

**DEPT OF GEOGRAPHY & ENVIRONMENTAL STUDIES**  
**CARLETON UNIVERSITY**

**Course Outline**  
**GEOG 3103A: Watershed Hydrology**  
**September – December 2021**

Instructor: Dr. Jennifer Totten

Office Hours: Wednesdays, 1-2 pm (on campus); Fridays, 10 – 11:30 am (on Discord)

E-mail: [jennifer.totten@carleton.ca](mailto:jennifer.totten@carleton.ca) (typically the best way to get in touch with me – I do not answer emails on weekends)

Lectures: Wednesdays, 8:35 to 11:25 am; Loeb C264

Labs: Lab A1 – Fri: 14:35 - 16:25 hrs; Lab A2 – Wed: 15:35 – 17:25 hrs. Loeb A211

TA: TBD

Pre-Requisite: GEOG 2013A

**Course Objectives/ Learning outcomes:**

Hydrology is the study of the hydrologic cycle: the continuous movement of water from the atmosphere to the surface of the earth, on and into the surface, through the subsurface, and back to the atmosphere. During this course, students will develop a sound understanding of the various components of the hydrological cycle. Students will be able to identify these components, describe how they work, and identify how we measure them. Students will be able to discuss the importance of measuring and monitoring these components for water resource assessment. Students will be able to analyze various hydrological data sets to interpret specific hydrological regimes and extreme hydrological events.

**General areas of study:**

1. Hydrological cycle & world water balance
2. Precipitation
3. Interception
4. Evaporation and Evapotranspiration
5. Infiltration
6. Soil moisture and groundwater hydrology
7. Surface runoff
8. Snow hydrology
9. Urban hydrology
10. Drylands hydrology
11. Wetlands hydrology
12. Extreme hydrological events: floods & droughts
13. Water quality and pollution

**Reading material:**

There is no textbook for this course. Readings for all the various topics will be provided on the *BrightSpace* course web site. It is the responsibility of each student to familiarize themselves with

this material. Material contained in the course readings will be included on the final exam. Additional material may be assigned during the term.

Course teaching and learning activities, including outlines, lectures, PowerPoint presentations, discussions, posted notes, labs etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s). Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).”

### **Course communication:**

Communication for this course will be through a number of means. The lectures & labs will be held in-person, on campus (lectures in a HyFlex mode). Additionally, there will be an online forum (hosted on Discord), there is access via email or you may consult me on campus or online. There are several forums set up on the GEOG 3103 Server on Discord: a general discussion forum for students to be able to communicate with one another, one set up for asking the Instructor questions (so you don't have to email, unless it's personal), and one for asking the TA questions. There are both texting channels & voice channels, so there are many options for us to stay in touch. The instructions for accessing the Discord server are posted separately on the *Brightspace* course page, but the link is here below.

<https://discord.gg/9dZW82S>

I will be available for my **office hours** on Wednesdays from 1 – 2 pm on campus (Loeb A209) or online on Discord (on Office Hours voice channel) on Fridays from 10 – 11:30 am. I may also answer questions at other times on the Discord server if I drop by the server. I will be checking the “Ask-the-Prof” forum frequently.

There are also Lab Questions Channels (both voice & text) on Discord where the TA will answer questions periodically, and may hold their office hours (TBD).

### **Course assessment:**

The assessment for the course will be based on several components:

1. There will be 5 assignments on various aspects of the hydrological cycle. These will comprise 60% of the total grade.
2. A final examination worth 40% of the total grade will be given, which will be made up of both long and short answer questions. **You MUST pass the exam to pass the course.**
3. All elements of the course will be marked both for content (e.g. ideas, structure of arguments, research, citations etc.) and presentation (e.g. quality of writing, grammar, spelling, and graphical presentation). All assignments are to be submitted through *Brightspace*.

### Exercise topics:

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| 1. Precipitation data analysis               | 15% |
| 2. Field Exercise – Streamflow measurement   | 10% |
| 3. Field Exercise – Infiltration measurement | 10% |
| 4. Recurrence interval analysis              | 10% |
| 5. Discharge data analysis                   | 15% |

### Attendance and submission policy for course

All 5 Labs contribute to your grade. Completion of all labs and the final exam are required for successful completion of the course. Submission dates are important. Lab reports are due via *Brightspace* by 11:59 pm on the date specified (see attached schedule). Assignments will only be accepted for 2 days beyond the due date with a penalty of 5% (of the lab itself) per day, unless prior arrangements have been made. The only exception is for reasons of illness or equivalent circumstances (e.g. bereavement). These types of situations must be fully documented in writing **within 3 business days** of the assignment due date. If in doubt, please send me an email or discuss this with me during my Office Hours or on the Discord platform.

Carleton University has suspended the need for a doctor's note or medical certificate until further notice due to the Covid-19 Pandemic when requesting academic accommodations related to COVID-19. Students should complete the self-declaration form available on the Registrar's Office website to request academic accommodation for missed course work including exams and assignments. Here is the link to the form: <https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf> Students should also connect directly with me to discuss required accommodations arising from medical or other situations. If in doubt, please send me an email or discuss this with me during my Office Hours.

Unless otherwise specified, group work is not acceptable. This includes all term work and the final exam. Sharing of answers on the final exam is ***strictly forbidden***. Submitting work that has been previously used in this or other courses is not permitted **in this course**. Assignments will be returned via *Brightspace*, and general feedback will be provided in the lab period following. If you have any questions about the grading, please discuss this with your TA, or with me via email or during Virtual Office Hours.

Standing in this course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

### Carleton University's Covid-19 Policies

All members of the Carleton community are required to follow COVID-19 prevention measures and all mandatory public health requirements (e.g. wearing a mask, physical distancing, hand hygiene, respiratory and cough etiquette) **and mandatory self-screening prior to coming to campus daily**. <https://carleton.ca/covid19/cuscreen/>

If you feel ill or exhibit COVID-19 symptoms while on campus or in class, please leave campus immediately, self-isolate, and complete the mandatory symptom reporting tool. For purposes of

contact tracing, attendance will be taken in all classes and labs. Participants can sign in using posted QR codes where provided.

All members of the Carleton community are required to follow guidelines regarding safe movement and seating on campus (e.g. directional arrows, designated entrances and exits, designated seats that maintain physical distancing). In order to avoid congestion, allow all previous occupants to fully vacate a classroom before entering. No food or drinks are permitted in any classrooms or labs.

For the most recent information about Carleton's COVID-19 response and required measures, please see the University's COVID-19 webpage and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact [covidinfo@carleton.ca](mailto:covidinfo@carleton.ca)

Please note that failure to comply with University policies and mandatory public health requirements, and endangering the safety of others are considered misconduct under the Student Rights and Responsibilities Policy. Failure to comply with Carleton's COVID-19 procedures may lead to supplementary action involving Campus Safety and/or Student Affairs.

### **Academic Integrity & various offences**

Instructional offences include among other activities cheating, contravening examination regulations, plagiarism, submitting similar work in 2 or more courses without prior permission, and disrupting classes. Conduct offenses apply in areas of discrimination and sexual harassment. Further information about University regulations which define and regulate these offences is found at: <http://www2.carleton.ca/studentaffairs/academic-integrity>

The University Senate defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This can include:

- reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings;
- failing to acknowledge sources through the use of proper citations when using another’s works and/or failing to use quotation marks;

Plagiarism is a serious offence which cannot be resolved directly with the course instructor. A rigorous investigation is conducted by the Office of the Faculty Dean, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of “F” for the course.

## **Academic Accommodation**

You may need special arrangements to meet your academic obligations during the term because of disability, pregnancy or religious obligations. Please review the course outline promptly. For an accommodation request, the processes are as follows.

**Pregnancy obligation:** write to me with any requests for academic accommodation during the 1<sup>st</sup> two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the Student Guide.

**Religious obligation:** write to me with any requests for academic accommodation during the 1<sup>st</sup> two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the Student Guide.

**Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), Psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairment in mobility, hearing and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term. After requesting accommodation from PMC, email me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally scheduled exam.

## **Survivors of Sexual Violence**

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: <https://carleton.ca/equity/sexual-assault-support-services>.

## **Accommodation for Student Activities**

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

## **Schedule for this term: (Lecture Order and Required Readings):**

Lesson 1	Introduction & the hydrological cycle	Arnell, N. (2002) Hydrology and Global Environmental Change. Chapters 1 & 2 – pg. 1 – 20
Lesson 2	Precipitation	Hendricks, M.R. (2010) Introduction to Physical Hydrology. Chapter 2 – pg. 14 – 32  Knutson, T.R. <i>et al</i> , <u>Tropical cyclones and climate change</u> . Nature Geoscience, 2010;

Lesson 3	Interception	Davie, T. & Quinn, N.W. (2019) <i>Fundamentals of Hydrology</i> . Chapter 4 Interception Pg. 69 - 85
Lesson 4	Evaporation & evapotranspiration	Arnell, N. (2002) Hydrology and Global Environmental Change. Chapter 3 – pg. 42 - 64
Lesson 5	Infiltration	Manning, J.C. (1997). <i>Applied Principles of Hydrology</i> . Chapter 4 Infiltration and soil water Pg. 75 - 104.
Lesson 6	Groundwater hydrology	Davie, T. & Quinn, N.W. (2019) <i>Fundamentals of Hydrology</i> . Chapter 5 Groundwater Pg. 86 - 106
Lesson 7	Surface hydrology	Dingman, S.L. (2002) <i>Physical Hydrology (2<sup>nd</sup> ed)</i> . Chapter 9 Stream response to water-input events– pg. 389 – 435
Lesson 8	Snow hydrology	Viessman, W. & Lewis, G. (1996). <i>Introduction to Hydrology</i> . Chapter 14 Snow Hydrology - pp. 265 – 271 & 284 - 288.
Lesson 9	Urban Hydrology	MacKenzie, F.B. (1987) <i>Urbanization and the Hydrological Regime</i> , in <i>Canadian Aquatic Resources</i> (Healey & Wallace, eds.) Dept. of Fisheries & Oceans. Pg. 277 – 292
Lesson 10	Drylands Hydrology	Thomas, D.S.G. (2011) <i>Arid zone Geomorphology</i> . Chapter 11 Runoff generation, overland flow and erosion on hillslopes. Pg. 237 – 259.
Lesson 11	Wetland Hydrology	Mitsch W.J. & Gosselink, J.G. (2007) <i>Wetlands</i> , Chapter 4 Hydrology of Wetlands. Pg.67-113.
Lesson 12	Floods & Droughts	Newson, M. (1994) <i>Hydrology and the River Environment</i> , Chapter 4 Runoff Extremes Pg. 64 – 89
Lesson 13	Water Quality	Cech, T.V. (2010) Principles of Water Resources. Chapter 5: Water Quality. Pg. 137 – 184.
	Course review	

<b>Lab Assignment Schedule for Fall 2021 Term. <i>Assignment due dates are fixed.</i></b>
<b>Week of Sep 12 to 18: Assignment 1 given &amp; explained, due September 29/ October 1.</b>
<b>Week of Sept 19 to 25: Lab working periods, T.A. will help during your lab period.</b>
<b>Assignment 1 DUE @ 11:55 pm the night before this week's lab</b>
<b>Week of September 26 to Oct 2: Assignment 2 given &amp; explained, due Oct 13/15<sup>th</sup>.</b>
** Field Assignment **
<b>Week of October 3 – 9: Lab working periods, T.A. will help during your lab period</b>
<b>Assignment 2 DUE @ 11:55 pm the night before this week's lab</b>
<b>Week of October 10 to Oct 16: Assignment 3 given &amp; explained, due Nov 3<sup>rd</sup> /5<sup>th</sup> .</b>
** Field Assignment **
<b>Oct 24 - 30: Reading Week, no classes or lab sessions</b>
<b>Assignment 3 DUE @ 11:55 pm the night before this week's lab</b>
<b>Week of October 31 to Nov 6<sup>th</sup>: Assignment 4 given &amp; explained, due Nov 17<sup>th</sup> /19<sup>th</sup>.</b>
<b>Week of Nov. 7 to Nov 13: Lab working periods, T.A. will help during your lab period</b>

**Assignment 4 DUE @ 11:55 pm the night before this week's lab**

**Week of Nov 14 to Nov 20<sup>th</sup>: Assignment 5 given & explained, due Dec 1<sup>st</sup> /3<sup>rd</sup>.**

**Week of Nov 21 to Nov 27: Lab working periods, T.A. will help during your lab period**

**Assignment 5 DUE @ 11:55 pm the night before this week's lab**

**Week of Nov 28<sup>th</sup> to Dec 4<sup>th</sup>: no more lab sessions.**