

Master of WRM Thesis Topic Ideas

| | Priority Research Themes | Research Aim |
|---|--|--|
| 1 | Managing Better I: Technology & Infrastructure | To develop and assess innovative infrastructure, technologies and Best Management Practice to improve water use efficiency and reduce water contamination, while supporting economic growth in the industry sector. |
| 2 | Managing Better II: People and Water | To build a better understanding of the relationship between people and water, in order to underpin alternative, sustainable freshwater management approaches that meet community aspirations for the resource. |
| 3 | EoRE End-of-river environments | To develop best practice for the protection of community – specified values in lower catchment environments, such as river mouths, coastal lakes and estuaries. Encompasses many Te Waihora /Lake Ellesmere research initiatives. |
| 4 | Blue-Green Urban Waters | To better manage water use, discharge and re-use in an urban environment, assessing infrastructure and processes that enhance the value of urban water, promote efficient use (e.g., recycling) and protect natural waterways. |
| 5 | Functional Waterways Networks | To enhance aquatic ecosystem services and biodiversity in water networks, from the mountains to the sea (ki uta ki tai); assessing the ability of ecosystems to adapt to change (in climate, high/low water flow, quality and species invasions), and how network systems can be optimized to improve ecosystem resilience in the face of these changes. |
| 6 | Sustainable Nutrients | To minimize nutrient movement, within economic and environmental constraints, from developed land into water, and to reduce the effects of excessive nutrients in water bodies. |
| 7 | Sustainable Groundwaters | To improve confidence in the assessment of the effects of groundwater use, utilizing interdisciplinary aspects of groundwater research, applied knowledge and existing monitoring sites and data. |

Notes

1. All of the Waterways Centre's research falls within these **Priority Research Themes**. Thesis topics that have been suggested by potential supervisors are grouped under these themes in this document, together with the type of skills that would be needed to undertake this topic, and potential supervisors.
2. Where an **external interest** in the topic is cited, this simply indicates an expressed interest which could translate into supervision, support in-kind or scholarship contributions, or may not. Where a scholarship arrangement has been discussed and is likely, this is denoted by (\$). This cannot be confirmed until an appropriate thesis student is available and the specific research conditions are negotiated.
3. The skill sets indicated are a very general guide and should not be taken as exhaustive or definitive. Further clarification can be sought from the proposed supervisor(s) on the skills that would be required. The key is;

| | |
|----------|--|
| PG or HG | Physical Geography or Human Geography |
| G | Geology |
| C | Chemistry |
| B | Biology, particularly ecology |
| ERM | Environmental and/or Resource Management |
| E | Engineering |
| Ec | Economics |
| M | Māori studies |
| Ag | Agricultural science or management |
| L | Landscape Architecture |

Multiple skill sets, where indicated, usually imply that the topic can be slanted to suit particular skills.

4. If you see a topic here that interests you, make a time to talk to the proposed supervisor about it. Find out more about what the research entails. Ask about the skills that will be required, and be prepared to talk about what your skills, interests and career plans are. The topic may evolve and change during your discussion - that is fine as long as the final topic suits both you and your supervisor.
5. Supervisors can only take on so many students for thesis supervision – if they are already “full” they may not be able to help you with a topic. Contacting them as early as possible helps avoid this situation. If it happens, don't take it personally ... It just means you need to continue trying to find a suitable topic.

PRT 1: Managing Better I: Technology and Infrastructure

| Thesis topic | Skill set | Supervisors | External interest? |
|--|-----------|-----------------------------------|---------------------|
| Low impact urban design (e.g. green roof) options for minimizing stormwater flows and contaminants in rebuilt Christchurch | E, C | Tom Cochrane | CCC/CWMS Zone Comm. |
| Developing water efficiency standards for exported goods (as for energy efficiency ratings) | HG, Ec | John Reid (NTRC) | |
| Stream augmentation: An option for returning "swimmability" to Coes Ford, Selwyn River? | E, PG | Brett Painter/Jenny Webster-Brown | ECan |
| Effluent from WSUD systems (e.g. rain gardens) and its potential toxicity. | E, C | Tom Cochrane | ECan/CCC |
| Fish screen design for irrigation races | E | Tonny DeVries (CNRE) | Irrigation NZ |
| Improved remote sensing of water quality and riparian development | E, PG | Peyman Zawar-reza | ECan |
| Spatio-temporal estimates of soil drainage using soil moisture networks and hydrological/agricultural models | E, PG, Ag | Markus Pahlow | NIWA |
| Hydrological process knowledge to support flood estimation in small catchments | E, PG | Markus Pahlow | NIWA |
| Hierarchical calibration of hydrological models | E, PG | Markus Pahlow | NIWA |

PRT 2: Managing Better II: People and Water

Note there are many other potential social science/resource management research topics under this PRT, relating to other catchments and other countries, and to iwi resource management issues. Please look up the research profiles of Ed Challies, Kelly Dombroski (UC), Hirini Matunga (LU) and the Ngāi Tahu Research Centre (UC) for further information on potential research areas.

| Thesis topic | Skill set | Supervisors | External Interest? |
|---|----------------|--------------------------------|--------------------|
| Valuing (economically) the aesthetics, recreational and ecosystem services of Te Waihora and its tributaries/drains | B, HG, ERM, Ec | Adrienne Lomax & Hamish Rennie | WET |
| The rise and demise of the commercial fishing community and industry at Te Waihora | ERM, HG, Ec | Hamish Rennie | |
| Understanding (and modelling?) bird shooter behaviour and choice of bird hide site at Te Waihora | B, HG, ERM | Hamish Rennie | |
| Selwyn Huts, Greenpark Huts and Fisherman's point community relationships with Te Waihora/Lake Ellesmere and the Selwyn River | HG, ERM | Hamish Rennie | |
| Foodways and cultural customs of the Te Waihora/Lake Ellesmere Pakeha | HG, ERM | Hamish Rennie | |
| Land ownership models that encourage sustainability behaviours. | M, ERM | TBC | |
| Cost/benefit analysis of improved water quality (considering wetland, mahinga kai/riparian planting etc). | Ec, B, ERM, M | TBC | |
| Public attitudes towards/relation to urban waterways | HG, ERM | Ed Challies | CCC |

| | | | |
|--|------------|-------------|---------------------------|
| Governance of urban waterways and storm water in Christchurch | HG, ERM | Ed Challies | CCC |
| Comparative analysis of collaborative water resource management in NZ and beyond | HG, ERM | Ed Challies | |
| Analysis of public consultation and stakeholder engagement in irrigation scheme development in NZ and beyond | HG, ERM | Ed Challies | |
| Social dimensions of groundwater governance | HG, ERM | Ed Challies | |
| Implications for Māori of collaborative water governance arrangements or co-management agreements | M, HG, ERM | Ed Challies | Ngāi Tahu Research Centre |
| Greening flood risk management | HG, ERM | Ed Challies | |
| Carbon co-benefits of riparian planting | HG, ERM | Ed Challies | |
| Collaborative and participatory approaches in flood risk management | HG, ERM | Ed Challies | |
| Water resource management in Pacific Island states | HG, ERM | Ed Challies | |
| Transfer of water resource management policies/paradigms through the NZ Aid Programme | HG, ERM | Ed Challies | |
| Values, perceptions and management of the University of Canterbury campus streams | HG, ERM | Ed Challies | |
| Case studies of grassroots/community-driven local water resource management or restoration projects | HG, ERM | Ed Challies | |
| The Waimea Inlet Management Strategy and Action Plan / Waimea Inlet governance (Tasman District) | HG, ERM | Ed Challies | Waimea Inlet Forum |

PRT 3: EoRE: End of River Environments

NB. Many of these relate to Te Waihora/Lake Ellesmere and its catchment, where there is external interest from ECan WET, Ngai Tahu, ECan, DoC, MPI and others.

| Thesis topic | Skill set | Supervisors | External Interest? |
|--|-----------|------------------------------|--------------------|
| A nitrogen budget for Lake Forsyth/ Wairewa | C,B | Jenny W-B & Jon Harding | ECan |
| What should be the baseline target for Te Waihora restoration? | ERM, B | Hamish R, Jenny W-B | WET |
| Diurnal extremes in EColi, nutrients and other water quality parameters in Te Waihora and Wairewa. | C, B | Jenny W-Brown & Tim Clough | |
| Gas fluxes and dissolved gases (e.g, N ₂ O) in Te Waihora. | C | Tim Clough | |
| Coastal shore erosion (accretion rates and determinant factors) in Te Waihora | PG | Hamish Rennie | |
| Vehicle damage to ecology on margins of Te Waihora | B | Nick Dickinson , Robin Smith | DoC |
| Soil salinity state and trend around Te Waihora | Ag, C, G | Adrienne Lomax/Jenny W-B | WET |
| Modelling potential impacts of climate change on Te Waihora | PG | Peyman Zawar-reza | |
| The relationship between macrophytes and water quality in lowland streams | B | Jon Harding | |
| Amberley Beach Lagoon – is salinity change causing flipping? | B | Angus MacIntosh | |
| Hydrodynamics of Te Waihora and relationship to opening regimes, and catchment dynamics. | E, PG | Tom Cochrane | |
| Why have freshwater mussels disappeared from Te Waihora? | B | Islay Marsden | |
| A field investigation of groundwater seepage entering Te Waihora through the lake bed | G, E | Leanne Morgan | |
| A hydrogeological characterisation of Te Waihora's Kaitorete Barrier. | G, E | Leanne Morgan | |
| A modelling study of groundwater dynamics in Te Waihora's Kaitorete Barrier. | G, E | Leanne Morgan | |

| | | | |
|--|----------------------|--|-------------------------|
| Lake Flies: Factors affecting abundance around Te Waihora. | B | Mike Bowie Jon Harding | |
| Distribution of invasive plants in Te Waihora | B | Nick Dickinson | |
| Te Waihora food webs: Role in support of swamp birds | B | Ken Hughey | |
| Ecosystem services assessment and value (e.g., of invertebrates) for Te Waihora | B, Ec, ERM | Ken Hughey Angus McIntosh | DOC (Philippe Gerbeaux) |
| Effects of Canadian Geese on water quality and Te Waihora ecology. | B, ERM | Nick Dickinson | |
| Emerging contaminants from current and changing farm practices in the Selwyn catchment. | C, Ag | Sally Gaw, Brett Robinson, Tim Clough. | |
| The role of storm events in adding nutrients to Te Waihora | PG, B, ERM | Jenny W-B | |
| Shoreline accretion rates in Canterbury , and effect of sediment delivery from rivers | PG, E | Crile Doscher, Deidre Hart | ECan, CCC |
| Te Waihora pH levels –should they be manipulated, what do they correlate to? | C, PG, ERM | Jenny W-B | |
| The effects of elevated E. coli on fish and other aquatic organisms (cf. the effects on humans) | B | Jon Harding or ext supervisor | CCC, ESR |
| Sustainable Fishery: Impact of commercial eel fishing on customary fishing, and impact of lake closure and seasons. | B, ERM | NIWA researchers? | |
| Concentration of pathogens present in mahinga kai from Te Waihora and potential health risk | B, C | TBC | Ngai Tahu |
| Priorities for on-farm nutrient limiting practices: Going beyond GMP to reduce nutrient losses | Ag, C, PG, ERM | TBC | |
| Interactions of turbidity, salinity and nutrients, and the effect on algal blooms. | C, PG, B | Brett Robinson | TRONT, ECan |
| Testing possible sediment amendments to reduce P release from lake sediments | C, PG, G, Ag | Jenny W-B, Brett Robinson | ECan, SDC |
| Lower Selwyn spring chemistry (incl. nutrient & isotopes) survey, to determine spatial and temporal variability and establish nutrient pathways. | C, Ag, G | Travis Horton? Jenny W-B | ECan |

PRT 4: Urban Waters

| Thesis topic | Skill set | Supervisors | External Interest? |
|--|-----------|-------------------------------|--------------------|
| GIS modelling of contaminant loading of urban streams in Christchurch | PG, E | Tom Cochrane & Ash O'Sullivan | |
| Trace metal inputs to the Akaroa Harbour | C | Sally Gaw | |
| Effects of Ruapuna Raceway use on local air and water quality | C | Jenny W-B & Sally Gaw | ECan |
| Modelling metal toxicity and removal mechanisms in urban stormwaters | C | Jenny W-B & Frances Charters | |
| Trace element concentrations in the sediments of Avon-Heathcote estuary, and their variation through time. | C, ES | Jenny W-B | |
| Assessment of municipal pesticide use on urban water quality | C | Jenny W-B | |

PRT 5: Functional water networks

| Thesis topic | Skill set | Supervisors | External Interest? |
|---|-------------|--|--|
| Changes in land cover/use and riparian planting, and relationship to water quality changes in the Styx River catchment. | PG, B | Chris Phillips, Jenny W-B. | Styx Living Laboratory |
| The effects of culverts on freshwater fish, in particular crayfish | B | Angus McIntosh, Helen Warburton? | Boffa Miskell (\$) |
| Effect of wildfires on water quality: Port Hills stream monitoring and assessment | C, B, PG | Jenny W-B, Greg Burrell, Daniel Collins. | NIWA, CCC |
| Zinc in rural runoff and groundwater systems in Canterbury | C, G | Sally Gaw & Jenny W-B | |
| Testing new national flood standards through their application to Christchurch | PG, G, E | Terry Day & Tim Davies | |
| The state of stock water races and their future in Selwyn District – causes, effects, consequences and implications | PG, C, B | Hamish Rennie & Jenny W-B. | |
| 3 Ashburton lakes projects, on factors driving trophic status of the Ashburton lakes, long fin eel recruitment and sediment accumulation (4 topics) | B, C, PG, G | See Jenny W-B for more information | DOC (\$) |
| The composition of the “first flush” water flow through the seasonally dry beds of Canterbury rivers. | C | Jenny W-B | |
| Lower Waitaki Catchment monitoring – assessing the effect of more sustainable irrigation on water and nutrient cycling. | C, PG, G | Leanne Morgan, Jenny W-B | Waitaki Irrigators Collective Ltd (\$) |

PRT 6: Sustainable Nutrients

| Thesis topic | Skill set | Supervisors | External Interest? |
|--|---------------|--------------------------------------|----------------------|
| Mitigation of N-leaching from rural land | B, C, Ag ,PG | Keith Cameron & Hong Di | |
| Nitrate removal from groundwater ...what are our options? | C, E | Jenny W-B and CNRE | |
| Baseline nitrate concentrations in Canterbury water – what should we be aiming for? | B, C, ERM | Jenny W-B and Ian Hawes | |
| Quantification of the effects of irrigation on nutrient cycling in an agricultural landscape | C, Ec, Ag, PG | John Hunt | Landcare (\$) |
| Lakes 380 project: establishing the trophic history of lakes of the Canterbury region | C, B | Jenny W-B and Sean Waters (Cawthron) | Lakes 380 initiative |

PRT 7: Sustainable Groundwaters

| Thesis topic | Skill set | Supervisors | External Interest |
|--|---------------|-------------------------------|-------------------|
| Quantifying the Waimakariri River's contribution to the Chch groundwater aquifer | G, C, E | Travis Horton & Leanne Morgan | CWMS |
| Quantifying groundwater recharge in Canterbury aquifers at the regional scale using unsaturated zone modelling | E, Ag, G, C | Leanne Morgan & MS Srinivasa | NIWA |
| Sand-tank and/or numerical modelling to assess various aspects of seawater intrusion vulnerability in the Canterbury coastal aquifers | E, PG, G, ERM | Leanne Morgan | |
| Exploring regional-scale groundwater flow patterns in Canterbury aquifers from a Tothian flow perspective using analytic and/or numerical groundwater modelling. | E, PG, G, ERM | Leanne Morgan | |
| Should we trust water divining for making management decisions? | E, PG, G, ERM | Leanne Morgan | |
| Using the nitrate-phosphate-iron relationship to estimate groundwater redox conditions | C, G, PG | Jenny W-B | |
| Spatial Interpolation of groundwater quality parameters using copulas | PG, G, E | Markus Pahlow | |
| The effects of Rolleston Sewage Treatment plant on groundwater quality. | C, G, PG | Jenny W-B | |
| Exploring the implications to groundwater flow and contaminant transport of different – yet equally plausible – degrees of heterogeneity in Canterbury aquifers | E, PG, G, ERM | Leanne Morgan | Lincoln Agritech |
| Tracking the leachate plume at the now closed Burwood landfill. | G, C, E | Hugh Thorpe | |
| Groundwater quality in the vicinity of the old Waimairi County "dump" | G, C, E | Hugh Thorpe | |