WATR7001 - Science of water (2 units)

Foundation module

Module description

This module introduces participants to some of the fundamental science which underpins the understanding of the whole of catchment water cycle, including aspects of water quality and water treatment for human consumption. The module introduces the physical, chemical and biological properties of water (physical and chemical), microbial and biogeochemical processes as well as concepts relating to the natural hydrological cycle and groundwater systems. The module also addresses the human uses of water including water quality and water treatment and highlights the dynamic relationship between human and natural aquatic systems.

Key issues include: concepts and practice of integrated water resource management; principles of water science; and, whole-of-water-cycle approaches.

Module introduction

This module covers key knowledge that is critical for a rigorous understanding of integrated water management problems. There is an emphasis on the physical, chemical and biological aspects of water and how an understanding of these disciplines is necessary when developing whole-of-water-cycle and adaptive management approaches to ensure the sustainable use of water. Participants will be exposed to both the theoretical and practical components of the module content (case study material, etc). The module content will also be reflected against material presented through case-study exploration.

Module delivery

- **Full-time** (on-campus) students, including international students, are required to enrol in the internal offering in Semester 1. Semester 1 begins with a three-day field trip to North Stradbroke Island. Full-time students also participate in a one-day field trip on the Brisbane River from the catchment to the coast. Other field trips include a visit to a wastewater treatment plant, and a water sampling day at Griffith University.

- **Part-time** (external) students are required to attend a three-day field trip to North Stradbroke Island followed immediately by an intensive three-day block of classes (9am-5pm). The remainder of the module is taught externally on-line.

Assumed background

This is a postgraduate module in general water science offered as part of the IWC Master of Integrated Water Management. Participants are expected to have basic background knowledge through undergraduate science or engineering programs. For this particular module, it is assumed that participants have a basic understanding of chemical equations and stoichiometry.

Learning objectives

After successfully completing this module participants are able to:

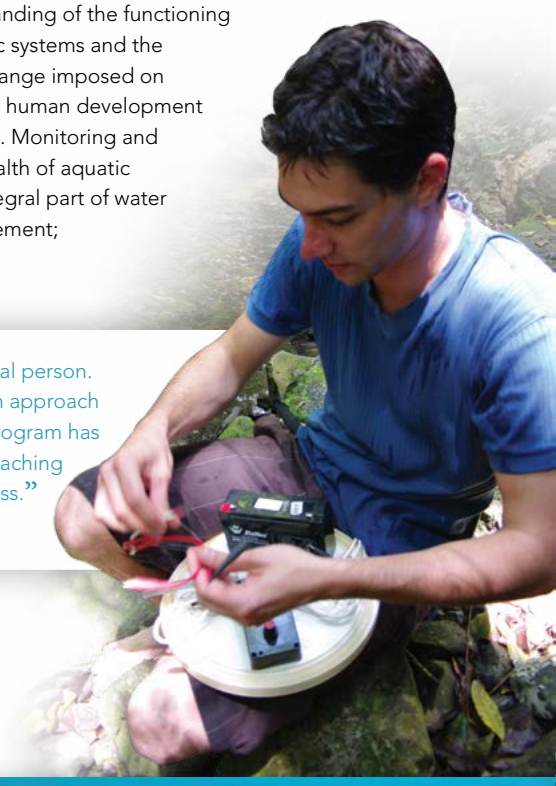
- Describe the physical and chemical properties of water. These are the basic properties of water that underpin its role in the environment, and contribute to an understanding of water quality and water treatment for human consumption;l

- Describe the processes that affect these physical and chemical properties with respect to water quality. This includes human influences in the environment, such as increased nutrient and organic loads on waterways, land use changes, hydrological changes and urbanisation;

- Analyse, interpret and write about water quality data. Analyse given water quality data using correct analysis methods and statistics; present water quality data using correct tables and figures; interpret the outcomes of this analysis; write a meaningful report about the data and its implications for water quality, ecosystem health, or human use;

- Describe basic hydrology of catchments, and physical processes within catchments. An understanding of basic catchment hydrology is important in understanding water quality, linkages between the terrestrial and aquatic environment, the influence of land-use change on aquatic systems, reservoir function and water treatment needs and environmental flows;

- Describe basic ecological processes in aquatic systems and measure key water quality and biologic indicators for ecological health in an aquatic system. In understanding the whole of catchment water cycle it is important to also have an understanding of the functioning of natural aquatic systems and the trajectories of change imposed on these systems by human development and modification. Monitoring and assessing the health of aquatic systems is an integral part of water resource management;



> "I am a very practical person. I love the hands-on approach that the Masters Program has offered us in the teaching and learning process."
> — Masters participant

A participant is preparing equipment for measuring aquatic ecosystem productivity.

- Understand the principles of water storage and treatment. Most of the world's freshwater systems have been modified for human use with water storage for human consumption a major use. Understanding the principles of water storage and its subsequent treatment for human use is a major component of integrated water management, particularly with respect to sustainable water use;
- Be aware of larger issues of water security, such as climate change. In the current context of climate change it is important to understand issues relating to water security. Climate change models can be used to assess water supply changes and also model changes in water quality;
- Have improved (1) their ability to manage their own study and (2) their ability to work effectively in an engineering team; and should particularly be able to:
  - Reflect on own learning and improve study approaches on basis of this learning;
  - Work in a team to solve a large complex problem and communicate the solution effectively;
  - Identify and overcome issues/problems in a team to make the team result better than the sum of the individuals;
  - Have participated in an integrated group project exploring detailed aspects of integrated water management.

Teaching staff

Lead Lecturer: Dr Wade Hadwen (School of Environment and Australian Rivers Institute, Griffith University)

Lecturer: Dr Steven Pratt (School of Chemical Engineering, The University of Queensland)

Problem-Based Learning (PBL) projects

PBL projects and field trips run through the semester, comprising roughly 50% of the assessment weight. These enable students to develop skills that complement the content delivered in the four Foundation modules.

Full-time students complete two PBL projects per semester while part-time students complete one PBL per semester:

- **PBL1:** Situation analysis and critique of an existing water management project or program *(Group project)*
- **PBL2:** Design of a project proposal to address a real-world water management issue from an integrated water management perspective *(Individual project)*

Field trips

Students begin the Foundation semester with a three-day field trip to North Stradbroke Island. The cost of the trip (including transport from Brisbane, accommodation and meals) is included in the tuition fees.

As part of this module (Science of water) students also participate in the following activities:

- One-day trip on the Brisbane River
- Half-day field trip to an Advanced Wastewater Treatment Plant (Queensland)
- Half-day water sampling field trip (Griffith University, Nathan Campus, Brisbane)

For a complete list of field trips that students undertake during the program, please refer back to "Field trips" on page 7 of this syllabus or visit the IWC website.

Photos: Brisbane River field trip