

FINAL ASSESSMENT REPORT

Institutional Quality Assurance Program (IQAP) Review

School of Earth and Environmental Sciences Graduate and Undergraduate Programs

Date of Review: April 26 and 27, 2022

In accordance with the University Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the undergraduate and graduate programs delivered by the School of Earth and Environmental Sciences. This report identifies the significant strengths of the program, together with opportunities for program improvement and enhancement, and it sets out and prioritizes the recommendations that have been selected for implementation.

The report includes an Implementation Plan that identifies who will be responsible for approving the recommendations set out in the Final Assessment Report; who will be responsible for providing any resources entailed by those recommendations; any changes in organization, policy or governance that will be necessary to meet the recommendations and who will be responsible for acting on those recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

Executive Summary of the Review

In accordance with the Institutional Quality Assurance Process (IQAP), the School of Earth and Environmental Sciences submitted a self-study in March 2022 to the Vice-Provost Teaching and Learning and Vice-Provost and Dean of Graduate Studies to initiate the cyclical program review of its undergraduate and graduate programs. The approved self-study presented program descriptions, learning outcomes, and analyses of data provided by the Office of Institutional Research and Analysis. Appendices to the self-study contained all course outlines associated with the program and the CVs for each full-time member in the department.

Two arm's length external reviewers and one internal reviewer were endorsed by the Deans, Faculty of Social Science and Science, and selected by the Vice-Provost, Teaching and Learning and Vice-Provost and Dean of Graduate Studies. The review team reviewed the self-study documentation and then conducted a review on April 26 and 27, 2022. The visit included interviews with the Provost and Vice-President (Academic); Vice-Provost, Teaching and Learning, Vice-Provost and Dean of Graduate Studies, Associate Dean, Grad Studies and Research, Director of the School of Earth and Environmental Sciences and meetings with groups of current students, full-time faculty and support staff.

The Director of the School and the Deans of the Faculty of Science and Social Sciences submitted responses to the Reviewers' Report (August 2022 and January 2023). Specific recommendations were

discussed and clarifications and corrections were presented. Follow-up actions and timelines were included.

Strengths

- Clear curriculum, and high level of success among undergraduate students.
- Experiential learning and field courses
- GIS requirement across all programs
- Graduate and undergrad students feel professors are accessible, attentive, and engaged
- Teaching faculty are valued and supported with Instructional Assistants to help manage loads

Areas for Enhancement or Improvement

- Increase experiential learning in BA program courses (especially Planning practical)
- Increase in integration between the social science and science graduate students.
- Involvement/integration of graduate students in department governance.
- Structure and mentorship for faculty/teaching faculty
- Lack of gender diversity on the faculty, especially in science programs.

Implementation Plan

Summary of the Reviewers’ Recommendations with the Department’s and Dean’s Responses

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow-Up	Timeline for Addressing Recommendation
<p>1.1. Increase experiential learning in BA program courses (especially Planning practical). (Executive Summary, Page 7)</p>	<p>SEES already offers several experiential learning opportunities for all students, including internship opportunities and co-op placements (Science), and BA students complete a field course in Toronto.</p> <p>The Faculty of Social Science (FSS) is in the process of launching a co-op program, and we have expressed our interest in developing a co-op option for SEES BA students. At this time, FSS is not including SEES students in their initial</p>	<p>Associate Director (Undergraduate) and Undergraduate committee.</p>	<p>For logistical and managerial reasons, Social Science (FSS) is limiting the co-op option to only three programs during its pilot phase. FSS has signaled that they are open to including SEES in the co-op program following the pilot. Discussions with FSS around co-op options will continue.</p> <p>Communications from FSS suggests that it will be 2-3 years before the co-op expands to all units within the Faculty.</p>

	<p>rollout of the co-op program. We will continue to explore the opportunities for a BA co-op option as the FSS program expands.</p> <p>It should be noted that we cannot offer a direct Planning practical to our students as we do not offer a planning degree program (nor do we plan to do so). In most cases, students in a planning program would have greater opportunities for planning placement opportunities.</p> <p>Careers events, for both BA & BSc students, have been collaboratively organized by the undergraduate student association, the School of Earth, Environment & Society Student Association (SEESSA, previously GESS), the Undergraduate Committee and individual faculty (i.e., Peace, Wilton) to provide students with an opportunity to understand the practical applications of their academic programs.</p>		<p>We continue to discuss with the undergraduate student association (SEESSA) and the McMaster Science Society (MSS) about ways to modify and expand the career events to appeal to the broad range of interests of our students. FSS has also invested in additional resources (i.e., new Director, Career Services) in career planning. Part of the Director’s mandate is to work with student societies to plan and coordinate events.</p>
<p>1.2. Increase in integration between the social science and science graduate students. (Executive Summary, Page 7)</p>	<p>The School already offers a seminar series where graduate students are encouraged to attend and participate. Post-Docs and Senior PhD students are often called upon to present their work.</p>	<p>Director and Associate Director (Graduate & Research)</p>	<p>Fall 2022 and on-going September 2022 (Welcome event): Will introduce Grad Society to incoming grads and encourage participation in all School events.</p>

	<p>Although pandemic restrictions have limited opportunities for interaction over the past two years, the Associate Director (Graduate & Research) has encouraged the graduate students to organize a group that will be associated with the McMaster Graduate Society (the 'SEES Graduate Student Collective'), and the School has supported them financially where appropriate. SEES has also supported the organization of a student-run seminar series where contributions were made by both social science and science graduate students, and whose activities were all the more important during the pandemic. Although the group has not identified leadership for the 2022/23 academic year, we will continue to encourage this group and support as needed. This will include ensuring that they have a leadership sustainability plan in place.</p> <p>We will also continue working with the graduate students to identify an effective mechanism for a graduate research day that is separate from undergraduate research activities (as has</p>		<p>Sept-Dec. 2022: Associate Director, Grad & Research, will work with Graduates to identify timing and format of a graduate student research day.</p> <p>Seminar Series runs September – April, and all graduate students are encouraged to attend. During the fall of 2022, the Graduate Committee will explore ideas to increase participation (i.e., mandatory attendance, other incentives). Should a course of action be approved, this will be in place for the fall of 2023.</p>
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	<p>previously been the case) and which has a focus of encouraging students to gain awareness of what other students are doing.</p>		
<p>1.3. Involvement/ integration of graduate students in department governance. (Executive Summary, Page 7)</p>	<p>It is unclear what is being asked in this case. Graduate students are already involved on the School Council, along with other committees including Equity, Diversity and Inclusion (EDI), Graduate Committee, Seminars, and Outreach. With respect to School Council, there is a standing item in the agenda where graduate students are given time to speak at each Council meeting and are asked to share information between grad students and the School.</p> <p>We will reach out to graduate students in the fall to seek their feedback and further explore their interests around governance.</p>	<p>Director and Associate Director (Graduate & Research)</p>	<p>Fall 2022</p>
<p>1.4. Structure and mentorship for faculty/teaching faculty. (Executive Summary, Page 7)</p>	<p>New faculty hires are paired with more senior faculty mentors within the School. The mentoring relationship will be codified so that both mentor and hire are aware of expectations.</p> <p>Hires are also provided with teaching release to participate in the 8-month structured Faculty of Science new faculty mentoring program.</p>	<p>Director</p>	<p>On-going</p>

<p>1.5. Lack of gender diversity on the faculty, especially in science programs. (Executive Summary, Page 7)</p>	<p>SEES has recognized the lack of diversity within its faculty complement and has closely followed equity, diversity and inclusion (EDI) strategies for recruitment with our recent hires. Over the past 5-7 years, we have hired (or jointly hired) 5 female faculty, including Drs. Bedore, Kidd^{Sci}, Papangelakis^{Sci}, Ljubicic, and Ravensbergen (starting January 2023). Their hires complement our current female faculty including Drs. Chouinard, Eyles^{Sci}, Mills, Padden^{Sci}, and Williams. We have also grown our faculty diversity in terms of BIPOC hires (i.e., Chikanda, Gonsamo^{Sci}).</p> <p>We recognize that there is more work to be done in this space and we will continue to engage diversity candidates when we can hire. We will discuss with the Dean of Science whether faculty hires to be proposed in the coming year can be specifically focused on addressing this issue.</p> <p>^{Sci} = Science faculty.</p>	<p>Director & Hire Committees</p>	<p>On-going</p>
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1. Recommendations

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow-Up	Timeline for Addressing Recommendation
<p>2.1. The School should explore how it can foster community, synergies and</p>	<p>Collaborative opportunities have, of course, been negatively impacted by the pandemic over the past</p>	<p>Director</p>	<p>On-going</p>

<p>collaboration across the physical and social sciences, both at the faculty level and among graduate students. This could include cross-disciplinary research forums, increased numbers of informal gatherings and ideation activities, and support for interdisciplinary and convergent extramural funding and projects. (Executive Summary, Page 7)</p>	<p>2.5 years. Despite this, we have continued to hold virtual seminars and faculty, staff, and students are encouraged to participate in the School’s seminar series. It is our hope going forward that the return to in-person activities will allow for more collaborative and formal/informal learning and research opportunities. With the aid of the Associate Dean Research office and our Associate Director, Graduate & Research, we will look for opportunities to explore new strategic initiatives that cut across the School. These could include cross-disciplinary research forums, increased numbers of informal gatherings and ideation activities, and support for interdisciplinary and convergent extramural funding and projects</p> <p>As noted, we are specifically discussing with graduate students how they would like to build interactions via colloquia and/or research day activities.</p>		
<p>2.2. More structured inclusion of Graduate students within the School’s governance, in addition to continued</p>	<p>See #1.3 above.</p>		

<p>participation in the Undergraduate and Graduate Committees. (Executive Summary, Page 7 & 15)</p>			
<p>2.3. Address the inequity in the teaching loads among the faculty in the program. (Executive Summary, Page 7)</p>	<p>The difference in teaching loads enabled us to sustain our programs in some areas despite the lack of faculty renewal and other delays in hiring at the time. With recent hires, we will be a position to revisit this.</p> <p>The Director will initiate discussion of teaching load among faculty. This discussion will include how we address the issue of a high number of sessional instructors while working toward greater equity in teaching loads and continuing to deliver our program.</p>	<p>Director and Undergraduate Committee</p>	<p>Start: Fall 2022 and on-going</p>
<p>2.4. Seek to increase the gender diversity among the science faculty complement. (Executive Summary, Page 7)</p>	<p>See #1.5 above</p>		
<p>2.5. Seeking a teaching stream faculty member to fill the geochemistry gap in the professional degree program ahead of the next hiring cycle. (Page 8 & 9)</p>	<p>The School has recognized that there is a gap in our ability to teach geochemistry, and we have unsuccessfully sought a hire in this area in the last few Faculty Appointments Advisory Committee (FAAC) cycles. As the report notes, research in geochemistry is an opportunity for</p>	<p>Director, Advisory group, Undergraduate Committee and School Council.</p>	<p>Fall 2022 and on-going</p>

	<p>research collaboration within the School, and can attract new funding, neither of which are the mandate of Teaching Stream appointments. It is worth noting that both Drs. Bernier and Padden are also geochemists and are teaching faculty members. There are also faculty needs in other areas that this report did not address.</p> <p>We will initiate discussions on two fronts: (1) explore opportunities to re-align teaching duties among our teaching faculty to reflect training (i.e., Bernier or Padden teaching Geochem), and (2) discuss the best fit for a teaching faculty member within the School. Longer term we will continue to advocate for hires in these critical areas.</p>		
<p>2.6. Explore ways to effectively address problematic behaviors (forms of micro-aggressions) in the classroom context, and to enact training or other policies in the School to correct this. (Page 9)</p>	<p>The School’s leadership and faculty are keen to address any concerns associated with microaggressions and discrimination in the classroom. To this end, SEES implemented an EDI committee in the fall of 2021, and we will re-double our efforts to address concerns of this nature when we are made aware of them.</p> <p>We would note that data included in the IQAP report that indicated</p>	<p>Director, SEES Faculty and staff</p>	<p>Fall 2022 and on-going</p>

	<p>variations in instructors' responses to discriminatory behaviours was based on a 2015 survey. The same survey question was not repeated in future years so may capture a one-time event.</p> <p>That said, we will explore opportunities to share effective teaching responses to such events. Specifically, we will ask staff at the MacPherson Institute to organize a workshop for SEES instructors, with the plan to offer this in the fall of 2022.</p>		
<p>2.7. The Faculty of Social Sciences might consider offering a first year introductory or remedial numeracy option specifically geared towards social science students who have not done the appropriate high school math to prepare them for Undergraduate degree numeracy requirements. (Page 9)</p>	<p>In discussing this recommendation with the Dean of FSS, they have signaled that there is support for a social science focused numeracy course as a substitute for the current statistical requirement. Other priorities within FSS have delayed discussion, but we will raise this opportunity with the Faculty of Social Sciences academic programming and planning committee in Fall 2022. There is some concern (with SEES) that such a course has the potential to turn students away from Level 1 enrollment, so this requires careful consideration.</p>	<p>Associate Director (Undergraduate)</p>	<p>Fall 2022</p>
<p>2.8. The School should consider a</p>	<p>GIS is introduced in all our first-year courses.</p>	<p>No action is recommended</p>	<p>NA</p>

<p>level 1 course that is geared at introducing the foundations of geographic information and its representation in maps and related modes. (Page 9)</p> <p>The School should consider adding an Introduction to Cartography (or Principles of Map Design) course that teaches students how to responsibly and ethically convey geospatial data in map form. (Page 10)</p>	<p>Our existing introductory GIS courses (2GI3) offers students detailed instruction on map making and modern approaches to cartography using GIS, including discussion on colour models, appropriate use of map projections, symbolization, text, and other map elements in combination with the design principles that cartographers and GIS practitioners employ to create an effective map composition. The principles, which are covered early in this course are employed in every following exercise and continue for each exercise in the upper year courses. In subsequent courses, students' cartographic knowledge is augmented with specific examples related to terrains, 3D Mapping and networks. In 4GT3 (Web Mapping), students are exposed to cartographic design approaches that are customized for interactive displays of geographic information such as in a web mapping application. Students in SEES have performed very well in competitions like the Esri Story Maps competitions which heavily feature interactive displays of spatial data.</p>		
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	<p>It is important to note that the introduction of a new level 1 course would require our existing 1st year courses to be re-visited, as it is unlikely we can support 5 first year courses.</p> <p>For these reasons, we do not support the introduction of these two new courses at this time, particularly given discussion around our ability to staff our existing courses (see #2.12).</p>		
<p>2.9. Address the issue of progression and availability of courses. (Page 9)</p>	<p>The Undergraduate Committee will evaluate our course offerings. Following models in our GIS offerings, some courses may be targeted to be offered every other year, addressing both sessional needs and low enrollment, while keeping in mind the need for our coop students to access required courses in a timely fashion. However, it is unclear how many additional courses can be offered on a rotating basis while ensuring program continuity. It is also worth noting that some upper-level courses, while small, are required to ensure PGO certification, although with sufficient planning and announcements to students, alternating course options is likely viable.</p>	<p>Undergraduate Committee</p>	<p>Fall 2022</p>

<p>2.10. Offering a course in Spatial Database Design. (Page 11)</p>	<p>Our existing GIS courses already emphasize databases, data management, and project management (i.e., in 2GI3, students are exposed to SQL statements, and in 3GV3, the deliverable is a project with accompanying database). Elements of enterprise-level server and databases are covered in 4GT3, with a discussion about system architectures, REST endpoints, consuming live feeds of spatial data and various OGC compliant geographic information services in a variety of web mapping applications.</p>	<p>No action is recommended</p>	<p>NA</p>
<p>2.11. It would be instructive for the department to examine how the results “success” changes if this benchmark is increased to a C+ for Honors programs, or at least for some specific outcomes that are deemed key to the program. (Page 11)</p>	<p>We will explore how other units within the Faculty of Science set benchmarks.</p>	<p>Undergraduate Committee</p>	<p>Winter 2023</p>
<p>2.12. SEES’ over reliance on sessional instructors. (Page 12)</p>	<p>This is a concern that has been flagged in a number of different areas. The Undergraduate Committee will address this by exploring whether some courses should be cancelled and/or offered</p>	<p>Undergraduate Committee</p>	<p>Fall 2022</p>

	<p>every other year to help reduce this need. This will also be considered in the bigger discussion of teaching load and equity as noted above.</p>		
<p>2.13. Expectations of weekly or biweekly one-on-one meetings between faculty supervisors and their graduate students. (Page 15)</p>	<p>Meeting frequency between supervisor and students has largely been left to the discretion and needs of both parties, with frequency often increasing at key times of the research program. Supervisors will be encouraged to have a check-in meeting in the first term, at which time the SGS Supervisory Relationship form can be discussed.</p> <p>We have strongly recommended using the SGS Supervisory Relationship form upon the initiation of supervision such that student and supervisor expectations and responsibilities are directly discussed at the outset of studies.</p>	<p>Associate Director, Graduate and Graduate Committee</p>	<p>Fall 2022</p>
<p>2.14. Once per term meetings of the supervisory committee, increased from once per year. (Page 15)</p>	<p>SEES follows SGS guidelines for yearly meetings of the supervisory committee. In many cases, committees already meet more frequently at the request of the supervisor, committee, or the student. Going forward, we will recommend increased supervisory committee meeting frequency. Given the need for additional</p>	<p>Associate Director, Graduate and Graduate Committee</p>	<p>Fall 2022</p>

	supervisory meetings likely extend beyond SEES, we will also talk to the School of Graduate Studies.		
2.15. An annual graduate student review (including Individual Development Plans (IDPs). (Page 15)	<p>It is not completely clear here what the review committee was suggesting, as such reviews already occur for both Masters and PhD students. The annual supervisory form already accomplishes some of this, with students identifying progress and goals.</p> <p>It is unclear if the reviewers felt an IDP was an extension to the existing form, with students expanding on broader career goals, experiential goals, etc. that are indirectly related to their studies. The IDP would be a new option and would need to be developed with MacPherson.</p>	Associate Director, Graduate and Graduate Committee, along with assistance from the MacPherson Institute	Fall 2023

Faculty Response

The Deans thanked the reviewers for their thoughtful and constructive review of the SEES undergraduate and graduate programs. The team recognized many strengths of each program, areas of activities, and continued progress. Below is their response to their recommendations. The School has provided a more detailed, point-by-point response, along with specific steps to be taken, and timelines. This Dean’s response is submitted jointly between Science and Social Sciences.

2.1. The School should explore how it can foster community, synergies and collaboration across the physical and social sciences, both at the faculty level and among graduate students. This could

include cross-disciplinary research forums, increased numbers of informal gatherings and ideation activities, and support for interdisciplinary and convergent extramural funding and projects.

The issue of collaborations and cross-disciplinary activities is an important one. The program response has mentioned a few ideas that are being explored. The Deans support the School in taking steps to address the recommendation and look forward to working with them in meaningful ways.

2.2. More structured inclusion of Graduate students within the School's governance, in addition to continued participation in the Undergraduate and Graduate Committees.

As noted in the program response, graduate students are part of various committees and have opportunities to influence decisions. We will work with the School to review the current process and ways to improve future communications with the student community.

2.6. Explore ways to effectively address problematic behaviors (forms of micro-aggressions) in the classroom context, and to enact training or other policies in the School to correct this. (Page 9)

The SEES recognizes it is not clear if the issue identified here is a current concern or relates to specific instances prior to the IQAP that have since been addressed. Nevertheless, the Deans applaud the SEES's acknowledgment of the seriousness of these concerns and the necessity to provide safe, supportive and inclusive teaching and learning spaces for all stakeholders in the McMaster community. Accordingly, they support the School's initiative to organize a workshop for SEES instructors with the MacPherson Institute and will encourage additional input/participation from other units including the Equity and Inclusion Office, to connect instructors with resources and encourage conversations to reinforce appropriate behaviours in teaching and learning spaces in SEES.

2.8. The School should consider a level 1 course that is geared at introducing the foundations of geographic information and its representation in maps and related modes.

The School should consider adding an Introduction to Cartography (or Principles of Map Design) course that teaches students how to responsibly and ethically convey geospatial data in map form.

The Deans recognize the importance of comprehensive curriculum content aligning with the Program Learning Objectives in each of the degree pathways offered by the SEES and the suggestions of the reviewers to enhance content via new course offerings. Although there is currently a Gateway in Level 1 that offers 3 level 1 courses, students do not officially enroll in any of the SEES programs until Level 2. Accordingly, expanding the Level 1 curriculum to include one or more additional courses in the suggested areas may not be practical. We support the SEES's response to these recommendations, indicating the content identified by the reviewers is already, or in the process of being, incorporated in the existing introductory courses and encourage their ongoing exploration of ways to include more of the suggested content within the current course offerings.

2.9. Address the issue of progression and availability of courses.

The Deans acknowledge the efforts and actions of the SEES efforts to review the structure and content of their course offerings on a year-to-year basis. Recognizing there are challenges and rewards to offering a diverse curriculum and accommodating the staggered schedules of co-op students, SEES will continue to manage course offerings with goals to optimize students' opportunities to access prerequisite and required courses through adaptive course scheduling.

2.10. Offering a course in Spatial Database Design.

The Deans have reviewed and support the SEES response that Spatial Database Design content is effectively delivered within the current course offerings.

2.11. It would be instructive for the department to examine how the results "success" changes if this benchmark is increased to a C+ for Honors programs, or at least for some specific outcomes that are deemed key to the program.

SEES is currently working on a plan, in coordination with the Deans office to bring some stability for delivery of courses and maintain consistently high-quality teaching. This plan will likely involve a combination of approaches including the elimination and consolidation of some courses, offering some upper year courses on a rotating year basis and the provision of more stable resourcing where fiscally possible.

2.13. Expectations of weekly or biweekly one-on-one meetings between faculty supervisors and their graduate students.

2.14. Once per term meetings of the supervisory committee, increased from once per year.

2.15. An annual graduate student review (including Individual Development Plans (IDPs)).

Recommendations 2.13, 2.14 and 2.15 are related to communications between the student, supervisor, and supervisory committee. The Deans appreciated the concern of reviewers and agree that SEES could take steps to improve supervision further. The Faculty of Science expects each program to establish an optimum frequency of student-supervisor meetings. In most of their programs, supervisors meet with students informally several times each month.

School of Graduate Studies recommends that the supervisor and student have a mutual obligation to meet on an annual basis formally, and Ph.D. supervisory meetings should happen at least once (and possibly more) per year. The frequency of such meetings should be guided by factors such as student's progress, difficulties encountered during research, and supervision issues. We will support SEES in their efforts to review the existing procedure and will work with them to establish more explicit expectations of meeting frequencies in the future.

The Deans appreciated the recommendation of reviewing the Individual Development Plan (IDP) as part of the supervisory meeting. The Faculty of Science is in the process of establishing a comprehensive graduate career program for all students that will include annual completion and review of IDP. The program is expected to be launched in fall 2023. We are working to establish a process that will allow IDP and other career-related activities to be part of the existing annual supervisory committee meetings.

The School of Graduate Studies is currently participating in a working group with the Ontario Council on Graduate Studies (OCGS) to establish principles and best practice for graduate supervision at Ontario universities. These principles will also provide guidelines for best practices of communication that SEES might draw on.

Quality Assurance Committee Recommendation:

McMaster's Quality Assurance Committee (QAC) reviewed the above documentation at the March 22, 2023, meeting. The committee recommends that the **School of Earth and Environmental Sciences undergraduate and graduate programs** should follow the regular course of action with an 18-month progress report, and a subsequent full external cyclical review to be conducted no later than eight years after the start of the last review.