Two Year Progress Report
Earth and Environmental Sciences (BA/MA/PhD)
September 2015

**Undergraduate Program:**
The reviewers note that recruitment is generally an issue for Earth Science and Geology departments, and suggested several mechanisms to increase intake. Our undergraduate population has increased rapidly in recent years, from 156 students in 2012 to 268 students in 2014. These numbers represent Earth & Environmental Science students only and do not include students in Geological Engineering. We have managed to absorb this increase without compromising on quality of offerings, particularly with respect to experiential learning. Details follow.

**Recommendation 1:** It is recommended that the Department and the University explore opportunities for recruitment from the Ontario college system credit transfer agreement. Acceptance of transfer credits from colleges is now done routinely, but is not a major source of enrolment. During 2012 to 2014 we accepted 14 transfers into our programs from other universities and colleges.

We have instituted an agreement with the Waterloo Region District School Board and provide advanced standing for Earth Science 121 (Introduction to Earth Science) through a dual credit high school course (Earth and Space Science). In 2013/14, 53 students wrote the test to get the credit. However, none ended up registering for our programs.

**Recommendation 2:** It is recommended that the Department ensure alignment of minimum program requirements with APGO standards for professional registration, and communicate APGO standards clearly to students.
Our EES programs all meet APGO standards for accreditation, and APGO provides an information session to students on campus each fall as well as an informative website approved by APGO for University of Waterloo students. As well, we counsel students in related programs (mostly Environmental Science) on how to use their electives to qualify for APGO accreditation.
Recommendation 3: It is recommended that the Department ensure that all undergraduate courses are integrated, and that faculty undertake to maintain an ongoing process of collaborative course renewal that ensures continuity while eliminating gaps and redundancy. This is an ongoing process. We have instituted an annual teaching retreat as of 2015, and also annual meetings of people teaching in each of the three specializations for our Honours EES program to enhance information sharing with respect to teaching matters.

Recommendation 4: It is recommended that the Department undertake to expand opportunities for undergraduate students to engage in undergraduate thesis, co-operative work terms, or other research or employment experiences within the analytical research facilities. Our EES program is offered in co-op format and 29% of our students elect to do a co-op degree. All of our EES programs require students to do either an undergraduate thesis (2 terms) or a project (1 term). Our research laboratories make extensive use of summer assistants from the undergraduate program, often but not always via the co-op program. On-line courses were discouraged by the reviewers, and we remain lightly invested in this form of course delivery although we are being encouraged to develop in this direction. Field trips and labs retain their prominence in our courses. We also subsidize students to attend the Prospectors and Developers Conference in Toronto each year, and as of last year we are sending a team to the World Mining Competition in Saskatoon.

Recommendation 5: It is recommended that the Geophysics Specialization be discontinued if no additional faculty expertise can be recruited to support the program. This program continues to attract excellent students and held 24 students in 2014. The courses within the program are also very popular with our Geological Engineering students. We hesitate to cancel it for these two reasons. We are currently searching for a new Department Chair, and are in discussion with a senior faculty member (an NSERC IRC) from another university who wishes to move to our Department. Her group includes PhD-level geophysicists. In view of these opportunities to recruit new faculty, we wish to continue to offer the Geophysics Specialization.

Recommendation 6: It is recommended that the Geochemistry Specialization be discontinued. This program is undersubscribed, but is in an area where we have considerable research strength and where we are mounting relevant courses that are well subscribed by students in other specializations. Until now the program has been run out of the Chemistry Department. We are in the process of rebuilding a Geochemistry offering based in Earth Sciences better suited to the needs of geochemists, and making it a specialization within Earth and Environmental Sciences.
Recommendation 7: It is recommend that the Department identify essential core areas of foundational earth sciences as priorities in recruitment of faculty.
Retirements had eroded our strength in core areas of Earth Science. Recent recruits of our Department (Chris Yakymchuk – petrology and economic geology; John Johnston – sedimentology and stratigraphy; Brian Kendall – sedimentary geochemistry and metal isotope geochemistry) have addressed this. As well, we have had discussions with adjunct faculty recently retired from the Geological Survey of Canada about stronger involvement in the undergraduate side of the Department.

Recommendation 8: We recommend expanding collaborative delivery of courses that meet the needs of both Geoscience and Ecology specializations within the Environmental Science program.
These two specializations have many courses in common, including a common first year. Thereafter, there are relatively few required Biology courses in the Geoscience specialization but ample opportunity for Biology electives in years 3 & 4. There are some Earth Science courses in the Ecology specialization, plus electives. We are about to enter discussions with Biology about a new joint Environmental Science specialization in Water Science, designed to be taught both here and in select Chinese universities in years 1 and 2. This discussion will also provide the opportunity for us increase our collaboration in teaching the Environmental Science program. However, we do wish to continue to provide students in all of the Environmental Science specializations the scope to pursue their particular interests rather than mandate the mix of courses.

Recommendation 9: It is recommended that all faculty be encouraged to take part in Honours Thesis supervision.
Our increased enrollment is putting a major strain on thesis and project courses. Getting more project supervisors remains a significant challenge that we must overcome. Options that we have discussed include, in order of preference: 1) strongly encouraging faculty participation; 2) increased use of research faculty and possibly postdoctoral fellows as supervisors; 3) formal assignment of a quota of students to faculty members; 4) using teaching assistants; 5) eliminating the requirement for a project and/or restricting access based on grades. It should be noted that very few faculty do not participate, and most take on several students at a time. For the indolent, forcing them to take undergrad students may not be in the best interests of the students or the advisors. The current problem is actually driven by increasing enrollment and decreased faculty numbers. The options listed above may not all be necessary to solve our problem, but the issue certainly has our attention at the moment.

Recommendation 10: It is recommended that the University Administration re-evaluate admission and student-preparation practices for the China-Canada 2+2 program.
It is an ongoing challenge to improve communication skills and provide experiential learning to the China 2+2 students. A major initiative we launched in this direction is Earth 10, a non-credit course that focuses on communications and problem solving. While created for 2+2 students, all students are welcome to participate in their first year at UW. The Earth 10 model is now being replicated by other Science departments. As well, all EES students are required to take an English or communication course as their Arts core elective. More generally, many Earth courses include oral and written assignments giving students opportunity to improve their communication skills as they learn.

*Recommendation 11: It is recommended that the Department continue to build relationships with its alumni, develop mechanisms for more effectively gathering student feedback on degree completion, and create a means for tracking careers of alumni.*

Earth Science has strong ongoing relationships with many of its alumni. There are annual alumni events (Farvolden Day, PDAC Alumni Reception). We do not have a staff person devoted to this task, but Faculty of Science has two individuals who coordinate interaction with alumni. We are re-instituting an exit survey for graduating students as of this year.

** Graduate Program:**

Since the last external review several actions have been taken, some of which are still underway, to remediate shortcomings and strengthen graduate training in the Department. Below we provide a follow-up response to the recommendations outlined in the External Reviewers’ Report.

*Recommendation 12: Now is the time to realign graduate course offerings with the realities of existing departmental complement and expertise, and with desired student learning outcomes.*

A purge of courses no longer offered was conducted in fall 2014. Three old courses are in the process of being deactivated and removed from the online list of courses. A total of five new graduate courses have also been added since. The graduate course offerings now better reflect the current expertise of the department.

*Recommendation 13: It is recommended that the new graduate curriculum include a multidisciplinary “techniques” course that exposes students to diverse, advanced analytical techniques in the earth and environmental sciences.*

The graduate committee considered this recommendation and found that, given the breadth of the department, targeted courses would be more appropriate. Some of these exist already (e.g., Earth 656, Groundwater Modelling; Earth 661, Analytical Methods; 671, Field Methods in Hydrogeology). We have added a course in Geographical Information Systems.
Recommendation 14: Graduate course delivery needs to be more equably distributed across the department.
Faculty in EES are expected to teach a graduate course annually, and this expectation is largely adhered to. We do not feel that the load is unfairly distributed at this time.

Recommendation 15: It should be absolutely a requirement that students meet with their complete supervisory committee within weeks of arrival, in order to lay out the necessary program of study, courses and research.
The Graduate Committee monitors students closely to ensure Committees are established within the recommended timelines at Waterloo and that committee meetings do occur at least once per year. Recent changes to the regular MSc program, such as the implementation of a formal thesis seminar course (Earth 695), is one new mechanism in place now to ensure committees are formed in the first two terms of a student’s program and that the thesis project, research plan, and courses are discussed in a timely manner.

Recommendation 16: It is recommended that the requirement for remedial undergraduate training in earth science be re-evaluated at this time in order to allow for consideration of the context of a student’s specific research plans, recognizing the increasingly interdisciplinary nature of earth science research and faculty specializations within the Department.
This is related to the previous recommendation, and although we agree that a student’s background needs to be reviewed in light of their research project at the first committee meeting, a meeting within weeks of arrival is impractical.

Recommendation 17: It is recommended that the graduate admissions processes be investigated, with a view to elimination of unnecessary procedures and inefficiencies, and to rapid turnaround of offers of admission.
A Task Force on Graduate Recruiting (2013) identified a number of recommendations to improve key strategic recruitment practices. We continue to work with the Associate Dean of Graduate Studies for the Faculty of Science on these recommendations to improve admissions.

Recommendation 18: It is recommended that the Department place a high priority on preparing a new, comprehensive Graduate Student Handbook.
Such a handbook was prepared in September 2014 and it is given to all incoming graduate students and is available in pdf format on the department website. The plan was to update this document once per year to ensure it stays up to date. There have been no changes to programs and rules since 2014, however we plan to review everything before fall 2016 to ensure that the handbook is consistent with the current calendar. An additional initiative that is being considered is to invite new graduate students twice a year (e.g., in September and January) to a meet and greet with the Graduate Committee and to run Q&A sessions about graduate studies.

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Recommendation 19: *It is recommended that the Department foster awareness of instructional support services available at the UW, and work with the Centre for Teaching Excellence to create opportunities for graduate students to increase their instructional skills.*

The responsibility of communicating these services to graduate students is shared between Departments and the CTE itself. This is one of the things that could be discussed during the meet and greet with graduate students (cf. Rec 18 response). Another planned initiative is to send an email to all graduate students about the available resources and to encourage them to visit the graduate student page of the CTE for more information and to sign-up for their workshops. A separate email will be sent out to students on the TA list to remind them about these programs.
Signatures of Approval:

Chair/Director

Date 12 Apr '16

Faculty or Administrative Dean

Date 12 - 4 - 16

Associate Vice-President, Academic
(For undergraduate and augmented programs)

Date April 13, 2016

Associate Provost, Graduate Studies
(For Graduate and augment programs)

Date April 18, 2016