboration with the Illinois State Water Survey, will expose participating students to cutting-edge groundwater modeling techniques that will directly benefit community stakeholders through improved contaminant assessment and modelling. Further, the new online M.S. will include courses in water chemistry and bioremediation, taught by GEOL's world-class faculty. Students in these courses will learn state-of-the-art, applied bioremediation strategies and technologies to address environmental contamination. Over time, public and private sector environmental consulting organizations will benefit not only from hiring students receiving our new online M.S. degree, but also from collaborations through capstone research projects and internships. These collaborations will help improve community health over time as environmental contamination is characterized and remediated using cutting-edge approaches taught through our proposed online M.S. degree program.

- "Create workforce-development strategies and related partnerships across the public and private sectors, with an emphasis on using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers" [Goal 3.H].

In addition to the aforementioned partnerships and synergies, the online nature of Geology's proposed online M.S. degree program will be of particular interest to continuing workers. GEOL anticipates that individuals already working in industry positions will obtain enhanced skill sets in applied geology through our new online, graduate-level degree program. The new degree will help these potential applicants and workers in public and private sector organizations to advance in their respective organizations and manage projects. Furthermore, individuals wishing to enter public and private sector environmental consulting organizations will be able to increase their chances of employment by matriculating through our new online M.S. degree program in applied Geology.

- "Develop and execute an integrated, coordinated, and sustained marketing and communications effort to all stakeholders and influencers: students, alumni, parents and friends, business and government leaders, and residents of the state of Illinois" [Goal 3.I].

GEOL will participate in the College of Liberal Arts and Sciences (LAS) new Corporate Affiliates Program (CAP), the goal of which is to achieve Goal 3.I through sustained, coordinated, and integrated relationships with alumni positioned in related public and private sector organizations. Online M.S. marketing strategies will build on these relationships, focusing particular attention on Illinois-based organizational connections. Strategic marketing communications will be developed with the help of LAS and the Center for Innovation in Teaching and Learning (CITL) at UIUC to weave narratives and celebrate success stories of connections developed through our new online M.S. program and partnerships with public and private sector organizations, Research Park, DPI, and the State Water and Geological Surveys.

- "Understand that the largest resource on campus is its employees and students while creating an inclusive and welcoming campus climate" [Goal 4D].

The online nature of our proposed M.S. degree program will directly benefit non-traditional students through the more flexible and affordable nature of online education. Similarly, because students living in any location, nationally or internationally, can obtain our new degree, overall diversity will be greatly increased. Narratives highlighted in our marketing collaborations will also celebrate this fostered diversity and set a diverse representation of all involved parties. Fostering safe and welcoming working environments will be a continuing focus in advising and round-table discussions as part of the online M.S. degree program. Virtual panel discussions will be organized to help students in our program.

State of Illinois

**Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)**

College Affordability - ensure college affordability for students, families, and taxpayers.

Educational Attainment - increase educational attainment to match the best-performing states.

High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.

Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

**Describe how the proposed program supports these goals.**

According to the American Geoscience Institute, Illinois has less than half of the number of certified geology workers per capita as peer states (such as California and Texas) and this is partly due to a mismatch between the largest geology educational institution in the state (the Department of Geology at UIUC) and the largest population center (Chicago). Our proposed program will increase educational attainment in the field by reducing the importance of the geographic obstacle.

The online degree program will be more affordable than other geology degree programs in Illinois. Not only does the online format allow for much lower tuition costs for students, it makes it possible for workers to simultaneously undertake further their education while supporting their families. This is also a great deal for taxpayers: the self-supporting nature of the degree will mean that taxpayers are not supporting the program. The proposed program will address rapidly growing needs for geologists in industry requiring post-graduate degrees to move into project management positions. Further, our proposed Geology online M.S. degree program adds time-value to consultants working toward P.G. licensing. One of the requirements of the proposed degree program is a capstone research project, designed to help online M.S. students apply their growing knowledge of applied geology to a specific industry and site problem. GEOL is working closely with LAS to pilot the new LAS Corporate Affiliates Program so that industry partnerships are in place to help identify capstone research project collaborations. Further, GEOL will build on existing alumni connections through GEOL's Alumni Advisory Board to help foster these synergies and therefore achieve aforementioned goals of High Quality Credentials to Meet Economic Demand and Integration of Educational, Research and Innovation Assets.

## Admission Requirements

### Desired Effective Admissions Term

Fall 2022

**Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.**

Students in the Environmental Geology online M.S. program will need to fulfill the key requirements listed on GEOL's graduate admissions page, e.g., a minimum grade point average of 3.0 (on a 4.0 scale) and a firm background in physics, chemistry and mathematics is required for admission. Individuals interested in applying to the program but lack the requisite 3.0 GPA may be considered for admission based upon their application and communications with the program advisor. Please refer to the Academic Catalog Entry section for more detail.

**Describe how critical academic functions such as admissions and student advising are managed.**

Students in the new Environmental Geology online M.S. program will follow GEOL's existing admissions and advising structures. Advising will be conducted by Specialized Faculty member Dr. Cory Pettijohn, who will work closely with GEOL's Graduate Admissions Committee and other faculty to design a list of courses and capstone research project unique to each student in the program. As mentioned above, the creation of a separate degree code that incorporates revenue-sharing will support the planned expansion and increased faculty advising and teaching loads.

From the Geology Graduate Handbook:

#### Advisor Requirement

The student's program must be developed with the academic advisor and approved by the advisor and the Graduate Studies Committee. The advisor is responsible for monitoring the student's program and ensuring that all degree requirements have been satisfied.

In addition, all graduate students follow an annual review in which their progress is assessed. From the Geology Graduate Handbook:

#### Annual Review Process for Academic Progress

Following the policy of the Graduate College the Geology program will conduct an annual review of all currently enrolled graduate students. The purpose of the review is to evaluate a student's progress and to identify an ongoing pathway to professional success. This form of annual progress-tracking allows the student and supervisor to meet and establish objectives for the year. This ensures that both students and advisors be held accountable for timely progress and for constructive feedback. Initially, the annual review will follow procedures used for the on-campus graduate degree programs. Over time, the online M.S. review process may evolve to reflect the specific needs of the student enrolled.

The annual review of Geology degree candidates is currently conducted in the spring semester according to the following structure: The review begins with a self-assessment. This and other written parts of the process are done online at [my.atlas.illinois.edu](http://my.atlas.illinois.edu). Once the student has completed the online form, their advisor will make comments on the student's progress and the plan for the upcoming academic year.

Following Graduate College guidelines, the student and advisor must meet in person to communicate and discuss the advisor's feedback. A Geology affiliate should be present for the review discussion between the student and their advisor. The meeting includes an oral presentation of up to 15 minutes in length by the student, outlining progress made during the past year, and research plans for the upcoming year.

If there is disagreement of opinion between the student and the advisor on the performance evaluation, proposed plan of action, or both, the Grad Studies Committee Chair must be informed immediately by the advisor. It is stressed that the primary purpose of this review is to provide feedback and discussion to assist the student in their progress towards graduation and other career goals. A meeting of the Grad Studies Committee of the Department will be held to discuss the annual reviews of every student.

## Enrollment

### Number of Students in Program (estimate)

#### Year One Estimate

5

#### 5th Year Estimate (or when fully implemented)

20

### Estimated Annual Number of Degrees Awarded

#### Year One Estimate

0

#### 5th Year Estimate (or when fully implemented)

5

### What is the matriculation term for this program?

Fall

### What is the typical time to completion of this program?

2 years

### What are the minimum Total Credit Hours required for this program?

32

## Delivery Method

### This program is available:

Online Only

### Describe the use of this delivery method:

The online degree program will be more affordable than other geology degree programs in Illinois. Not only does the online format allow for much lower tuition costs for students, it makes it possible for workers to simultaneously undertake further their education while supporting their families. This is also a great deal for taxpayers: the self-supporting nature of the degree will mean that taxpayers are not supporting the program. The proposed program will address rapidly growing needs for geologists in industry requiring post-graduate degrees to move into project management positions. Further, our proposed Geology online M.S. degree program adds time-value to consultants working toward P.G. licensing.



# Budget

## Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

Yes

### Please explain/describe:

The requested tuition revenue return to the department (70%) will allow the creation of the new Environmental Geology online M.S. degree program without additional expenditures by the College of LAS. The program's start-up costs are covered by support from the Provost's "Investment for Growth" (IFG) fund. After the startup phase, the long-term additional costs related to the online option will be covered sustainably by tuition return, with net positive revenue for the Department and revenue for the College of LAS. See Resources section below for details regarding IFG funding and sustainability of finances.

Faculty costs are budgeted to:

- Expand, develop, and/or deliver online versions of current courses
- Develop new courses aimed at the high-demand areas of applied Geology
- Advise the additional M.S. students
- Coordinate capstone projects for the additional M.S. students
- Handle administrative tasks related to admissions, advertising, and other general aspects

Teaching Assistant Professor Cory Pettijohn has been recently installed as the coordinator of this program. Dr. Pettijohn will teach several courses and handle most of the other tasks listed above, with the exception of some clerical and advertising tasks to be handled by a planned administrative hire to be shared with the counterpart programs in ATMS and GGIS. Some courses are already taught online as part of existing programs; no additional costs are budgeted as enrollments are expanded. Several new courses specific to this program will require expenditures for overload or summer pay to department faculty, or payments to adjunct faculty.

GEOL's 70% share of the tuition revenue will cover, with a small enrollment of approximately 10 students, the program's instructional effort costs described above and other miscellaneous costs of the program (e.g., IT support, advertising costs) Importantly, the new, fully-online M.S. program will not be allowed to have negative effects on teaching efforts serving our face-to-face degrees. The department has no excess teaching capacity among the state-funded faculty, and thus the teaching effort for the new program will be supplied in various ways described above.

### Additional Budget Information

The additional instructional, support, and administrative effort will be provided by:

- One specialized faculty member, full time in Geology. A specialized faculty member is dedicated to supporting online instruction (their own, as well as other faculty). This person will also be responsible for general academic advising of new students and overseeing some of the capstone projects. Teaching Assistant Professor, Dr. Cory Pettijohn occupies this position, as of January 2020.
- One School-level program administrative staff member covered 33% by Geology, who will have responsibility to manage miscellaneous program advertisement and upkeep in collaboration with Dr. Pettijohn of this and the other new IFG-sponsored programs in the School, as well as recruiting, applications and admission, course registration, grades, and related duties.
- Summer and/or overload salary for current faculty to develop and offer online courses.
- TA support, if needed to expand courses.
- Additional IT support effort at the School level to help administer the online courses.

These activities are fully funded via the "Investment for Growth" grant for the first 3 years of the program and are fully costed as part of the self-sustaining model, thereafter.

Although the new program will be initially supported by IFG grant funds, the program is planned to be self-supporting, with AY 22/23 tuition set at the online Base + Differential per credit hour rate, currently at \$712/credit hour. Following the budget model, the net tuition will flow to the College. Within the College, the Department will be responsible for all costs and will receive 70% of the net tuition (an agreement is in negotiation with the LAS Dean's office), 30% of the net tuition is to go to the College of LAS.

## Resource Implications

### Facilities

**Will the program require new or additional facilities or significant improvements to already existing facilities?**

No

### Technology

**Will the program need additional technology beyond what is currently available for the unit?**

No

### Non-Technical Resources

**Will the program require additional supplies, services or equipment (non-technical)?**

No

## Resources

**For each of these items, be sure to include in the response if the proposed new program or change will result in replacement of another program(s). If so, which program(s), what is the anticipated impact on faculty, students, and instructional resources? Please attach any letters of support/acknowledgement from faculty, students, and/or other impacted units as appropriate.**

### Faculty Resources

**Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.**

An additional specialized faculty member and a 33% FTE program coordinator will be employed as part of this new initiative (see "Budget", above), and as a consequence we do not expect significant impacts will occur for existing faculty.

The new specialized faculty member is dedicated to supporting instruction relevant to the hybrid program (their own, as well as other faculty) and will handle most of the additional instruction and coordination workload. This person will also be responsible for general academic advising of new students and placement efforts.

There is no expectation to increase regular semester teaching loads for current faculty. Some overload or summer teaching is expected to occur on an optional basis. Given the projected enrollment, any impact on student-faculty ratios will be minor. If enrollments are much greater than expected, a second specialized faculty member will be hired to teach additional sections or classes.

### Library Resources

**Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.**

Current collections and services are adequate for the proposed program as existing courses from GEOL GEOG ATMS ESE are being used in the curricula.

## Instructional Resources

**Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?**

No

**Does the program include other courses/subjects impacted by the creation/revision of this program?**

No

## Financial Resources

**How does the unit intend to financially support this proposal?**

The first 3 years of the online M.S. program are supported by the Provost's "Investment for Growth" program; it is planned to be self-supporting after that, with AY 22/23 tuition set at the online Base + Differential per credit hour rate, currently at \$712/credit hour. Following the budget model, the net tuition will flow to the College. Within the College, the Department will be responsible for all costs and will receive 70% of the net tuition (an agreement is in negotiation with the LAS Dean's office). 30% of the net tuition is to go to the College of LAS.

**Will the unit need to seek campus or other external resources?**

No

**Attach letters of support**

GEOL- Program Tuition Waiver Policy Proposal- request self supporting FINAL.pdf  
MS Environmental Geology Tuition Waiver Policy.pdf

**Are you seeking a change in the tuition rate or differential for this program?**

No

**Is this program requesting self-supporting status?**

Yes

## Market Demand

**What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students:**

According to the American Geoscience Institute, nearly 30% of Geology B.S. degree graduates were hired by environmental consulting firms in 2017. Another large fraction of Geology B.S. degree graduates have entered similar environment-related federal government jobs. As such, these Environmental Geology positions represent the largest sector of employment for recent Geology graduates nationwide. The department of GEOL has observed that UIUC B.S. degree recipients, after a few years employed by organizations in this sector, discover that advanced skills and certification obtained through a M.S degree in Geology are required to migrate into project management and leadership positions. However, taking time out of industry to complete a graduate degree can pose a high risk for individuals (particularly those supporting families) wishing to re-enter the work force after completing their graduate degree, making online graduate studies highly attractive, particularly with employer sponsorship.

The UIUC campus has a national reputation in Hydrogeology and our campus overall has great strength in this area across many units. Geology faculty include three faculty who concentrate on water chemistry and contaminants. The Illinois State Water Survey (ISWS) and the Illinois State Geological Survey (ISGS) have senior scientists that work to address water contamination in Illinois and who would be part of the new online MS program.

Although the program would be designed so it can be completed 100% online, we expect that a large fraction of the students will live in the Chicago area and would complete capstone projects or work as interns through GEOL's Chicago connections. Both the ISWS and the ISGS have ongoing practical projects and there is great interest in getting students in this program involved as interns or capstone students. The department's network includes environmental consulting firms with internship programs that would naturally link with the new online degree.

The new program will allow the Department of Geology, which currently has a small Urbana-based, face-to-face M.S. program, to meet demand for a practical, flexible M.S. accessible to Chicago-area residents. The overall Chicago-focused nexus of research by the ISWS and ISGS, connections to private-sector Environmental Consulting firms, student involvement and focus on water and environment would be perfectly aligned with the Discovery Partners Institute.

More broadly, the new program would be the first fully online M.S. degree in Environmental Geology and would therefore have global reach and a large pool of potential applicants.

**What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.**

The new Environmental Geology online M.S. degree will prepare this cross-section of students to work, or continue to work as Project Managers, in the Environmental Consulting industry or public-sector jobs that focus on assessment and remediation of water and soil contamination, and related environmental issues. Currently, this is the most productive sector for employment of geologists. An M.S. degree is essential for desirable jobs in this industry; many geologists begin work with a B.S. degree but soon realize an M.S. is needed for career advancement. Key skills include advanced understanding of groundwater migration, geochemistry of natural waters, the materials and layering that characterize aquifers, use of GIS systems, and data manipulation/analytics.

As discussed in the "Program Description and Justification" section, the new Environmental Geology online M.S. program is designed to meet high demand for advanced Geology expertise and would be the nation's first M.S. degree option in a Geology subdiscipline that can be completed fully online. The new M.S. degree is designed to accommodate a demographic comprised of nontraditional and working learners by offering online coursework, advising, and capstone research. The primary target is the environmental consulting sector, which is the most productive sector for employment of geologists and will remain a consistent area of employment for decades, particularly for students completing the new online Environmental Geology M.S. program.

Further, as State-based Professional Geology (P.G.) certification programs often credit advanced degree time toward the minimum time required for P.G. certification and licensing, the value of our proposed, online Environmental Geology M.S. is amplified to entry-level employees seeking graduate degrees remotely, especially with employer tuition support.

**What resources will be provided to assist students with job placement?**

The students in the online program will receive academic advising and mentoring by new GEOL Teaching Assistant Professor Dr. Cory Pettijohn, whose position is fully dedicated to the online program. More generally, the Department of GEOL will continue to communicate all job announcements to all students. Furthermore, GEOL will participate in the College of Liberal Arts and Sciences (LAS) new Corporate Affiliates Program (CAP), the goal of which is to foster relationships with alumni positioned in related public and private sector organizations. Online M.S. marketing strategies will build on these relationships, focusing particular attention on Illinois-based organizational connections. Students in the new Environmental Geology online M.S. will benefit from these connections developed through our new online M.S. program and partnerships with public and private sector organizations, Research Park, DPI, and the State Water and Geological Surveys, particularly with capstone project and associated internships.

## **Program Regulation and Assessment**

**Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).**

The outcomes and assessment procedures will essentially follow those already in place within the Department of Geology. Specifically, the learning outcomes for the proposed Environmental Geology online M.S. degree program are:

- Students will have a fundamental understanding of basic concepts of geoscience that underlie aspects of environmental quality and environmental management

- Students will have advanced level knowledge of geoscience concepts that aid in environmental assessment and management
- All students will have the ability to formulate a scientific problem and develop an approach towards solving that problem.
- All students will have ethically responsible and effective communication skills, written and verbal, at a professional scientific level.

#### Assessment procedures

The Department of Geology performs formal annual evaluations of every graduate student to determine their progress in achieving the learning outcomes, as well as to identify any roadblocks that may be inhibiting the student from progress toward the degree. This evaluation includes a self-evaluation by the student, a written review of the self-evaluation and a separate evaluation by the student's advisor, and a final evaluation of the review process by the Graduate Studies Committee. In the case where deficiencies have been identified, the Graduate Studies Committee, in consultation with the student's advisor, recommends approaches to address the deficiencies.

The Department of Geology will do an annual anonymous survey of current graduate student outcomes, including approximately 20 questions such as "Has the Department provided me with an excellent educational experience while in graduate school?", "Has the Department prepared me for a career in my chosen discipline?", "Does the Department have an adequate range of courses at the graduate level?". The survey will request, but not require, that the students self-identify gender and whether they are domestic or international students. The survey will not ask if they are from an underrepresented minority since there are currently a sufficiently small number that their survey could be used to identify them. The results of the survey will be presented by the Graduate Studies committee to the faculty, and later to all the graduate students. Comments and suggestions made by students and faculty will lead to proposed actions to improve the graduate program.

Finally, the Department continually gathers information about our alumni and their careers beyond our graduate program. This is done through direct contact, our alumni network, and searches through LinkedIn and other online sources. The Department updates the database every year to keep track of student outcomes.

#### **Is the career/profession for graduates of this program regulated by the State of Illinois?**

No

## **Program of Study**

"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: <https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf>). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

**All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.**

#### **For new programs, attach Program of Study**

Online Environmental Geology MS Figure 1.docx  
 Academic Catalog Entry Online Environmental Geology MS.docx  
 Appendix A Environmental Geology Electives List.docx  
 Online Environmental Geology MS program application GEOL 1 January2021.docx

Catalog Page Text

**Catalog Page Text: Description of program for the catalog page. This is not official content, it is used to help build the catalog pages for the program. Can be edited in the catalog by the college or department.**

The fully-online Environmental Geology M.S. degree program requires 32 credit hours (thesis not required), 12 of which must be at the 500-level (8 in GEOL). Students must work with their program advisor to individualize their program and the required capstone research project. Students must complete a minimum of 24 hours of coursework, 12 of which must be from within the unit. All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 graduate hours of graded coursework, it must be raised to 3.0 or above after the

completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter. See approved elective course list at <https://geology.illinois.edu/environmental-geology-online-ms-approved-courses>:

For additional details and requirements refer to the department's Graduate Degree Programs and the Graduate College Handbook.

### Statement for Programs of Study Catalog

Code	Title	Hours
<b>Complete 2 of the following core courses focusing on geodata science and analysis:</b>		<b>7-8</b>
GEOG 407	Foundations of CyberGIS & Geospatial Data Science (crosslist withGEOL 407)	
ATMS 421	Earth Systems Modeling (crosslist withGEOL 481)	
ATMS 404	Risk Analysis in Earth Science (crosslist withGEOL 485)	
ESE 486	Environmental Consulting (crosslist withGEOL 486)	
GEOL 507	GIS for Geology	
ATMS 517	Data Science for the Geosciences	
<b>Complete 3 of the following courses focusing on advanced topics:</b>		<b>10-12</b>
GEOL 450	Probing the Earth's Interior	
GEOL 451	Env and Exploration Geophysics	
GEOL 470	Introduction to Hydrogeology	
ESE 482	Challenges of Sustainability (crosslist withGEOL 483)	
GEOL 565	Water Chemistry & Bioremediation	
GEOL 572	Hydrogeology with Python	
<b>Additional 400-500 level courses as needed to meet or exceed the minimum credit hour requirement of the program. Selected in consultation with the program advisor; chosen from courses in the Core and Advanced Topics lists (if not taken to meet those requirements) or from a list of electives maintained by the department.</b>		<b>4-11</b>
GEOL 598	Capstone Research Project	4 or 8
<b>Total Hours</b>		<b>32</b>

### Other Requirements

Code	Title	Hours
<b>Proposed Requirement</b>		
Other requirements may overlap.		
Successful completion of the program requires a written capstone report.		
At least 12 of the 32 required hours must be in GEOL (8 at the 500-level).		
At least 12 of the 32 required hours must be in 500-level courses.		
Course substitutions are permitted with the consent of the departmental advisor.		
A maximum of 2 elective courses may be taken CR/NC.		
All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 or more graduate hours of graded coursework, it must be raised to 3.0 or above after the completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter.		

### EP Documentation

### DMI Documentation

#### Program Reviewer Comments

Deb Forgacs (dforgacs) (Tue, 19 Jan 2021 17:30:51 GMT):Rollback: grad program.

Key: 1018

**1. Describe the reasons for this request and explain: (a) the pros and cons of the classification requested, and (b) how the requested classification will benefit and not adversely affect the academic quality of the program.**

This is a new M.S. program and it is designed to accommodate non-traditional students whose work/life situation precludes them from pursuing a traditional, on-campus, thesis-based M.S. degree. It will complement our on-campus M.S. program, which is limited in size because almost all students in it are fully supported by assistantships with tuition and fee waivers. This departmental support for students in the existing M.S. program will continue unchanged, and thus there will be no such support available for students in the new program.

(a) The advantage of this classification is its alignment with the goals of the program. Students are expected to be remote from campus and, in many cases, employed full time. Thus, they could not hold assistantships, because their work/life situation would not allow them to devote additional time to assistantship duties nor be present on our campus to carry out research or teaching roles. This classification establishes a clear distinction between the new program and our existing M.S. program.

The disadvantage of this classification is that it may make the program less attractive to prospective students, relative the other option: traditional on-campus programs with assistantships. However, the new program aims specifically to serve students who cannot pursue those on-campus programs, so this is not a significant concern.

(b) The academic quality of the new program depends on its ability to prepare students for careers in industry. Keeping the students focused on that goal rather than basic research or teaching duties required by assistantships will enhance the focus and quality of the program.

**2. What type of financial assistance will be offered to students in the program?**

No research or teaching assistantships will be offered to the students in this M.S. degree program. It is meant to be self-funded.

**3. Has this program had past practice of offering graduate assistantships? If so, please describe.**

This is a new (proposed) M.S. degree, which therefore has no history of offering graduate assistantships.

**4. What provisions will be made to communicate the new classification to prospective and newly admitted students?**

The M.S. degree program is new and has yet to be approved. Thus, no students have yet to be admitted, and there are no prospective students at this stage. After the program is approved, public information about the program (e.g., web pages) and admission letters will communicate students' ineligibility for assistantships and tuition waivers.





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## Proposal for new curricula (degree, major, concentration, minor)

Submit completed proposals via email to Associate Dean Kelly Ritter ([ritterk@illinois.edu](mailto:ritterk@illinois.edu)). Please obtain Executive Officer and School Director (if applicable) approval via email and forward with the proposal to LAS.

**Proposal Title:** A new online, non-thesis Master of Science degree in Environmental Geology

**Proposed effective date:** August 2022

**Sponsor(s):** Tom Johnson, Head of Geology, [tmjohnson@illinois.edu](mailto:tmjohnson@illinois.edu)

**College contact:** Kelly Ritter, Associate Dean for Curricula and Academic Policy, College of Liberal Arts and Sciences, [ritterk@illinois.edu](mailto:ritterk@illinois.edu)

**Is this program interdisciplinary:** Yes, to some extent, with the Departments of Geography and Atmospheric Sciences.

### PROGRAM DESCRIPTION and JUSTIFICATION

#### 1) Provide a brief but concise description of your proposal

The Department of Geology (GEOL) proposes a new online, non-thesis Master of Science (M.S.) degree in Environmental Geology to accommodate remotely-located learners and working professionals. As outlined below, the proposed non-thesis M.S. degree option is designed to meet the high demand for advanced Geology expertise used in applied industry sectors, including groundwater modeling and contaminant migration characterization, geophysics, and “big data” analysis. This new degree will be able to satisfy demand from non-traditional students seeking to obtain an advanced degree in applied Geology, and from working professionals whose employers may pay some or all of the tuition. As such, the new Environmental Geology M.S. degree program satisfies an under-served educational community while not detracting from on-campus undergraduate and graduate-level GEOL programs. The new Environmental Geology M.S. will accommodate remotely-located students, particularly those located in the greater Chicago area, and builds upon existing GEOL faculty expertise in innovative online pedagogy. The requested new program will enable this expansion without drawing resources from other Geology graduate programs; to the contrary, it will increase course offerings.

#### 2) Provide a justification of the program

The existing on-campus Geology, MS, "applied geology" (or non-thesis) option, in its current form, is not able to serve the intended student demographic. **Only 2 students have completed this option over the past ten years, because of geographic and capacity limitations.** Many prospective students

are working professionals in urban areas far from Champaign-Urbana, and the current Geology graduate program emphasizes basic research rather than applied training. It does not have the capacity to serve applied geology students. The department seeks to 1) expand the geographic reach of the department's teaching mission to serve students in Chicago, other cities, and globally, and 2) expand course offerings to provide optimal training in advanced topics. Both of these goals can be met through the creation of a new, fully-online M.S. degree in Environmental Geology funded through tuition revenue return to the department and the college. This revenue stream will allow the department to offer a series of online courses to optimally serve these new Environmental Geology online M.S. students living far from Champaign-Urbana, without diverting resources from the existing Geology graduate program.

GEOL's Environmental Geology online M.S. program is designed to meet high demand for advanced Geology expertise and would be the nation's first M.S. degree option in a Geology subdiscipline that can be completed fully online. The new M.S. degree is designed to accommodate a demographic comprised of nontraditional and working learners by offering online coursework, advising, and capstone research. The primary target is the environmental consulting sector, which is the most productive sector for employment of geologists and will remain a consistent area of employment for decades. According to the American Geoscience Institute, nearly 30% of Geology B.S. degree graduates were hired by environmental consulting firms in 2017. Another large fraction of Geology B.S. degree graduates have entered similar environment-related federal government jobs. As such, these Environmental Geology positions represent the largest sector of employment for recent Geology graduates nationwide. The department has observed that UIUC B.S. degree recipients, after a few years employed by organizations in this sector, discover that advanced skills and certification obtained through a M.S. degree in Geology are required to migrate into project management and leadership positions. However, taking time out of industry to complete a graduate degree can pose a high risk for individuals (particularly those supporting families) wishing to re-enter the work force after completing their graduate degree, making online graduate studies highly attractive, particularly with employer sponsorship.

Further, as State-based Professional Geology (P.G.) certification programs often credit advanced degree time toward the minimum time required for P.G. certification and licensing, the value of our proposed, online Environmental Geology M.S. is amplified to entry-level employees seeking graduate degrees remotely, especially with employer tuition support.

GEOL anticipates that a large fraction of students participating in our online Environmental Geology M.S. program will reside in the State of Illinois, especially in the Chicago metro. area, and will complete capstone projects and/or internships with environmental consulting firms in Illinois. Further, because the Illinois State Water Survey (ISWS) and the Illinois State Geologic Survey (ISGS) have ongoing practical projects in need of student and GEOL departmental involvement, significant potential exists in partnering with Illinois-based students in the online M.S. through the required capstone projects. As such, the new Environmental Geology online M.S. program allows the Department of Geology, which currently has a very small Urbana-based, face-to-face M.S. program, to meet demand for a practical, flexible M.S. accessible to Illinois-based students and, in particular, Chicago metro. residents. Finally, the overall Chicago-focused nexus of research by the ISWS and ISGS, connections to private-sector Environmental Consulting firms, and student involvement and focus on applied Geology will be ideally aligned with the Discovery Partners Institute (DPI).

The new online M.S. in Environmental Geology degree program offers the opportunity to learn advanced topics in geology through online coursework and capstone collaborations with GEOL and other UIUC faculty, all of whom have strong international reputations in their respective Geology subdisciplines. Specifically, GEOL has four faculty members with research and teaching programs focusing on groundwater, water chemistry, and contaminant characterization and migration. The Illinois State Water Survey (ISWS) and the Illinois State Geological Survey (ISGS) have Senior Scientists specializing in subsurface contamination at a variety of Illinois-based project sites. One of these scientists is already developing an online version of their Python-based hydrogeology modeling course that would be offered as part of the expanded M.S. degree program. ***The Covid-19 pandemic has rapidly accelerated faculty online teaching and learning expertise, particularly with the Summer 2020's first fully-online Geology field course. Our proposed Environmental Geology online M.S. program will build on these strengths as faculty teach in a variety of modalities and serve a more diverse cross-section of students.***

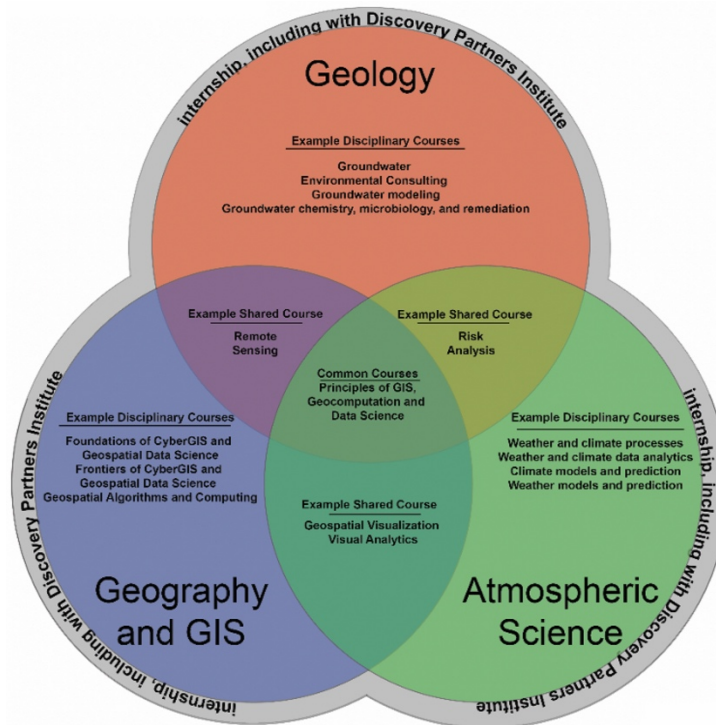
The proposed Environmental Geology online M.S. degree program is part of three connected, synergistic M.S. programs in development with funding from an Office of the Provost's "Investment for Growth" (IFG) Program Grant (<https://provost.illinois.edu/about/initiatives/investment-for-growth-program/>), housed in the School for Earth, Society, and the Environment (SESE). The proposed "Weather and Climate Risk and Analytics" (Dept. of Atmospheric Sciences) and "CyberGIS and Geospatial Data Science" (Dept. of Geography and GIS) online M.S. degree programs will both enhance Geology's proposed Environmental Geology online M.S. program by providing shared courses (<https://geology.illinois.edu/environmental-geology-online-ms-approved-courses>), specialized courses in certain key areas (see below), and a larger group of faculty and staff collaborating to achieve overall program success, both on-campus and online.

In summary, GEOL's new online M.S. degree program will provide a high-quality, cutting-edge M.S. degree while targeting a more diverse cross-section of learners previously unable to complete this degree program on campus. As stated above, the initial, expanded target market will focus on the environmental consulting industry. GEOL notes that the UIUC 2018-2023 strategic plan articulates the goal of making UIUC "the go-to place for professional and continuing education programs" through "the creation of workforce-development strategies and related partnerships across the public and private sectors...using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers." The proposed Environmental Geology online M.S. degree program will align GEOL's graduate programs with this campus-wide goal while simultaneously benefitting both on-campus and remotely placed GEOL graduate students and programs.

Worldwide, industries and governments face the challenge of assimilating and analyzing enormous streams of data. SESE faculty are experts in working with large geophysical and geospatial datasets, advanced scientific programming, and cyberGIS (that is, new-generation geographic information science and systems based on advanced computing and cyberinfrastructure). Recognizing these building "Big Geodata" challenges facing professionals, students in the Environmental Geology online M.S. program are required to enroll in a minimum of two core courses focusing on geodata science and analysis (6 min. hrs.), building upon data science synergies with GGIS and ATMS through IFG funding, as illustrated in Fig. 1 below.

Fig. 1 illustrates the relationships between the new or existing 400 and 500-level online courses developed and offered by each of the three departments within SESE through IFG funding, providing educational advancement for SESE online, non-thesis graduate students while taking advantage of

the strengths of each department’s expertise in computational and data sciences as well as geospatial analysis. Courses related to common core learning objectives, specifically Principles of GIS, and Geocomputation and Data Science with Python and R, can be taken by students in the Environmental Geology online M.S. as part of their core course requirements (see Academic Catalog Entry section below for details).



*Fig. 1: The relationship between the Investment for Growth-funded courses offered in the proposed online SESE non-thesis M.S. degree programs.*

In addition to the core courses in geodata science and analysis, students have the opportunity to select, with the aid of their Program Advisor Dr. Pettijohn, 400 and 500 level course work focusing on advanced subjects and case studies. As such, students will work closely with the advisor to select advanced courses that provide the theoretical foundation and knowledge to successfully complete the capstone research project.

## **INSTITUTIONAL CONTEXT (new majors and degrees ONLY)**

University of Illinois at Urbana-Champaign

Mission: The University of Illinois at Urbana-Champaign is charged by our state to enhance the lives of the citizens in Illinois, across the nation, and around the world through our leadership in learning, discovery, engagement, and economic development.

**1) Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built. Also, explain the nature**

**and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).**

The proposed program is designed to attain a long-standing goal of the Department of Geology: To prepare students for careers in applied geology using the unique strengths of faculty in Geology and elsewhere on campus. This goal has not been attained for many years, for several reasons:

- The Geology graduate program, with its emphasis on externally funded, leading-edge research, enrolls mostly Ph.D. students. Most applied geology jobs are done by M.S. degree holders, but the department has had little capacity to serve M.S. degree seekers.
- M.S. theses in the Department of Geology emphasize advanced research which is not ideally aligned with applied geology careers.
- Most B.S. degree holders in industry cannot afford to stop working for two years to pursue an M.S. degree on our campus.
- Most careers in applied geology are located far from Champaign-Urbana; pursuing a UIUC Geology M.S. degree while continuing to work is not feasible.
- The department's budget and staffing have not allowed it to offer a suite of courses that would provide excellent, targeted training for applied geology students.

***The proposed program overcomes all of these barriers by providing an industry-focused M.S. degree that is accessible to students around the globe (but most importantly in the Chicago area) and which generates revenue to support the offering of industry-focused courses.***

An existing non-thesis Geology M.S. degree exists, but only two students have completed this degree in the past ten years. For the reasons listed above, it has not been in great demand. It has been used mostly in cases where Ph.D. students exited that program but have completed enough coursework to warrant awarding an M.S. degree. The department plans to modify the face-to-face, non-thesis M.S. program description to reflect that reality.

The proposed program overlaps synergistically, and to small extent, with two new online M.S. programs being developed by SESE departments ATMS and GGIS (see above). Roughly 15% of the new Geology degree consists of shared courses serving all three degree programs (<https://geology.illinois.edu/environmental-geology-online-ms-approved-courses>). The proposed program will also make use of a few advanced online courses previously developed for the existing, SESE-level, online B.S. in Earth, Society, and Environmental Sustainability (ESES). Although the new Geology program will include some courses developed for these other SESE programs, the Geology program has very distinct goals.

The Geology program has some content overlap with M.S. degrees in the Department of Civil and Environmental Engineering (CEE) and the Department of Natural Resources and Environmental Sciences (NRES). However, the CEE degree only overlaps in the area of groundwater flow and remediation and has a very different overall emphasis. Similarly, the NRES program is a broad environmental program with an emphasis on biological aspects, without the emphasis on geological skills required for jobs in the environmental geology field.

Overall, there are no conflicts with existing programs at UIUC. The coursework as part of the proposed Geology online M.S. degree program will not detract from on-campus offerings of the face-to-face courses serving on-campus students. The new program will increase the variety of

advanced coursework offered by the department. On-campus students will benefit from this expanded choice, as on-campus students will be able to enroll in the new online courses.

**2) Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.**

The proposed Environmental Geology online M.S. degree program will advance, in part, the careers of professionals working to improve the environment as regulated by federal and state environmental legislatures. As such, our program supports the University's mission and priorities by broadening the reach of GEOL's environmental and societal impacts domestically and internationally. Through state-of-the-art knowledge and skills provided such as groundwater contamination plume characterization and remediation, big data analysis and communication, and other central public and environmental health issues, our proposed online M.S. program will provide advanced skills and knowledge to professionals working in the environmental geology public and private sectors. As such, the proposed degree program directly supports the University's mission through its underlying goal to reduce human vulnerability to environmental degradation. As noted above, this basic goal intersects with the following UIUC strategic initiatives:

- "Innovate in graduate, professional, and continuing education, with new degree programs and certificates at the intersection of disciplines, and support recruitment and retention of graduate students" [Goal 2.F].

The new and innovative Geology online M.S. degree program will help achieve UIUC Strategic Initiative Goal 2.F through synergies with the two additional proposed SESE online M.S. programs. Specifically, shared online courses and cross-discipline teaching and learning environments as part of the three new SESE online M.S. programs will increase graduate student enrollment while not detracting from on-campus programs.

- "Accelerate the growth of the Illinois entrepreneurial ecosystem to establish Champaign-Urbana as the best university-based entrepreneurship and innovation hub in the Midwest" [Goal 3.F].

The capstone course required as part of Geology's proposed online M.S. degree program will build heavily upon partnerships with both Research Park affiliates and Discovery Partners Institute (DPI) members. Such partnerships through the online M.S. program will also benefit on-campus undergraduates and graduates through faculty and student research projects and internships. The increased partnerships will therefore benefit the local, State, and national economy through shared connections between UIUC, DPI, and Research Park.

- "Reach out to all community stakeholders and partner with them to make our university and its surrounding region the leading innovation center and testbed for the technologies and services that will enable the safe, healthy, and sustainable communities of the future" [Goal 3.G].

Because Geology's proposed online M.S. degree program is initially geared heavily toward the environmental consulting industry, students participating in the new program will learn about innovative numerical modeling and geomicrobiological-based remediation strategies and technologies used in the environmental consulting industry. An online M.S. course such as "GEOL 572: Hydrogeology with Python," taught in collaboration with the Illinois State Water

Survey, will expose participating students to cutting-edge groundwater modeling techniques that will directly benefit community stakeholders through improved contaminant assessment and modelling. Further, the new online M.S. will include courses in water chemistry and bioremediation, taught by GEOL's world-class faculty. Students in these courses will learn state-of-the-art, applied bioremediation strategies and technologies to address environmental contamination. Over time, public and private sector environmental consulting organizations will benefit not only from hiring students receiving our new online M.S. degree, but also from collaborations through capstone research projects and internships. These collaborations will help improve community health over time as environmental contamination is characterized and remediated using cutting-edge approaches taught through our proposed online M.S. degree program.

- "Create workforce-development strategies and related partnerships across the public and private sectors, with an emphasis on using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers" [Goal 3.H].

In addition to the aforementioned partnerships and synergies, the online nature of Geology's proposed online M.S. degree program will be of particular interest to continuing workers. GEOL anticipates that individuals already working in industry positions will obtain enhanced skill sets in applied geology through our new online, graduate-level degree program. The new degree will help these potential applicants and workers in public and private sector organizations to advance in their respective organizations and manage projects. Furthermore, individuals wishing to enter public and private sector environmental consulting organizations will be able to increase their chances of employment by matriculating through our new online M.S. degree program in applied Geology.

- "Develop and execute an integrated, coordinated, and sustained marketing and communications effort to all stakeholders and influencers: students, alumni, parents and friends, business and government leaders, and residents of the state of Illinois" [Goal 3.I].

GEOL will participate in the College of Liberal Arts and Sciences (LAS) new Corporate Affiliates Program (CAP), the goal of which is to achieve Goal 3.I through sustained, coordinated, and integrated relationships with alumni positioned in related public and private sector organizations. Online M.S. marketing strategies will build on these relationships, focusing particular attention on Illinois-based organizational connections. Strategic marketing communications will be developed with the help of LAS and the Center for Innovation in Teaching and Learning (CITL) at UIUC to weave narratives and celebrate success stories of connections developed through our new online M.S. program and partnerships with public and private sector organizations, Research Park, DPI, and the State Water and Geological Surveys.

- "Understand that the largest resource on campus is its employees and students while creating an inclusive and welcoming campus climate" [Goal 4D].

The online nature of our proposed M.S. degree program will directly benefit non-traditional students through the more flexible and affordable nature of online education. Similarly, because students living in any location, nationally or internationally, can obtain our new degree, overall diversity will be greatly increased. Narratives highlighted in our marketing collaborations will also celebrate this fostered diversity and set a diverse representation of all involved parties.

Fostering safe and welcoming working environments will be a continuing focus in advising and round-table discussions as part of the online M.S. degree program. Virtual panel discussions will be organized to help students in our program

**3) Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)**

1. Educational Attainment - increase educational attainment to match the best-performing states.
2. College Affordability - ensure college affordability for students, families, and taxpayers.
3. High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.
4. Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

The new degree program supports goals 1, 2, 3 and 4.

**4) Describe how the proposed program supports the goals above:**

According to the American Geoscience Institute, Illinois has less than half of the number of certified geology workers per capita as peer states (such as California and Texas) and this is partly due to a mismatch between the largest geology educational institution in the state (the Department of Geology at UIUC) and the largest population center (Chicago). Our proposed program will increase educational attainment in the field by reducing the importance of the geographic obstacle.

The online degree program will be more affordable than other geology degree programs in Illinois. Not only does the online format allow for much lower tuition costs for students, it makes it possible for workers to simultaneously undertake further their education while supporting their families. This is also a great deal for taxpayers: the self-supporting nature of the degree will mean that taxpayers are not supporting the program.

The proposed program will address rapidly growing needs for geologists in industry requiring post-graduate degrees to move into project management positions. Further, our proposed Geology online M.S. degree program adds time-value to consultants working toward P.G. licensing.

One of the requirements of the proposed degree program is a capstone research project, designed to help online M.S. students apply their growing knowledge of applied geology to a specific industry and site problem. GEOL is working closely with LAS to pilot the new LAS Corporate Affiliates Program so that industry partnerships are in place to help identify capstone research project collaborations. Further, GEOL will build on existing alumni connections through GEOL's Alumni Advisory Board to help foster these synergies and therefore achieve aforementioned goals of High Quality Credentials to Meet Economic Demand and Integration of Educational, Research and Innovation Assets.



## ADMISSION REQUIREMENTS

**1) Desired admissions term:** *For LAS units, a fall semester effective term for all curricula will be requested, please indicate the proposed year*

Fall, \_\_\_\_\_ **2022**

**2) Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students. (degrees, majors, concentrations ONLY)**

Students in the Environmental Geology online M.S. program will need to fulfill the key requirements listed on GEOL's graduate admissions page, e.g., a minimum grade point average of 3.0 (on a 4.0 scale) and a firm background in physics, chemistry and mathematics is required for admission. Individuals interested in applying to the program but lack the requisite 3.0 GPA may be considered for admission based upon their application and communications with the program advisor. Please refer to the Academic Catalog Entry section for more detail.

**3) Describe how critical academic functions such as admissions and student advising are managed.**

Students in the new Environmental Geology online M.S. program will follow GEOL's existing admissions and advising structures. Advising will be conducted by Specialized Faculty member Dr. Cory Pettijohn, who will work closely with GEOL's Graduate Admissions Committee and other faculty to design a list of courses and capstone research project unique to each student in the program. As mentioned above, the creation of a separate degree code that incorporates revenue-sharing will support the planned expansion and increased faculty advising and teaching loads.

From the Geology Graduate Handbook:

### **Advisor Requirement**

The student's program must be developed with the academic advisor and approved by the advisor and the Graduate Studies Committee. The advisor is responsible for monitoring the student's program and ensuring that all degree requirements have been satisfied.

In addition, all graduate students follow an annual review in which their progress is assessed. From the Geology Graduate Handbook:

### **Annual Review Process for Academic Progress**

Following the policy of the Graduate College the Geology program will conduct an annual review of all currently enrolled graduate students. The purpose of the review is to evaluate a student's progress and to identify an ongoing pathway to professional success. This form of annual progress-tracking allows the student and supervisor to meet and establish objectives for the year. This ensures that both students and advisors be held accountable for timely progress and for constructive feedback. Initially, the annual review will follow procedures used for the on-campus graduate degree programs. Over time, the online M.S. review process may evolve to reflect the specific needs of the student enrolled.

The annual review of Geology degree candidates is currently conducted in the spring semester according to the following structure: The review begins with a self-assessment. This and other written parts of the process are done online at my.atlas.illinois.edu. Once the student has completed the online form, their advisor will make comments on the student's progress and the plan for the upcoming academic year.

Following Graduate College guidelines, the student and advisor must meet in person to communicate and discuss the advisor's feedback. A Geology affiliate should be present for the review discussion between the student and their advisor. The meeting includes an oral presentation of up to 15 minutes in length by the student, outlining progress made during the past year, and research plans for the upcoming year.

If there is disagreement of opinion between the student and the advisor on the performance evaluation, proposed plan of action, or both, the Grad Studies Committee Chair must be informed immediately by the advisor. It is stressed that the primary purpose of this review is to provide feedback and discussion to assist the student in their progress towards graduation and other career goals. A meeting of the Grad Studies Committee of the Department will be held to discuss the annual reviews of every student.

## **ENROLLMENT**

### **1) Number of students in program estimates**

Year 1 estimate: 5

Year 5 estimate (or when fully implemented): 20

### **2) Estimated Annual Number of Degrees Awarded (degrees, majors, concentrations ONLY)**

Year 1: 0

Year 5 (or when fully implemented): 5

### **3) Delivery Method, what is the program's primary delivery method?**

The proposed Environmental Geology M.S. degree program will be completed fully online.

#### **Describe the use of this Delivery Method**

The online degree program will be more affordable than other geology degree programs in Illinois. Not only does the online format allow for much lower tuition costs for students, it makes it possible for workers to simultaneously undertake further their education while supporting their families. This is also a great deal for taxpayers: the self-supporting nature of the degree will mean that taxpayers are not supporting the program.

The proposed program will address rapidly growing needs for geologists in industry requiring post-graduate degrees to move into project management positions. Further, our proposed Geology online M.S. degree program adds time-value to consultants working toward P.G. licensing.

### **4) What is the matriculation term for this program?**

Program matriculation will be on a rolling basis. As such, matriculation term will vary depending on each student in the program. Students can therefore start the new online M.S. beginning with a Fall, Spring, or Summer academic term.

**5) What is the typical time to completion of this program?**

Students should be able to complete the program in 3-4 academic terms, although working professionals may take longer if they do not wish to enroll in as high of a course load per semester.

**6) What are the minimum Total Credit Hours required for this program?**

The minimum Total Credit Hours required for completion of this program are 32 min. hours, including 4 min. (8 max.) hours of GEOL 598: *Capstone Research Project* credit

## **BUDGET**

**1) Please describe any budgetary implications for this new program - addressing applicable personnel, facilities, technology and supply costs.**

The requested tuition revenue return to the department (70%) will allow the creation of the new Environmental Geology online M.S. degree program without additional expenditures by the College of LAS. The program's start-up costs are covered by support from the Provost's "Investment for Growth" (IFG) fund. After the startup phase, the long-term additional costs related to the online option will be covered sustainably by tuition return, with net positive revenue for the Department and revenue for the College of LAS. See Resources section below for details regarding IFG funding and sustainability of finances.

Faculty costs are budgeted to:

- Expand, develop, and/or deliver online versions of current courses
- Develop new courses aimed at the high-demand areas of applied Geology
- Advise the additional M.S. students
- Coordinate capstone projects for the additional M.S. students
- Handle administrative tasks related to admissions, advertising, and other general aspects

Teaching Assistant Professor Cory Pettijohn has been recently installed as the coordinator of this program. Dr. Pettijohn will teach several courses and handle most of the other tasks listed above, with the exception of some clerical and advertising tasks to be handled by a planned administrative hire to be shared with the counterpart programs in ATMS and GGIS. Some courses are already taught online as part of existing programs; no additional costs are budgeted as enrollments are expanded. Several new courses specific to this program will require expenditures for overload or summer pay to department faculty, or payments to adjunct faculty.

GEOL's 70% share of the tuition revenue will cover, with a small enrollment of approximately 10 students, the program's instructional effort costs described above and other miscellaneous costs of the program (e.g., IT support, advertising costs) ***Importantly, the new, fully-online M.S. program will not be allowed to have negative effects on teaching efforts serving our face-to-face degrees.***

The department has no excess teaching capacity among the state-funded faculty, and thus the teaching effort for the new program will be supplied in various ways described above.

**2) Will the new program require staffing (faculty, advisors, etc.) beyond what is currently available?**

The additional instructional, support, and administrative effort will be provided by:

- One specialized faculty member, full time in Geology. A specialized faculty member is dedicated to supporting online instruction (their own, as well as other faculty). This person will also be responsible for general academic advising of new students and overseeing some of the capstone projects. Teaching Assistant Professor, Dr. Cory Pettijohn occupies this position, as of January 2020.
- One School-level program administrative staff member covered 33% by Geology, who will have responsibility to manage miscellaneous program advertisement and upkeep in collaboration with Dr. Pettijohn of this and the other new IFG-sponsored programs in the School, as well as recruiting, applications and admission, course registration, grades, and related duties.
- Summer and/or overload salary for current faculty to develop and offer online courses.
- TA support, if needed to expand courses.
- Additional IT support effort at the School level to help administer the online courses.

These activities are fully funded via the “Investment for Growth” grant for the first 3 years of the program and are fully costed as part of the self-sustaining model, thereafter.

**3) Please provide any additional budget information needed to effectively evaluate the proposal.**

Although the new program will be initially supported by IFG grant funds, the program is planned to be self-supporting, with AY 22/23 tuition set at \$686/credit hour. The Department will be responsible for all costs and will receive 70% of the gross tuition (an agreement is in negotiation with the LAS Dean’s office). 30% of the gross income is to go to the College of LAS.

## **RESOURCE IMPLICATIONS**

**1) Facilities - Will the program require new or additional facilities or significant improvements to already existing facilities?**

No new facilities will be required.

**2) Technology - Will the program need additional technology beyond what is currently available for the unit?**

No new technology will be required. All the planned platforms are already available, especially with the changes brought about by the Covid-19 crisis and rapid migration of courses online.

**3) Non-Technical Resources - Will the program require additional supplies, services or equipment (non-technical)?**

The new online M.S. program in Environmental Geology will not require additional supplies, services or non-technical equipment.

## RESOURCES

**1) Faculty Resources: Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.**

An additional specialized faculty member and a 33% FTE program coordinator will be employed as part of this new initiative (see "Budget", above), and as a consequence we do not expect significant impacts will occur for existing faculty.

The new specialized faculty member is dedicated to supporting instruction relevant to the hybrid program (their own, as well as other faculty) and will handle most of the additional instruction and coordination workload. This person will also be responsible for general academic advising of new students and placement efforts.

There is no expectation to increase regular semester teaching loads for current faculty. Some overload or summer teaching is expected to occur on an optional basis. Given the projected enrollment, any impact on student-faculty ratios will be minor. If enrollments are much greater than expected, a second specialized faculty member will be hired to teach additional sections or classes.

**2) Library Resources: Describe your proposal's impact on the University Library's resources, collections, and services. If necessary, please consult with the appropriate disciplinary specialist within the University Library.**

No unusual impact on the University Library is expected.

**3) Instructional Resources: Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?**

No – to the contrary, course offerings and impact will expand. Online course content will benefit on-campus teaching and learning efforts through hybridized course structures. Many GEOL faculty members teach in a "flipped" mode, using online lectures and assignments so on-campus class time can prioritize active teaching and learning.

**4) Does this new program/proposed change result in the replacement of another program?**

No. The new, fully online Environmental Geology M.S. program option will leave all existing options intact. Only two students have completed the existing, on-campus, non-thesis M.S. in Geology over the last ten years.

**5) Does the program include any required or recommended subjects that are offered by other departments? If yes, please list the courses. Explain how these additional courses will be used by the program and provide letters of support from the departments.**

No, the program does not include any required or recommended subjects that are offered by other departments.

## FINANCIAL RESOURCES

### 1) How does the unit intend to financially support this proposal?

The first 3 years of the online M.S. program are supported by the Provost's "Investment for Growth" program; it is planned to be self-supporting after that, with AY 22/23 tuition set at \$686/credit hour. The Department will be responsible for all costs and will receive 70% of the gross tuition (an agreement is in negotiation with the LAS Dean's office). 30% of the gross income is to go to the College of LAS.

### 2) Will the unit need to seek campus or other external resources? If yes, please provide a summary of the sources and an indication of the approved support.

No.

### 3) Will an existing tuition rate be used or continue to be used for this program?

The \$686/credit hour rate is an established existing tuition rate for graduate programs in CITL.

### 4) Is this program requesting self-supporting status? (degrees, majors and concentrations ONLY)? If yes, please explain.

As mentioned above, the first 3 years of the online M.S. program are supported by the Provost's "Investment for Growth" program; it is planned to be self-supporting after that, with AY 22/23 tuition set at \$686/credit hour. The Department will be responsible for all costs and will receive 70% of the gross tuition (an agreement is in negotiation with the LAS Dean's office). 30% of the gross income is to go to the College of LAS.

## MARKET DEMAND

### 1) What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students.

According to the American Geoscience Institute, nearly 30% of Geology B.S. degree graduates were hired by environmental consulting firms in 2017. Another large fraction of Geology B.S. degree graduates have entered similar environment-related federal government jobs. As such, these Environmental Geology positions represent the largest sector of employment for recent Geology graduates nationwide. The department of GEOL has observed that UIUC B.S. degree recipients, after a few years employed by organizations in this sector, discover that advanced skills and certification obtained through a M.S degree in Geology are required to migrate into project management and leadership positions. However, taking time out of industry to complete a graduate degree can pose a high risk for individuals (particularly those supporting families) wishing to re-enter the work force after completing their graduate degree, making online graduate studies highly attractive, particularly with employer sponsorship.

The UIUC campus has a national reputation in Hydrogeology and our campus overall has great strength in this area across many units. Geology faculty include three faculty who concentrate on water chemistry and contaminants. The Illinois State Water Survey (ISWS) and the Illinois State Geological Survey (ISGS) have senior scientists that work to address water contamination in Illinois and who would be part of the new online MS program.

Although the program would be designed so it can be completed 100% online, we expect that a large fraction of the students will live in the Chicago area and would complete capstone projects or work as interns through GEOL's Chicago connections. Both the ISWS and the ISGS have ongoing practical projects and there is great interest in getting students in this program involved as interns or capstone students. The department's network includes environmental consulting firms with internship programs that would naturally link with the new online degree.

The new program will allow the Department of Geology, which currently has a small Urbana-based, face-to-face M.S. program, to meet demand for a practical, flexible M.S. accessible to Chicago-area residents. The overall Chicago-focused nexus of research by the ISWS and ISGS, connections to private-sector Environmental Consulting firms, student involvement and focus on water and environment would be perfectly aligned with the Discovery Partners Institute.

More broadly, the new program would be the first fully online M.S. degree in Environmental Geology and would therefore have global reach and a large pool of potential applicants.

**2) What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.**

The new Environmental Geology online M.S. degree will prepare this cross-section of students to work, or continue to work as Project Managers, in the Environmental Consulting industry or public-sector jobs that focus on assessment and remediation of water and soil contamination, and related environmental issues. Currently, this is the most productive sector for employment of geologists. An M.S. degree is essential for desirable jobs in this industry; many geologists begin work with a B.S. degree but soon realize an M.S. is needed for career advancement. Key skills include advanced understanding of groundwater migration, geochemistry of natural waters, the materials and layering that characterize aquifers, use of GIS systems, and data manipulation/analytics.

As discussed in the "Program Description and Justification" section, the new Environmental Geology online M.S. program is designed to meet high demand for advanced Geology expertise and would be the nation's first M.S. degree option in a Geology subdiscipline that can be completed fully online. The new M.S. degree is designed to accommodate a demographic comprised of nontraditional and working learners by offering online coursework, advising, and capstone research. The primary target is the environmental consulting sector, which is the most productive sector for employment of geologists and will remain a consistent area of employment for decades, particularly for students completing the new online Environmental Geology M.S. program.

Further, as State-based Professional Geology (P.G.) certification programs often credit advanced degree time toward the minimum time required for P.G. certification and licensing, the value of our proposed, online Environmental Geology M.S. is amplified to entry-level employees seeking graduate degrees remotely, especially with employer tuition support.



### **3) What resources will be provided to assist students with job placement?**

The students in the online program will receive academic advising and mentoring by new GEOL Teaching Assistant Professor Dr. Cory Pettijohn, whose position is fully dedicated to the online program. More generally, the Department of GEOL will continue to communicate all job announcements to all students. Furthermore, GEOL will participate in the College of Liberal Arts and Sciences (LAS) new Corporate Affiliates Program (CAP), the goal of which is to foster relationships with alumni positioned in related public and private sector organizations. Online M.S. marketing strategies will build on these relationships, focusing particular attention on Illinois-based organizational connections. Students in the new Environmental Geology online M.S. will benefit from these connections developed through our new online M.S. program and partnerships with public and private sector organizations, Research Park, DPI, and the State Water and Geological Surveys, particularly with capstone project and associated internships.

## **PROGRAM REGULATION**

### **1) Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable.**

The outcomes and assessment procedures will essentially follow those already in place within the Department of Geology. Specifically, the learning outcomes for the proposed Environmental Geology online M.S. degree program are:

- Students will have a fundamental understanding of basic concepts of geoscience that underlie aspects of environmental quality and environmental management
- Students will have advanced level knowledge of geoscience concepts that aid in environmental assessment and management
- All students will have the ability to formulate a scientific problem and develop an approach towards solving that problem.
- All students will have ethically responsible and effective communication skills, written and verbal, at a professional scientific level.

#### Assessment procedures

The Department of Geology performs formal annual evaluations of every graduate student to determine their progress in achieving the learning outcomes, as well as to identify any roadblocks that may be inhibiting the student from progress toward the degree. This evaluation includes a self-evaluation by the student, a written review of the self-evaluation and a separate evaluation by the student's advisor, and a final evaluation of the review process by the Graduate Studies Committee. In the case where deficiencies have been identified, the Graduate Studies Committee, in consultation with the student's advisor, recommends approaches to address the deficiencies.

The Department of Geology will do an annual anonymous survey of current graduate student outcomes, including approximately 20 questions such as "Has the Department provided me with an excellent educational experience while in graduate school?", "Has the Department prepared me for a career in my chosen discipline?", "Does the Department have an adequate range of courses at the graduate level?".

The survey will request, but not require, that the students self-identify gender and whether they are domestic or international students. The survey will not ask if they are from an underrepresented minority since there are currently a sufficiently small number that their survey could be used to identify them. The results of the survey will be presented by the Graduate Studies committee to the faculty, and later to all the graduate students. Comments and suggestions made by students and faculty will lead to proposed actions to improve the graduate program.

Finally, the Department continually gathers information about our alumni and their careers beyond our graduate program. This is done through direct contact, our alumni network, and searches through LinkedIn and other online sources. The Department updates the database every year to keep track of student outcomes.

**2) Is the career/profession for graduates of this program regulated by the State of Illinois?**

There is a Professional Geologist (P.G.) license program in Illinois, but it is not required for practicing geologists.

## ACADEMIC CATALOG ENTRY

- 1) All proposals must submit the major requirements (courses, hours) for the proposed curricula. Please see the University of Illinois Academic Catalog- <http://catalog.illinois.edu/> for your unit for an example of the entry.

### Environmental Geology, MS

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Head of Department: Thomas Johnson  
Director of Graduate Studies: Lijun Lu

Department Website: <https://www.geology.edu/>  
College Website: <https://las.illinois.edu/>

Overview of Graduate College Admissions & Requirements: <https://grad.illinois.edu/admissions/apply>  
Department Contact: Lana Holben  
Department Office: 3028 Natural History Building, 1301 W. Green Street, Urbana, IL 61801  
Phone: (217) 333-3540  
Email: [holben@illinois.edu](mailto:holben@illinois.edu)

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The fully-online Environmental Geology M.S. degree program requires 32 credit hours (thesis not required), 12 of which must be at the 500-level (8 in GEOL). Students must work with their program advisor to individualize their program and the required capstone research project. Students must complete a minimum of 24 hours of coursework, 12 of which must be from within the unit. All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 graduate hours of graded coursework, it must be raised to 3.0 or above after the completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter. See approved elective course list at <https://geology.illinois.edu/environmental-geology-online-ms-approved-courses>:

For additional details and requirements refer to the department's [Graduate Degree Programs](#) and the [Graduate College Handbook](#).

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Proposed Requirements	Proposed Credit Hours
Formal coursework (24 min.)	24-28
Complete 2 of the following core courses focusing on geodata science and analysis (6 min. hrs.): GEOG 407 ( <a href="#">GEOL 407</a> ), ATMS 421 ( <a href="#">GEOL 481</a> ), ATMS 404 ( <a href="#">GEOL 485</a> ), ESE 486 ( <a href="#">GEOL 486</a> ), <a href="#">GEOL 507</a> , ATMS 517 ( <a href="#">GEOL 517</a> )	6-8
Complete at least 3 of the following courses focusing on advanced topics (9 min. hrs.): <a href="#">GEOL 450</a> , <a href="#">GEOL 451</a> , <a href="#">GEOL 470</a> , ESE 482 ( <a href="#">GEOL 483</a> ), <a href="#">GEOL 565</a> , <a href="#">GEOL 572</a>	9-12
Elective 400-500 level courses, selected with help from the program advisor	0-9
GEOL 598 Capstone Research Project (4 min., 8 max. applied toward degree)	4-8
<b>Total Hours</b>	<b>32</b>

### Other Requirements<sup>1</sup>

Proposed Requirement
Other requirements may overlap.
Successful completion of the program requires a written capstone report.
At least 12 of the 32 required hours must be in GEOL (8 at the 500-level).
At least 12 of the 32 required hours must be in 500-level courses.
Course substitutions are permitted with the consent of the departmental advisor.
A maximum of 2 elective courses may be taken CR/NC.
All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 or more graduate hours of graded coursework, it must be raised to 3.0 or above after the completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter.

<sup>1</sup> For additional details and requirements refer to the Department's [Graduate Degree Programs](#) the [Graduate College Handbook](#).

**Appendix A**  
Environmental Geology, MS Non Thesis

Elective 400-500 level courses, selected with help from the program advisor      0-9 hours

Sustainability

ENSU 410      Sustainable Organizations

Atmospheric Sciences

ATMS 523      Weather and Climate Data Analytics

Geography and GIS

GEOG 410      Green Development

GEOG 466      Environmental Policy

GEOG 473      Digital Cartography & Map Design

GEOG 476      Applied GIS to Environ Studies

GEOG 477      Introduction to Remote Sensing

GEOG 479      Advanced Topics in GIS

GEOG 480      Principles of GIS

GEOG 489      Programming for GIS

GEOG 507      High-Performance Geospatial Computing

GEOG 517      Geospatial Visualization & Visual Analytics

GEOG 527      Geospatial Artificial intelligence and Machine Learning

**Appendix A**  
Environmental Geology, MS Non Thesis

Elective 400-500 level courses, selected with help from the program advisor      0-9 hours

Sustainability

ENSU 410    Sustainable Organizations

Atmospheric Sciences

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Geography and GIS

GEOG 410    Green Development

GEOG 466    Environmental Policy

GEOG 473    Digital Cartography & Map Design

GEOG 476    Applied GIS to Environ Studies

GEOG 477    Introduction to Remote Sensing

GEOG 479    Advanced Topics in GIS

GEOG 480    Principles of GIS

GEOG 489    Programming for GIS

GEOG 507    High-Performance Geospatial Computing

GEOG 517    Geospatial Visualization & Visual Analytics

GEOG 527    Geospatial Artificial intelligence and Machine Learning

## ACADEMIC CATALOG ENTRY

- 1) All proposals must submit the major requirements (courses, hours) for the proposed curricula. Please see the University of Illinois Academic Catalog- <http://catalog.illinois.edu/> for your unit for an example of the entry.

### Environmental Geology, MS (Overview)

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Head of Department: Thomas Johnson  
Director of Graduate Studies: Lijun Lu

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For additional details and requirements refer to the department's [Graduate Degree Programs](#) and the [Graduate College Handbook](#).

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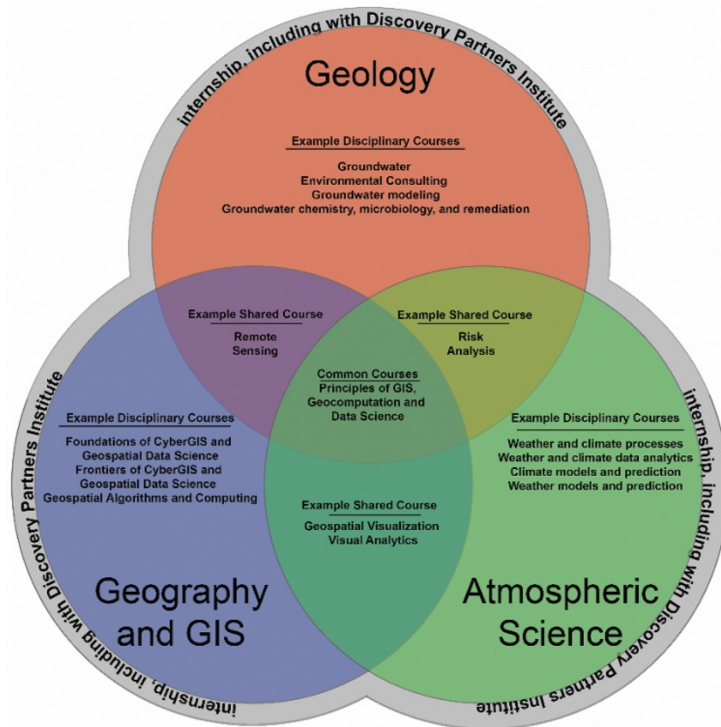
Proposed Requirements	Proposed Credit Hours
Formal coursework (24 min.)	24-28
Complete 2 of the following online core courses focusing on geodata science and analysis (6 min. hrs.): GEOG 407 ( <a href="#">GEOL 407</a> ), ATMS 421 ( <a href="#">GEOL 481</a> ), ATMS 404 ( <a href="#">GEOL 485</a> ), ESE 486 ( <a href="#">GEOL 486</a> ), <a href="#">GEOL 507</a> , ATMS 517 ( <a href="#">GEOL 517</a> )	6-8
Complete at least 3 of the following online courses focusing on advanced topics (9 min. hrs.): <a href="#">GEOL 450</a> , <a href="#">GEOL 451</a> , <a href="#">GEOL 470</a> , ESE 482 ( <a href="#">GEOL 483</a> ), <a href="#">GEOL 565</a> , <a href="#">GEOL 572</a>	9-12
Elective 400-500 level courses, selected with help from the program adviser	0-9
GEOL 598 Capstone Research Project (4 min., 8 max. applied toward degree)	4-8
<b>Total Hours</b>	<b>32</b>

### Other Requirements<sup>1</sup>

<b>Proposed Requirement</b>
Other requirements may overlap.
Successful completion of the program requires a written capstone report.
At least 12 of the 32 required hours must be in GEOL (8 at the 500-level).
At least 12 of the 32 required hours must be in 500-level courses.
Course substitutions are permitted with the consent of the departmental advisor.
A maximum of 2 elective courses may be taken CR/NC.
All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 or more graduate hours of graded coursework, it must be raised to 3.0 or above after the completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter.

<sup>1</sup> For additional details and requirements refer to the Department's [Graduate Degree Programs](#) the [Graduate College Handbook](#).





*Fig. 1: The relationship between the Investment for Growth-funded courses offered in the proposed online SESE non-thesis M.S. degree programs.*

