

Water Matters

The Annual Report of the Waterways Centre for Freshwater Management – 2018

Te Waihora/Lake Ellesmere, January 2019. Credit: Luke Jeffrey

Waterways Postgraduate Conference 2018



Attendees reviewing some of the student posters

The annual Waterways Postgraduate Student Conference was hosted by Lincoln University, on November 20th, and was again a resounding success. There were over 150 attendees from outside the universities, representing all aspects of freshwater management and freshwater interests. The research topics presented ranged widely, from identifying land owner's attitudes to kaitiakitanga, to the uptake of water sensitive urban design, to boosting biological recovery and water governance in Vietnam.

This year the students presenting had a new challenge, as members of the WCFM Advisory Board were including in the judging panels. One of the judges, Scott Pearson (Fish & Game New Zealand) noted he was "... really impressed with the calibre and enthusiasm of the student speakers – both in their presentation skills and research. It is gratifying to see the Waterways Centre preparing students so well for their future careers."

Our winners on the day were; Christopher Meijer (MSc, Biology) for best oral presentation about

Canterbury mudfish, with Channell Thoms (PhD, Biology) and Helena Ruffell (MSc, Chemistry) in second and third place, for their presentations on Kākahi (freshwater mussels) and microplastics in waste water, respectively. Poster prize winners were Will Keay (MSc, Geography) for his poster on using community-based initiatives to improve freshwater ecosystem health and Forrest Bilek (PhD, Engineering) for his poster on stormwater treatment devices. This year the Rivers Group awarded two prizes for best oral presentations pertaining to rivers; to Chris Meijer (as above), and to Corinne Bataille (PhD, Management), who presented on landowners' attitudes to kaitiakitanga. The Water NZ People's Choice award in 2018 went to Channell Thoms.

Our heartfelt thanks to all of our sponsors for this conference, who collectively provided a record level of sponsorship for this year. Surplus funds not spent on the postgraduate symposium itself, were deposited into the Waterways Contestable Fund to support students with their research in 2019, with sponsors permission of course!



Irene Setiwan, (B AgSC (Hon)) presenting on assessing seawater intrusion associated with sea level rise in Christchurch



Acting Vice Chancellor, Lincoln University, Prof. James McWha, opening the 2018 symposium.

Director's Review 2018

2018 has been a challenging year for the Waterways Centre, with structural changes at both of our host universities creating an atmosphere of uncertainty and deferred decision-making.

The shifting relationships between the two universities, and the College of Science's decision to merge the Waterways Centre at UC into a Joint

School with Geology and Geography in 2019, have certainly tested our ability to stay afloat in choppy waters (so to speak). However, the strong mandate we were given in 2009 when the Centre was launched, to help improve freshwater management in this country through teaching and research, remains the yardstick against which we measure our success. Events such as the popular Waterways Postgraduate Conference, the graduation ceremonies at both universities, and the various minor achievements celebrated by our staff and students each year confirms to

me that we are indeed achieving what we set out to do. While we anticipate that 2019 will bring further change, it also brings a milestone; the Waterways Centre will be 10 years old! In 10 years we have grown from a glimmer of an idea, to one and a half staff in a small windowless room, to the 8 full and part-time staff with offices and laboratories on two campuses, that makes up the Centre today - delivering a full postgraduate teaching programme in water resource management. I trust many of you will celebrate *this* achievement with us next year.

I hope you enjoy looking through our 2018 annual report. It is intended to highlight our accomplishments and provide you with an insight into the Centre's operations and ongoing development. If you wish to follow up on these stories, please see our website for further information, publications, reports and other research and teaching news, or contact the Centre directly. We



are more than happy to add interested parties to our contacts list!

Jenny Webster-Brown,
Director

Teaching news

In addition to the four routinely offered postgraduate courses (*Advanced Water Resources, Water Quality and Quantity Assessment, Water Policy and Planning, and Research and Communication Methods*), in 2018 a special WATR topic in Integrated Data to Support Water Modelling was offered to all interested postgraduate students.

This was taught by visiting Erskine scholar Prof. David Maidment, a former LU and UC engineering graduate, now based at the University of Texas. He specialises in water use forecasting and statistical techniques in hydrology and water resources planning. David spent 3 months with the Waterways Centre in early 2018, and during this time he taught this special topic on the use of large datasets and GIS to support the visualisation, classification and modelling of water systems to better inform water management. He also gave a public lecture on the role of GIS-supported hydrological mapping in predicting the effects of Hurricane Harvey, and ran a 2 day workshop for national and regional government staff engaged in data management, looking at appropriate platforms for managing and using water data to support national level environmental outcomes.

The Waterways Centre was awarded a Blended Learning Grant at Lincoln University, which was used to redevelop the undergraduate papers (WATR 201 and 301) using an innovative mix of online and face-to-face learning experiences.

Lecture content is now delivered online through short videos with clear guidance on learning aims and outcomes. Face-to-face learning is interactive during field trips and tutorials. The grant also enabled Julie Clarke and Dr Ed Challies to attend the Ako Aotearoa 'Talking Teaching' Conference in late 2018.

Research

Development of the Priority Research Themes (PRTs) for the Centre took a major leap forward in 2018, with the formulation of strategies for each of the themes, and the creation of a research webpage thanks to Research Project Manager, Katie Nimmo. This allows interested parties to quickly identify areas of research for the Centre and its members.¹

Research publications and other outputs from all of the Centre's membership have been compiled into an annual bibliography for 2018.² The research outputs are sorted according to the PRT they relate to (there may be more than one). Masters and PhD theses are now systematically profiled on both UC and LU Research Repositories under a Waterways Centre community collection page, significantly improving their discoverability

¹ http://www.waterways.ac.nz/Research/Research_priorities.shtml

² http://www.waterways.ac.nz/research/research_outputs.shtml

by the broader community.³ Also on the website, there is a new map which shows the global reach of our student research – it is very gratifying to see pins all over the world!⁴

Research Snippet: Fire water!

Research on the effects of the Port Hills fire on stream water quality has been underway since the devastating fires in early 2017. Monthly or bimonthly monitoring through 2017 and 2018 has shown increased nitrate concentrations in the ephemeral hill streams as nutrients are released from burnt organic material. Increases in the concentrations of some trace elements indicate they are also being released from the ash. These streams flow into the Ōpāwaho-Heathcote River, and the downstream implications of the wildfire are also being considered.



John Revell, Waterways laboratory manager at LU, sampling Cashmere Stream after the Port Hills fires.

³ UC; <https://ir.canterbury.ac.nz/handle/10092/13501>, LU <https://researcharchive.lincoln.ac.nz/handle/10182/10379>

⁴ http://www.waterways.ac.nz/research/Student_research.shtml

Masters Thesis Students

In 2018, 11 students completed their Master of WRM (a 2 year degree), and a further 9 completed their Postgraduate Diploma in WRM. We have profiled a few of our active and completed Masters research students below.



Nekelia Gregoire, an MFAT New Zealand Scholar at Lincoln University, is from the Commonwealth of Dominica and

completed her WRM Masters thesis early in 2018. Supervised by Dr. Frances Charters and Prof. Tom Cochrane, she investigated the use of limestone, zeolite and mussel shell as filter materials for the removal of dissolved Zn and Cu from roof-runoff. The results will inform the design of an "at source" stormwater filtration treatment

system that can be installed directly into downpipes of buildings. Nekelia is now a Project Manager for a Soil Fertility and Mapping Project, for the Ministry of Agriculture, Food and Fisheries for the Commonwealth of Dominica. Her intention is to pursue PhD research that would encompass the wider water-food-energy-climate-ecosystem nexus.



Nicole Calder-Steel began her part-time Masters thesis research in 2017, and plans to complete her research in mid-2019. She also works for Environment Canterbury in their

groundwater team as a hydrogeologist. Her thesis research investigates the history of targeted stream augmentation in the Eiffelton Irrigation Scheme, and how this has affected the hydrology and water quality of the receiving water systems. She is also undertaking a survey of how land managers view the augmentation approach, and its benefits or drawbacks. Her research is supervised by Prof. Jenny Webster-Brown, Dr Adrian Meredith (ECan) and Dr Ed Challies.



Khiem Nguyen is an MFAT scholar from Vietnam, studying towards a Masters in Water Resource Management at

Canterbury University. He is exploring current water uses and

water resource management challenges in the Dong Thap Muoi sub-region (the Plain of Reeds) in the Vietnamese Mekong Delta. His thesis research identifies factors constraining integrated water resource management in this cross-border wetland ecoregion, and makes recommendations for policy makers and practitioners that should inform greater inter-provincial collaboration and cross-border cooperation in water management in the area.

Khiem's fieldwork, carried out in mid-2018, involved focus group discussions with water users, and key informant interviews with experts and government officials in Dong Thap Muoi. He is supervised by Dr. Ed Challies and Thanh Tung Phan, and is due to complete his studies in February 2019.

Scholarships Recipients

Two WRM Masters theses funded by external scholarships were completed in 2018. **Katie Coluccio** who investigated the surface/groundwater interactions of braided rivers was supported by the Advance Ashburton Community Foundation. Katie is now conducting research for a PhD, supervised by Dr. Leanne Morgan. ESR funded **Hazel Clemens'** thesis on virus transport through soil from on-site waste water treatment systems.



Katie Coluccio in the field

The 2018 Waterways Masters scholarship was awarded to **Kate McDonald** who is investigating at the 'effects of coastal tectonic uplift on the Kaikoura hazard-landscape'. She is supervised by Dr Deirdre Hart (Geography). A fees scholarship was also provided to **Allan Brent**, a Law Masters student who is exploring limitations of the Resource Management Act in addressing water quality. He is co-supervised by Dr Elizabeth Macpherson (Law) and Dr Ed Challies.

As usual, the Waterways Contestable fund was fully allocated across a number of students undertaking freshwater-related research, supporting activities ranging from conference attendance to field costs. Demand for this fund is always high.

Summer Scholarships Students

During the 2017/2018 summer break there were two summer scholarship students working with the Waterways Centre; **Ariana Painter**, who designed a water quality monitoring programme for the UC campus and rivers, working with Jenny Webster-Brown, and **Cavin Wei**, who investigated microplastics in the intertidal zone of the Avon-Heathcote estuary, working with Shane Orchard and Prof. Sally Gaw.

As the 2018/2019 summer students began in December, there were a record number of student projects getting underway, mainly on externally funded projects such as determining the spatial variation of groundwater macroinvertebrates, and exploring different dimensions of urban storm water management for the Christchurch City Council. There is also a LU-funded project to conduct oral history interviews about the Selwyn-Waikirikiriri river, which will help inform decisions made by the Selwyn-Waikirikiriri Working Group. Watch this space in next year's Annual Report for details of these projects.

Waterways Stakeholder Fund Update

The "Waterways Stakeholder Fund" was set up with the UC Foundation in 2017 as a way of providing better support for (particularly Masters) students at a time when they typically have limited financial resources. The Waterways Stakeholder Fund enables organisations to pay into the fund, and specify an area of research they seek to support, while also allowing flexibility in the funding amount and time to taken to find an appropriate student to undertake the research. Discussions are underway with a range of organisations regarding contributing to the fund. If you are interested in making a contribution to support student research in freshwater systems, please contact the Waterways Centre.



Students from WATR 203 at Cass Field Station. Photo: Helen Warburton

PhD student profiles

A record number of three WRM PhD students completed their theses in 2018!



Tara McAllister – WRM PhD Graduate, with baby Mason

Dr Tara McAllister, who worked on factors driving toxic algal blooms, graduated in the December ceremony at UC with her son Mason (see new "staff" section) on board and thoroughly enjoying the ceremony. Tara is now working as a post-doctoral researcher on an iwi resource management research project with the University of Auckland. **Dr Phil Clunies-Ross** also finished his PhD on the characteristics of glacial suspended sediment and has since secured a role with Orbica, a

geospatial company. Late in 2018, **Dr Qian Hu** completed his PhD, and he is now applying for post-doctoral positions in New Zealand and in China.

For all that we farewelled a number of our familiar faces, we also welcomed new PhD students such as Carlos Rosado, profiled with some of our other PhDs below.

Marlese Fairgray's PhD is focussed on the rehabilitation of mining sites and the use of geochemical modelling programs to support mine site rehabilitation. This research investigates the fate of heavy metals and other chemicals as they enter waterways near the mine sites before remediation and after, and assesses whether their behaviour can be accurately modelled using geochemical models. Once completed, this research will be used to inform

future remediation projects on the expected outcome of rehabilitation works. Marlese has worked on mine sites at the top of New Zealand (Puhipuhi mine in Northland) in the Coromandel (Tui Mine) and on the West Coast of the South Island (Bellvue mine). Her research is supervised by Prof. Jenny Webster-Brown and Dr. James Pope (CRL Energy).



Marlese Fairgray sampling at Bellvue mine. Photo: Jenny Webster Brown



Carlos Rosado's PhD research was getting underway in 2018. Carlos plans to assess groundwater vulnerability

and resilience in the coastal zone of New Zealand. He aims to address the issues of anthropogenic and climate change impacts on coastal groundwater resources, with a focus on the Christchurch aquifers and how they might respond under a regime of rising sea levels. Carlos also works part time for Environment Canterbury, in their groundwater team. His supervisors are Dr Leanne Morgan as senior supervisor, and Dr Zeb Etheridge (ECAN) as co-supervisor.

Out there doing it...

An important part of the Waterways Centre's mandate is outreach and communication; disseminating knowledge about freshwater systems and their issues to the public and informing the debates on freshwater issues that take place outside of academia and conferences.

WCFM academic staff were busy raising the profile of water management issues in many different contexts this year; including 3 interviews on Radio New Zealand and TVNZ, serving on conference organising committees, four community presentations, and contributing as a subject expert for the Science Media website on regulating farm runoff and the 2018 National River Water Quality Trends report. Waterways

Technical publications and reports

Core staff of the Waterways Centre published seven journal articles and three technical reports in 2018, as well as presenting at various national and international conferences. WRM PhD student Shane Orchard published three journal articles.

Details of publications, theses and technical reports can be found on the Waterways website, and on staff member's research profiles on the university websites.

Centre core staff also participated in several sessions of the UC Science Camp, which targeted year ten students from all over New Zealand. The Centre hosted two key note speeches in 2018; one by David Maidment and Tim Davies about managing flooding; lessons from Hurricane Harvey and Christchurch. The other was a Darcy Lecture by Masaki Hayashi on the role of groundwater in sourcing the headwaters of the world.

WRM students were also very active with PhD candidate Shane Orchard blogging on resilient shorelines, distributing his research findings on whitebait recovery via DoC, contributing to a local mahinga kai exemplar project and advising councils on improving shoreline resilience and urban storm water partnerships. Masters student Rachel Teen was a guest speaker at the Avon Heathcote Estuary Ihutai Trust AGM, and presented to a primary school Year 5 class as part of a module on environmental issues. PhD candidate Marlese Fairgray is a board member for the Styx Living Laboratory Trust, while Masters student Vicki Southworth serves on the Canterbury Water Management Strategy Regional Committee. Vicki also built a demonstration raingarden during a Matariki event at Avebury House in Christchurch. Katie Coluccio's and Irene Setiawan's work was profiled in two provincial newspapers; the Ashburton Courier and Central Rural Life. Katie also presented to the Ashburton Zone Committee and the Graduate Women Canterbury Awards Night.



Vicky Southworth building a demonstration rain garden with volunteers at a Matariki event, Richmond, Christchurch. Photo: Katie Nimmo

Administration of the Waterways Centre

The Waterways Centre continues to function as a joint university research and teaching centre: a collaboration between the University of Canterbury and Lincoln University. The operations of the Centre at both universities is governed by a formal MoU and offices and laboratories exist at both the Lincoln and Christchurch Campuses. A 7 member external Advisory Board (with current representation from NIWA, Aqualinc, Ngai Tahu, Fish & Game, Our Land & Water Science Challenge and Environment Canterbury) has strategic oversight, while the day to day operations are the responsibility of a small team of core academic and general staff, guided by a consultative committee made up of 2 academic staff from each university. In 2018, the 18th Advisory Board meeting was held on March 15, and the Consultative Committee meeting on July 3rd 2018.

Staff News



Crile Doscher is a Senior Lecturer and has taught at Lincoln University for many years. He

has been an active Waterways Centre member since the Centre's inception in 2009. His expertise is in environmental engineering, GIS, hydrology and computer modelling, and he has considerable experience with the flume and physical modelling facility at Lincoln, which is part of the Waterways Centre. Crile joined the Waterways Centre core staff in August, and we are very glad to have him! He will be based mostly at Lincoln University where he has a number of postgraduate students under his supervision.



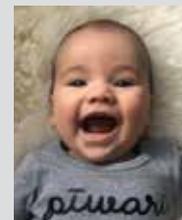
Dr. Susie Woods, who is based at the Cawthron Institute, was appointed as an Adjunct Senior lecturer early in

2018. Susie is a specialist in algal biology, and has worked previously with Waterways Centre staff on Canterbury rivers and Antarctic meltwater systems. She was one of Tara McAllister's PhD supervisors, and her expertise is greatly needed in Canterbury where toxic algal blooms are becoming increasingly frequent during summer in our rivers and lakes.



Marlese Fairgray (one of our PhD students) was appointed as a part-time lab manager at

Lincoln University, to cover the two days a week when the permanent lab manager, John Revell is either working at UC, or is otherwise unavailable. Marlese is a chemist, and has been able to contribute significantly to the analysis of water samples coming thorough the lab, as well as the safety of new students.



Waterways babies
Hard on the heels of Tara McAllister's 'intellectual baby' (PhD), came Mason,

her bonnie wee boy. He already has one graduation ceremony and a national freshwater society conference under his belt. We may need to create a new category of junior Waterways Centre membership.

The Waterways Centre for Freshwater Management is a teaching and research centre, jointly supported by the University of Canterbury and Lincoln University. Established in 2009, it aims to improve the knowledge-driven management of freshwater resources by offering a full complement of nationally accredited tertiary courses and actively supporting postgraduate research programmes.

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