

Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

The sections shown on this interface are based on the templates [UG OBTL+](#) or [PG OBTL+](#)

If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to [Data Transformation Status](#) for more information.

Expected Implementation in Academic Year	AY2025-2026
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Asst Prof Pierre Taillardat
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Course Title	Environmental Hydrology
Course Code	ES4906
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	NA
Co-requisites	NA
Pre-requisite to	NA
Mutually exclusive to	NA
Replacement course to	NA
Remarks (if any)	NA

Course Aims

This course aims to provide a comprehensive understanding of the processes that govern water movement, distribution, and quality in natural and human-influenced systems. You will understand key hydrological concepts such as river dynamics, groundwater flow, water balance, water chemistry and the impact of climate change on water resources.

The course is ideal for students interested in environmental science who want to gain both theoretical knowledge in physical hydrology and practical skills in field data collection and hydrological analysis.

By taking this course, you will gain knowledge and experience relevant to careers in water resources management, environmental consultancy, conservation, and research, making it relevant for anyone looking to address global water challenges.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Model the contemporary hydrological cycle
ILO 2	Define key hydrological processes, including precipitation, evapotranspiration, runoff, and groundwater flow.
ILO 3	Analyse and interpret real-world hydrology data
ILO 4	Apply field-based techniques to measure water flow and quality in various environments.
ILO 5	Evaluate the impact of climate change and the consequences of human activities on the water cycle
ILO 6	Communicate hydrological concepts and findings effectively in both written and oral formats.

Course Content

The course will cover both theoretical and practical aspects of hydrological processes and their relevance to environmental systems and will include two field excursions. The key topics include:

- Introduction to environmental hydrology: Overview of the hydrological cycle, including precipitation, evapotranspiration, infiltration, and runoff.
- Surface water hydrology: Stream dynamics , flow regimes and soil water processes.
- Groundwater hydrology: groundwater flow, aquifers, recharge and sustainable groundwater use.
- Water balance and water budgets: Estimation of water balance.
- Water chemistry and quality: Understanding chemical processes affecting water quality in natural and human-influenced systems.
- Field data collection and hydrological measurements: Techniques for measuring streamflow, groundwater levels and water quality.
- Impact of climate change on hydrological systems: Effects of changing climate on water resources, flooding, droughts and water scarcity.
- Human impacts on hydrological systems: Water extraction, land use change, urbanization and pollution.
- Sustainable water resource management: Strategies for managing water resources in the face of environmental challenges.

Reading and References (if applicable)

Ward, A. D., Trimble, S. W., Burckhard, S. R., & Lyon, J. G. (2016). Environmental hydrology. Third edition. Boca Raton, FL, CRC Press, Taylor & Francis Group.

Brooks KN, Folliot PF, Gregersen HM, and Thames JL (2012) Hydrology and the Management of Watersheds. Ames, IA: Iowa State University Press

Bierkens, M.F., Dolman, A.J., Troch, P.A. (2008). Climate and the Hydrological Cycle.

International Association of Hydrological Sciences.

NOTE: The above listing comprises the foundational readings for the course and more up-to-date relevant readings will be provided when they become available.

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction: The Water Cycle	1		In-person	Hands-on workshop
2	Precipitation, Evaporation, Evapotranspirati on and the Energy Budget	2	Environmental Hydrology - Chapter 2 and 4	In-person	Exercise 1
3	Infiltration and Soil Water Processes	2	Environmental Hydrology - Chapter 3	In-person	Exercise 2
4	Surface water hydrology	2	Environmental Hydrology - Chapter 5 and 6	In-person	Exercise 3
5	Field measurement techniques in hydrology	4	Environmental Hydrology - Chapter 6	In-person	Field trip
6	Groundwater	2, 3	Environmental Hydrology - Chapter 11	In-person	Exercise 4
7	Wetland Hydrology & Mid-term Quiz	3	Hydrology and the management of watersheds - Chapter 13	In-person	Exercise 5
8	Aquatic Chemistry and Watershed Management	2, 3	Hydrology and the management of watersheds - Chapter 11 and 14	In-person	Exercise 6
9	Water Resource Management and Monitoring	3, 5	Hydrology and the management of watersheds - Chapter 11	In-person	Guest Lecture
10	The Impact of Climate Change on hydrological systems	5	Climate and the Hydrological Cycle – Chapter 13	In-person	Group Discussion

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
11	The Impact of Human Activities on Hydrological Systems	5	Environmental Hydrology - Chapter 12	In-person	Case study
12	Field trip & End-term Quiz	2, 5	NA	In-person	Field trip - Sustainable Singapore Gallery at Marina Barrage
13	Final project: Watersheds of the World	6	NA	In-person	Group Project Presentations

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lecture	Lectures will pass on the theoretical knowledge required to understand the different components of environmental hydrology and water resources management.
Tutorials	Tutorials will allow students to apply theoretical knowledge to practical problems. Through guided exercises and case studies, the tutorials will help reinforce key concepts in hydrology. The exercises and assignments will enhance problem-solving skills, improve understanding of hydrological tools and methods, develop code using R, and foster critical thinking needed to tackle complex environmental challenges.
Practicum	A field excursion to the NTU campus will provide hands-on experience in characterizing hydrological processes by collecting hydrological data using scientific field equipment.
Field Trip	A field excursion to the Sustainable Singapore Gallery at Marina Barrage will expose students to Singapore's water management practices and its efforts toward sustainable development.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Class Participation(Participation)	6		10	Individual	Analytic	Not Applicable
2	Continuous Assessment (CA): Test/Quiz(Continuous Assessment 1: Mid-term quizzes)	1, 2, 6		15	Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Others(Continuous Assessment 2: Water Balance Analysis)	1, 3, 4, 6		30	Individual	Analytic	Extended Abstract
4	Continuous Assessment (CA): Test/Quiz(Continuous Assessment 3: End-term quizzes)	1, 5, 6		15	Individual	Analytic	Relational
5	Continuous Assessment (CA): Presentation(Final project: Presentation and report)	1,2, 3, 5, 6		30	Team	Analytic	Extended Abstract

Description of Assessment Components (if applicable)

Participation evaluates your engagement in discussions, your ability to ask and answer questions, complete exercises, contributions to group activities, and overall involvement in the learning experience.

Continuous Assessment 1: Mid-term quizzes and Continuous Assessment 3: End-term quizzes assess your understanding of class content through a mix of multiple-choice questions and short written answers. These quizzes evaluate your comprehension of key concepts, ability to apply knowledge and clarity in expressing your understanding of the material covered in the course.

Continuous Assessment 2: Water Balance Analysis require you to plot real-world data, make observations, and provide an interpretation using scientific methodology. You will analyze the data, identify patterns or trends, build a simple hydrological model and draw conclusions based on your findings.

The Final project: Presentation and Report (4500 words) You will randomly be assigned to your group of 5 students for the final project (please see instructors if you have any concerns). Each group will collect and synthesize information on a watershed of their choice from anywhere in the world. You will present its natural characteristics, identify contemporary challenges based and propose possible solutions to mitigate or adapt to these changes. This exercise tests your ability to conduct research, collaborate effectively and apply knowledge

to real-world environmental issues. You will need to propose the watershed you want to study and justify which environmental issues (e.g., floods, drought, pollution, saltwater intrusion) it covers by week 9. You will need to submit a peer evaluation form to get marks for the final project.

Formative Feedback

You will receive informal feedback continuously throughout the course where appropriate, and formal feedback following every assignment. In addition, I will be available to answer questions regarding your research or assignments throughout this course.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Care for Environment	Intermediate
Collaboration	Intermediate
Communication	Basic
Sense Making	Intermediate
Critical Thinking	Intermediate

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project critiques, class discussions and activities.

Policy (Absenteeism)

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your participation grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science. It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer, Ms Christina Tee, or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

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