PRESENTED BY: Susan Detmer; Chair, Academic Programs Committee

DATE OF MEETING: January 16, 2020

SUBJECT: Admissions Qualifications change – Master of Water Security (MWS) Program

DECISION REQUESTED: It is recommended:
That Council approve the proposed changes to the admissions qualifications for the Master of Water Security (MWS) program, effective the 2021-22 admissions cycle

PURPOSE: Changes to admissions qualifications require approval by University Council and confirmation by University Senate.

CONTEXT AND BACKGROUND:

The College of Graduate and Postdoctoral Studies is proposing a change to admissions qualifications for the Master of Water Security (MWS) program. These changes are proposed as part of the strategic planning in the School of Environment and Sustainability as because of an opportunity to offer the MWS program at Beijing Normal University in China.

The change will require students applying for the MWS program to submit a written statement indicating why they want to join the program and to have completed a course at the undergraduate level (100-level or equivalent) in mathematics as well as one in statistics with at least 70% (USask grade system equivalent). An interview, either online or by another method, may be required.

These proposed changes are to ensure that students have the skills needed to be successful in the MWS program as they move forward toward the goal of moving to the option of offering this
program internationally. SENS has been considering how they could ensure students coming into the program at Beijing Normal University would be able to demonstrate that they had the required skills and interest to be able to complete the program.

APC reviewed this proposal at its December 18, 2019 meeting. The committee had concerns about how the possible interviews will be conducted and the impact it might have on applicants. Clarification was received that the purpose of the interview will be for students to be given an opportunity to provide additional information so that they could be added to the pool of acceptable candidates and not to weed people out. Concerns were also raised time zone differences and access to internet as an issue with online interviews, but these issues are already managed for international applicants to many USask programs.

In addition to these proposed change to the admissions qualifications for this program, curricular changes were proposed through University Course Challenge in December 2019 and were approved. These curricular changes are included in Attachment 2 and are for information only.

**FURTHER ACTION REQUIRED:**
University Senate will be asked to confirm this decision at its April 25, 2020 meeting.

**ATTACHMENTS:**

1. Change in Admissions Requirements for the Master of Water Security

2. (FOR INFORMATION ONLY) – Proposal for Academic or Curricular Change - Revision to Master of Water Security (M.W.S.)
MEMORANDUM

To: Academic Programs Committee of University Council
Copy: Dr. Andrew Ireson, School of Environment & Sustainability
From: Martha Smith, Associate Dean, CGPS
Date: December 11, 2019
Re: Changes to Admission Requirements – Master of Water Security

As a result of strategic planning processes, as well as a partnership and opportunity to deliver the Master of Water Security (MWS) program at the Beijing Normal University in China, multiple changes to the MWS are being proposed. Curricular changes have been submitted to the December University Course Challenge process, and tuition changes will be considered as part of the Institutional Planning & Assessment tuition consultations early in the new year as they are unrelated to the curricular changes. The CGPS is requesting that APC recommend the proposed changes to admission requirements to University Council for approval.

The proposed changes are noted in red:

• a four-year honours degree, or equivalent, from a recognized college or university in an academic discipline relevant to the proposed field of study
• a cumulative weighted average of at least a 70% (U-of-S USask grade system equivalent) in the last two years of study (e.g. 60 credit units)
• Language Proficiency Requirements: Proof of English proficiency may be required for international applicants and for applicants whose first language is not English. See the College of Graduate and Postdoctoral Studies Academic Information and Policies in this Catalogue for more information.
• For all students, a written statement of why they want to join the program; and an online or other interview may also be required.
• Students must have completed a course at the undergraduate level (100-level or equivalent) in both mathematics and statistics with at least 70% (USask grade system equivalent).

The Graduate Programs Committee approved the changes on December 5, 2019, and they were subsequently approved by the Executive Committee of CGPS on December 9, 2019.

Attached please find documentation specific to the proposed admission changes. The full proposal has also been provided as a supplementary document.

If you have any questions, please contact Kelly Clement at kelly.clement@usask.ca or 306-966-2229
MEMORANDUM

To: Academic Programs Committee of University Council

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Date: December 11, 2019

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If you have any questions, please contact Kelly Clement at kelly.clement@usask.ca or 306-966-2229.
The School of Environment and Sustainability discussed the following issue and resulting resolutions when making these revisions:

**Issue:** Type of student the program is attracting

**Resolution:** Faculty agreed that the original intention of offering an interdisciplinary program for both social science and natural science/engineering students must be maintained. However, to ensure that students of all backgrounds would be successful in the program, a new admission requirement in mathematics and statistics was added.

The Graduate Programs Committee discussed the proposed language on the admission requirements informally in April 2019, and formally on September 30, 2019, and December 5, 2019. The Executive Committee of CGPS also discussed the language at their meeting on December 9, 2019. With each review, the proposed language was slightly modified to result in the proposed language that has been submitted to APC.
On December 9, 2019, the Executive Committee (EC) of CGPS considered a recommendation from the Graduate Programs Committee (CGPS) to approve the revisions to the Master of Water Security program.

In principle the EC voted in favour of the revisions to the Master of Water Security program (Newton/McIntyre/1 abstention – CARRIED) with a friendly amendment to change the Skype language to ...online conferencing platform or otherwise for a possible interview may be required.

The attached appendix provides additional background for consideration. If you have any questions, please contact Dean Trever Crowe at trever.crowe@usask.ca or by phone at 966-5759.

/ll
MEMORANDUM

To: Executive Committee of CGPS

Copy: Dr. Andrew Ireson, Master of Water Security Program Coordinator, School of Environment and Sustainability

From: Graduate Programs Committee

Date: December 6, 2019

Re: Master of Water Security program modification

On September 30, 2019, and December 5, 2019, the Graduate Programs Committee considered revisions to the Master of Water Security Program. Some members of the Graduate Programs Committee had initially reviewed the proposal and provided feedback in April 2019.

The revised program removed the concentration options. Students will complete 30 credit units of coursework through a cohort-based modular delivery and wrap up the program with a 6 credit unit capstone project.

The program revisions resulted from the School of Environment and Sustainability’s strategic planning process, as well as a partnership and opportunity to deliver this UofS program at Beijing Normal University in China.

The Graduate Programs Committee passed the following motion unanimously.

“To recommend approval of the revisions to the Master of Water Security program.”

Mendoza/Smith CARRIED

Based on University governance approval timelines, we request that programmatic changes be implemented effective May 1, 2020, admission changes be implemented for the 2020-2021 admission cycle, and tuition changes be implemented for September 2020.

Attached please find the full program proposal and supporting documents.

If you have any questions, please contact Kelly Clement at kelly.clement@usask.ca or 306-966-2229
Proposal for Academic or Curricular Change

Revision to
Master of Water Security (M.W.S.)

Submitted February 25, 2019
Resubmitted with revisions 20 September 2019
Revised 25 November 2019
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Proposal Identification

Title of proposal: Re-imagined Master of Water Security Degree

Degree(s): Master of Water Security (M.W.S.)

Field(s) of Specialization: Water Security

Level(s) of Concentration: The existing concentrations, i) Hydrology; ii) Hydrogeology; iii) Socio-hydrology, will be removed.

Option(s): N/A

Contact person(s) (name, telephone, fax, email): School of Environment and Sustainability
Dr. Marth Smith, Associate Dean, CGPS, 906-966-2229 (kelly.clement@usask.ca)

Proposed date of implementation: Due to special circumstances the Dean, CGPS and Registrar provided us permission to implement the changes for 2018/19 as they go through the approval process.

Proposal Document

1. Academic Justification:
   a. Describe why the program would be a useful addition to the university, from an academic programming perspective. This is a modification to an existing USask degree program that builds both disciplinary expertise, and awareness of and capability for interdisciplinary work. The Master of Water Security (M.W.S.) is a vital program to the university as water security is one of its six signature areas. The M.W.S. provides an alternative for students who are seeking professional degrees; the proposed changes to the program better prepare students with professional skills and experiences necessary to be successful in the workforce.

   b. Giving consideration to strategic objectives, specify how the new program fits the university signature areas and/or integrated plan areas, and/or the college/school, and/or department plans. This program is designed to address one of the university’s signature areas of research, water security, and is associated with the Global Institute for Water Security. USask is ranked #1 in water resources research in Canada, according to the 2017 Shanghai Academic Ranking of World Universities. Within SENS, water security is one of our core strengths, as reflected in our Strategic Plan (to 2025) with a goal to create and enhance internationally-sought after graduate programs in the areas of Water, Energy and Food Security in partnership with other units on campus. The revisions to the program come as a result of the work done on our strategic plan and a fledging partnership with Beijing Normal University in China to offer the USask M.W.S. program within China.

   c. Is there a particular student demographic this program is targeted towards and, if so, what is that target? (e.g. Aboriginal, mature, international, returning) This program is open to all students interested in a graduate professional (courses and project) program. We continue to work to make our programs relevant to Indigenous and international students. With the changes to the program we hope to increase interest and accessibility to working professionals. The target for this program is 25 students/year.
d. **What are the most similar competing programs in Saskatchewan, and in Canada? How is this program different?** There are no known comparator programs in Saskatchewan. Please see Appendix A for other comparator programs in Canada and internationally. Our program is unique, in that it offers critical substantive knowledge and professional skills that will propel graduates to become leaders in their chosen careers.

2. **Admissions:**
   a. **What are the admissions requirements of this program?**
      1. A four-year honours degree, or equivalent, from a recognized college or university in an academic discipline relevant to the proposed field of study
      2. A cumulative weighted average of at least a 70% (USask grade system equivalent) in the last two years of study (e.g., 60 credit units)
      3. Language Proficiency Requirements: Proof of English proficiency may be required for international applicants and for applicants whose first language is not English. See the College of Graduate and Postdoctoral Studies Academic Information and Policies in this Catalogue for more information.
      4. For all students, a written statement of why they want to join the program; and an online or other interview may also be required.
      5. Students must have completed a course at the undergraduate level (100-level or equivalent) in both mathematics and statistics with at least 70% (USask grade system equivalent).

3. **Description of Program:**
   a. **What are the curricular objectives, and how are these accomplished?**
      The mission of the M.W.S. program is to train the next generation of water scientists, engineers, managers and policy-makers to tackle the complex and interdisciplinary water problems of the future. Our vision is to be the best program of its kind in Canada—and be among the best internationally—with strong course content and high expectations for scholarship. A major reason for the proposed revisions is to increase the predictability of course offerings (by moving from different streams to a single stream with courses offered each year), to ensure we are covering the most important topics for water security within the course content and combining it in a way that allows students to see the synthesis between topics, and to offer real-world experiences through team-based projects that will be done in partnership with external agencies. We expect that graduates from the M.W.S. program may be job-ready for positions in government, industry and not-for-profit sectors and will also be sought-after students to go on to Masters (thesis based) or PhD programs at USask or elsewhere.
      Within the scope of a professional-oriented Master’s degree, graduates will have a solid understanding of current issues and methods in water security and will be capable of applying this understanding in practical or professional contexts.
      As a project-based Master’s degree, the program will provide graduates with a broader background in water security, with a much greater dependence on coursework and team-based projects within course offerings. Aside from research activities embedded within the coursework there will be less focus on preparing students to conduct independent study and research.
In line with the College of Graduate and Postdoctoral Studies policies on degree-level Learning Outcomes, the M.W.S. will be configured as follows (Table 1):

Table 1: M.W.S. Program Requirements

<table>
<thead>
<tr>
<th>Course units</th>
<th>Project</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 cu</td>
<td>6 cu</td>
<td>36 cu required</td>
</tr>
</tbody>
</table>

Length: 8 months, 4 months; 12 months required

- The project-based M.W.S. program includes 30 credit units of course work plus 6 credit units devoted to a team-based project. This team-based project will see the students work with a partner organization to foster project management and critical thinking skills. The project provides an opportunity for students to investigate applied topics in water security. Projects are interdisciplinary in scope and may include scientific, technical, social, economic, cultural, institutional, or other appropriate attributes of water security challenges. Through active hands-on experience, students will be well-equipped to begin a successful career in water science.

b. Describe the modes of delivery, experiential learning opportunities, and general teaching philosophy relevant to the programming. Where appropriate, include information about whether this program is being delivered in a distributed format.

The revised M.W.S. program will be taught using the principles of the 5E instructional model that will be delivered in a compressed course framework.

5E Instructional Model: Program development in SENS is guided by a belief that learners construct their own knowledge through experience. When learners encounter something new, they are able to connect it to previous understandings and can create new understandings as a result. Further, teaching and learning activities, course design, and more broadly, program design ought to be built on this core assumption about learning (also known as “constructivism”). This core assumption about learning shows respect for learners’ past experiences, knowledge, and ways of knowing—a respect of fundamental importance for indigenization and reconciliation as well as for practitioners engaged in graduate study that advances their own professional competencies in their own contexts.

The active role of the instructor includes expert knowledge, especially where the instructor provides tools for problem-solving and inquiry-based learning. The active role of the learner relies on designs that create opportunities for students to engage with concrete experiences, reflective observation, abstract conceptualization, and active experimentation (aligned with Kolb’s experiential learning cycle). The following model, known as the 5E Learning Model (originally a lesson planning model for science education developed in the late 1980s, having been adopted more broadly), provides more specific guidance and suggests ways forward for implementation of delivery where instructors are involved in face
to face instruction of students for intensive periods and in contact with students who are actively engaged in co-constructed learning with peers at other times.

Presented here as a linear process, the 5E model should also be understood as iterative and repeating, including at the level of even a 10-minute lesson plan. A single course can attend to the 5E model as a teaching and learning arc. At the program level, earlier emphasis is on “engage” where students situate themselves and their learning goals in comparison to the program-level competencies. Next, “explore”, “explain”, and “elaborate” can be achieved to an increasing standard as students progress through the program. Finally, “evaluate” occurs for students when they are judged to have completed the program requirements and presented their competence through culminating product or process. Cells in the following table are framed in terms of what the student does or can do at these levels and at the points of the 5-E Learning Model.

Table 2: The 5-E Learning Model

<table>
<thead>
<tr>
<th>5-E Learning Model</th>
<th>Lesson Level</th>
<th>Course Level</th>
<th>Program Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Engage”</td>
<td>Access prior knowledge or experience of the topic, find personal relevance in the lesson topic</td>
<td>Connect prior learning to the learning required in the course, find personal relevance in the course</td>
<td>Recognize extents of prior learning as related to program-level competencies, identify relevant experiences, establish personal learning goals</td>
</tr>
<tr>
<td>“Explore”</td>
<td>Participate in or get actively involved in a problem or area of inquiry that forms the focus of the lesson</td>
<td>Participate in or get actively involved in learning activities designed to provide exploratory opportunities in the course</td>
<td>Participate in a range of learning activities designed to explore a breadth of problems and areas of inquiry, engaging in at least one to further depth</td>
</tr>
<tr>
<td>“Explain”</td>
<td>Describe what has occurred and/or been discovered via the preceding learning activity</td>
<td>Describe what has occurred and/or been discovered via the various learning activities in the course</td>
<td>Explain to a range of audiences the nature of a problem or area of inquiry</td>
</tr>
<tr>
<td>“Elaborate”</td>
<td>Connect that explanation to concepts, existing or emerging knowledges or ways of knowing</td>
<td>Explicate the meanings of course concepts, situate these in existing or emerging knowledges or ways of knowing</td>
<td>Analyse and bring critical synthesis to a problem or area of inquiry, extrapolating relevance to stakeholder groups</td>
</tr>
<tr>
<td>“Evaluate”</td>
<td>Present or demonstrate understanding for assessment against established criteria by others (feedback can be formative &amp;/or summative)</td>
<td>Present or demonstrate knowledge, skills, values as per course learning objectives to instructor (feedback can be formative &amp;/or summative, i.e., in the form of assignment and course grades)</td>
<td>Receive verification of program-level competencies achieved.</td>
</tr>
</tbody>
</table>

Compressed Course Framework: The approximately 39 hours required for each 3 credit unit course will be taught in roughly a two-week compressed format, for the majority of courses. Each course in the term will include a portion dedicated to a group term project; students will work together at the end of each term to complete this term project, incorporating concepts and ideas learned in all the courses that term. At the completion of the first two terms, students will be provided with short-courses that promote professional skills such as communication, leadership, entrepreneurship, project management, and others at the start of their 6 credit unit project course that they can then apply to their project. If a student must take a leave of absence that requires them to miss a course or a significant portion of the course, faculty will work with the student to find a suitable alternative. This could
include the following options: 1) review the course material independently and complete all the course assignments, independently, on a time line agreed with the course instructor or 2) complete the course the following year.

**Proposed Course Sequence:**

<table>
<thead>
<tr>
<th>Term</th>
<th>Course number</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>ENVS 990</td>
<td>Seminar Requirement</td>
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<tr>
<td></td>
<td>ENVS 806</td>
<td>Ethics Requirement</td>
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<td></td>
<td>GEOG 826</td>
<td>Fundamentals of Hydrology</td>
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<tr>
<td></td>
<td>ENVS 805</td>
<td>Field Skills in Environment and Sustainability</td>
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<tr>
<td></td>
<td>ENVS 815</td>
<td>Data Analysis and Management</td>
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<tr>
<td></td>
<td>ENVS 829</td>
<td>Modelling for Water Security</td>
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<tr>
<td></td>
<td>ENVS 992</td>
<td>River, Lake and Wetland Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Term Project (weaved throughout above courses)</td>
</tr>
<tr>
<td>Two</td>
<td>ENVS 817</td>
<td>Fundamentals of Hydrogeology</td>
</tr>
<tr>
<td></td>
<td>ENVS 816</td>
<td>Chemicals in Aquatic Systems</td>
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<tr>
<td></td>
<td>ENVS 820</td>
<td>Water and Human Health and Wellbeing</td>
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<td></td>
<td>JSGS 870</td>
<td>Water Policy in an Age of Uncertainty</td>
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<tr>
<td></td>
<td>ENVS 821</td>
<td>Sustainabile Water Resources</td>
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<tr>
<td></td>
<td>ENVS 992</td>
<td>Term Project (weaved throughout above courses)</td>
</tr>
<tr>
<td>Three</td>
<td>ENVS 992</td>
<td>Project Course Requirement w Capstone Event</td>
</tr>
</tbody>
</table>

c. **Provide an overview of the curriculum mapping.**

The courses in the existing version of the M.W.S. were carefully reviewed through consultation with over 20 faculty members from across campus with expertise in various areas of water security. Discussions were held regarding the most important areas of water security and these discussions shaped the new courses in the proposed revised M.W.S. program.

d. **Identify where the opportunities for synthesis, analysis, application, critical thinking, problem solving are, and other relevant identifiers.**

See b above and note the addition of the term project in attached course syllabi. In addition, ENVS 992.6 Project in Environment and Sustainability will be a key point in the program for those in the Project options for synthesis, analysis and application of the concepts and skills learned in the program.

e. **Explain the comprehensive breadth of the program.**

UN-Water defines water security as “the capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.”
USask’s M.W.S. program trains students in science, social science, engineering, health, planning, and policy analysis to investigate water security issues of local to international consequence.

The M.W.S. is a cross-disciplinary, course and project-based professional-style program that can be completed in 12 months of full-time study (see Table 1). This program is intended to provide prospective and current environmental practitioners with a post-graduate learning opportunity in water security.
f. Referring to the university “Learning Charter”, explain how the 5 learning goals are addressed, what degree attributes and skills will be acquired by graduates of the program.

See Table 3 for a breakdown of how the revised M.W.S. program addresses the 5 learning goals.

<table>
<thead>
<tr>
<th>Table 3: Learning Charter’s 5 Learning Goals</th>
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<tbody>
<tr>
<td>Description</td>
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<tr>
<td>Pursuit of Truth and Understanding</td>
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<tr>
<td>Pursuit of Knowledges</td>
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<td></td>
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<tr>
<td>Pursuit of Integrity and Respect</td>
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<td></td>
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<tr>
<td>Pursuit of Skills and Practices</td>
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<td>Individual and Community Pursuits</td>
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g. Describe how students can enter this program from other programs (program transferability).
To truly gain all the benefits of the revised M.W.S. structure, students are expected to take all required courses when offered. Transfer students will not be accepted to the M.W.S. program.

h. Specify the criteria that will be used to evaluate whether the program is a success with a timeframe clearly specified by the proponents in the proposal.
The program will be monitored closely over the first three years using student satisfaction and employment data compiled from surveys and verbal feedback on a yearly basis. Faculty teaching in the program will also be requested to provide feedback given the changes in how the program is offered. Enrollment numbers and graduate rates will also be used to evaluate success. This program will be evaluated based on the metrics used to evaluate initiatives in the SENS’s strategic plan.

i. If applicable, is accreditation or certificate available, and if so how will the program meet professional standard criteria. Specify in the budget below any costs that may be associated. N/A

4. Consultation:
a. Describe how the program relates to existing programs in the department, in the college or school, and with other colleges. Establish where students from other programs may benefit from courses in the program. Does this proposed program lead into other programs offered at the university or elsewhere?
This program is a revised version of the existing M.W.S. program approved in 2015 and currently running. Students from other graduate programs on campus, both existing and new proposed programs, will benefit from courses in this program (i.e., the courses will be open to all eligible graduate students on campus, with eligibility determined based on having prerequisite knowledge for successful completion of the course. In particular, we expect that students in water-related thesis based programs will be interested in taking some of the courses to complete the requirements of their thesis degree programs). Students completing a M.W.S. program may choose to pursue thesis masters or doctoral programs here at the USask or at other institutions.

b. List units that were consulted formally, and provide a summary of how consultation was conducted and how concerns that were raised in consultations have been addressed. Attach the relevant communication in an appendix.
The decision to revise the M.W.S. program was made during M.W.S. Governance Committee meetings on November 10, 2017 and on April 13, 2018. The M.W.S. Governance Committee consists of faculty representatives from a number of partner units across campus (see Appendix B). In April 2018, a first draft of proposed revisions was circulated for comment to members of the M.W.S. Governance Committee by email, and then a second draft of proposed revisions was circulated for comment to faculty members with a connection to the M.W.S. (see Appendix C for those that participated (April and May emails) on drafts of the revised program). Over the summer, a series of “world café” meetings were held where faculty interested in water were invited to provide feedback and ultimately to co-develop and co-design the revised
M.W.S. program. A final ad hoc committee within SENS then met on August 15, 2018 to finalize the courses (see Appendix C for those that participated in creating the final draft of the revised program). Multiple email and in-person meetings to discuss the program also took place with the Acting Dean, College of Graduate and Postdoctoral Studies.

In a separate activity, starting in May 2018, meetings with IPA were held to discuss the tuition model for the revised program.

c. **Provide evidence of consultation with the University Library to ensure that appropriate library resources are available.**
   No new resources are required as a result of the revisions to the program. No consultation with the University Library was conducted for this reason.

d. **List other pertinent consultations and evidence of support, if applicable (e.g. professional associations, accreditation bodies, potential employers, etc.)**
   N/A

5. **Budget:**

   a. **How many instructors will participate in teaching, advising and other activities related to core program delivery (not including distribution/breadth requirements or electives)? (Estimate the percentage time for each person).**
   A faculty member is the M.W.S. Program Director and responsible for overseeing the program implementation, and recruiting and advising students; it is estimated that this faculty member spends about 15% of their time on these activities, as a yearly average. Furthermore, up to 7 faculty members are responsible for teaching the courses in the M.W.S. program; it is estimated that these faculty members spend about 15% of their time per course on a yearly average.

   b. **What courses or programs are being eliminated in order to provide time to teach the additional courses?**
   None; this is a revision to an existing M.W.S. program; any courses removed are being replaced on a 1:1 basis.

   c. **How are the teaching assignments of each unit and instructor affected by this proposal?**
   Teaching assignments should not be affected by this proposal. As SENS creates and implements new courses, we may need to teach the odd course as “overload” (e.g., School of Public Policy offering on Water Policy). However, as we fill the new positions within SENS and allow time for other participating units to make this part of their faculty’s regular workload, we strive to make the entire program part of the normal workload.

   d. **Describe budget allocations and how the unit resources are reallocated to accommodate this program. (Unit administrative support; space issues, class room availability, studio/practice rooms, laboratory/clinical or other instructional space requirements).**
   Yes, we need high quality “smart” classrooms to implement the course. With the upcoming move of SENS to WP Thompson, we will work to gain access to these types of
rooms that will become part of the renovated classrooms in WP Thompson. In the interim, we will need to make room requests each year as early as possible to ensure access to needed classrooms.

e. If this program is to be offered in a distributed content, please describe the costs associated with this approach of delivery and how these costs will be covered. At this time there is no distributed content in the program. In future, once the revised program is thriving, we will look to offering online courses.

f. If this is an interdisciplinary program, please indicate whether there is a pool of resources available from other colleges involved in the program. Other colleges or schools who participate in teaching in the M.W.S. program will receive a portion of the net revenue, prorated based on a TABBS model that is designed specifically for this type of interdisciplinary, inter-unit collaborations.

g. What scholarships will students be able to apply for, and how many? What other provisions are being provided for student financial aid and to promote accessibility of the program? Small scholarships ($1,500/student for 5 students on an annual basis) are currently available for students in our professional programs. Applicants are assessed for scholarship funding based on merit. Partners are encouraged to provide whatever financial support to students for the projects that is possible and desirable for them, ranging from covering direct expenses to providing full scholarships. However, we cannot require this of all partners as we will not be able to secure enough projects if funding is a requirement. In future, we will seek additional sources of funding, including donors, MITACs, Queen Elizabeth Scholars, and paid team or independent work placements.

h. What is the program tuition? Will the program utilize a special tuition model or standard tuition categories? (The approval authority for tuition is the Board of Governors). As with the current M.W.S. program, the revised program with fall under “Programs with Special Tuition Rates”. SENS is working with IPA to finalize the tuition for the 12 month project-based program—we are projecting a 10% increase in tuition from our current tuition rate of $10,500 (domestic rate).

i. What are the estimated costs of program delivery, based on the total time commitment estimates provided? (Use TABBS information, as provided by the College/School financial officer). Total cost of the program is $346,476. See Appendix D.

j. What is the enrolment target for the program? How many years to reach this target? What is the minimum enrolment, given the limitations of the resources allocated to the program? The enrolment target for this program is 25 students. We estimate we will reach this target in 2020–2021. Minimum enrolment to break even on incremental costs is 16 students.
k. What are the total expected revenues at the target enrolment level, separated into core program delivery and distribution/breadth requirements or electives? What portion of this expected revenue can be thought of as incremental (or new) revenue? The total tuition revenue is $356,079 based on enrolment targets (25 project-based). Based on the 15 current M.W.S. students, the incremental revenue is $183,915.

As all components of the program are “core” (i.e., required), there is no need to separate this revenue into core vs. electives.

l. At what enrolment number will this program be independently sustainable? If this enrolment number is higher than the enrolment target, where will the resources come from to sustain the program, and what commitments define the supply of those resources? The increase in enrollment that we expect as a result of the redesign will lead to an incremental tuition revenue of $183,915. The program is (and will be) financially sustainable, and represents an important alternative revenue stream for SENS. To breakeven on full costs, we require 24 students; however, based on incremental costs, the breakeven is 18 students.

m. Proponents are required to clearly explain the total incremental costs of the program. This is to be expressed as: (i) total cost of resources needed to deliver the program: (ii) existing resources (including in-kind and tagged as such) applied against the total cost: and (iii) a listing of those resource costs that will require additional funding (including new in-kind support).

Total cost for the program is $346,476 which is less than the projected tuition revenue of $356,079 by $9,602. See Appendix D.

n. List all new funding sources and amounts (including in-kind) and the anticipated contribution of each to offsetting increment program costs. Please identify if any indicated funding is contingent on subsequent approval by a funding authority and/or future conditions. Also indicate under what conditions the program is expected to be cost neutral. This proponents should also indicate any anticipated surpluses/deficits associated with the new program.

All funding sources will be the tuition revenue. Anticipated surplus is $9,602. See Appendix D.

Acknowledgements
The School of Environment and Sustainability would like to acknowledge the expertise and support of many faculty members and administrative personnel who participated in reimagining the M.W.S. program and creating this proposal. A special thank you to Andrew Ireson, M.W.S. Program Director, for his hard work and dedication to the program both to date and ongoing.
MEMORANDUM

To: College of Graduate and Postdoctoral Studies
   University Council

From: Irena Creed, Executive Director

Date: 31 January 2019

Subject: School Statement – Proposal for Revision of Master of Water Security Program

To the College of Graduate and Postdoctoral Studies and University Council,

As the Executive Director of the School of Environment and Sustainability (SENS), I approve the revisions to the Master of Water Security (M.W.S.) program as outlined in this proposal. Many faculty from within and outside the School have participated in the reimagining of the program and we are proud and excited about the revisions.

The process followed to create this proposal is outlined in Section 4 of the preceding document, followed by a thorough review by the Executive Director, Assistant Director-Academic, M.W.S. Program Director, SENS Academic Programs Committee and a vote by SENS Faculty.

The School discussed the following issues and resulting resolutions when making these revisions:

- **Issue**: Type of student the program is attracting
  - **Resolution**: Faculty agreed that the original intention of offering an interdisciplinary program for both social science and natural science/engineering students must be maintained. However, to ensure that students of all backgrounds would be successful in the program, a new admission requirement in mathematics and statistics was added.
• **Issue**: Concentrations – should the three concentrations in hydrology, hydrogeology and socio-hydrology be maintained?

  **Resolution**: Faculty agreed that the unpredictability of course offerings in each stream made it difficult for students to complete a given stream. To ensure stability, predictability, and quality of the M.W.S. program, the program with 3 streams (each with a suite of elective courses) was changed into a program with a slate of courses that each student will be required to complete (no electives).

• **Issue**: Experiential learning - should “real world” experiences be added to the program?

  **Resolution**: Based on the report *Humans Wanted* (RBC 2018) and reports from ECOCanada, a range of skills such as critical thinking, communication, collaboration, etc. are becoming more important than ever for new graduates. We included more training and options to develop these competencies. To ensure opportunities for students to develop these competencies, we changed the “thesis” project that was conducted under the supervision of an academic, to the following: (1) Cumulative team-based project will be completed at the end of each of the first two semesters under the supervision of the team of instructors for each semester and (2) A “team-based” project that will be completed under the supervision of external partners to the program from government and industry.

• **Issue**: English Language Proficiency Requirements – how can we ensure students have adequate communication skills entering the program.

  **Resolution**: Faculty agreed that there should be no change to the English Language Proficiency Requirements at this time – we are a nascent program and until we achieve our enrollment targets we will consider all qualified students. We will conduct interviews prior to accepting the students into the program, and we will provide opportunities for students to access writing and speaking supports that are offered on campus.

• **Issue**: Classroom Availability for Compressed Courses

  **Resolution**: Faculty are aware that this may be a problem area. SENS will arrange a meeting with room scheduling to discuss. This will also be in consideration as we work with Space Planning on the updates to the WP Thompson Building.

• **Issue**: Compressed Courses Impacting Other Students

  **Resolution**: SENS is discussing ways to minimize the impact compressed courses will have on students outside the program who would like to take the course and are looking at more compressed and blended format options across programs.

Thank you for reviewing this proposal. Please advise if you require any additional information.

Sincerely,

Dr. Irena Creed
Executive Director
Related Documents
At the online portal, attach any related documentation which is relevant to this proposal to the online portal. It is particularly important for Council committees to know if a curriculum changes are being made in response to College Plans and Planning Parameters, review recommendations or accreditation recommendations.

1. Excerpts from the SENS Strategic Plan to 2025

COMMITEMNT 3: Boundless Collaboration

Presently, SENS offers internationally-recognized, undisciplinary graduate programs that place our students in highly-sought occupations following graduation. We will enhance the university's reputation by expanding these programs through collaborative research networks and teaching initiatives that will foster Planetary Health and Human Security.

GOAL 8: Create and Enhance Internationally-Recognized and Sought-after Undergraduate Certificates, and Graduate and Postdoctoral Programming

Our enhanced Undergraduate Certificate in Sustainability will serve as an undisciplinary backbone for all undergraduate environmental programs (Figure 1). We will collaborate with other units to reimagine and deliver new proposed professional master's (course, project) programs paralleled with potential research master's and doctoral programs in the Water-Energy-Food Nexus and Biocultural Conservation (Figure 2). We will partner with other units to design and deliver an Executive Master's program in Planetary Health. We will create and honour strategic agreements with international institutions to offer our master's and PhD programs in their countries (e.g. China). SENS will create an opportunity for graduate students and postdoctoral scholars to participate in an entrepreneurship competition to solve real world problems.

Teaching and research are intimately connected – faculty must be engaged in state-of-the-art research to provide the highest quality experience to students as mentors and teachers. In turn, quality of teaching and research drive recruitment of high caliber students. A consistent focus on these fundamentals will establish a stable framework for long-term growth in external (e.g. rankings, legacy donations) and internal measures (e.g. retention of top-tier faculty). We will determine who are aspirational peers are and strive to meet and/or surpass them in our teaching and research.
2. Letters of Support

The following letters of support have been received for this proposal:

SENS, Karsten Liber, Executive Director (Interim)
Department of Civil, Geological and Environmental Engineering, College of Engineering
Department of Geography and Planning, College of Arts & Science
Global Institute for Water Security
Johnson-Shoyama Graduate School of Public Policy
MEMORANDUM

To: College of Graduate and Postdoctoral Studies
   University Council

Date: 19 September 2019

Subject: Confirmation of support for revision of Master of Water Security Program

As Executive Director (Interim) of the School of Environment and Sustainability (SENS), I am pleased to confirm my approval and support of the proposed changes to our Master of Water Security (MWS) program. The MWS program embodies a key partnership between SENS and the Global Institute for Water Security and is an important part of our school’s academic programming. As such, we in SENS are committed to revising this program to offer the best program possible that suits the needs of both our students and our academic and community partners.

Please let me know if you require further information. Thank you.

Karsten Liber, Ph.D.
Executive Director (Interim) and Distinguished Professor
School of Environment and Sustainability
University of Saskatchewan
February 7, 2019

Andrea Eccleston, M.A.
Strategic Projects Specialist
School of Environment and Sustainability

Dear Andrea:

Re: Support for the revised Master of Water Security program

I am writing to express the support of the Department of Civil, Geological, and Environmental Engineering for the revised Master of Water Security program. Several of our faculty were part of the consultation process, helped to shape the new program, and expect to participate in its delivery. The single stream approach of the revised program is a significant improvement in that it provides a clearer focus and better predictability of course offerings for students. We also believe that engineers interested in expanding their perspective and knowledge in water security will find the program particularly beneficial to their professional engineering practice.

We look forward to having the revised MWS program available to our graduates.

Sincerely,

Leon D. Wegner, Ph.D., P.Eng.
Professor and Head
14 February 2019

Dr. Irena Creed, Executive Director
School of Environment and Sustainability

Re: Master of Water Security Program

Dear Irena:

The Department of Geography and Planning is pleased to offer its support for the revised Master of Water Security (M.W.S.) professional degree program in the School of Environment and Sustainability. The University of Saskatchewan is a global leader in water research and the revised M.W.S. program will play an important role in preparing students interested in professional degrees with the skills and experience to be leaders in the workforce.

The Department is committed to offering GEOG 827 Principles of Hydrology on a regular basis, as an option for MWS students. The Department is also in the process of submitting GEOG 826 Fundamentals of Hydrology for regularized offering as part of the MWS program. This course will be offered on a regular basis and supported by MWS program resources, with the instructor determined jointly by Department and the School.

Several faculty members from the Department were involved in the early stages of review and revision of the M.W.S. program, and our faculty have contributed to the delivery of M.W.S courses. We are interested in continued engagement in M.W.S. program delivery and look forward to the possibility of extending our course offerings as the program grows. Our faculty members are also excited about the opportunity to work with M.W.S. students, serving as mentors and project supervisors.

We look forward to the revised M.W.S. program and to collaborating with the School on the development of thesis-based graduate programming in water security in the near future.

Sincerely,

Bram Noble, PhD
Acting Department Head
March 4, 2019

Prof. Irena Creed
Executive Director
School of Environment and Sustainability

Re: Support for the revised Master of Water Security Program

Dear Irena:

I am pleased to write on behalf of the Global Institute of Water Security (GIWS) to express our support for the revised Master of Water Security program. Members of GIWS were integral in the proposal for the initial program and several of the us, including myself, were part of the consultation process and helped to shape the revised program. In addition a number of GIWS faculty will be involved in the delivery.

The proposed revisions to the program make it unique and improve the program significantly for the students. The improvements mean greater predictability of course offerings, a strong experiential learning component throughout the program and an innovative delivery method.

We look forward to collaborating with the School on the delivery of this revised program.

Sincerely,
Jay Famiglietti
Executive Director, Global Institute for Water Security
January 21, 2019

Dr. Irena Creed  
Executive Director  
School of Environment and Sustainability  
University of Saskatchewan

Dear Dr. Creed:

I am pleased to write on behalf of the Johnson Shoyama Graduate School of Public Policy (JSGS) in support of the revised Master of Water Security (MWS) program offered by the School of Environment and Sustainability (SENS).

With the University of Saskatchewan (USask)'s 2025 Strategic Plan urging new and collaborative programming, we commend SENS for leading the way with changes to the MWS program. This program is a first in a suite of professional graduate programs being developed in collaboration with JSGS, the Edwards School of Business, and the Colleges of Law and Arts and Sciences. We see the revised MWS as a prototype for these new programs and a model that other academic units can emulate.

We appreciate the extensive consultation with JSGS during the development of the revised MWS program, and we are committed to offering the three-credit-unit course, JSGS 870: Water Policy in an Age of Uncertainty, as part of the program. Additionally, the involvement of the instructor (Professor Jeremy Rayner) in the development at all stages and the delivery of the program demonstrated genuine collaboration.

The MWS program features several components that make it unique: a multi-disciplinary teaching team, a strong experiential learning component throughout the program, and improved integration of the social sciences with the natural sciences (an area where students could truly benefit). Initial feedback from the student cohort is that they find the program demanding but enjoyable – elements essential to engaged student learning.

As SENS continues their efforts to develop energy and food security programs, of which policy will be a key component, JSGS looks forward to continued collaboration to ensure comprehensive and well-rounded programming for USask students.

We wish you the best as you go through the university approval process for the revised MWS program.

Sincerely,

Murray Fulton  
Director, USask Campus  
Johnson Shoyama Graduate School of Public Policy

MEF/alm
Consultation Forms

1. Consultation with the Registrar Form - completed by CGPS with Registrar’s Office
2. Complete Catalogue Entry with Changes in Red

Water Security

Would you like to apply to this program?

Application information

Website: Global Institute for Water Security-School of Environment and Sustainability (https://sens.usask.ca/programs/professional-degrees/master-water-security.php)

Program Requirements

Master of Water Security (M.W.S.)

The Master of Water Security (M.W.S.) is an cross-disciplinary interdisciplinary project-based program that focuses on a holistic approach to water security. The program requires: This multidisciplinary program offers students the following three concentrations:

1. Hydrology
2. Hydrogeology
3. Socio-hydrology

Admission Requirements

- a four-year honours degree, or equivalent, from a recognized college or university in an academic discipline relevant to the proposed field of study
- a cumulative weighted average of at least a 70% (U of S USask grade system equivalent) in the last two years of study (e.g. 60 credit units)
- Language Proficiency Requirements: Proof of English proficiency may be required for international applicants and for applicants whose first language is not English. See the College of Graduate and Postdoctoral Studies Academic Information and Policies in this Catalogue for more information.
- For all students, a written statement of why they want to join the program; and an online or other interview may also be required.
- Students must have completed a course at the undergraduate level (100-level or equivalent) in both mathematics and statistics with at least 70% (USask grade system equivalent).

Degree Requirements
GPS 960.0
GPS 961.0 if research involves human subjects
GPS 962.0 if research involves animals subjects
total of 30 credit units including the following:

- ENVS 990.0 - Seminar in Environment and Sustainability (in course build include a sub-title: Breakthroughs in Water Security)
- ENVS 806.3 – Field Skills in Environment and Sustainability (in course build include a sub-title: Water Security Research)
- GEOG 427.3
- GEOG 826.3 – Fundamentals of Hydrology
- GEOG 827.3 – Principles of Hydrology
- ENVS 805.3 – Data Analysis and Management
- ENVS 815.3 (proposed new #) – Modelling for Water Security
- ENVS 816.3 (proposed new #) – Chemicals in Aquatic Systems
- ENVS 817.3 (proposed new #) – Fundamentals of Hydrogeology
- ENVS 820.3 (proposed new #) – Water and Human Health and Wellbeing
- ENVS 821.3 – Sustainable Water Resources
- ENVS 829.3 (proposed new #) – River, Lake and Wetland Science
- JSGS 870.3 – Water Policy in an Age of Uncertainty
- ENVS 992.6 – Project in Environment and Sustainability (in course build include a sub-title: Team Based Project in Water Security)

A minimum of 6 credit units of restricted electives from a single concentration
A minimum 3 credit units chosen in consultation with and with approval from the Program Director

Concentrations

Hydrology

- CE 415.3
- CE 464.3
- CE 834.3
- CE 840.3
- ENVS 805.3
- ENVS 813.3
- ENVS 823.3
- ENVS 824.3
- ENVS 825.3
- ENVS 826.3
- GEOG 827.3
- TOX 843.3

Hydrogeology

- CE 834.3
- CE 850.3
- ENVS 813.3
- ENVS 826.3
- ENVS 805.3
- GEOE 375.3
- GEOE 412.3
- GEOL 413.3
- SLSC 821.3

Socio-hydrology

- AREC 430.3
- CHEP 802.3
- ENVS 805.3
- ENVS 807.3
- ENVS 811.3
- ENVS 823.3
- ENVS 832.3
- JSGS 807.3
- JSGS 863.3
- PUBH 815.3
- RRM 312.3
3. Course Proposal Forms

Please see Appendix E for the following Course Proposal or Modification Forms and course syllabi.

- ENVS 815.3 (proposed new #) – Modelling for Water Security
- ENVS 816.3 (proposed new #) – Chemicals in Aquatic Systems
- ENVS 817.3 (proposed new #) – Fundamentals of Hydrogeology
- ENVS 820.3 (proposed new #) – Water and Human Health and Wellbeing
- ENVS 829.3 (proposed new #) – River, Lake and Wetland Science
- ENVS 992.6 – Project in Environment and Sustainability: Team Based Project in Water Security
# Appendix A: Sample of Comparator Programs – Information Compiled Summer 2018

<table>
<thead>
<tr>
<th>University of British Columbia</th>
<th>Faculty of Applied Science</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 year</strong></td>
<td></td>
</tr>
<tr>
<td>Coursework only</td>
<td></td>
</tr>
<tr>
<td>(39 credit units)</td>
<td></td>
</tr>
<tr>
<td><strong>Master of Engineering</strong></td>
<td></td>
</tr>
<tr>
<td>Leadership in Integrated Water Management</td>
<td></td>
</tr>
<tr>
<td><a href="https://www.grad.ubc.ca/prospective-students/graduate-degree-programs/master-of-engineering-leadership-integrated-water-management">https://www.grad.ubc.ca/prospective-students/graduate-degree-programs/master-of-engineering-leadership-integrated-water-management</a></td>
<td></td>
</tr>
<tr>
<td>Program Info:</td>
<td></td>
</tr>
<tr>
<td><a href="https://apscpp.ubc.ca/programs/mel/integrated-water-management/">https://apscpp.ubc.ca/programs/mel/integrated-water-management/</a></td>
<td></td>
</tr>
<tr>
<td><strong>Tuition:</strong> $28,652</td>
<td></td>
</tr>
<tr>
<td><strong>Program Description:</strong></td>
<td></td>
</tr>
<tr>
<td>The Master of Engineering Leadership (MEL) in Integrated Water Management is designed for engineers and environmental science graduates who want to develop and lead advanced and sustainable water management initiatives. Participants of the program will learn how to apply physical, chemical and biological unit operations and processes to water resources, and will become conversant with regulatory and environmental frameworks.</td>
<td></td>
</tr>
<tr>
<td><strong>Additional Notes:</strong></td>
<td></td>
</tr>
<tr>
<td>in partnership with the business school, offering PD classes</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>University of Waterloo</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Faculty of Applied Science</td>
<td></td>
</tr>
<tr>
<td><a href="https://uwaterloo.ca/discover-graduate-studies/programs/civil-engineering-masc-water">https://uwaterloo.ca/discover-graduate-studies/programs/civil-engineering-masc-water</a></td>
<td></td>
</tr>
<tr>
<td>2. School of Environment, Resources and Sustainability (Collaborative Water Program)</td>
<td></td>
</tr>
<tr>
<td>3. Department of Earth and Environmental Sciences</td>
<td></td>
</tr>
<tr>
<td><a href="https://uwaterloo.ca/graduate-studies-academic-calendar/science/department-earth-and-environmental-sciences/master-science-msc-earth-sciences-water">https://uwaterloo.ca/graduate-studies-academic-calendar/science/department-earth-and-environmental-sciences/master-science-msc-earth-sciences-water</a></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. Full-time and part-time</th>
<th>1. Civil Engineering- MASc Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional Thesis</td>
<td><a href="https://uwaterloo.ca/discover-graduate-studies/programs/civil-engineering-masc-water">https://uwaterloo.ca/discover-graduate-studies/programs/civil-engineering-masc-water</a></td>
</tr>
<tr>
<td>No CUs listed</td>
<td>Tuition: Domestic: $2926/term International: $8702/term</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. &amp; 3. Course-based, research-paper option</th>
<th>2. MES in Social and Ecological Sustainability – Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Program Description: N/A</td>
<td>2. &amp; 3. Program Description: This degree is offered through the Collaborative Water Program. This program, jointly offered by</td>
</tr>
</tbody>
</table>
| Collaborative Master’s Research Program | 3. MSc in Earth Sciences – Water | University of British Columbia  
Faculty of Land and Food System  
[http://mlws.landfood.ubc.ca/](http://mlws.landfood.ubc.ca/) |
|----------------------------------------|---------------------------------|-----------------------------------------------------------------------------------|
| 12–16 months full time                | Tuition: Domestic: $2254/term  
International: $7042/term  
[https://uwaterloo.ca/finance/student-financial-services/tuition-fee-schedules/fee-schedule-graduate-students-fall-2017](https://uwaterloo.ca/finance/student-financial-services/tuition-fee-schedules/fee-schedule-graduate-students-fall-2017) | **Program Description:** The 12-month, professional Master of Land and Water Systems program provides students an opportunity to obtain science-based skills, training and knowledge in the area of Land and Water Systems to address the emerging environmental issues of food security, maintenance of ecological services, restoration of degraded lands, climate change adaptation, and resource conservation. **Additional Notes:** Because this is a professional degree, a Master’s thesis is not required. Instead, students carry out a major project throughout the 12-month duration of the program under the co-supervision of a UBC Faculty Member and a Professional Advisor. **There is no designated classroom time.** |
| (Note: course requirements determined as 1.0 and 0.5 unit weights for courses. Require min. five 1.0 unit weight equivalents.) | A range of departments across several academic faculties, promotes the development of interdisciplinary perspectives on water. Collaborative Water Program students complete their specialist training in their respective home departments, while working with colleagues from a variety of other departments in core interdisciplinary courses (WATER 601 and WATER 602). | |
| University of British Columbia  
Faculty of Land and Food System  
[http://mlws.landfood.ubc.ca/](http://mlws.landfood.ubc.ca/) | **Additional Information:** Note: University of Waterloo has a Collaborative Water Program that offers 13 master’s degree programs (thesis or research project-based) that specialize in water. | |
| Full-time or Part-time | **Master of Land and Water Systems**  
[http://mlws.landfood.ubc.ca/](http://mlws.landfood.ubc.ca/)  
**Tuition:** $19,737 | |
| 1 Year | | |
| Major Project required | | |
| (33 credit units) | | |
| McGill University  
Department of Bioresource Engineering  
| 1 Year Course-based (45 credit units) | Integrated Water Resources Management Program  
https://www.mcgill.ca/iwrm/iwrm-program/program-curriculum  
**Tuition:** Domestic $9500  
International $19454 | **Program Description:** This non-thesis Master’s in IWRM is offered by the Department of Bioresource Engineering. In this program students are offered the unique opportunity to study the various biophysical, environmental, legal, institutional, and socio-economic aspects of water use and management in an integrated context. The integrated perspective ensures that social, economic, environmental as well as technical dimensions are all taken into account in the management and development of water resources. This is a one-year, non-thesis program that leads to the Master of Science in Integrated Water Resources Management degree.  
**Additional Notes:** |
| Oxford University  
Department of Geography and the Environment  
[https://www.ox.ac.uk/admissions/graduate/courses/msc-water-science-policy-and-management?wssl=1](https://www.ox.ac.uk/admissions/graduate/courses/msc-water-science-policy-and-management?wssl=1) | MSc in Water Science, Policy and Management  
[https://www.ox.ac.uk/admissions/graduate/courses/msc-water-science-policy-and-management?wssl=1](https://www.ox.ac.uk/admissions/graduate/courses/msc-water-science-policy-and-management?wssl=1)  
**Tuition:** Domestic £18,455 or $31,198 CDN  
International £24,910 or $42,110 CDN | **Program Description:** The MSc in Water Science, Policy and Management aims to equip the next generation of water professionals with the blend of skills necessary to make a significant contribution to sustainable water management pathways across competing priorities of water for ecosystems, food, energy, economic growth and human consumption.  
**Additional Notes:** The course comprises eight core modules within three thematic areas – water science, water and society, and water management. These modules are assessed by written examination. You also study two electives which are each assessed through a 4,000-word essay. You will also write an individual dissertation of 15,000 words.  
**Additional Links for Possible Comparator Programs:**  
https://www.mastersportal.com/disciplines/124/hydrology-water-management.html  
https://www.cuahsi.org/community/graduate-programs-in-water-science/category/masters  
https://www.un-ihe.org/msc-programmes  
http://watercentre.org/our-services/ |
Appendix B: M.W.S. Governance Committee – 2017-2018
(Group in place during meetings listed in Section 4)

Yanping Li, SENS (Chair)
Irena Creed, SENS
Tim Jardine, SENS
Matt Lindsay, Geology
Jeff McDonnell, SENS/GIWS
Kerry McPhedran, Engineering
Robert Patrick, Geography and Planning
Graham Strickert, SENS
Howard Wheater, SENS/GIWS
Appendix C: Consultation List

April 26, 2018 Email and May 16, 2018 Follow Up Email
Baulch, Helen - SENS
Brinkmann, Markus - SENS
Creed, Irena - SENS
Hecker, Markus - SENS
Ireson, Andrew - SENS
Jardine, Tim - SENS
Jones, Paul - SENS
Li, Yanping - SENS
Liber, Karsten - TOX
Lindenschmidt, Karl-Erich - SENS
Lindsay, Matt - GEOL
McDonnell, Jeffrey - SENS
McPhedran, Kerry - ENG
Morrissey, Christy - BIOL
Patrick, Robert - GEPL
Pomeroy, John – GEPL
Razavi, Saman - SENS
Strickert, Graham - SENS
Whitfield, Colin - SENS

“World Café” Meetings – Invite List: Participants in Yellow; Email Responses in Green

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>MWS Advisory</th>
<th>SE NS</th>
<th>GE PL</th>
<th>Civil, Geo &amp; Environ Eng</th>
<th>Geolog &amp; Geological Science</th>
<th>Biology</th>
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</tr>
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<tbody>
<tr>
<td>Aitken, Alec</td>
<td><a href="mailto:alec.aitken@usask.ca">alec.aitken@usask.ca</a></td>
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<td>Bedard-Haughn, Angela</td>
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<td><a href="mailto:dirk.deboer@usask.ca">dirk.deboer@usask.ca</a></td>
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<tr>
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<td><a href="mailto:amin.elshorbagy@usask.ca">amin.elshorbagy@usask.ca</a></td>
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MWS Proposal for Academic Change—updated 25 November 2019
<table>
<thead>
<tr>
<th>Name</th>
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<tr>
<td>Ferguson, Grant</td>
<td><a href="mailto:grant.ferguson@usask.ca">grant.ferguson@usask.ca</a></td>
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<tr>
<td>Fonstad, Terry</td>
<td><a href="mailto:terry.fonstad@usask.ca">terry.fonstad@usask.ca</a></td>
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<tr>
<td>Guo, Xulin</td>
<td><a href="mailto:xulin.guo@usask.ca">xulin.guo@usask.ca</a></td>
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<td><a href="mailto:markus.hecker@usask.ca">markus.hecker@usask.ca</a></td>
</tr>
<tr>
<td>Helgason, Warren</td>
<td><a href="mailto:warren.helgason@usask.ca">warren.helgason@usask.ca</a></td>
</tr>
<tr>
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<td><a href="mailto:jeff.hudson@usask.ca">jeff.hudson@usask.ca</a></td>
</tr>
<tr>
<td>Ireson, Andrew</td>
<td><a href="mailto:andrew.ireson@usask.ca">andrew.ireson@usask.ca</a></td>
</tr>
<tr>
<td>Jardine, Tim</td>
<td><a href="mailto:tim.jardine@usask.ca">tim.jardine@usask.ca</a></td>
</tr>
<tr>
<td>Jones, Paul</td>
<td><a href="mailto:paul.jones@usask.ca">paul.jones@usask.ca</a></td>
</tr>
<tr>
<td>Kells, James</td>
<td><a href="mailto:jim.kells@usask.ca">jim.kells@usask.ca</a></td>
</tr>
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<td>Li, Yanping</td>
<td><a href="mailto:yanping.li@usask.ca">yanping.li@usask.ca</a></td>
</tr>
<tr>
<td>Lindenschmidt,</td>
<td><a href="mailto:karl-erich.lindenschmidt@usask.ca">karl-erich.lindenschmidt@usask.ca</a></td>
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<tr>
<td>Karl-Erich</td>
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<td>Martz, Lawrence</td>
<td><a href="mailto:L.Martz@USask.CA">L.Martz@USask.CA</a></td>
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<tr>
<td>McDonnell, Jeffrey</td>
<td><a href="mailto:jeffrey.mcdonnell@usask.ca">jeffrey.mcdonnell@usask.ca</a></td>
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<td>McPhedran, Kerry</td>
<td><a href="mailto:kerry.mcphedran@usask.ca">kerry.mcphedran@usask.ca</a></td>
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<td>Morrissey, Christy</td>
<td><a href="mailto:christy.morrissey@usask.ca">christy.morrissey@usask.ca</a></td>
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<td>Noble, Bram</td>
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<td>Rayner, Jeremy</td>
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<tr>
<td>Wilson, Ken</td>
<td><a href="mailto:ken.wilson@usask.ca">ken.wilson@usask.ca</a></td>
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</table>

Email Follow up after “World-Café Meetings”

From: Martin, Jennifer
Sent: Wednesday, July 18, 2018 4:33 PM
To: Creed, Irena <irena.creed@usask.ca>; Baulch, Helen <helen.baulch@usask.ca>; McDonnell, Jeffrey <jeffrey.mcdonnell@usask.ca>; Ireson, Andrew <andrew.ireson@usask.ca>; Li, Yanping <yanping.li@usask.ca>; Strickert, Graham <graham.strickert@usask.ca>; Lindenschmidt, Karl-Erich <karl-
Good afternoon everyone,

Thank you to all who participated in the MWS Small Group discussions regarding the re-imagined Masters of Water Security (MWS) program. The sessions were very informative and essential to the design of the enhanced MWS. Thank you to all who were able to attend or provided feedback in other ways.

Throughout the course of these small group discussions, we arrived at a consensus as to what the enhanced MWS program would look like, which resulted in the development of the attached document “Enhanced MWS Program”

We have allocated course units under each theme: Seminar (0cu), Concepts (6cu), Tools & Techniques (12cu), Water & Health (6cu), Water and Policy Management (6cu), Entrepreneurial Project (6cu), and the optional Work Placement or Practicum (6cu). We will look for opportunities to offer more flexible 1, 2, and 3 cu offerings.

a. Please identify specific topics under at course that you would like covered. The present course titles are placeholders and we need to identify topics under each title.

b. Please identify which course or a topic within a course that you are interested and able to instruct in the 2018-2019 academic year or thereafter and whether you would do this as a part of your normal assignment of duties or overload teaching.

To keep momentum going forward and to see if we can input new courses and new topics this academic year, we would appreciate your feedback by July 27.
Appendix D: Budget Information

University of Saskatchewan
School of Environment & Sustainability
Masters of Water Security degree program
Projected Revenue and Expenditures based on assumptions listed below

<table>
<thead>
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<th>Incremental Revenue / Expenditures</th>
<th>Yr. 1</th>
<th>Yr. 1</th>
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<tr>
<td></td>
<td>2020/21</td>
<td>2020/21</td>
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<tr>
<td>Tuition Revenue to the university</td>
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<td>7 @ 0.15 Faculty time</td>
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<tr>
<td>0.15 FTE Graduate secretary</td>
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<td>0.15 FTE Academic coordinator</td>
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<td>0.25 FTE Work placement coordinator</td>
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<td>$19,506</td>
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<td>$3,750 4 Taships Teacher Assistantships</td>
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<td>Salary &amp; Benefits-sub-total</td>
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<td>Operating costs</td>
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<td>Scholarships</td>
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<td>Indirect Costs - TABBS</td>
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<td>Non-salary - sub-total</td>
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<td>Total expenditures</td>
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<td>Revenue over expenditures - surplus (deficiency)</td>
<td>$9,602</td>
<td>$98,609</td>
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**ASSUMPTIONS:**

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<td><strong>Course plus project</strong></td>
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<td>Int'l differential</td>
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<td>Tuition increase - 10% projected</td>
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Appendix E: Course Proposal and Modification Forms and Syllabi
# New Graduate Course Proposal

## GSR 400.1

### Course Information

Please append the Course Outline (Syllabus), including a separate Undergraduate Course Outline (Syllabus) if required. A syllabus template is available at usask.ca/cgps/forms.php

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<th>Department/Unit</th>
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<tbody>
<tr>
<td>SENS</td>
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<tr>
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<tr>
<td>Dr. Karsten Liber</td>
<td>[Signature]</td>
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### INFORMATION REQUIRED FOR COURSE AND PROGRAM CATALOGUE

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<th>Label and Course Number</th>
<th>Course Title</th>
<th>Total Course Hours</th>
<th>Lecture</th>
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<td>☐ Term 1 or 2</td>
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<td>☐ Term 1 and 2</td>
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<td>☐ Biennially</td>
</tr>
<tr>
<td>☐ Alternate Years</td>
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<tr>
<td>☐ Other</td>
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<table>
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<th>Prerequisite(s) or restriction(s)</th>
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<table>
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<th>Catalogue Description (not more than 50 words)</th>
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<td>An overview of the fundamentals of hydrologic modelling from our perceptions of the behavior of watershed systems to developing and testing watershed simulation models. Theory and numerical implementation of model calibration approaches are taught. Includes an introduction to multi-objective optimization and different approaches to sensitivity and uncertainty analysis of hydrologic models.</td>
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<table>
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<th>Can this course be repeated for credit?</th>
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<table>
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<tr>
<th>Are there any existing courses that should be set up as equivalent or mutually-exclusive? Specify.</th>
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### CHECKLIST

- Course objectives need to be clearly stated
- Description of and Activities for Evaluation must be listed
- Course Outline (syllabus) with Reading List must be included
- Percentage of Total Mark for each evaluation listed
- Professor must be a member of the Graduate Faculty

### EXAM EXEMPTION

- Grade Mode:
  - ☐ Pass/Fail (PF)
  - ☐ Percentage/Numeric
  - ☐ Completed Requirements/In Progress/Not Completed Requirements (C/PL/N)

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<th>Will there be a final exam for this course</th>
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<tbody>
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</tr>
<tr>
<td>☒ No</td>
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</table>

If there is no final exam or if the final examination is worth less than 30% of the final grade, provide a brief statement which explains why a final examination is inappropriate for this course. This is an advanced, non-traditional course designed for students to become familiar with the state of the art in hydrologic modelling and systems analysis. It blends the advanced theories with computer programming and computational analysis. Therefore, a standard final examination will not be appropriate to evaluate students' grasp of the materials. For evaluation, students need to show what they have learned through a set of carefully designed assignments and a project, which assess their understanding of the theories, their abilities to implement the theories, and their abilities to interpret the results.
Rationale

What is the rationale for introducing this course?
SENS has revised its Master of Water Security degree. This course has been created specifically to provide knowledge and skills relevant to this program.

Impact of Course

Are the programs/courses of other academic units/colleges affected by this new course (possible duplication)?

☐ Yes  ☐ No

If yes, please list:

Were any other academic units asked to review or comment on the proposal?

☐ Yes  ☐ No  If yes, please attach correspondence

Will the offering of this course lead to the deletion or modification of any other course(s)?

☐ Yes  ☐ No

If yes, please list:

Course(s) for which this graduate course will be a prerequisite?

NA

Is this course to be required by your graduate students, or by graduate students in another program?

☐ Yes  ☐ No

If yes, please list:

Required for students in the MWS program.
Enrolment

Expected Enrolment
25

From which colleges/programs:
SENS

Resources

Proposed Instructor(s) (Please include qualifications):
Dr. Saman Razavi
Saman Razavi (University of Saskatchewan) is a hydrologist, water resources engineer, and systems scientist by training, specializing in modelling and management of water systems. His overarching research goal is to enhance our ability to predict future water resources and to thereby deliver innovative solutions in support of decision and policy making. Central to his research program is transdisciplinarity and integration to enable feedbacks between different water-related systems, particularly natural and human-driven systems. He has published 33 peer-reviewed journal papers, one peer-reviewed commentary, one book chapter, and (co-)authored 110+ presentations at national and international conferences/meetings. He is the Principal Investigator of the Integrated Modelling Program for Canada (IMP, https://gwi.usask.ca/imp2/), Chair of the American Geophysical Union (AGU)’s Technical Committee on Hydrologic Uncertainty (http://hydroincertainty.org/), Associate Editor of the Journal of Hydrology, and Editorial Board Member of Environmental Modelling & Software. He has received a Water Security Research Excellence Award from the University of Saskatchewan and the Editors’ Choice Award from Water Resources Research.

How does the department plan to handle the additional teaching or administrative workload:
It will be part of the regular assignment of duties.

Are sufficient library or other research resources available for this course:
Yes

Are any additional resources required (library, audio-visual, technology, lab equipment, lab space, etc.):
No

Declaration

This course will conform to the academic requirements and standards for graduate courses, including the rules of Student Appeals in Academic Matters (usask.ca/university_secretary/council/reports_forms/reports/12-06-99.php) and Academic Integrity and Student Conduct (usask.ca/university_secretary/honesty/).

The signature of the Dean of your College signifies that the necessary resources are either available or shall be supplied by the College/Department budget.

Authorizing College Dean/Head
Dr. Karsten Liber

Signature

College Approval Date
19 September 2019
ENVS 815.3
MODELLING FOR WATER SECURITY
School of Environment and Sustainability
Term 1, 2018–19

Course Coordinator: Saman Razavi
Saman.razavi@usask.ca
1020, Global Institute for Water Security
306-966-2923

Course times: October 29th to November 9th - 9:30am to 3:00pm.
Course notes: See course website http://bblearn.usask.ca
Assessment:
Attendance and In-Class Participation 10%
Assignments 70%
Term Project 20%

Prerequisites: Undergraduate degree in engineering or natural sciences
Enrollment limit: 15

Course Description
This course provides an overview of the fundamentals of hydrologic modelling from our perceptions of the behavior of watershed systems to developing and testing watershed simulation models. Theory and numerical implementation of model calibration approaches, including local and global optimization, are taught. An introduction to multi-objective optimization and different approaches to sensitivity and uncertainty analysis of hydrologic models is included.

Learning Outcomes
Upon completion of the course, students will be able to:
• Demonstrate an understanding of how watershed systems work
• Carry out model calibration and estimate behavioral model parameters
• Apply a range of performance metrics for model evaluation and diagnostic testing

Course Outline
Most days will begin with a lecture (~1.5 hours). This will be followed by an in-class exercise (2-3 hours). Students will need to have their personal laptops to be able to run the exercise. The exercises need Microsoft Excel and MATLAB. The students will access MATLAB through the university license or through virtual MATLAB provided by the UofS library. The second half of an exercise session is supervised by the instructor (or a guest lecturer). Each day will end with a discussion (20-30 minutes) on the materials presented that day.

Week 1
Students will work with data and models in HBV-SASK (a MATLAB-based hydrologic model) for two watersheds, Oldman and Banff.

Students will learn about different model performance metrics and how local optimization works. This includes hands-on experience with fmincon (MATLAB optimization function).

Day 3 (Oct 31): GIWS Distinguished Lecture – Andras Bardossy – Breakthroughs in Hydrologic Modelling
**Day 4 (Nov 1): Global and Multi-Criteria Optimization.**
Students will become familiar with theories of global optimization and learn about trade-offs between different modelling objectives.


**Week 2**
**Day 1 (Nov 5): An Introduction to Uncertainty Analysis Approaches.**
Students will learn about the different sources of uncertainty in modeling and different approaches to characterize uncertainty (at an introductory level).

**Day 2 (Nov 6): Cold Region Hydrology Model (CRHM) (Guest Lecturer: Diogo Costa).**

**Day 3 (Nov 7): Modular Modelling and Properly Constraining the Model Behavior (Guest Lecturer: Shervan Gharari)**

**Day 4 (Nov 8): Modelling Water Management and Reservoir Operation.**
Students will learn about the general concepts on how reservoir operation and water allocation works and their importance in watershed modelling.

Potential ideas to be discussed include: modelling in a non-stationarity environment, how to deal with uncertainty, integrated modelling, modelling feedback between the different earth systems, etc.

**Assessment criteria**

**Attendance and Participation**
Attendance in all sessions and active participation in discussions and in-class activities are essential. These will be worth 10% of the total grade and will be based on the instructor’s evaluation. Each absence will subtract 25% of this grade.

**Assignments**
There are three assignments. Assignments 1 and 2 will be graded by the instructor. Assignment 3 will be graded by the guest lecturer and the instructor. All the assignments must be completed to pass the course. Late assignments will be accepted up to 3 days after the assignment due date but will be penalized at 10% per day. The rubric for grading will be provided along each assignment.

**Assignment 1 (25%):** Due 9am November 5th; Topic: Model Calibration and Evaluation.

**Assignment 2 (25%):** Due 9am November 9th; Topic: Sensitivity Analysis.

**Assignment 3 (20%):** Due 9am November 13th; Topic: Physically-based Cold Regions Modelling.
### RUBRIC FOR ASSIGNMENTS

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Low Performance &lt;70%</th>
<th>About or Below Average 71-85%</th>
<th>Exemplary Performance 85% or above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer questions and required components</td>
<td>Questions not answered and/or missing required components</td>
<td>Question answers are vague, high level of understanding not demonstrated. Components are present, but do not meet all requirements indicated in the instructions.</td>
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<td>Content and Approach</td>
<td>Concepts were not explained, missing key points or poorly expressed. Background research does not appear to support approach.</td>
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<td>An effort was made to make it interesting to reader/listener. The writing was clear and organized. Some issues of clarity, organization or grammar/spelling.</td>
<td>Clear effort was made to engage reader/listener. Writing was well done, easy to understand, succinct and organized.</td>
</tr>
<tr>
<td>Evidence of background research and context</td>
<td>Little or no reference to sources. Missing key points and context.</td>
<td>Some source materials are mentioned, but not well integrated into the text. A well-articulated context is presented.</td>
<td>Appropriate literature is used to make arguments and demonstrates a well-articulated understanding of the background materials and context.</td>
</tr>
</tbody>
</table>

### Term project

An assessment of the anticipated consequences of wetland drainage at the St Denis National Wildlife Area, SK

**Objective**
The objective of this term project is to synthesize and apply the skills and knowledge that you have acquired from your Term 1 classes. You must demonstrate understanding and apply techniques from each class: ENVS806 Field Skills in Water Security Research; GEOG 826 Fundamentals of Hydrology; ENVS805 Data Analysis and Management - MWS; ENVS 815 Modeling for Water Security; ENVS 829 River, Lake, and Wetland Science.

**Problem**
Wetland drainage is a major issue in the Canadian prairies. Wetlands are drained to acquire more agriculturally productive land, but wetland drainage is associated with some negative hydrological and ecological consequences. You are to assess a (hypothetical) proposal to drain Pond 109 into Pond 90 at St Denis. You will be provided with hydrological and biogeochemical data for the various ponds and surrounding uplands and watershed. You are to use your knowledge of hydrological processes and biogeochemical processes and your
skills in data analysis and modelling to assess the likely impact of this drainage, with particular emphasis on downstream flood risk, and changes in the productivity and eutrophic status of the various wetlands involved.

**Assessment**

The project will be undertaken and assessed in teams, with a collectively agreed upon assignment of duties. This project is worth 20% of each of the five 3CU classes: ENVS806 Field Skills in Water Security Research; GEOG 826 Fundamentals of Hydrology; ENVS805 Data Analysis and Management - MWS; ENVS 815 Modeling for Water Security; ENVS 829 River, Lake, and Wetland Science.

A single report (pdf file) is to be submitted electronically to Andrew Ireson. The report should contain the following sections, with the mark breakdown provided:

<table>
<thead>
<tr>
<th>Item</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover sheet: Title and team members</td>
<td>NA</td>
</tr>
<tr>
<td>Executive summary (1 page max)</td>
<td>15%</td>
</tr>
<tr>
<td>Table of contents</td>
<td>NA</td>
</tr>
<tr>
<td>Assignment of duties</td>
<td>5%</td>
</tr>
<tr>
<td>Description of the problem</td>
<td>10%</td>
</tr>
<tr>
<td>Data analysis and interpretation</td>
<td>20%</td>
</tr>
<tr>
<td>Modelling</td>
<td>20%</td>
</tr>
<tr>
<td>Synthesis</td>
<td>10%</td>
</tr>
<tr>
<td>Conclusions and recommendations</td>
<td>10%</td>
</tr>
<tr>
<td>Peer evaluation</td>
<td>10%</td>
</tr>
</tbody>
</table>

The peer evaluation is completed individually, and submitted separately from the report. In the peer evaluation you must provide an assessment of the contribution of each of the other members of your team and a mark out of 10 for their performance. This will be confidential.

**School and University policy statements**

**University of Saskatchewan Grading System (for graduate courses)**

The following describes the relationship between literal descriptors and percentage scores for courses in the College of Graduate Studies and Research:

**90-100 Exceptional**

A superior performance with consistent strong evidence of:

- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.
80-89 Very Good to Excellent
A very good to excellent performance with strong evidence of:

- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;
- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

70-79 Satisfactory to Good
A satisfactory to good performance with evidence of:

- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

60-69 Poor
A generally weak performance, but with some evidence of:

- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
- some ability to examine the material in a critical and analytical manner.

<60 Failure
An unacceptable performance.

Program Requirements
Percentage scores of at least 70% are required for a minimal pass performance in undergraduate courses taken by graduate students;
Percentage scores of at least 70% are required for a minimal pass performance for each course which is included in a Ph.D. program;
Percentage scores of at least 70% are required for a minimal pass performance in all courses used toward JSGS Public Policy and Public Administration programs and all core courses for Master of Public Health students, whether included in a Ph.D. program or a Master's program;
For all other graduate courses, percentage scores of at least 60-69% are required for a minimal pass performance for each course which is included in a Master's program, provided that the student's Cumulative Weighted Average is at least 70%;
Graduate courses for which students receive grades of 60-69% are minimally acceptable in a Postgraduate Diploma program, provided that the Cumulative Weighted Average is at least 65%;
Students should seek information on other program requirements in the Course & Program Catalogue and in academic unit publications.
Midterm and Final Examination Scheduling

Midterm and final examinations must be written on the date scheduled.

Final examinations may be scheduled at any time during the examination period [INSERT FIRST AND LAST DAY OF CURRENT EXAM PERIOD]: students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures: [https://students.usask.ca/academics/exams.php](https://students.usask.ca/academics/exams.php)

Integrity Defined (from the Office of the University Secretary)

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.


For more information on what academic integrity means for students see the Student Conduct & Appeals section of the University Secretary Website at: [http://www.usask.ca/secretariat/student-conduct-appeals/index.php](http://www.usask.ca/secretariat/student-conduct-appeals/index.php)

Examinations with Access and Equity Services (AES)

Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals. In order to access AES programs and supports, students must follow AES policy and procedures. For more information, check www.students.usask.ca/aes, or contact AES at 306-966-7273 or aes@usask.ca.

Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

Student Supports

Student Learning Services
Student Learning Services (SLS) offers assistance to U of S undergrad and graduate students. For information on specific services, please see the SLS web site http://library.usask.ca/studentlearning/.

Student and Enrolment Services Division

The Student and Enrolment Services Division (SESD) focuses on providing developmental and support services and programs to students and the university community. For more information, see the students’ web site http://students.usask.ca.

Financial Support

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact Student Central (https://students.usask.ca/student-central.php).

Aboriginal Students Centre

The Aboriginal Students Centre (ASC) is dedicated to supporting Aboriginal student academic and personal success. The centre offers personal, social, cultural and some academic supports to Métis, First Nations, and Inuit students. The centre is also dedicated to intercultural education, brining Aboriginal and non-Aboriginal students together to learn from, with and about one another in a respectful, inclusive and safe environment. Students are encouraged to visit the ASC’s Facebook page (https://www.facebook.com/aboriginalstudentscentre/) to learn more.

International Student and Study Abroad Centre

The International Student and Study Abroad Centre (ISSAC) supports student success in their international education experiences at the U of S and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange and English as a Second Language students and their families in their transition to the U of S and Saskatoon. ISSAC offers advising and support on all matters that affect international students and their families and on all matters related to studying abroad. Please visit students.usask.ca for more information.
New Graduate Course Proposal
GSR 400.1

Course Information

Please append the Course Outline (Syllabus), including a separate Undergraduate Course Outline (Syllabus) if required. A syllabus template is available at usask.ca/cgps/forms.php

<table>
<thead>
<tr>
<th>College</th>
<th>SENS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department/Unit</td>
<td>NA</td>
</tr>
<tr>
<td>Authorizing Unit Head</td>
<td>Dr. Karsten Libe</td>
</tr>
<tr>
<td>Authorizing Unit Head Signature</td>
<td></td>
</tr>
</tbody>
</table>

INFORMATION REQUIRED FOR COURSE AND PROGRAM CATALOGUE

<table>
<thead>
<tr>
<th>Label and Course Number</th>
<th>ENVS 816.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Title</td>
<td>Chemicals in Aquatic Systems</td>
</tr>
<tr>
<td>Total Course Hours</td>
<td>39</td>
</tr>
<tr>
<td>Lecture</td>
<td>39</td>
</tr>
<tr>
<td>Seminar</td>
<td>19.5</td>
</tr>
<tr>
<td>Lab</td>
<td>19.5</td>
</tr>
<tr>
<td>Tutorial</td>
<td>Other</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

| Weekly Course Hours     | 19.5       |
| Lecture                 | 19.5       |
| Seminar                 | Other      |
| Lab                     |            |
| Tutorial                |            |
| Other                   |            |

Term(s) in which course will be offered:
- Term 1
- Term 2
- Term 1 or 2
- Term 1 and 2
- Course is to be offered:
- Annually
- Biennially
- Alternate Years
- Other

Prerequisite(s) or restriction(s):
Registration in the MWS Program, or instructors approval

Catalogue Description (not more than 50 words):
The movement of chemicals in aquatic systems has major implications for water policy and management. A wide variety of man-made contaminants reach aquatic systems. Case studies will investigate the properties that determine where chemicals will go in the environment and whether they will pose risks when they get there.

Tuition code and any additional class fees:
TC 31

Number of credit units: 3
Can this course be repeated for credit?
- Yes
- No

Are there any existing courses that should be set up as equivalent or mutually-exclusive? Specify:
Yes, ENVS 823.3 and TOX 843.3 are equivalent.

CHECKLIST

Course objectives need to be clearly stated
Description of and Activities for Evaluation must be listed
Course Outline (syllabus) with Reading List must be included
Percentage of Total Mark for each evaluation listed
Professor must be a member of the Graduate Faculty

If undergraduate lectures are included, also submit the Undergraduate Course Outline (Syllabus) and include information on what additional activities make this a graduate level course. For guidelines, see "Undergraduate Component of Graduate Courses" under 'Forms for Graduate Chairs' at usask.ca/cgps/forms.php

EXAM EXEMPTION

Grade Mode
- Pass/Fail (P/F)
- Percentage/Numeric
- Completed Requirements/In Progress/Not Completed Requirements (CR/IP/NC)

Will there be a final exam for this course?
- Yes
- No

If there is no final exam or if the final examination is worth less than 30% of the final grade, provide a brief statement which explains why a final examination is inappropriate for this course.

Final exams are not appropriate for this 2 week compressed mode – grading is based on 5 written exercises completed during the course of the class.
Rationale

What is the rationale for introducing this course?

SENS has revised its Master of Water Security degree. This course has been created specifically to provide knowledge and skills relevant to this program.

Impact of Course

Are the programs/courses of other academic units/Colleges affected by this new course (possible duplication)?

☐ Yes  ☐ No

If yes, please list:

Were any other academic units asked to review or comment on the proposal?

☐ Yes  ☐ No  If yes, please attach correspondence

Will the offering of this course lead to the deletion or modification of any other course(s)?

☐ Yes  ☐ No

If yes, please list:

Course(s) for which this graduate course will be a prerequisite?

NA

Is this course to be required by your graduate students, or by graduate students in another program?

☐ Yes  ☐ No

If yes, please list:

Required for students in the MWS program.
Enrolment

Expected Enrolment
25

From which colleges/programs:
SENS

Resources

Proposed Instructor(s) (Please include qualifications):
Dr. Paul Jones
BSc (Hons, First Class) Zoology, University of Otago, Dunedin, New Zealand, 1983.
PhD, Biochemistry, University of Otago, Dunedin, New Zealand 1987.

How does the department plan to handle the additional teaching or administrative workload:
It will be part of the regular assignment of duties.

Are sufficient library or other research resources available for this course:
Yes

Are any additional resources required (library, audio-visual, technology, lab equipment, lab space, etc.):
No

Declaration

This course will conform to the academic requirements and standards for graduate courses, including the rules of Student Appeals in Academic Matters (usask.ca/university_secretary/council/reports_forms/reports/12-06-99.php) and Academic Integrity and Student Conduct (usask.ca/university_secretary/honesty/).

The signature of the Dean of your College signifies that the necessary resources are either available or shall be supplied by the College/Department budget.

Authorizing College Dean/Head

Dr. Karsten Liber

Signature

College Approval Date
19 September 2019
Calendar description

The movement of chemical contaminants in aquatic systems has major implications for water policy and management. In addition to traditional uses of aquatic systems for waste disposal a variety of man-made contaminants are able to reach aquatic systems. Through case studies we will investigate the environmental and chemical properties that determine where chemicals will go in the environment and whether they will pose risks to human and environmental health when they get there. We will discover how good chemical measurements can be made and how the data can be used in environmental fate models to predict chemical fate and effects. We will also look at risk assessment procedures that are used to evaluate the risks that chemicals pose to the environment and human health.

Learning Outcomes

- Recognize the significance of chemical contaminants in aquatic systems
- Describe the environmental and chemical properties that drive chemical movement
- Predict chemical fate in aquatic systems using basic environmental modelling
- Evaluate the significance of chemical contaminants to human/environmental health and policy
- Apply the basic principles of risk chemical risk assessment to chemicals in aquatic systems

Important Dates

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
<th>Day 8</th>
<th>Day 9</th>
<th>Day 10</th>
<th>Day 11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Exercise 1 due</td>
<td></td>
<td>Exercise 2 due</td>
<td></td>
<td></td>
<td>Exercise 3 due</td>
<td></td>
<td>Exercise 4 Due</td>
<td></td>
</tr>
</tbody>
</table>
Detailed course subject description

The course will be structured to provide 10 3hr in class sessions to cover basic course materials. Students will then have the remainder of the time for detailed reading of materials provided and for a series of 5 exercises to be completed as part of the class.

<table>
<thead>
<tr>
<th>Class</th>
<th>Materials</th>
<th>Exercise</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Introduction (web information)</td>
<td></td>
<td>Exercise 1</td>
</tr>
<tr>
<td>2</td>
<td>Great Lakes Case Study/POPs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3Bs and pharm modelling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sorption/solids/sedimentation (MI inland Lakes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Analysis methods and Data Quality monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Metals Lead Modelling (IEUBK) – Flint MI</td>
<td></td>
<td>Exercise 4</td>
</tr>
<tr>
<td>7</td>
<td>Slave Athabasca river</td>
<td></td>
<td>Slave Athabasca Materials</td>
</tr>
<tr>
<td>8</td>
<td>Organics Movement/fugacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Emerging Contaminants/Water treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Risk Assessment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) General Introduction (3 hr)
This session will outline the plans for the course including expectations for the exercises and self-study. A general refresher on chemistry will bring all students to the same level with respect to the chemical physical and environmental properties that are important in determining chemical fate in the environment. This session will also introduce the first class exercise which will be to identify relevant web sources for chemical property information using an assigned set of chemicals.

2) Great Lakes Case Study/Persistent Organic Pollutants (3 hr)
The North American great lakes have a long history of human use/abuse. This session will cover some of the pertinent history including novel policy approaches such as the IJC which were developed to manage these transboundary waters. One of the major chemicals classes of concern in the Great Lakes are the persistent organic pollutants and this session will introduce this chemical class, discuss its movement in the environment and its impacts on the ecosystem.

3) Bioconcentration/Bioaccumulation/Biomagnification/Uptake Modelling (3 hr)
The phenomena of bioconcentration bioaccumulation and biomagnification are the ultimate expression of chemicals in the environment. They lead to the accumulation and increasing concentration of chemicals in organisms and so ultimately lead to adverse effects. Understanding and predicting these phenomena provide us with the ability to predict chemical behavior and ultimately the potential of adverse effects. This session will be accompanied by an exercise on the evaluation of uptake and elimination constants for chemicals in a laboratory exposure study.

4) Sorption Solids and Sediments (3 hr)
In aquatic systems solids and colloids play a very large role in the fate of chemicals. Dissolved organic matter binds metals and a variety of organic chemicals thus altering their cycling and bioavailability. Once precipitated as sediments solids can act a long term reservoirs for a variety of chemicals by protecting them for light and oxidative reactions. This session will discuss the nature of solids and the mechanisms by which they bind chemicals. The preservation of chemicals in sediments provides a
means of accumulating a historical record of chemical accumulation. Methods and applications of using sediment cores for trend analysis will be presented.

5) Analysis Methods and Data Quality Assurance
An understanding of analytical procedures and in particular issues of data quality are essential to an understanding of the fate and effects of chemicals in aquatic environments. This session will provide an introduction to the most common analytical methods used to generate data on the concentrations of chemicals in environmental samples. Sampling schemes will be introduced for monitoring chemicals in aquatic environments and aspects of GLP and data QA/QC will also be discussed. The session exercise will involve the review of a chemical data package with extensive QA/QC procedures.

6) Metals Modelling and Flint MI (3hr)
Metals in aquatic environments are generally present in the water column in their ionic forms and so behave differently to organic chemicals and so different approaches are needed to address their movement and accumulation. This session will present general information on the movement of metals and their interaction with organisms. Models to address the bioavailability of metals to aquatic organisms will also be presented. Finally, recent drinking water Pb contamination issues in Flint MI have highlighted the risks of metal exposure to human health. The class exercise for this session will be the use of a human lead accumulation model (IEUBK, US-EPA) to assess exposure to and risks from Pb exposure in children.

7) Slave/Athabasca river Case study (3hr)
This session will present a history of issues relating to the Slave and Athabasca rivers in Alberta and the Northwest Territories. This system has been heavily exploited over several generations and this has caused social as well as environmental concerns on the rivers. Runoff from agriculture, paper mill effluents, mine drainage, urban runoff, impoundments and most recently oilsands activities all contribute to impacts on the river. Currently available data on the system will be provided and discussed.

8) Organics Movement and Modelling in Aquatic Systems (3hr)
It is paradoxical that some of the least water soluble organic contaminants are in fact major issues when discussing accumulation and adverse impacts on aquatic systems. This paradox can be understood better by investigating the partitioning of chemicals between environmental compartments with an approach known as fugacity modelling. The principles of fugacity modelling will be discussed and presented in class and the session exercise will involve application of these models to investigate chemical movement in the environment.

9) Emerging Contaminants / Water Treatment
As the name suggests the issue of ‘emerging contaminants’ pertains to the recent discovery of a variety of unexpected chemicals in the environment. Many of these chemicals come for human waste water discharges and as a chemical class they can be of particular concern due to their biological potency and ongoing constant sources. While some of these chemicals are removed from water by treatment some are not. Water treatment technologies both for waste water and for drinking water will be introduced and discussed.

10) Risk Assessment
The primary tool used in assessing and managing chemical risks and impacts is risk assessment. While many approaches exist the most commonly used assesses exposure to and hazard from a chemical and
combines these in a risk characterization paradigm. The principles and applications of this approach will be covered in this session as will more advanced probabilistic approaches to risk assessment.

**Grading Scheme**

<table>
<thead>
<tr>
<th>Component</th>
<th>% of final grade</th>
</tr>
</thead>
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<td>15%</td>
</tr>
<tr>
<td>Exercise 4</td>
<td>15%</td>
</tr>
<tr>
<td>Exercise 5</td>
<td>15%</td>
</tr>
<tr>
<td>Participation</td>
<td>5%</td>
</tr>
<tr>
<td>Term Project for MWS</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Rubric for Exercises**

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Term project: An assessment of the anticipated consequences of wetland drainage at the St Denis National Wildlife Area, SK

Objective
The objective of this term project is to synthesize and apply the skills and knowledge that you have acquired from your Term 1 classes. You must demonstrate understanding and apply techniques from each class: ENVS806 Field Skills in Water Security Research; GEOG 826 Fundamentals of Hydrology; ENVS 805 Data Analysis and Management - MWS; ENVS 815 Modeling for Water Security; ENVS 829 River, Lake, and Wetland Science.

Problem
Wetland drainage is a major issue in the Canadian prairies. Wetlands are drained to increase arable land and improve trafficability for agricultural producers, but wetland drainage is also associated with negative hydrological and ecological consequences. You are to assess a (hypothetical) proposal to drain Pond 109 into Pond 90 at St Denis. You will be provided with hydrological and biogeochemical data for the various ponds and surrounding uplands and watershed. You are to use your knowledge of hydrological processes and biogeochemical processes and your skills in data analysis and modelling to assess the likely impact of this drainage, with particular emphasis on downstream flood risk, and changes in the productivity and eutrophic status of the various wetlands involved.

Assessment
The project will be undertaken and assessed in teams, with a collectively agreed upon assignment of duties.

This project is worth 20% of each of the five 3CU classes: ENVS806 Field Skills in Water Security Research; GEOG 826 Fundamentals of Hydrology; ENVS805 Data Analysis and Management - MWS; ENVS 815 Modeling for Water Security; ENVS 829 River, Lake, and Wetland Science.

A single report (pdf file) is to be submitted electronically to Andrew Ireson. The report should contain the following sections, with the mark breakdown provided
<table>
<thead>
<tr>
<th>Item</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover sheet: Title and team members</td>
<td>NA</td>
</tr>
<tr>
<td>Executive summary (1 page max)</td>
<td>15%</td>
</tr>
<tr>
<td>Table of contents</td>
<td>NA</td>
</tr>
<tr>
<td>Assignment of duties</td>
<td>5%</td>
</tr>
<tr>
<td>Description of the problem</td>
<td>10%</td>
</tr>
<tr>
<td>Data analysis and interpretation</td>
<td>20%</td>
</tr>
<tr>
<td>Modelling</td>
<td>20%</td>
</tr>
<tr>
<td>Synthesis</td>
<td>10%</td>
</tr>
<tr>
<td>Conclusions and recommendations</td>
<td>10%</td>
</tr>
<tr>
<td>Peer evaluation</td>
<td>10%</td>
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</tbody>
</table>

The peer evaluation is completed individually, and submitted separately from the report. In the peer evaluation you must provide an assessment of the contribution of each of the other members of your team and a mark out of 10 for their performance. This will be confidential.

**Readings (Indicative at this time)**


Detailed assessment of students

Students will be assessed based on performance in the 5 exercises carried out during the course. Rubrics for grading of exercises will be provided when the exercises are described and provided. In the case of team-based exercises a portion of the grade will be allocated to performance assessment by other members of the group.

A portion of the final grade will be assessed on participation and engagement in class.

Finally, 20% of the grade from this class will be assessed on the term project.
School and University policy statements

1. Grading System Description
SENS uses the following grading system as adopted by the CGPS:

**90-100 Exceptional**
A superior performance with consistent strong evidence of
- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.

**80-89 Very Good to Excellent**
A very good to excellent performance with strong evidence of
- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;
- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

**70-79 Satisfactory to Good**
A satisfactory to good performance with evidence of
- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

**60-69 Poor**
A generally weak performance, but with some evidence of
- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
- some ability to examine the material in a critical and analytical manner.

**<60 Failure**
An unacceptable performance.
2. Midterm and Final Examination Scheduling
Midterm and final examinations must be written on the date scheduled. Final examinations may be scheduled at any time during the examination period; students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures: http://students.usask.ca/academics/exams.php

3. Assessment Issues and Grade Disputes
A student shall be permitted to see any examination unless otherwise stated at the beginning of the course. Students dissatisfied with the assessment of their work in any aspect of course work, including midterm or final examination should consult the University policy ‘Student Appeals or Evaluation, Grading and Academic Standing’ found at the Office of the University Secretary: http://policies.usask.ca/policies/student-affairs-and-activities/student-appeals.php

4. Examinations with Disability Services for Students (DSS)
Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Disability Services for Students (DSS) if they have not already done so. Students who suspect they may have disabilities should contact DSS for advice and referrals. In order to access DSS programs and supports, students must follow DSS policy and procedures. For more information, check http://www.students.usask.ca/disability/, or contact DSS at 966-7273 or dss@usask.ca.

Students registered with DSS may request alternative arrangements for midterm and final examinations. Students must arrange such accommodations through DSS by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by DSS.

5. Academic Honesty
The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students should read and be familiar with the Regulations on Academic Student Misconduct as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of Complaints and Appeals (http://www.usask.ca/secretariat/student-conduct-appeals/)

For more information on what academic integrity means for students see the Academic Integrity Awareness site at: http://www.usask.ca/integrity/index.php

6. Recording
The syllabus must include a notice of whether the instructor intends to record lectures and whether students are permitted to record lectures.
Honesty and integrity are expected of every student at the University of Saskatchewan. There are many forms of academic misconduct; perhaps the most common is plagiarism. According to the University of Saskatchewan Guidelines for Academic Conduct:

“Plagiarism is the theft of the intellectual creation of another person without proper attribution. It is the use of someone else's words or ideas or data without proper documentation or acknowledgment. Quotations must be clearly marked, and sources of information, ideas, or opinions of others must be clearly indicated in all written work. This applies to paraphrased ideas as well as to direct quotations. A student must acknowledge and fairly recognize any contributions made to their personal research and scholarly work by others, including other students.”

There are many resources on campus to assist you with proper citation and paraphrasing.

- For guidance on when and how to quote from other documents and how to properly paraphrase information in other documents, see http://library.usask.ca/howto/honesty.php.
- To learn about different styles of citation and how to properly cite a variety of different sources including statistics, archival materials, maps, legal documents and government reports, see http://libguides.usask.ca/citation.

When in doubt about a citation requirement or your approach to paraphrasing, ask your librarian or your course instructor or your academic supervisor for assistance.

**Before you submit any written work, review it against the following checklist:**

1. I have acknowledged the use of all ideas with accurate citations.
2. I have used the words of another author, instructor, information source, etc., and I have properly acknowledged this and used proper citation.
3. In paraphrasing the work of others, I have put the idea into my own words and did not just change some words or rearrange the sentence structure.
4. I have checked my work against my notes to be sure that I have correctly referenced all quotes or ideas.
5. When using direct quotations I have used quotation marks (or other means to clearly identify the quoted text) and provided full citations.
6. Apart from material that is a direct quotation, everything else in the work is presented in my own words.
7. When paraphrasing the work of others I have acknowledged the source or the central idea.
8. I have checked all citations for accuracy (e.g. page numbers, journal volume, dates, web page addresses).
9. I have used a recognized reference style (i.e. APA, MLA, Chicago etc.) consistently throughout my work.
10. My list of references/bibliography includes all of the sources used to complete the work.
11. I have accurately and completely described any data or evidence I have collected or used.
12. I fully understand all of the content (e.g., terms, concepts, theories, data, equations, ideas) of the work that I am submitting.
13. The content of the work has not been shared with another student, unless permitted by the instructor.
14. The content of the work reflects wholly my own intellectual contribution or analysis and not that of another student(s), unless the instructor approved the submission of group or collaborative work.
15. If another person proofread my work it was for the sole purpose of indicating areas of concern, which I then corrected myself.
16. This work has not been submitted, whole or in part, for credit in another course or at another institution, without the permission of the current course instructor(s).
17. I understand the University of Saskatchewan’s policy and expectations concerning academic honesty and the consequences of plagiarism or other forms of academic misconduct.

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## New Graduate Course Proposal

### Course Information

Please append the Course Outline (Syllabus), including a separate Undergraduate Course Outline (Syllabus) if required. A syllabus template is available at usask.ca/cgps/forms.php

<table>
<thead>
<tr>
<th>College</th>
<th>SENS</th>
<th>Department/Unit:</th>
<th>n/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorizing Unit Head</td>
<td>Dr. Karsten Liber</td>
<td>Authorizing Unit Head Signature</td>
<td>K. Liber</td>
</tr>
</tbody>
</table>

### INFORMATION REQUIRED FOR COURSE AND PROGRAM CATALOGUE

<table>
<thead>
<tr>
<th>Label and Course Number</th>
<th>ENVS 817.3</th>
<th>Course Title</th>
<th>Fundamentals of Hydrogeology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Course Hours</td>
<td>39</td>
<td>Lecture</td>
<td>39</td>
</tr>
<tr>
<td>Weekly Course Hours</td>
<td>19.5</td>
<td>Lecture</td>
<td>19.5</td>
</tr>
<tr>
<td>Course Title</td>
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<td>Seminar</td>
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<tr>
<td></td>
<td></td>
<td>Lab</td>
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<tr>
<td></td>
<td></td>
<td>Tutorial</td>
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<td></td>
<td></td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

### Prerequisite(s) or restriction(s)

If there are prerequisites, who can waive them:
- Department
- Instructor

### Catalogue Description (not more than 50 words)

Groundwater flow; connections between groundwater and the rest of the hydrologic cycle; well hydraulics; groundwater chemistry; solute and contaminant transport in groundwater systems

### Tuition code and any additional class fees

TC31

### Number of credit units

3

### Can this course be repeated for credit?

- Yes
- No

### CHECKLIST

- Course objectives need to be clearly stated
- Description of and Activities for Evaluation must be listed
- Course Outline (syllabus) with Reading List must be included
- Percentage of Total Mark for each evaluation listed
- Professor must be a member of the Graduate Faculty

### EXAM EXEMPTION

- Grade Mode: Pass/Fail (P/F) / Percentage/Numeric / Completed Requirements/In Progress/Not Completed Requirements (CR/IP/NP)
- If there is no final exam or if the final examination is worth less than 30% of the final grade, provide a brief statement which explains why a final examination is inappropriate for this course.

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College of Graduate and Postdoctoral Studies
University of Saskatchewan ▪ Rm 116 Thorvaldson Bldg, 110 Science Place ▪ Saskatoon SK Canada S7N 5C9
Tel: 306-966-5751 ▪ Fax: 306-966-5756 ▪ Email: grad.studies@usask.ca

Revised: August 2017
Page 1 of 3
Rationale

What is the rationale for introducing this course?

SENS has revised its Master of Water Security degree. This course has been created specifically to provide knowledge and skills relevant to this program.

Impact of Course

Are the programs/courses of other academic units/Colleges affected by this new course (possible duplication)?

- Yes  
- No

If yes, please list:

Were any other academic units asked to review or comment on the proposal?

- Yes  
- No  

If yes, please attach correspondence.

Will the offering of this course lead to the deletion or modification of any other course(s)?

- Yes  
- No

If yes, please list:

Course(s) for which this graduate course will be a prerequisite?

n/a

Is this course to be required by your graduate students, or by graduate students in another program?

- Yes  
- No

If yes, please list:

Required for students in the MWS program.
Enrolment

Expected Enrolment
25
From which colleges/programs:
SENS

Resources

Proposed Instructor(s) (Please include qualifications):
Dr. Grant Ferguson
BSc, University of Waterloo
PhD, University of Manitoba

How does the department plan to handle the additional teaching or administrative workload:
It will be part of the regular assignment of duties.

Are sufficient library or other research resources available for this course:
Yes

Are any additional resources required (library, audio-visual, technology, lab equipment, lab space, etc.):
No

Declaration

This course will conform to the academic requirements and standards for graduate courses, including the rules of Student Appeals in Academic Matters (usask.ca/university_secretary/council/reports_forms/reports/12-06-99.php) and Academic Integrity and Student Conduct (usask.ca/university_secretary/honesty/).
The signature of the Dean of your College signifies that the necessary resources are either available or shall be supplied by the College/Department budget.

Authorizing College Dean/Head
Dr. Karsten Liber
Signature

College Approval Date
19 September 2019
ENVS 817.3
Fundamentals of Hydrogeology
School of Environment and Sustainability
April 13-24, 2020

Course Coordinator: Grant Ferguson
grant.ferguson@usask.ca

Office hours by appointment only

Prerequisites: Registration in the MWS Program

Calendar description

Groundwater flow; connections between groundwater and the rest of the hydrologic cycle; well hydraulics; groundwater chemistry; solute and contaminant transport in groundwater systems

Learning Outcomes

Upon completion of the course, student will be able to:
1. Explain groundwater flow patterns and rates from hydraulic and geologic data.
2. Analyze hydraulic tests from aquifers and aquitards.
3. Predict responses of groundwater systems to pumping using simple models.
4. Explain patterns of groundwater chemistry.
5. Predict distribution of contaminants in groundwater systems using simple models.

Important Dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 13</td>
<td>First day of Lectures</td>
<td>April 17</td>
<td>Assignment 1</td>
</tr>
<tr>
<td>April 21</td>
<td>Assignment 2</td>
<td>April 22</td>
<td>Assignment 3</td>
</tr>
<tr>
<td>April 22</td>
<td>Mock Trial</td>
<td>April 24</td>
<td>Final day of lectures – Final project presentations and reports due</td>
</tr>
</tbody>
</table>

Detailed course subject description

Course Format

This course will be delivered as a compressed course through the Masters of Water Security program in the School of Environment and Sustainability. Most days will begin with three hours of lecturing and will be followed by an afternoon session where students will work on assignments covered during the lecture with assistance from the instructor. These assignments will completed individually although working in groups during afternoon sessions is encouraged. Additional time in the afternoon will be set aside to work on the term project.

Lecture slides and assignments will be posted to Blackboard along with reference material to support the assignments. There is no required textbook for the course but the following textbooks are recommended if students would like additional reference material:


**Schedule of Topics**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Approximate Lecture Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INTRODUCTION (April 13)</td>
<td></td>
</tr>
<tr>
<td>1.1. Overview/review</td>
<td></td>
</tr>
<tr>
<td>1.2. Groundwater and the hydrologic cycle</td>
<td>3</td>
</tr>
<tr>
<td>2. BASIC PRINCIPLES OF GROUNDWATER FLOW (April 14)</td>
<td>3</td>
</tr>
<tr>
<td>2.1. Porosity</td>
<td></td>
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<tr>
<td>2.2. Darcy’s law</td>
<td></td>
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<tr>
<td>2.3. Hydraulic conductivity and permeability</td>
<td></td>
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<tr>
<td>2.4. Anisotropy and heterogeneity</td>
<td></td>
</tr>
<tr>
<td>3. GROUNDWATER AND GEOLOGY (April 15)</td>
<td>3</td>
</tr>
<tr>
<td>3.1. Aquifers and confining beds</td>
<td></td>
</tr>
<tr>
<td>3.2. Transmissive and storage properties of aquifers</td>
<td></td>
</tr>
<tr>
<td>3.3. Geology and hydraulic properties</td>
<td></td>
</tr>
<tr>
<td>4. THEORY OF GROUNDWATER FLOW (April 16)</td>
<td>3</td>
</tr>
<tr>
<td>4.1. Differential equations for groundwater flow</td>
<td></td>
</tr>
<tr>
<td>4.2. Boundary conditions</td>
<td></td>
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<tr>
<td>4.3. Initial conditions</td>
<td></td>
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<tr>
<td>4.4. Flownets</td>
<td></td>
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<tr>
<td>4.5. Analytical solutions to the groundwater flow equation</td>
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<tr>
<td>4.6. Unsaturated flow</td>
<td></td>
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<tr>
<td>4.7. Groundwater flow in fractured rocks</td>
<td></td>
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<tr>
<td>5. REGIONAL GROUNDWATER FLOW (April 17)</td>
<td>3</td>
</tr>
<tr>
<td>5.1. Groundwater basins</td>
<td></td>
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<tr>
<td>5.2. Mathematical analysis of regional flow</td>
<td></td>
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<tr>
<td>5.3. Recharge</td>
<td></td>
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<tr>
<td>5.4. Discharge</td>
<td></td>
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<tr>
<td>5.5. Groundwater-surface water interaction</td>
<td></td>
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<tr>
<td>6. WELL HYDRAULICS (April 20)</td>
<td>3</td>
</tr>
<tr>
<td>6.1. Aquifers and aquifer tests</td>
<td></td>
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<tr>
<td>6.2. Theis solution</td>
<td></td>
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<tr>
<td>6.3. Cooper-Jacob solution</td>
<td></td>
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<tr>
<td>6.4. Complex conditions</td>
<td></td>
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<tr>
<td>6.5. Slug tests</td>
<td></td>
</tr>
</tbody>
</table>
7. GROUNDWATER CHEMISTRY (April 21)
   7.1. Dissolved solids in groundwater
   7.2. Kinetic and equilibrium reactions
   7.3. Acid-base reactions
   7.4. Redox reactions

8. MASS TRANSPORT (April 22)
   8.1. Advection and dispersion
   8.2. Contaminant transport and fate
   8.3. Isotopes and age dating

9. CASE STUDY (April 23)

10. FINAL PROJECT PRESENTATIONS (April 24)

Detailed assessment of students

Overall grades of ≥60% in the course constitute a pass for a masters. An overall grade of ≥70% is required for a PhD student.

Assignments (3 x 15 = 45 marks):

Assignments based on lecture material will be provided. These assignments will consist of exercises where the students apply concepts from that morning’s lecture with the assistance of the instructor. The intent is that these assignments will be completed within the afternoon session and will be due the next morning.

1. Groundwater and the hydrologic cycle (due April 16)
2. Groundwater and wells (due April 20)
3. Groundwater chemistry and solute transport (due April 22)

Submitting Assignments

Written assignments must be submitted at the start of class except where noted. You should keep a personal copy of all assignments submitted. Late assignments will be accepted up to two classes after the assignment due date, but a grade of 15% per day will be subtracted from the mark received. Students may submit late assignments electronically to grant.ferguson@usask.ca. Where extenuating circumstances exist, students are advised to contact the instructor immediately to make suitable arrangements regarding extensions.
Case Study (5 marks)

On April 23, a mock trial based on contamination of municipal groundwater supply at Woburn, MA will be undertaken based on an exercise provided by the Science Education Resource Centre at Carleton College (https://serc.carleton.edu/woburn/student-modules/mocktrial/index.html). The background material and evidence will be introduced in a one-hour lecture at the beginning of the day. Students will then be given two hours to work as groups to assess available evidence to make a case to support their position as one of the defendants or the plaintiff.

Case Study Assessment:

- Performance of the group in the mock trial: 50%
- Brief written summary of their arguments and what they could have done better. Assignment is to be completed in 30-minute work period following the end of the mock trial due the following day. Discussion of this assignment within the group is encouraged but each student must submit their own summary (~1-2 pp): 50%

Final Assignment (30 marks)

Students will produce a source water protection plan for a municipal water supply. A list of possible study areas will be supplied to the students. This work will focus on transit times for contaminants and will largely draw on course content on groundwater flow, well hydraulics and solute transport. Locations will be selected during the first week of class and modules building on each subject matter will be worked on each day. The results will be presented as both a written report (~10 pp) and an oral presentation to the class (~10 minutes) on the final day of lectures.

Assessment:

- Written report with maps: 80%
  - Introduction: 5%
  - Background geology, hydrology and hydrogeology: 15%
  - Inventory contaminant sources: 5%
  - Analysis and mapping of transport times: 35%
  - Recommendations and Conclusions: 15%
  - References: 5%
- Oral presentation: 20%

Term 2 MWS Project (20 marks)

Information on literal descriptors for grading at the University of Saskatchewan can be found at: http://students.usask.ca/current/academics/grades/grading-system.php
Please note: There are different literal descriptors for undergraduate and graduate students.
More information on the Academic Courses Policy on course delivery, examinations and assessment of student learning can be found at [http://www.usask.ca/university_secretary/council/academiccourses.php](http://www.usask.ca/university_secretary/council/academiccourses.php)
School and University policy statements
University of Saskatchewan Grading System (for graduate courses)

The following describes the relationship between literal descriptors and percentage scores for courses in the College of Graduate and Postdoctoral Studies:

90-100 Exceptional
A superior performance with consistent strong evidence of:
- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.

80-89 Very Good to Excellent
A very good to excellent performance with strong evidence of:
- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;
- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

70-79 Satisfactory to Good
A satisfactory to good performance with evidence of:
- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

60-69 Poor
A generally weak performance, but with some evidence of:
- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
- some ability to examine the material in a critical and analytical manner.
<60 Failure
An unacceptable performance.

Program Requirements
- Percentage scores of at least 70% are required for a minimal pass performance in undergraduate courses taken by graduate students;
- Percentage scores of at least 70% are required for a minimal pass performance for each course which is included in a Ph.D. program;
- Percentage scores of at least 70% are required for a minimal pass performance in all courses used toward JSGS Public Policy and Public Administration programs and all core courses for Master of Public Health students, whether included in a Ph.D. program or a Master's program;
- For all other graduate courses, percentage scores of at least 60-69% are required for a minimal pass performance for each course which is included in a Master's program, provided that the student's Cumulative Weighted Average is at least 70%;
- Graduate courses for which students receive grades of 60-69% are minimally acceptable in a Postgraduate Diploma program, provided that the Cumulative Weighted Average is at least 65%;

Students should seek information on other program requirements in the Course & Program Catalogue and in academic unit publications.

Midterm and Final Examination Scheduling
Midterm and final examinations must be written on the date scheduled.

Final examinations may be scheduled at any time during the examination period (INSERT FIRST AND LAST DAY OF CURRENT EXAM PERIOD); students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures: https://students.usask.ca/academics/exams.php

Integrity Defined (from the Office of the University Secretary)
The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

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International Student and Study Abroad Centre
The International Student and Study Abroad Centre (ISSAC) supports student success in their international education experiences at the U of S and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange and English as a Second Language students and their families in their transition to the U of S and Saskatoon. ISSAC offers advising and support on all matters that affect international students and their families and on all matters related to studying abroad. Please visit students.usask.ca for more information.

Copyright
Course materials are provided to you based on your registration in a class, and anything created by your professors and instructors is their intellectual property, unless materials are designated as open education resources. This includes exams, PowerPoint/PDF slides and other course notes. Additionally, other copyright-protected materials created by textbook publishers and authors may be provided to you based on license terms and educational exceptions in the Canadian Copyright Act (see http://laws-lois.justice.gc.ca/eng/acts/C-42/index.html).

Before you copy or distribute others’ copyright-protected materials, please ensure that your use of the materials is covered under the University’s Fair Dealing Copyright Guidelines available at https://library.usask.ca/copyright/general-information/fair-dealing-guidelines.php. For example, posting others’ copyright-protected materials on the open web is not covered under the University’s Fair Dealing Copyright Guidelines, and doing so requires permission from the copyright holder.

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New Graduate Course Proposal
GSR 400.1

Course Information
Please append the Course Outline (Syllabus), including a separate Undergraduate Course Outline (Syllabus) if required. A syllabus template is available at usask.ca/cgps/forms.php

College: SENS
Department/Unit: NA

Authorizing Unit Head: Dr. Karsten Liber

INFORMATION REQUIRED FOR COURSE AND PROGRAM CATALOGUE

Label and Course Number: ENVS 820.3
Course Title: Water and Human Health and Wellbeing

Total Course Hours: 39
Lecture: 39
Seminar: 
Lab: 
Tutorial: 
Other: 

Weekly Course Hours: 19.5
Lecture: 19.5
Seminar: 
Lab: 
Tutorial: 
Other: 

Term(s) in which course will be offered:
- Term 1
- Term 2
- Term 1 or 2
- Term 1 and 2

Course is to be offered:
- Annually
- Biennial
- Alternate Years
- Other

Prerequisite(s) or restriction(s):

Catalogue Description (not more than 50 words):
Students examine critical water-health issues through a distinctly interdisciplinary lens. Water and wellbeing connections from individual to chronosphere scales are explored via case study, epidemiological modeling, GIS, media fact-checking and assignments. Students deepen knowledge about roles of water in preserving social, cultural, economic and political resilience related to health.

Tuition code and any additional class fees: TC 31
Number of credit units: 3
Can this course be repeated for credit? Yes

CHECKLIST
- Course objectives need to be clearly stated
- Description of and Activities for Evaluation must be listed
- Course Outline (Syllabus) with Reading List must be included
- Percentage of Total Mark for each evaluation listed
- Professor must be a member of the Graduate Faculty

EXAM EXEMPTION
- Grade Mode: Pass/Fail (P/F) Percentage/Numeric Completed Requirements/In Progress/Not Completed Requirements (CR/P/F)
- Will there be a final exam for this course? Yes

If undergraduate lectures are included, also submit the Undergraduate Course Outline (Syllabus) and include information on what additional activities make this a graduate level course. For guidelines, see ‘Undergraduate Component of Graduate Courses’ under ‘Forms for Graduate Chairs’ at usask.ca/cgps/forms.php

If there is no final exam or if the final examination is worth less than 30% of the final grade, provide a brief statement which explains why a final examination is inappropriate for this course.

The course is meant to deepen application of interdisciplinary thought and hydrological modeling skills in accessing water-health research and applying that research to emerging problems. As it is applied in nature, a final exam is an insufficient rubric for measuring students’ application. As much of the two-week compressed course is about skill development, an exam testing ‘content’ would be arbitrary at the end, though a planned midterm exam tests foundational content halfway through the course.
Rationale

What is the rationale for introducing this course?

SENS has revised its Master of Water Security degree. This course has been created specifically to provide knowledge and skills relevant to this program.

Impact of Course

Are the programs/curricula of other academic units/Collages affected by this new course (possible duplication)?

- Yes
- No

If yes, please list:

In the original MWS Program we used PUBH 815.3. With a new faculty hire in SENS we were able to create this version tailored for our program. The focus of the two courses is different. The ENVS course focuses on applying modeling and GIS skills to water and wellbeing issues across scales to create outputs for decision making. The PUBH course is focused on human health risk assessment and public health issues concerning water.

Were any other academic units asked to review or comment on the proposal?

- Yes
- No
  If yes, please attach correspondence

Will the offering of this course lead to the deletion or modification of any other course(s)?

- Yes
- No

If yes, please list:

- Courses for which this graduate course will be a prerequisite:
  NA

Is this course to be required by your graduate students, or by graduate students in another program?

- Yes
- No

If yes, please list:

- Required for students in the MWS program:
Enrolment

Expected Enrolment
25

From which colleges/programs:
SENS

Resources

Proposed instructor(s) (Please include qualifications):
Dr. Lori Bradford
Honours Bachelor of Science in Biochemistry from McMaster in 2000
Master of Environmental Studies from Lakehead in 2005
PhD in Social Psychology from Lincoln University in New Zealand in 2010

How does the department plan to handle the additional teaching or administrative workload:
It will be part of the regular assignment of duties.

Are sufficient library or other research resources available for this course:
Y

Are any additional resources required (library, audio-visual, technology, lab equipment, lab space, etc.):
No

Declaration

This course will conform to the academic requirements and standards for graduate courses, including the rules of Student Appeals in Academic Matters (usask.ca/university_secretary/council/reports_forms/reports/12-06-99.php) and Academic Integrity and Student Conduct (usask.ca/university_secretary/honesty/).

The signature of the Dean of your College signifies that the necessary resources are either available or shall be supplied by the College/Department budget.

Authorizing College Dean/Head
Dr. Karsten Liber

Signature

College Approval Date
19 September 2019
**ENVS 820.3**  
**Water and Human Health and Wellbeing**  
School of Environment and Sustainability  
February 2019

<table>
<thead>
<tr>
<th>Course Coordinator</th>
<th>Dr. Lori Bradford, Ph.D.</th>
<th>Kirk Hall 332</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><a href="mailto:Lori.Bradford@usask.ca">Lori.Bradford@usask.ca</a></td>
<td>306-966-1617</td>
</tr>
</tbody>
</table>

| Course notes:     | See course website [http://bblearn.usask.ca](http://bblearn.usask.ca) |
| Assessment:       | [Assignments (2 @ 30% each)] 60% |
|                   | [Midterm Exam] 20% |
|                   | [Term Project] 20% |

| Prerequisites:    | Registration in the MWS Program |

**Calendar description**

This course will examine increasingly critical water and health-related issues through a distinctly global and interdisciplinary lens. It will explore the connections between water, health and wellbeing through the individual to macro-system scales and draw from local to global examples. Through case study, epidemiological modeling, and social psychological challenges, the course will deepen knowledge about the central role of water in preserving health and wellbeing; human health risks of chemical contaminations, waterborne pathogens; and the vital role of water for social, cultural, economic and political resilience as it relates to health.

**Learning Outcomes**

Students will be able to:

1. Describe the central role of water quality, quantity, aesthetics, and spiritual value for health and the effect of a safe water supply on population health and community wellbeing
2. Explain why and how different types of waterborne diseases occur, how to treat them, and discuss social justice and policy issues concerning preventing such diseases through provision of safe clean water for drinking, recreation, cultural and sanitation purposes
3. Understand the role of water scientists, health researchers, and policy makers on prevention of physical and cultural effects on wellbeing in the broad sense from water and how research, behavioural adaptation, and engineered infrastructure contributes to creating and maintaining a safe water supply
4. Carefully consider social psychological dimensions of water and health including water’s vital role in sustaining communities, cultures, and worldviews and changing political and economic systems
5. Work together as an interdisciplinary group, respecting each other’s backgrounds and skills to achieve learning outcomes.
6. Apply theory, methods, and tools (i.e., frameworks for examining water, health and wellbeing challenges, epidemiological GIS methods, water and health predictive modeling tools, fact-checking skills, photography for knowledge mobilization) learned in the course to a variety of water and health challenges including bacteria and parasites, industrial wastes, petrochemicals, detergents, prescription medication, fertilizers and sewage, and silt and soils.
**Important Dates**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic/Activities</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 11 Mon</td>
<td>First day of Lectures</td>
<td></td>
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<tr>
<td>Feb 15 Fri</td>
<td>Assignment 1 due (Nobel nomination)</td>
<td></td>
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<tr>
<td>Feb 25 Mon</td>
<td>Classes resume</td>
<td></td>
</tr>
<tr>
<td>Feb 27 Wed</td>
<td>Midterm Exam and IF-AT test</td>
<td></td>
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<tr>
<td>Feb 18 Mon</td>
<td>Family Day – no classes</td>
<td></td>
</tr>
<tr>
<td>Feb 27 Wed</td>
<td>Classes resume</td>
<td></td>
</tr>
<tr>
<td>Feb 25 Mon</td>
<td>Nobel nomination</td>
<td></td>
</tr>
<tr>
<td>Feb 27 Wed</td>
<td>Midterm Exam and IF-AT test</td>
<td></td>
</tr>
<tr>
<td>Feb 28 Thu</td>
<td>Last day, Assignment 2 due (Fact checking)</td>
<td></td>
</tr>
<tr>
<td>Feb 19-22</td>
<td>Reading Break – University closed</td>
<td></td>
</tr>
</tbody>
</table>

**Detailed course subject description**

Course outline:

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic/Activities</th>
<th>Readings</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Date/activities (every class students are invited to submit index card of unanswered ?s)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Readings *Required † Recommended</td>
<td></td>
</tr>
<tr>
<td>Feb 11th</td>
<td>Icebreaker activities</td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>Introduction to Water, Health and Wellbeing</td>
<td></td>
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<tr>
<td></td>
<td>Description of Assignment Approval of Syllabus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lecture: Frameworks for Water and Health study</td>
<td></td>
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<tr>
<td>Afternoon</td>
<td>Practical application of frameworks from case study reading in groups</td>
<td></td>
</tr>
<tr>
<td>Feb 12th</td>
<td>Explanation of Assignment 1</td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>Conversation Café’s: Water, Health and Wellbeing in the Individual (Individual scale, internal conditions)</td>
<td></td>
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<tr>
<td></td>
<td>Guest: Lalita Bharadwaj on Human Health Risk Assessment for Water and Wellbeing</td>
<td></td>
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<tr>
<td>Afternoon</td>
<td>Create a factsheet on a contaminant in source water that may impact health and wellbeing - group activity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Topics to choose from (one per group): E coli Salmonella typhi Birth control pills Cyanobacteria (algae blooms) Herbicide MCPA</td>
<td></td>
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<tr>
<td>Feb 13th</td>
<td>Lecture: Water, Health and Wellbeing in Families (Microsystem scale, immediate environment)</td>
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<tr>
<td>Morning</td>
<td></td>
<td></td>
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<tr>
<td>Date</td>
<td>Time</td>
<td>Activity</td>
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<td></td>
<td>Afternoon</td>
<td>Group work time for Assignment 1</td>
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<tr>
<td></td>
<td>Afternoon</td>
<td>Map a water-borne outbreak</td>
</tr>
<tr>
<td></td>
<td>Afternoon</td>
<td>Group work time for Assignment 1</td>
</tr>
<tr>
<td>February 18-22nd</td>
<td>Family</td>
<td>Family Day and Reading Break</td>
</tr>
<tr>
<td></td>
<td>Afternoon</td>
<td>Activity: $1 million box</td>
</tr>
</tbody>
</table>

*Note: *DOI links are not included in the table for brevity.
Morning Lecture: Water, Health and Wellbeing across time (Chronosystem, changes over time)


Afternoon Activity: Write a letter to a government agency as a water and health predictive modeler noting your concerns for future water and health related threats.

February 27th Morning Midterm Exam on Water, Health and Wellbeing 50 questions multiple choice + IF-AT testing in groups

Afternoon Time to work on Assignment 2

February 28th Morning Water, Health and Wellbeing policy mapping - Tracking how an outbreak led to new policy – and the consequences (positive and negative) of that policy From Walkerton and North Battleford to today


Afternoon Time to work on Assignment 2

March 1st Morning Class summary, unanswered questions Answer index card questions as they have been collected over the course

Afternoon Time to work on Assignment 2 Assignment 2 due end of day

Detailed assessment of students

Assignment 1: Nobel Prize nomination package – 30% of final mark
Due: Friday Feb 15 by 4pm
Learning outcomes: 1-3, 5
Up to this point, just a few Nobel nominations or awards have been directly related to issues around water. There was the Literature Prize in 1954 (Hemingway, for the book The Old Man and the Sea), Chemistry in 2003 (Agre, for discovery of cellular channels to transport water across membranes), and Chemistry 2017 (Dubochet; for developing cryo-electron microscopy for rapid cooling of water around a biomolecule). Given the challenges of population growth, extreme weather, climate change and migration, and water shortages, this year, your group of 4-5 people will nominate a person or group of up to three people for the Nobel prize (choose which category you like) for a discovery around water, health and wellbeing that worked for the greatest benefit for all of humankind.

Your nomination must include:
1. Text of no more than 2000 words, Times New Roman, 12 point font, APA formatting
2. A self-directed PowerPoint slideshow or Prezi pitch for the class (15 slides in length)
3. Headings and content as follows:
   a. Nominator name and details (who do you represent as a group and why are you in a position to nominate this water, health and wellbeing award? Can be fictional or based on a real life person/group you believe would nominate the person(s) for the Prize) about 200-300 words
   b. Motivation for the nomination (Why is it an important discovery/finding or work/treatment around the role of water for health and community wellbeing? How is it the greatest benefit to humankind in the current social, cultural, economic and political context?) about 1200 words
   c. Examples of the work of the nominee(s) – create a table or annotated bibliography of the work being nominated or provide high quality images of the photo or short excerpts from the selection from Literature with explanation 500-700 words that exemplify the importance of the work
   d. References (does not count in wordcount)

Nominations will be assessed by the following criteria out of 20 marks:
   A) Biographical information of nominating group and nominee reflect a relevant person/group with details about their role in water and health are accurate (0-3 marks)
   B) Motivation is well-researched, relevance to Nobel Prize mandate is clear, global water and health benefit is made evident, relevance to social justice, economic systems, political movements and/or policy making is described in detail (0-10)
   C) Examples (supporting work) are aptly presented and summarized (0-5)
   D) Appropriate formatting, writing style, persuasion and citations are used (0-2)

Nomination Package is due at 4pm February 15th 2019.

Assignment 2: Fact checking - Individual assignment – 30% of final mark
Due: Friday March 1st by 4pm
Learning outcomes: 1, 2, 4, 6

This assignment is designed to enhance student knowledge of different types of waterborne diseases, how to prevent and treat them, and approaches for overcoming related social justice and policy issues about water and health. It will also provide opportunity for you to apply your knowledge and skills as a future water scientist, health researcher and/or policy maker. You will need to provide accurate information to the ‘public’, and learn mechanisms to overcome some of the social psychological forces (i.e., conformity, obedience, persuasion, heuristics and biases, prejudice) that influence people’s decision making about water and health issues discussed in the media.

In this assignment, you will fact-check three interrelated media pieces about a water, health and wellbeing issue. These can include radio broadcasts (such as Quirks and Quarks style recordings, interviews, podcasts, news reports), newspaper articles, popular magazine articles, blog posts, print, television, movie clips, novellas, video games and internet sites. You must email the professor with your three choices for approval before you begin the fact-checking exercise.

Then, you will critical analyze the three pieces for content against conventional science, local knowledge and traditional knowledge sources. For instance, if a media article describes a traditional practice, you
should check with an Indigenous mentor, or another source for accuracy, relevance, and use of respectful tone. You could fact-check statistics from original published articles quoted in media pieces, and look at the limitations of the original sources to see if they have been included in the media piece.

You will create an attractive poster, which demonstrates your findings and informs your peers of potential bias in media pieces about water, health and wellbeing. Select posters will be displayed in SENS’ hallways once complete.

Posters will be assessed by the following criteria out of 30 marks:

a. Must include 3 media selections fact-checked with accuracy using peer-reviewed and primary sources when possible (i.e., explore the literature for citations and counter-arguments, include knowledge gained from a conversation with an Elder from a specified community; consult with experts like hydrologists, engineers, epidemiologists, or other professional, certified health practitioners) – 15 marks

b. Must include a thematic assessment of the fact-checking to tell a larger story about media portrayals of water, health and wellbeing issues - 10 marks

c. Must be attractive, concise, and free of spelling and grammatical errors, 36’ by 36-48’ printed in colour or greyscale, APA formatting for references – 5 marks

Midterm Exam: February 27th 2018 worth 20% of final mark

Learning outcomes: 1-3, 5-6

This multiple choice exam will contain 50 questions based on readings and lecture material. You will have one hour to finish the multiple choice questions individually, and this will count for 15%. In the second hour, a selection of 10 questions will be chosen from the initial midterm for you to complete as a group of 4-5 using IF-AT test cards. We will practice with IF-AT test cards as a group prior to the midterm. The score your group receives on the IF-AT test will count towards the other 5% allocated.

Midterm content will cover theory, methods, and tools used for research and activities in the context of water, health and wellbeing.

Term Project: 20% Inbox Exercise – To be completed in groups after coursework in April 2019

During this project, groups of students will role play two weeks in the life of a particular person assuming a particular role in an organization that is involved in the management of water resources. Groups will receive a suite of emails every other day for which they will need to reply, and begin a set of tasks (from prioritizing, conducting research, fact checking, calibrating equipment and taking measurements, predicting outcomes, assembling a working group, writing a policy brief, suggesting appropriate actions, etc.). Students will have to integrate knowledge and skills learned from the suite of Winter 2019 MWS courses to make decisions on how to reply and what actions to initiate. The exercise will following a deepening water management problem and test student’s abilities to integrate knowledge from a variety of sources to provide critical information for decision making.
School and University policy statements

University of Saskatchewan Grading System (for graduate courses)

The following describes the relationship between literal descriptors and percentage scores for courses in the College of Graduate and Postdoctoral Studies:

90-100 Exceptional
A superior performance with consistent strong evidence of:

- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.

80-89 Very Good to Excellent
A very good to excellent performance with strong evidence of:

- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;
- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

70-79 Satisfactory to Good
A satisfactory to good performance with evidence of:

- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

60-69 Poor
A generally weak performance, but with some evidence of:

- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
• some ability to examine the material in a critical and analytical manner.

<60 Failure
An unacceptable performance.

Program Requirements
• Percentage scores of at least 70% are required for a minimal pass performance in undergraduate courses taken by graduate students;
• Percentage scores of at least 70% are required for a minimal pass performance for each course which is included in a Ph.D. program;
• Percentage scores of at least 70% are required for a minimal pass performance in all courses used toward JSGS Public Policy and Public Administration programs and all core courses for Master of Public Health students, whether included in a Ph.D. program or a Master’s program;
• For all other graduate courses, percentage scores of at least 60-69% are required for a minimal pass performance for each course which is included in a Master’s program, provided that the student’s Cumulative Weighted Average is at least 70%;
• Graduate courses for which students receive grades of 60-69% are minimally acceptable in a Postgraduate Diploma program, provided that the Cumulative Weighted Average is at least 65%;

Students should seek information on other program requirements in the Course & Program Catalogue and in academic unit publications.

Midterm and Final Examination Scheduling
Midterm and final examinations must be written on the date scheduled.

Final examinations may be scheduled at any time during the examination period (INSERT FIRST AND LAST DAY OF CURRENT EXAM PERIOD); students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures: https://students.usask.ca/academics/exams.php

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**International Student and Study Abroad Centre**
The International Student and Study Abroad Centre (ISSAC) supports student success in their international education experiences at the U of S and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange and English as a Second Language students and their families in their transition to the U of S and Saskatoon. ISSAC offers advising and support on all matters that affect international students and their families and on all matters related to studying abroad. Please visit students.usask.ca for more information.
New Graduate Course Proposal  
GSR 400.1

Course Information

Please append the Course Outline (Syllabus), including a separate Undergraduate Course Outline (Syllabus) if required. A syllabus template is available at usask.ca/cgps/forms.php

<table>
<thead>
<tr>
<th>College</th>
<th>SENS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorizing Unit Head</td>
<td>Dr. Karsten Liber</td>
</tr>
<tr>
<td>Authorizing Unit Head Signature</td>
<td>K. Liber</td>
</tr>
</tbody>
</table>

INFORMATION REQUIRED FOR COURSE AND PROGRAM CATALOGUE

<table>
<thead>
<tr>
<th>Label and Course Number</th>
<th>ENVS 829.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Title</td>
<td>River, Lake, and Wetland Science</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Course Hours</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>20</td>
</tr>
<tr>
<td>Lab</td>
<td>19</td>
</tr>
<tr>
<td>Seminar</td>
<td>10</td>
</tr>
<tr>
<td>Tutorials</td>
<td>9.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weekly Course Hours</th>
<th>19.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>10</td>
</tr>
<tr>
<td>Lab</td>
<td>9.5</td>
</tr>
<tr>
<td>Seminar</td>
<td>10</td>
</tr>
<tr>
<td>Tutorials</td>
<td>9.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term(s) in which course will be offered</th>
<th>Term 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course is to be offered</td>
<td>Annually</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prerequisite(s) or restriction(s)</th>
<th>Registration in the MWS Program, or instructors approval</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Catalogue Description (not more than 50 words)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This course introduces river, lake and wetland science in the context of water security to students. This course will explore many of the physical, chemical and biological factors that characterize these water bodies. Students will learn, through case studies, many of the issues facing rivers, lakes and wetlands including dam and dam removal, eutrophication, wetland drainage, and invasive species.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tuition code and any additional class fees</th>
<th>TC 31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of credit units</td>
<td>3</td>
</tr>
<tr>
<td>Can this course be repeated for credit?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHECKLIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course objectives need to be clearly stated</td>
</tr>
<tr>
<td>Description of and Activities for Evaluation must be listed</td>
</tr>
<tr>
<td>Course Outline (syllabus) with Reading List must be included</td>
</tr>
<tr>
<td>Percentage of Total Mark for each evaluation listed</td>
</tr>
<tr>
<td>Professor must be a member of the Graduate Faculty</td>
</tr>
</tbody>
</table>

If undergraduate lectures are included, also submit the Undergraduate Course Outline (Syllabus) and include information on what additional activities make this a graduate level course. For guidelines, see 'Undergraduate Component of Graduate Courses' under 'Forms for Graduate Chairs' at usask.ca/cgps/forms.php

<table>
<thead>
<tr>
<th>EXAM EXEMPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Mode</td>
</tr>
<tr>
<td>□ Pass/Fail (PF)</td>
</tr>
<tr>
<td>□ Percentage/Numeric</td>
</tr>
<tr>
<td>□ Completed Requirements/In Progress/Not Completed Requirements (CR/IP/NCR)</td>
</tr>
<tr>
<td>Will there be a final exam for this course</td>
</tr>
</tbody>
</table>

If there is no final exam or if the final examination is worth less than 30% of the final grade, provide a brief statement which explains why a final examination is inappropriate for this course.
Rationale

What is the rationale for introducing this course?

SENS has revised its Master of Water Security degree. This course has been created specifically to provide knowledge and skills relevant to this program.

Impact of Course

Are the programs/courses of other academic units/Colleges affected by this new course (possible duplication)?

☐ Yes  ☐ No
If yes, please list:

Were any other academic units asked to review or comment on the proposal?

☐ Yes  ☐ No  If yes, please attach correspondence

Will the offering of this course lead to the deletion or modification of any other course(s)?

☐ Yes  ☐ No
If yes, please list:

Course(s) for which this graduate course will be a prerequisite?

NA

Is this course to be required by your graduate students, or by graduate students in another program?

☐ Yes  ☐ No
If yes, please list:

Required for students in the MWS program.
Enrolment

Expected Enrolment
25

From which colleges/programs:
SENS

Resources

Proposed Instructor(s) (Please include qualifications):

Dr. Tim Jardine
PhD in Biology, University of New Brunswick
MSc in Biology, University of New Brunswick
BSc (Honours) in Biology, Dalhousie University

How does the department plan to handle the additional teaching or administrative workload:
It will be part of the regular assignment of duties.

Are sufficient library or other research resources available for this course:
Yes

Are any additional resources required (library, audio-visual, technology, lab equipment, lab space, etc.):
No

Declaration

This course will conform to the academic requirements and standards for graduate courses, including the rules of Student Appeals in Academic Matters (usask.ca/university_secretary/council/reports_forms/reports/12-06-99.php) and Academic Integrity and Student Conduct (usask.ca/university_secretary/honesty/).

The signature of the Dean of your College signifies that the necessary resources are either available or shall be supplied by the College/Department budget.

Authorize College Dean/Head

Dr. Karsten Liber

Signature

College Approval Date
19 September 2019
ENVS 829.3
River, Lake, and Wetland Science
School of Environment and Sustainability
Term 1, 2018/2019

Course Coordinator: Tim Jardine
215 Toxicology Centre
tim.jardine@usask.ca 306-966-4158

Course notes: See course website http://bblearn.usask.ca

Time and location: 9:00 am to 12:00 pm and 1:00 pm to 2:00 pm, Monday October 28th to Friday November 1st and Monday November 4th to Friday November 8th; Education 1251

Assessment: [Assignments 35%]
[Participation 15%]
[Final Exam 30%]
[Term Project for MWS 20%]

Prerequisites:

Calendar description
This course, as part of the Masters of Water Security Program, seeks to introduce river, lake and wetland science in the context of water security to students. Further, this course will explore many of the physical, chemical and biological factors that characterize these water bodies. The students will learn, through case studies, many of the issues facing rivers, lakes and wetlands including dam and dam removal, eutrophication, wetland drainage, and invasive species.

Learning Outcomes

• Upon completion of the course, the student will be able to explain issues affecting the water quality, ecology, and ecosystem services provided by rivers, wetlands and lakes.
• Students will be able to:
  o Understand how the physical arrangement of rivers, wetlands and lakes affects ecosystem structure and function.
  o Conceptualize interactions between hydrological and biogeochemical processes that occur in watersheds.
  o Consider how climate change and land use/land cover changes affect key processes, ecosystem functions and associated services.
  o Discuss briefly management strategies to mitigate risks to aquatic ecosystems.

Course Overview
This course is designed to cover a broad range of topics as they relate to water security of rivers, lakes and wetlands. The course will use experiential learning, case studies, lectures and collaborative work to help build a strong understanding of challenges associated with water security.

Readings have been selected to provide background information, and support student involvement in classroom discussions and activities. Assignments are designed to encourage students to explore several aspects of water science, and support collaborative learning towards development of a deep understanding of an issue of interest, as it relates to sustainable water resources.

Course communications will be coordinated via BBLearn.
Required Reading Material
Readings for each day will be posted to BBLearn before the first day of class. These readings will consist of book chapters, journal articles and newspaper clippings. Much of the material presented in class and in-class activities will depend on the readings being done before class.
<table>
<thead>
<tr>
<th>Date/Room</th>
<th>Topics</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Nov</td>
<td>Education</td>
<td>Oxygen Cycle</td>
</tr>
<tr>
<td>Worksheet</td>
<td>Exam</td>
<td>8-Nov/Edution</td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
<td>---------------</td>
</tr>
<tr>
<td>Primary producers and Food</td>
<td>NA</td>
<td>1251</td>
</tr>
<tr>
<td>Case study: zebra mussel</td>
<td></td>
<td>1251</td>
</tr>
<tr>
<td>Study: zebra mussel</td>
<td></td>
<td>1251</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1251</td>
</tr>
</tbody>
</table>
Grading Scheme

<table>
<thead>
<tr>
<th>Component</th>
<th>% of final grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worksheets</td>
<td>15%</td>
</tr>
<tr>
<td>Participation</td>
<td>15%</td>
</tr>
<tr>
<td>Written Case Study</td>
<td>20%</td>
</tr>
<tr>
<td>Final exam on River, Lake and Wetland Science</td>
<td>30%</td>
</tr>
<tr>
<td>Term Project for MWS</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Summary of Evaluation Components

**Assignment: Worksheets**

*Purpose:* These worksheets present problems to assess student quantitative and qualitative understanding of the material presented in the readings and lectures.

*Description:* Short one-to-two page worksheets will be completed in class or turned in the next day. The worksheets will include quantitative and qualitative questions – likely similar to exam material for the short answer portion.

**Participation**

*Purpose:* Engaging in dialogue is a key skill for water security professionals. Leading and participating in discussions will allow students to practice this skill.

*Description:* Students will be expected to contribute to in-class discussions in two ways. The first (5% of grade) will involve regular participation in lectures and group discussions by asking and answering questions in a thoughtful and respectful manner. The second (10% of grade) will involve leading a discussion by summarizing a written article and guiding the rest of the class through a series of questions related to the article. Assessment will be based on the student’s readiness and advance preparation, and how well they engaged classmates on the topic. Each student will be assigned a reading to lead at some point in the semester.

**Assignment: Written Case Study**

*Purpose:* The written case study encourages students to tackle a problem and explain it in written form. The students will assess the issues of concern as it relates to water security, what the risk factors are for this particular problem and evaluation of solutions that have or have not worked and potential new solutions.

*Description:* Choose either a dam removal, wetland drainage, eutrophication or invasive species case study, **not presented in class**, and develop a written report. This report will be approximately 1250-1750 words long and should include the following information: introduction to the issue, how it relates to water security, evaluation of past and current solutions, the current state of the issue and works cited.

Other case studies will be considered outside of the topics presented in class but require **instructor approval** and have to have clear implications for water security of rivers, lakes and wetlands.

**Exam:**
Purpose: The goal of the exam is for students to demonstrate their knowledge of major topics and concepts discussed in class, and their ability to synthesize and apply course materials. Description: This will be a closed-book exam; however, a list of potential questions for the final exam will be provided in advance. The exam will be a mix of short and long answer questions and will contribute 30% to the final grade.
## Rubric for Assignments

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Low Performance &lt;70%</th>
<th>About or Below Average 71-85%</th>
<th>Exemplary Performance 85% or above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer questions and required components</td>
<td>Questions not answered and/or missing required components</td>
<td>Question answers are vague, high level of understanding not demonstrated. Components are present, but do not meet all requirements indicated in the instructions.</td>
<td>Questions are answered in a clear and concise manner and mastery of concepts is clear. All components are present and meet or exceed all requirements.</td>
</tr>
<tr>
<td>Content and Approach</td>
<td>Concepts were not explained, missing key points or poorly expressed. Background research does not appear to support approach.</td>
<td>Understanding of concepts is superficial, and some explanations are vague. Some background evidence is presented.</td>
<td>Appropriate literature and sources are cited and a solid grasp of the concepts is clear.</td>
</tr>
<tr>
<td>Writing/Communication</td>
<td>The work was dull and little or no effort was made to connect to the reader/listener. Writing was hard to read due to poor clarity, organization or spelling/grammar.</td>
<td>An effort was made to make it interesting to reader/listener. The writing was clear and organized. Some issues of clarity, organization or grammar/spelling.</td>
<td>Clear effort was made to engage reader/listener. Writing was well done, easy to understand, succinct and organized.</td>
</tr>
<tr>
<td>Evidence of background research and context</td>
<td>Little or no reference to sources. Missing key points and context.</td>
<td>Some source materials are mentioned, but not well integrated into the text. A well-articulated context is presented.</td>
<td>Appropriate literature is used to make arguments and demonstrates a well-articulated understanding of the background materials and context.</td>
</tr>
</tbody>
</table>
Term project: An assessment of the anticipated consequences of wetland drainage at the St Denis National Wildlife Area, SK

Objective
The objective of this term project is to synthesize and apply the skills and knowledge that you have acquired from your Term 1 classes. You must demonstrate understanding and apply techniques from each class: ENVS806 Field Skills in Water Security Research; GEOG 826 Fundamentals of Hydrology; ENVS805 Data Analysis and Management - MWS; ENVS 815 Modeling for Water Security; ENVS 829 River, Lake, and Wetland Science.

Problem
Wetland drainage is a major issue in the Canadian prairies. Wetlands are drained to increase arable land and improve trafficability for agricultural producers, but wetland drainage is also associated with negative hydrological and ecological consequences. You are to assess a (hypothetical) proposal to drain Pond 109 into Pond 90 at St Denis. You will be provided with hydrological and biogeochemical data for the various ponds and surrounding uplands and watershed. You are to use your knowledge of hydrological processes and biogeochemical processes and your skills in data analysis and modelling to assess the likely impact of this drainage, with particular emphasis on downstream flood risk, and changes in the productivity and eutrophic status of the various wetlands involved.

Assessment
The project will be undertaken and assessed in teams, with a collectively agreed upon assignment of duties. This project is worth 20% of each of the five 3CU classes: ENVS806 Field Skills in Water Security Research; GEOG 826 Fundamentals of Hydrology; ENVS805 Data Analysis and Management - MWS; ENVS 815 Modeling for Water Security; ENVS 829 River, Lake, and Wetland Science.

A single report (pdf file) is to be submitted electronically to Andrew Ireson. The report should contain the following sections, with the mark breakdown provided:

<table>
<thead>
<tr>
<th>Item</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover sheet: Title and team members</td>
<td>NA</td>
</tr>
<tr>
<td>Executive summary (1 page max)</td>
<td>15%</td>
</tr>
<tr>
<td>Table of contents</td>
<td>NA</td>
</tr>
<tr>
<td>Assignment of duties</td>
<td>5%</td>
</tr>
<tr>
<td>Description of the problem</td>
<td>10%</td>
</tr>
<tr>
<td>Data analysis and interpretation</td>
<td>20%</td>
</tr>
<tr>
<td>Modelling</td>
<td>20%</td>
</tr>
<tr>
<td>Synthesis</td>
<td>10%</td>
</tr>
<tr>
<td>Conclusions and recommendations</td>
<td>10%</td>
</tr>
<tr>
<td>Peer evaluation</td>
<td>10%</td>
</tr>
</tbody>
</table>
The peer evaluation is completed individually, and submitted separately from the report. In the peer evaluation you must provide an assessment of the contribution of each of the other members of your team and a mark out of 10 for their performance. This will be confidential.

**Submitting Assignments**
Written assignments must be submitted at the start of class. You should keep a personal copy of all assignments submitted. Late assignments will be accepted up to 3 days after the assignment due date but will be penalized at 10% per day. Students may submit late assignments electronically to tim.jardine@usask.ca. Where extenuating circumstances exist, students are advised to contact the instructor immediately to make suitable arrangements regarding extensions. All grading will be evaluated fairly based on the rubrics outlined above.

**Acknowledgements**
This course was developed by Dr. Emily Cavaliere using tools and approaches shared by Drs. Irena Creed, Andrew Ireson and Helen Baulch. Rubrics were modified from those developed by Dr. Maureen Reed.
School and University policy statements
1. Grading System Description
SENS uses the following grading system as adopted by the CGPS:

90-100 Exceptional
A superior performance with consistent strong evidence of
- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.

80-89 Very Good to Excellent
A very good to excellent performance with strong evidence of
- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;
- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

70-79 Satisfactory to Good
A satisfactory to good performance with evidence of
- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

60-69 Poor
A generally weak performance, but with some evidence of
- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
- some ability to examine the material in a critical and analytical manner.

<60 Failure
An unacceptable performance.

2. Midterm and Final Examination Scheduling
Midterm and final examinations must be written on the date scheduled. Final examinations may be scheduled at any time during the examination period; students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is
unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures:

http://students.usask.ca/academics/exams.php

3. Assessment Issues and Grade Disputes
A student shall be permitted to see any examination unless otherwise stated at the beginning of the course. Students dissatisfied with the assessment of their work in any aspect of course work, including midterm or final examination should consult the University policy ‘Student Appeals or Evaluation, Grading and Academic Standing’ found at the Office of the University Secretary:


4. Examinations with Access and Equity Services (AES)
Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals. In order to access AES programs and supports, students must follow AES policy and procedures. For more information, check www.students.usask.ca/aes, or contact AES at 306-966-7273 or aes@usask.ca.

Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

5. Academic Honesty
The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students should read and be familiar with the Regulations on Academic Student Misconduct as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of Complaints and Appeals (http://www.usask.ca/secretariat/student-conduct-appeals/)

For more information on what academic integrity means for students see the Academic Integrity Awareness site at: http://www.usask.ca/integrity/index.php

6. Recording
The syllabus must include a notice of whether the instructor intends to record lectures and whether students are permitted to record lectures.

Student Supports

Student Learning Services
Student Learning Services (SLS) offers assistance to U of S undergrad and graduate students. For information on specific services, please see the SLS web site http://library.usask.ca/studentlearning/.

Student and Enrolment Services Division
The Student and Enrolment Services Division (SESD) focuses on providing developmental and support services and programs to students and the university community. For more information, see the students’ web site http://students.usask.ca.

Financial Support

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact Student Central (https://students.usask.ca/student-central.php).

Aboriginal Students Centre

The Aboriginal Students Centre (ASC) is dedicated to supporting Aboriginal student academic and personal success. The centre offers personal, social, cultural and some academic supports to Métis, First Nations, and Inuit students. The centre is also dedicated to intercultural education, bringing Aboriginal and non-Aboriginal students together to learn from, with and about one another in a respectful, inclusive and safe environment. Students are encouraged to visit the ASC’s Facebook page (https://www.facebook.com/aboriginalstudentscentre/) to learn more.

International Student and Study Abroad Centre

The International Student and Study Abroad Centre (ISSAC) supports student success in their international education experiences at the U of S and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange and English as a Second Language students and their families in their transition to the U of S and Saskatoon. ISSAC offers advising and support on all matters that affect international students and their families and on all matters related to studying abroad. Please visit students.usask.ca for more information.
Academic Integrity Checklist

Honesty and integrity are expected of every student at the University of Saskatchewan. There are many forms of academic misconduct; perhaps the most common is plagiarism. According to the University of Saskatchewan Guidelines for Academic Conduct:

“Plagiarism is the theft of the intellectual creation of another person without proper attribution. It is the use of someone else’s words or ideas or data without proper documentation or acknowledgment. Quotations must be clearly marked, and sources of information, ideas, or opinions of others must be clearly indicated in all written work. This applies to paraphrased ideas as well as to direct quotations. A student must acknowledge and fairly recognize any contributions made to their personal research and scholarly work by others, including other students.”

There are many resources on campus to assist you with proper citation and paraphrasing.

- For guidance on when and how to quote from other documents and how to properly paraphrase information in other documents, see http://library.usask.ca/howto/honesty.php.
- To learn about different styles of citation and how to properly cite a variety of different sources including statistics, archival materials, maps, legal documents and government reports, see http://libguides.usask.ca/citation.

When in doubt about a citation requirement or your approach to paraphrasing, ask your librarian or your course instructor or your academic supervisor for assistance.

Before you submit any written work, review it against the following checklist:

- I have acknowledged the use of all ideas with accurate citations.
- I have used the words of another author, instructor, information source, etc., and I have properly acknowledged this and used proper citation.
- In paraphrasing the work of others, I have put the idea into my own words and did not just change some words or rearrange the sentence structure.
- I have checked my work against my notes to be sure that I have correctly referenced all quotes or ideas.
- When using direct quotations I have used quotation marks (or other means to clearly identify the quoted text) and provided full citations.
- Apart from material that is a direct quotation, everything else in the work is presented in my own words.
- I have checked all citations for accuracy (e.g. page numbers, journal volume, dates, web page addresses).
- My list of references/bibliography includes all of the sources used to complete the work.
- I have accurately and completely described any data or evidence I have collected or used.
- I fully understand all of the content (e.g., terms, concepts, theories, data, equations, ideas) of the work that I am submitting.
- The content of the work has not been shared with another student, unless permitted by the instructor.
- The content of the work reflects wholly my own intellectual contribution or analysis and not that of another student(s), unless the instructor approved the submission of group or collaborative work.
- If another person proofread my work it was for the sole purpose of indicating areas of concern, which I then corrected myself.
- This work has not been submitted, whole or in part, for credit in another course or at another institution, without the permission of the current course instructor(s).
- I understand the University of Saskatchewan’s policy and expectations concerning academic honesty and the consequences of plagiarism or other forms of academic misconduct.

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1 Compiled based on York University (http://www.yorku.ca/tutorial/academic_integrity/acadintechecklist.html), Curtin University (http://academicintegrity.curtin.edu.au/global/checklist.cfm), University of Toronto (http://www.utoronto.ca/academicintegrity/resourcesforstudents.html), and Skidmore College (http://cms.skidmore.edu/advising/integrity/checklist.cfm) checklists for academic integrity.
ENVS 992.6  
Project in Water Security  
School of Environment and Sustainability  
[Summer, 2019]

<table>
<thead>
<tr>
<th>Course Coordinator</th>
<th>Graham Strickert</th>
<th>Kirk Hall 334</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><a href="mailto:Graham.strickert@usask.ca">Graham.strickert@usask.ca</a></td>
<td>306 966 2403 (Internal: 2403)</td>
</tr>
</tbody>
</table>

Course notes: See course website [http://bblearn.usask.ca](http://bblearn.usask.ca)

Assessment:
- Project Management Skills: 20%
- Project report: 50%
- Project presentation: 20%
- Professional performance: 10%

Prerequisites: Registration in the MWS Program

**Calendar Description**

The objective of this course is to allow students to investigate applied topics in water security, including scientific, technical, social, economic, cultural, institutional, or other appropriate aspects through the completion of a project. The project engages students in active, service learning and takes place in collaboration with a partner organization in industry, consultancy, governmental or non-governmental organization, or with an academic partner from the U of S.

**Course Description:**

Students will be trained on campus in essential writing skills and essential management skills (leadership, communication, entrepreneurship, project and financial management), in short workshop style courses held in terms 1 and 2. An individual or team-based project will be undertaken, in which students work with a partner organization on a water security problem. Projects will be interdisciplinary in scope. Through active hands-on experience, students will be well-equipped to begin a successful career in water security. The project ends with a capstone event, attended by partner organizations and the SENS and GIWS community, where all students present their project outcomes.

**Learning Outcomes**

Over the course duration students will:
- Gain valuable practical experience and depth of understanding in the project area of focus.
- Contribute to the partner organizations objectives, including pushing forward research.
- Experience, understand and learn to manage team dynamics, including conflict.
- Develop critical thinking about connections between the subject matter of their studies and their experiences with partner organizations.
- Increase their awareness of community dynamics and opportunities for engagement.
- Have opportunities for practical application of theory.
- Develop an enhanced sense of independence and personal responsibility for learning and fulfilling the project outcomes.

**Important Dates in 2019/20**

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 25</td>
<td>Essential Writing Skills</td>
</tr>
<tr>
<td>Feb 10-14</td>
<td>Essential Management Skills</td>
</tr>
<tr>
<td>May 11-Aug 21</td>
<td>Projects (15 weeks duration). Internal deadlines will be worked out with partners</td>
</tr>
<tr>
<td>Aug 24-Aug 26</td>
<td>Capstone event – scheduled for 1/2 day this week</td>
</tr>
</tbody>
</table>
Detailed course subject description

Overview
The ENVS 992 course involves one week of on campus training in areas around writing and management, to provide students with a strong foundation for the subsequent projects, which are to be undertaken with partner organizations, either with individual students, or in interdisciplinary teams. Students will be provided with a list of potential projects, and will apply for a position on the projects they are interested in. Individual projects are be acceptable if desired by the partner organization. In the case of team projects, students will be in groups of 2 – 3, where each individual in the team has a defined role in the project. The project duration is 15 weeks, and finishes in the final week of August, with a capstone event. Further details about each of these components are described below.

Essential writing and management skills
This suite of five short courses will be led by Dr. Graham Strickert. We will also invite guest professionals to share experiences and tips on various aspects of project management. These visits will be a mix of formal presentations and informal chats. In 2019, we are seeking to include professionals with expertise in project management. Additional content and activities will be facilitated by Dr. Strickert. The core course content is divided into six categories:

1. Writing effectively
2. Leadership
3. Communication
4. Entrepreneurship
5. Project management
6. Financial management

In each case, roughly 4 hours of class time will be dedicated to each subject, over 5 days.

Reading List for Short Courses:
Entrepreneurship:

Leadership:

Communication:
Projects

Project roles

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MWS Program Director (PD)</strong> Andrew Ireson</td>
<td>Design of the ENVS992 course and implementation of continual improvements, works with the PI to coordinate and oversee the projects.</td>
</tr>
<tr>
<td><strong>ENVS992 Program Instructor (PI)</strong> Graham Strickert</td>
<td>ENVS 992 course coordinator, responsible for finding projects and partners, facilitating the matching of students with projects in teams. PI is in charge of coordinating two short courses: “essential writing skills”, around reading week time in Term 1, and “essential management skills” around reading week in Term 2.</td>
</tr>
<tr>
<td><strong>Work placement coordinator (PC)</strong> TBD</td>
<td>Works with the PI to find projects and partners and facilitate the matching of students with projects in teams, oversees each student’s progress with a monthly individual check-in (by email or in person), and organizing the capstone event. PI and PC are responsible for cultivating our relationships with external partners, and expanding the network as much as possible. PC will maintain a database of partners.</td>
</tr>
<tr>
<td><strong>Faculty advisor</strong> Various SENS faculty</td>
<td>Each team will have a faculty advisor who will likely be familiar with the partner organization. The faculty advisor will not normally be involved in the day to day running of the project (unless they choose to be), but should meet with the team at the outset of the project to discuss the plan, and will marking the project deliverables during the capstone event and at the end of the project.</td>
</tr>
<tr>
<td><strong>External advisor</strong> From partner organization</td>
<td>A member of the partner organization who is the primary contact for the student team, organizes resources for the students (data, software, literature, other), facilitates meetings with the student team and organization, as appropriate, and helps determine the project deliverable such that it is useful to the partner organization. There should be monthly updates (by email or in person) from the team, with the external advisor member providing timely and meaningful feedback.</td>
</tr>
<tr>
<td><strong>Student</strong></td>
<td>Individual students are to take personal responsibility for their engagement in the team project. Each student will have an individual deliverable, as well as a group deliverable, and must work in a professional manner with their team-mates, advisors and the program coordinator.</td>
</tr>
</tbody>
</table>

Project matching

**Stage 1.** Behind the scenes, the PD, PI and PC are continuously building relationships with partners who can participate in projects. By the end of Term 1 a database of specific projects will be finalized, with the following details:

| Partner project database details: |
1. Project title
2. Partner organization name, location, and type
3. Partner contact details
4. Faculty advisor
5. Project location, and working arrangements if students not based on campus
6. Location and approximate timing of any field work
7. Brief description of the problem to be addressed
8. Brief overview of the methods and disciplines that will be employed
9. List of any required resources, and how these will be provided (e.g. travel funding, equipment, software, etc.).

The database will be shared with all students over the winter break, and they will be invited to apply for projects, either individually, or in self-organized groups.

**Stage 2.** At the end of Term 1, students complete the following questionnaire about their aspirations:

**MWS Student Questionnaire:**

1. In terms of the range of content that we cover in the MWS, what area is of most interest to you?
2. Do you know what sector you wish to work after your MWS – consultancy, government, industry, academia, NGOs?
3. Do you know specifically what kind of job you would like – and if so can you provide some details, including the role (management, technical expert, etc)?
4. Where would you like to work: anywhere, in Saskatchewan, Canada or internationally (list ideal countries or areas. If you have specific organizations in mind, please list here)?
5. Would you to work in the field or in the office?
6. Do you want to be your own boss, work for a small company, or be part of a larger institution?
7. Anything else you would like to mention about your future plans, not captured above?

These responses will be used by the PI/PC to assist in the project matching process and follow up on any additional suggested projects that the students may provide.

**Stage 3.** In January, the students apply for the projects. The application process is designed to emulate the job market and provide valuable job seeking experience to the students. The students must provide a short cover letter and a curriculum vitae. The most compelling applications will be offered interviews by the advisors, and those that pass the interview successfully will be given the projects of their choice. The PI and PD will oversee this process to ensure that the process is fair and that all students get projects that are acceptable to them in the end. In advance, a session provided by the Student Employment and Career Centre will be arranged to assist the students in preparing for the application and interview process.

**Stage 4.** In February, the students will be matched with projects and students and advisors will be notified. At this point, it is acceptable for the advisors (faculty and external) to provide reading materials to the students, but it is not expected that any project work will be undertaken until the start of the project, defined in the important dates on page 1 of the syllabus.

**Working on the project**

Students are expected to work full time (around 40 hours a week) for the 15-week duration of the project. The working arrangements (office space, location, field work logistics) are to be determined by the team, faculty advisor and external advisor. These arrangements must be documented in the project plan, which is to be drafted in the first two weeks of the project and included in Appendix A of the final project report.
The plan should include specific deliverables with deadlines, and individual’s tasks. You will not lose marks in your project for not sticking rigidly to the original plan, but you should demonstrate in your reports (see next item below) that you have adapted and updated your planning as events and the project unfold.

Students are expected to manage their activities. As a team or individually, students must report to their advisors on a monthly basis, with a concise report that addresses each of the following headings:

<table>
<thead>
<tr>
<th>Heading with the project title, report number, date, student names.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Work completed in the last reporting period</td>
</tr>
<tr>
<td>2. Team meetings held in the last reporting period (dates, times, attendance)</td>
</tr>
<tr>
<td>3. Planned work for the next reporting period</td>
</tr>
<tr>
<td>4. Information requested from advisors or partners</td>
</tr>
<tr>
<td>5. Summary of any challenges</td>
</tr>
<tr>
<td>6. Summary of progress against the project plan</td>
</tr>
</tbody>
</table>

This report can be short and relatively simple (these are live working documents and should reflect that), but must be clear. The report can be shared by email. These reports will also go into Appendix B in the final report.

**Project deliverable**

All student projects will deliver a report conforming to the content requirements laid out below. Document templates are provided in markdown language ([https://github.com/adam-p/markdown-here/wiki/Markdown-Cheatsheet](https://github.com/adam-p/markdown-here/wiki/Markdown-Cheatsheet)), which include the font styles to be used, the MWS logo and text, and scripts are available to convert the markdown into html and a word document (details are at [https://git.cs.usask.ca/ani378/mws_992_report](https://git.cs.usask.ca/ani378/mws_992_report)). To compile your markdown report to Word/html, the program pandoc is used, and a Makefile is provided to do this compilation (configured for a Mac/Linux operating system). You are not required to compile the documents yourself, and Andrew/Andrew’s lab group are available to help with technical questions on this anytime. These reports will be archived electronically in SENS, and publicly available through the SENS website, which is why adherence to the style and content guidelines is so important. If you are working on an individual project, you will have to individually author all required sections of the report. The lengths of some individual sections are indicated below, and correspond to the page count when the document is compiled into Word. The overall report, not including appendices, should ideally be between 20 – 40 pages in length. These are guidelines and not strict limits, but marks can be deducted if the report is excessively lengthy, particularly if the writing is not concise, or if the report is insufficiently detailed in content.

**Header page:** Page 1. Title, student names, date of project, name of partner organization, name of faculty advisor, standard MWS logo and text.

**Executive summary:** Page 2. Assume that 90% of readers in future will only read this – must summarize the problem, what you did, how you did it, what you found, and what still needs to be done.

**Table of contents:** Page 3.
**Introduction:** Description of background to the problem, including a literature review. May include a short profile of the partner organization and their specific problem. End the introduction with a set of project objectives.

**Site description:** If applicable, the location of the field site where the project was based must be provided, with site coordinates (northing, easting) and if applicable/available, an overview of the climate, vegetation, hydrology, geology, soils, and land use.

Next, *individually authored sections* should be included, which describe in detail the methods and results of various aspects of the work. In each case, the author should be identified, and each team member should lead one section. These sections should not exceed 6 pages in total, including figures, and can include any of the following:

**Field work:** Describe any field work that was undertaken, including the rationale, the experimental design, description of instrumentation, results, interpretation and conclusions. You must be concise. If additional details are generated which will be useful to future workers, these can be included in an appendix (after Appendix B).

**Modelling exercise:** Describe the objective of the modelling exercise, describe the model used and any relevant methods, provide results and a conclusion. You must be concise. If additional details are generated which will be useful to future workers, these can be included in an appendix (after Appendix B).

**Data analysis:** If a substantial component of the work involves statistical analysis of existing data, which could include environmental, economic or social data, and could be time series data or spatial (GIS) data, this should be written up as a separate section. Include the objectives of the analysis, the data available (including the source of the data), quality assurance and quality control activities that were performed on the data by you, methods of analysis, results, including figures, interpretation and conclusions. Often appropriate plots of data are preferable to formal statistical analyses. You must be concise. If additional details are generated which will be useful to future workers, these can be included in an appendix (after Appendix B).

**Social science research:** Investigation of a social phenomenon using conventional (i.e., interviews, focus groups) or engaged social science research methods (workshops in communities, arts-based methods, photovoice, sharing circles, etc.). Appropriate ethics certifications or waivers must be sought prior to data co-gathering. Reporting should be concise and include details on the approach, methods, results, analyses, conclusions and any recommendations arising from the work. An appendix may be included with ethics certification, interview or focus group guides, and exemplars of data (after Appendix B).

**Policy Analysis:** an analysis of existing or proposed policy could be completed using an established framework. Outputs may include but are not limited to: identification and characteristics of stakeholders in opposition on policy maps, policy comparisons, power analyses, SWOT, cost-benefit, drafting policy briefs, or compiling and analyzing measurements of policy progress. The final sections are again *authored by the team collectively* and must include the following:

**Summary of findings:** 1 page of writing, with additional figures (i.e. you are encouraged to include figures, in particular conceptual diagrams, if these support your findings, and these don’t count towards the page limit). In this section, the conclusions from the individual components are brought together, showing how these are related to one another and how they support, or contradict one another. The overall findings are summarized, concisely. Do not repeat the results from earlier sections, but emphasize take home messages and conclusions. The primary audience for this section is your faculty advisor and the academic community.

**Towards a solution:** 1 page of writing, with additional figures or tables. In this section, you have the opportunity to either present a prototype solution to the partner organization, or provide a number of
future recommendations for further research towards a solution. For the prototype solution, you might provide a detailed method or policy, which could be expressed as a conceptual diagram, a flow chart, a table, or as a single page of text. For the further research, you should outline the outstanding problems that need to be overcome or understood to solve this problem, and you should try to make concrete recommendations for what the partner organization should do next to move towards a solution. The primary audience for this section is your external advisor and partner organization.

Acknowledgements: short section thanking individuals and sources of funding, if applicable.

References: Use APA style for references and consider using a reference manager, such as Zotero.

Appendices will be included in the final report, and will be archived, but may not be shared publicly on the website (unless relevant to include). The appendices include the following sections:

Appendix A: Project plan (drafted in the first 2 weeks of the project)

Appendix B: Monthly advisor reports (drafted throughout the project – important these are actually done)

Capstone event
In the ½ day capstone event, MWS student present their work to each other, faculty, partner organizations and the SENS and GIWS student body. Note particularly that incoming MWS students for the next year will all be invited to attend this event. This will be held from 13:00 to 17:00 on Friday 23rd August, immediately followed by a social activity from 17:00 to 18:30 in room ESB 112. Students are to prepare a 10 minute powerpoint or pdf presentation, and the time limit is strict. There will be 5 minutes for questions for each presentation. Students should design presentations that convey the problem statement, the methods and results, the findings and proposed solution, and a personal reflection of what they learned over the course of the project. Marks will be given for the quality of presentation materials, clarity of delivery and engagement of the audience. Each MWS student must ask at least one question of another student during the Q&A periods. Also, each MWS student will be asked to write a single sentence that describes the take home message from each presentation, and these will be provided to the presenters, so that they learn what the audience takes away from their talk.

Detailed assessment of students
The ENVS 992 project is worth 6 credit units. The ENVS992 project are to be marked by two individuals: the external advisor and the faculty advisor. In the situation where only one individual is able to mark the project, the program director will provide the second mark. The program director will review the marks, and provide a final mark based on the two independent recommendations. An overview of the mark breakdown is given below, followed by the marking template with the detailed mark breakdown. The marking template will be used by the two markers.

Project management short courses (20%)
The project management short courses will be assessed by a single take home exam, to be completed after the courses have been completed. The exam will test students’ understanding of the concepts covered by all instructors and guest lecturers, and will largely comprise short written answers. 48 hours will be allowed to complete the exam. The exam is work 20% of the grade for ENVS992. High marks will be given for clear answers that demonstrate understanding of the concepts, correct answers to questions, good English and evidence of critical thinking. Poor marks will be given for unclear explanations, contradictions, standard textbook answers that do not demonstrate individual understanding, incorrect
answers to questions, and poor English. Students should provide references if appropriate and plagiarism will not be tolerated and will result in a mark of zero.

**Individual/Team project report (50%)**
The team project report must conform to the style and content guidelines provided above to be acceptable. The detailed mark breakdown is provided below in the Marking template.

**Project capstone event (20%)**
The capstone event includes a team or individual presentation, worth 20%. These will be assessed by at least two of the following: the external advisor, the faculty advisor, the ____ and the program director. Good marks will be awarded for high quality presentation materials, clear communication, engagement of all team members, and for actively and effectively engaging the audience. Poor marks will be awarded for unclear presentations, with poor graphics, unorganized structure and unclear take home messages, and for failing to engage the audience in the activity.

**Professional performance (10%)**
This discretionary mark will be awarded to individuals by the MWS program director and faculty advisor, and reflects how effectively and enthusiastically the student engaged with the project. High marks will be given for good organizational skills, good time management, good attendance in team meetings, positive approaches to problem solving in the team and with the partners, proactive engagement in the project (e.g. actively contributing to discussions, having ideas and sharing them), and completing the planning documents (Appendix A and B). Poor marks will be given for missing meetings, missing deadlines and not planning effectively in response to this, failing to engage with team-mates and partners, and failing to complete the planning documents.
Marking template

Overview

The ENVS992 projects are to be marked by two individuals: the external advisor and the faculty advisor. In the situation where only one individual is able to mark the project, the program director will provide the second mark. The program director will review the marks, and provide a final mark based on the two independent recommendations.

The ENVS 992 project is worth 6 credit units, broken down as follows:

- Project management skills: 20%
- Project report: 50%
- Project presentation: 20%
- Professional performance: 10%

Project management skills marks are provided by Dr. Graham Strickert and are not addressed here.

For guidance for markers, a grade of less than 60% is a fail; 60-69% is poor; 70-79% is satisfactory to good; 80-89% is very good to excellent; and 90% and above is exceptional. 80% is an important threshold – grades above this may be required to qualify for entrance into further degree programs and/or scholarships in those programs. Note also that you do not have to give whole numbers for marks in the various sections – e.g. you could give someone 7.7 out of 10 to indicate an equivalent grade of 77%. For further guidance see Appendix II below.

Instructions

To mark the ENVS992 project, please complete the following marking template. The report deadline is August 23rd at midday, and the capstone event starts on the same day at 13:00. This completed document with recommended marks should be submitted to Andrew Ireson (andrew.ireson@usask.ca) by August 28th, 2019.
PROFESSIONAL PERFORMANCE (10% - 0.6 CU)

It is difficult to provide a prescribed mark breakdown for this section. It would be very helpful if markers could provide written feedback in the various categories and an overall mark out of 10 which broadly reflects the partner’s level of satisfaction and impression of the student’s performance.

<table>
<thead>
<tr>
<th>Feedback to be shared with the student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you happy with the student’s level of contact/responsiveness during this project?</td>
</tr>
<tr>
<td>Are you happy with the student’s professionalism during this project?</td>
</tr>
<tr>
<td>Did the student use creative approaches to solve problems? Did they show initiative and independence?</td>
</tr>
<tr>
<td>Did the student face any particular challenges during the project and did they take a positive approach to overcome these?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FINAL RECOMMENDED GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>/10</td>
</tr>
</tbody>
</table>

Private feedback for the Program Director/Staff only (optional)

| Is there anything you would like to share privately with the MWS staff? This will not be shared with the student. |
**PROJECT REPORT (50% - 3 CU)**

Use this table to mark the written project report. *Note the suggested mark breakdown for each individual question within the sections are recommendations only – if you feel more weight should be given to one category you are free to change the breakdown as you see fit. The only requirement is that a mark for each section (“SECTION RECOMMENDED GRADE”) and the overall report (“FINAL RECOMMENDED GRADE”) are graded out of the totals provided.

<table>
<thead>
<tr>
<th>Section</th>
<th>Detail</th>
<th>Marker comments</th>
<th>Suggested mark*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive summary</td>
<td>Is the writing clear and within 1 page?</td>
<td></td>
<td>/3</td>
</tr>
<tr>
<td></td>
<td>Can the problem be understood?</td>
<td></td>
<td>/2</td>
</tr>
<tr>
<td></td>
<td>Are the methods described concisely?</td>
<td></td>
<td>/2</td>
</tr>
<tr>
<td></td>
<td>Are there clear findings and recommendations?</td>
<td></td>
<td>/3</td>
</tr>
<tr>
<td>Common sections</td>
<td><strong>SECTION RECOMMENDED GRADE</strong></td>
<td></td>
<td>/10</td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td>Does the Introduction describe the problem and background clearly? Is the literature review well-researched and comprehensive, with appropriate sources cited? Is the writing comprehensive and clear?</td>
<td></td>
<td>/7</td>
</tr>
<tr>
<td><strong>Site description</strong></td>
<td>Are adequate details provided?</td>
<td></td>
<td>/3</td>
</tr>
<tr>
<td><strong>Summary of findings</strong></td>
<td>Does the summary reflect the work that was done and draw viable conclusions? Is the writing comprehensive and clear?</td>
<td></td>
<td>/6</td>
</tr>
</tbody>
</table>
## Towards a solution

Does the solution, which may be a recommendation for further research, address the partner’s priorities and concerns directly? Is it credible? Is it well written?

<table>
<thead>
<tr>
<th>SECTION RECOMMENDED GRADE</th>
<th>/4</th>
</tr>
</thead>
</table>

### Detailed section(s) (see Appendix I for examples of what these might be)

#### Chosen approach

Has the student chosen an appropriate methodological approach to the partner’s problem?

<table>
<thead>
<tr>
<th>SECTION RECOMMENDED GRADE</th>
<th>/2</th>
</tr>
</thead>
</table>

#### Methods

Are the methods appropriate, and clearly described?

<table>
<thead>
<tr>
<th>SECTION RECOMMENDED GRADE</th>
<th>/6</th>
</tr>
</thead>
</table>

#### Results – use of figures

Are high quality figures used to convey the results and/or summarize findings?

<table>
<thead>
<tr>
<th>SECTION RECOMMENDED GRADE</th>
<th>/4</th>
</tr>
</thead>
</table>

#### Results – general

Do the results presented address the core problem? Are the interpretations appropriate and useful?

<table>
<thead>
<tr>
<th>SECTION RECOMMENDED GRADE</th>
<th>/4</th>
</tr>
</thead>
</table>

#### Quality of presentation

Is the report generally well presented with good English, good structure, no formatting errors and appropriate figures?

<table>
<thead>
<tr>
<th>SECTION RECOMMENDED GRADE</th>
<th>/4</th>
</tr>
</thead>
</table>

### FINAL RECOMMENDED GRADE

| /50 |
**CAPSTONE EVENT (20% - 1.2 CU)**

Use this table to mark the presentations delivered at the capstone event. *Note, the mark breakdown is a recommendation only and can be modified if desired, as long as an overall grade out of 20 is provided.*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Marker comments</th>
<th>Suggested mark*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem statement.</strong> The partner priorities and concerns are well expressed, and a clear problem statement is formulated.</td>
<td><strong>Methods and results.</strong> The methods selected are appropriate, a clear justification is provided and the methodological details are clearly explained. Appropriate figures/graphics are used to present the key results. Clear and appropriate interpretations are provided.</td>
<td><strong>/3</strong></td>
</tr>
<tr>
<td><strong>Findings and solution.</strong> Conclusions are consistent with the results and recommendations are appropriate. There is a clear take home message.</td>
<td></td>
<td><strong>/4</strong></td>
</tr>
<tr>
<td><strong>Quality of the presentation materials.</strong> The slides are readable, appropriate in number and well laid out with good English.</td>
<td></td>
<td><strong>/6</strong></td>
</tr>
<tr>
<td><strong>Audience engagement.</strong> The presentation is well tailored to the audience and questions are responded to well.</td>
<td></td>
<td><strong>/4</strong></td>
</tr>
<tr>
<td><strong>FINAL RECOMMENDED GRADE</strong></td>
<td></td>
<td><strong>/20</strong></td>
</tr>
</tbody>
</table>
School and University policy statements

University of Saskatchewan Grading System (for graduate courses)

The following describes the relationship between literal descriptors and percentage scores for courses in the College of Graduate and Postdoctoral Studies:

90-100 Exceptional
A superior performance with consistent strong evidence of:
- a comprehensive, incisive grasp of subject matter;
- an ability to make insightful, critical evaluation of information;
- an exceptional capacity for original, creative and/or logical thinking;
- an exceptional ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- an exceptional ability to analyze and solve difficult problems related to subject matter.

80-89 Very Good to Excellent
A very good to excellent performance with strong evidence of:
- a comprehensive grasp of subject matter;
- an ability to make sound critical evaluation of information;
- a very good to excellent capacity for original, creative and/or logical thinking;
- a very good to excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently;
- a very good to excellent ability to analyze and solve difficult problems related to subject matter.

70-79 Satisfactory to Good
A satisfactory to good performance with evidence of:
- a substantial knowledge of subject matter;
- a satisfactory to good understanding of the relevant issues and satisfactory to good familiarity with the relevant literature and technology;
- a satisfactory to good capacity for logical thinking;
- some capacity for original and creative thinking;
- a satisfactory to good ability to organize, to analyze, and to examine the subject matter in a critical and constructive manner;
- a satisfactory to good ability to analyze and solve moderately difficult problems.

60-69 Poor
A generally weak performance, but with some evidence of:
- a basic grasp of the subject matter;
- some understanding of the basic issues;
- some familiarity with the relevant literature and techniques;
- some ability to develop solutions to moderately difficult problems related to the subject matter;
some ability to examine the material in a critical and analytical manner.

<60 Failure
An unacceptable performance.

Program Requirements

- Percentage scores of at least 70% are required for a minimal pass performance in undergraduate courses taken by graduate students;
- Percentage scores of at least 70% are required for a minimal pass performance for each course which is included in a Ph.D. program;
- Percentage scores of at least 70% are required for a minimal pass performance in all courses used toward JSGS Public Policy and Public Administration programs and all core courses for Master of Public Health students, whether included in a Ph.D. program or a Master's program;
- For all other graduate courses, percentage scores of at least 60-69% are required for a minimal pass performance for each course which is included in a Master's program, provided that the student's Cumulative Weighted Average is at least 70%;
- Graduate courses for which students receive grades of 60-69% are minimally acceptable in a Postgraduate Diploma program, provided that the Cumulative Weighted Average is at least 65%;

Students should seek information on other program requirements in the Course & Program Catalogue and in academic unit publications.

Midterm and Final Examination Scheduling

Midterm and final examinations must be written on the date scheduled.

Final examinations may be scheduled at any time during the examination period (INSERT FIRST AND LAST DAY OF CURRENT EXAM PERIOD); students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures: [https://students.usask.ca/academics/exams.php](https://students.usask.ca/academics/exams.php)

Integrity Defined (from the Office of the University Secretary)

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students should read and be familiar with the Regulations on Academic Student Misconduct ([https://secretariat.usask.ca/documents/student-conduct-appeals/StudentAcademicMisconduct.pdf](https://secretariat.usask.ca/documents/student-conduct-appeals/StudentAcademicMisconduct.pdf)) as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of
Complaints and Appeals (http://www.usask.ca/secretariat/student-conduct-appeals/StudentNon-AcademicMisconduct.pdf)

For more information on what academic integrity means for students see the Student Conduct & Appeals section of the University Secretary Website at: http://www.usask.ca/secretariat/student-conduct-appeals/index.php

Examinations with Access and Equity Services (AES)
Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals. In order to access AES programs and supports, students must follow AES policy and procedures. For more information, check www.students.usask.ca/aes, or contact AES at 306-966-7273 or aes@usask.ca.

Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

Student Supports

Student Learning Services
Student Learning Services (SLS) offers assistance to U of S undergrad and graduate students. For information on specific services, please see the SLS web site http://library.usask.ca/studentlearning/.

Student and Enrolment Services Division
The Student and Enrolment Services Division (SESD) focuses on providing developmental and support services and programs to students and the university community. For more information, see the students’ web site http://students.usask.ca.

Financial Support
Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact Student Central (https://students.usask.ca/student-central.php).

Aboriginal Students Centre
The Aboriginal Students Centre (ASC) is dedicated to supporting Aboriginal student academic and personal success. The centre offers personal, social, cultural and some academic supports to Métis, First Nations, and Inuit students. The centre is also dedicated to intercultural education, bringing Aboriginal and non-Aboriginal students together to learn from, with and about one another in a respectful,
inclusive and safe environment. Students are encouraged to visit the ASC’s Facebook page (https://www.facebook.com/aboriginalstudentscentre/) to learn more.

International Student and Study Abroad Centre
The International Student and Study Abroad Centre (ISSAC) supports student success in their international education experiences at the U of S and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange and English as a Second Language students and their families in their transition to the U of S and Saskatoon. ISSAC offers advising and support on all matters that affect international students and their families and on all matters related to studying abroad. Please visit students.usask.ca for more information.