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UNIVERSITY OF CANTERBURY
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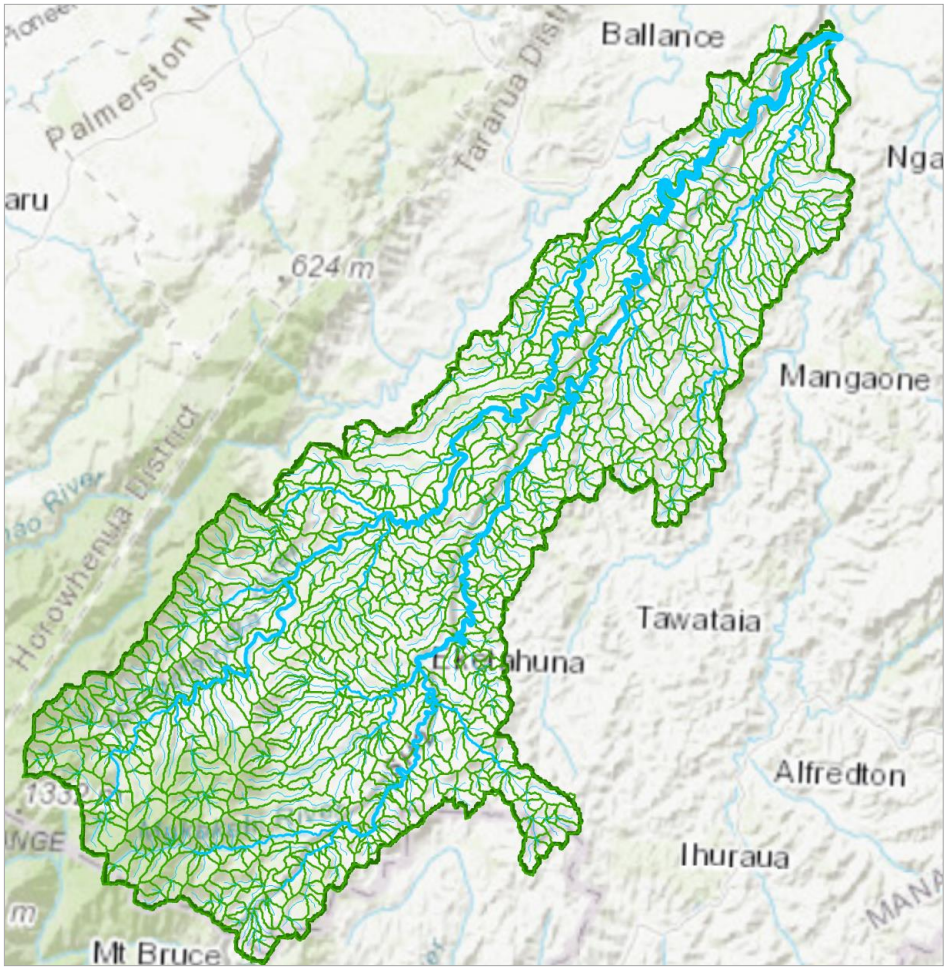
COURSE OUTLINE

WATR 404/604: Special Topic in Water Resource Management

Integrated Data to Support Water Modeling



2018

Waterways
Centre for Freshwater Management

COURSE DETAILS

WATR 404 (UC)/ WATR 604 (LU)	2018

Code:	WATR 404/604
Subject Name:	*Special Topic in Water Resource Management:* **Integrated Data to Support Water Modeling**
Degree:	Master in Water Resource Management (can be included in PG Diploma in Water Resource Management also)
Semester:	One
Lecture Room:	Engineering Core, E14 Ernest Rutherford 460 (workshop)
Lecture/tutorial times:	Wednesday 1pm – 4pm, Term 1 2 day workshop (April 10& 11)
Co-ordinator/Examiner:	Professor David Maidment (Erskine Fellow, from the University of Texas)
Snr Tutor:	Julie Clarke
Email:	David.maidment@canterbury.ac.nz Julie.clarke@canterbury.ac.nz

AIMS & OBJECTIVES

This one-off (2018) special topic course is on the use of large datasets to support visualization, classification and modelling of water systems, to inform water management. Water management in this context includes not just managing the use and quality of water, but also the risks such as flooding.

The application of science to support water management depends on several kinds of data: *observations* data measuring the flow, level and quality of water at a point, *simulation* data derived from mathematical models of water flow and transport, and *geospatial* data that describe the physical environment through which water flows. By integrating these three kinds of data together for a region, a *regional water data infrastructure* can be created. The goal of this class is to assemble two examples of these regional water data infrastructures – one for the surface water of the Mangatainoka catchment in Manawatu, and the other for groundwater in the Selwyn catchment on the Canterbury plans. In each case, the intent is to understand how changes in farming practice can reduce water pollution in downstream rivers.

In a larger sense, the goal is to point towards the establishment of a *national water data infrastructure* to describe the surface and groundwater systems of New Zealand. An important step towards this goal has already been achieved over the past several years in New Zealand through the adoption of *open water data standards* by all the Regional Councils and Crown Research Institutes so that the a national synthesis of observations data is possible without centralizing all the underlying databases. The *River Environment Classification* provides a nationally consistent layout of river segments and associated local catchment areas.

Topics covered will include;

- The status of water data management systems and their use in New Zealand currently
- Interfaces designed to integrate and provide access to data (e.g., LAWA) and what is needed to do this effectively.
- Classification systems for water catchments (e.g., REC), their use and limitations.
- Practical case studies of the Mangatainoka River (Manawatu) and the Selwyn River (Canterbury) catchments
- Tools and techniques, such as GIS, used to integrate and visualize data (the ArcGIS geographic information system will be used as the basic analytical tool, and no prior experience in GIS is assumed)
- The potential uses of a national water data infrastructure for New Zealand – how it could be used to inform water management and water hazard assessment.
- This course is offered by visiting Erskine Fellow, Professor David Maidment, from the Centre for Research in Water Resources, University of Texas at Austin, USA. It is highly recommended for numerate postgraduate students in an interest in water management, with skills in natural resources engineering, GIS, hydrology, physical

geography, modelling, water resource characterization and management and/or environmental science.

LEARNING OUTCOMES

Upon successful completion of this course, students should be able to;

- Take water observations data and a map of the region in which they are measured and prepare a report summarizing characteristics of the water data including a chart of the data and a map of the region.

- Understand the basic sources of GIS and water observations data in New Zealand, how to obtain these data, and how geospatial coordinate systems work.

- Take a particular point on a river system and delineate the drainage area of this location. Select from the River Environment Classification the river segments and catchments lying within the drainage area and prepare a base map of this region. Add to this base map measurement observation locations, roads and legal boundaries.

- Prepare a flow duration curve for an observation point and a load duration curve for bacteria to assess pollution loads under existing conditions. Determine the load reduction to achieve desired water quality conditions for bacteria and assess how this load reduction might be distributed across the drainage area.

- Take a groundwater flow field resulting from the output of a groundwater simulation model and create a geospatial coverage of that field so it can be set in a geographic context. Do a flow tracing study to identify the flow path from a particular farm in the drainage area to a downstream outlet point

- Assess the current pollution load for nutrients in the groundwater system and how that pollution load would have to be reduced to achieve desired water quality conditions.

- Look at the problem from the farmers viewpoint and see how the methods developed in the class using ArcGIS can be adapted to be applied with the open source software QGIS.

- Gain an overview of the subject by listening to speakers at a two-day workshop at the conclusion of the course and participating in discussions at this workshop

- Conduct an individual research project to illustrate the principles of the course in an area familiar to the student. Present a poster summarizing the project and a short oral presentation at the workshop

COURSE CONTENT:

Lecture sessions begin at 1pm in KE06 at UC

Note that, although a 3 hr period is scheduled, for most weeks this will not be taken up by lectures, allowing time for tutorials, discussion and practical experiences

	Date /Time	Topics	Lecturer(s)
Session 1	Wednesday 21 February	**Introduction** • Introduction to the course • GIS in Water Resources • Observations and modelling data • Preparation of a map and summary report for the Mangaitanoka catchment	David Maidment
Session 2	Wednesday 28 February	**Case Study 1: Mangatainoka Catchment, Geospatial Context** • Delineation of drainage area • Streams and catchments from the REC • Base map for Mangatainoka	David Maidment Brent Watson, (Horizons Regional Council)
Session 3	Wednesday 7 March	**Case study 1: Mangatinoka Catchment, Water Flow and Transport** • Flow duration and load duration curves • Tracking bacteria transport	David Maidment
Session 4	Wednesday 14 March	**Case study 2: Selwyn Catchment, Geospatial Context** • Regional context • The role of groundwater in surface water systems • Tracking nitrate transport	David Maidment ECan (Tim Davie, Stefanie Rixecker)
Session 5	Wednesday 21 March	**Case study 2: Selwyn Catchment, Water Flow and Transport** • Fundamental differences in groundwater data and analysis • Modelling movement of reactive chemicals • Physiographic considerations	David Maidment

Session 6	Wednesday 28 March	**Farmers Perspective** • Farmers perspective on mitigating water pollution • Use of QGIS as a farm planning tool • Regional context	David Maidment William Rolleston (former President of Federated farmers)

Term 1 of Semester 1 ends 29 March

WORKHOP: "Connecting all levels of water management through data integration"

2 day workshop in mid-semester break (9am - 5pm each day)

	Date /Time	**Topics**	**Speakers(s)**
Day 1	Tuesday 10 April	**Water data modelling:** **The current state of play …** • Key constructive uses and applications • Gaps and deficiencies • Reasons for these	David Maidment Dwane Young, Office of Water, US Environmental Protection Agency, Washington DC Other participants to be arranged
Day 2	Wednesday 11 April	**The way forward …** • What we need to model water at a national scale • Regional considerations • Development of a suggested plan	David Maidment Dwane Young, Office of Water, USEPA, Washington DC Other participants to be arranged

TEACHING AND LEARNING ARRANGEMENTS:

Key lectures will available as recordings, whereas tutorials and informal discussion sessions will not.

Students should consult “Recommended Course Readings and other Learning Support ” list to further their knowledge and support their assignment work.

Contact hours	**35 hrs** Lectures & Tutorials
Non Contact hrs	**115 hrs for UC students** **135 hrs for LU students**

A. Internal Assessment (100%)

- **Participation grade (10%)**

  Grade given to encourage participation and involvement in the class.

- **Week-long projects in Term 1 (5 @ 7.5% = 37.5%)**

In each lecture session a project requiring hands-on data use and manipulation will be assigned for the following week. This must be completed before the next lecture session.

- **Oral Term Paper Presentation (15%):**

Details to be advised

Date: (due April 10, at workshop)

- **Main assignment: (37.5% UC, 27.5% LU):**

A written term project showing how to use water data and modelling in a water management context.

Date: (due 5pm, Friday May 4)

- **LU-only assignment (10%)**

Water management on the Blue Cliffs Station in South Canterbury **(due 5pm, Friday May 4)**

Recommended Course Reading and other Learning Support

Key reference articles, videos and other media will be provided during the course of the lecture sessions. Links to these will be put on LEARN during the course, as needs are identified in lectures

Note that some references may be large documents, which you are not expected to read from cover-to-cover. However, learning how to scan these documents for useful information and data (e.g., by using the Table of Contents effectively) is a useful skill.

Glossary

A glossary of commonly used water science and management terms is available on LEARN

***General reference text*:**

Strassberg, G., N.L. Jones, D.R.Maidment, **ArcHydro Groundwater: GIS for Hydrogeology**, ESRI Press, Redlands California (copies will be provided for students in the class by the instructor)

General Written Assignment Guidelines

Such assignments are submitted online, on the LEARN site, unless you are told otherwise. Please note our policy on late submissions on the next page.

Title/author

The assignment should have a clear title and the student's name and ID number, course code and assignment name/number.

General Layout and Presentation

Use headings and subheadings to show the logical progression of your work. Usually the headings will relate to the tasks required of you in the assignment. Assignments will be assessed using a marking sheet. The standard of technical presentation, grammar, and clarity of expression will also be considered in the assessment (NB. Take care not to use capitals for words which should not have them (e.g., chemical names), or lower case for words that should have capitals (e.g., place names, biological species) – this is a common mistake in assignments).

Tables and Figures

Relevant figures and tables of data can be included. Data/images that need to be consulted while reading the text (i.e., support the text and are important) should be inserted **INTO** the text, **NOT** put in an appendix. Reference to these should be made in the text, otherwise it is unclear when they are relevant. Examples include: "As shown in Table 1, …" or " … not a clear trend (Figure 3)". Do not include photos, diagrams or tables without referring to them within your text ... and refer to all tabulated data as "Tables" and all diagrams, graphs, photos etc., as "Figures".

Referencing

Be careful to clearly reference ALL of the information you are using. The reference should be given in the text in APA style, according to the sheet available on LEARN. In the list of references at the end of your report, be sure to include sufficient information regarding report numbers, page numbers, publishers etc., so that someone else could find these same documents.

The order of preference for finding and citing material should be:

(i) text books and journal papers

(ii) other papers, technical reports and published articles

(iii) websites and newspapers. Use website information sparingly and if you access a report of other document via a website, reference the report, not the website. If referencing a website, report the webpage address and the date you consulted it.

Marking Feedback

Feedback on what you did well, and what needs improvement will be provided along with your assignment grades. The form your feedback takes will depend on the nature of the assignment. Major assignments (>20%) will be assessed using a marking sheet, and will include written comments for your feedback. The standard of technical presentation, grammar, and clarity of expression will usually also be considered in this assessment.

General Policies

Extension policy

It is our policy that **no individual extensions** will be granted for assignments. If you feel that your performance in a particular assignment has been significantly impaired by extenuating circumstances, you may submit an application for Special Consideration or an Aegrotat Application (with supporting documents) in order for your circumstances to be considered in your grade. Such Applications must be received **within 5 working days** of the due date of an assignment and, if approved, will be considered **at the end** of the course. *Please be aware that if you apply for an Aegrotat or Special Consideration, and your grade for an assignment is changed as a result, then your final grade for the course will denoted as an "AEG" grade on your university transcript.*

The only exception to this policy is if a significant number of students feel that a request for a **whole class extension** is justified. In order to receive a whole class extension for an assignment the **Class Rep** must contact either the course coordinator/examiner or the Senior Tutor in writing at least one week prior to the assignment deadline.

If you submit a project after the submission deadline, it is Waterways Centre policy that:

- 10% of the assignment's value will be deducted from your mark, for each day the assignment is late
- Assignments will not be accepted for marking more than one week after the due date.

If you are in any doubt, please contact the senior tutor as soon as any issue arises.

Special Consideration/Aegrotat application information and forms for UC and for LU can be found via the following links:
UC: http://www.canterbury.ac.nz/study/special-consideration/how-to-apply/
LU: http://learn.lincoln.ac.nz/mod/page/view.php?id=8588 (use your OWN login and see link at bottom right of LEARN page, under "Policies")

Academic integrity

The Waterways Centre adheres to both the University of Canterbury and Lincoln University policies on academic integrity, and does not tolerate dishonest practice. There are many forms of dishonesty in academic practice; some are intentional but some occur unintentionally through lack of knowledge and understanding. This mainly occurs around

ghostwriting and plagiarism, which can be avoided by rewording and reinterpreting your source, and attributing the information via referencing. If you have questions, please talk to the tutor before handing your work in. The Waterways Centre does use tools such as "Turnitin" to detect plagiarism.

Field trip attendance

It is a **mandatory** requirement that you attend the field trip as part of your participation in this course, unless you have discussed this with the tutor or course coordinator/examiner well in advance of the field trip and have a legitimate reason for not attending.

On mandatory components

All assignments and exams are mandatory, except for those students who undertake formal Special Consideration or Aegrotat procedures or obtain a prior exemption from the examiner. A satisfactory performance is expected in both the internal assessment **and** the exam, to pass this course.

On cell phones and laptops

Cell phones must be switched off during class. Laptops can be used in class only for the purpose of taking notes, and must be as unobtrusive as possible.

Student Support

The Library, Teaching & Learning Centre at Lincoln University and the Academic Skills Centre at the University of Canterbury offer **free** programmes and resources that can help you to succeed in your studies. These Centres provide workshops, individual appointments and resources for students who would like to further develop their academic writing, study and mathematics/statistics or English Language skills.

To find out more, log onto the Lincoln University Library, Teaching and Learning website at https://ltl.lincoln.ac.nz/advice/study-skills/book-a-workshop-or-appointment/ or the Academic Skills Centre at the University of Canterbury: http://www.lps.canterbury.ac.nz/lsc/

In addition to academic support, both institutions and their student associations offer medical, psychological, cultural, budgeting and time management support for those who seek it.