# water: ABOVE BELOVV and beyond.

Challenges facing civilisation

# **Conference Handbook**



NZ Hydrological Society Annual Conference, Rotorua 3-6 December 2019



Thank you to all our sponsors. This conference is made possible only through the commitment of many individuals and groups.



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# NEW ZEALAND'S EXPERTS ON CLIMATE FRESHWATER & OCEAN SCIENCE Guiding our future

## Conference Committee Welcome

# The NZ Hydrological Society welcome you to their annual conference to be held in the exciting geothermal, tourist and outdoor sports venue Rotorua City.

The environment surrounding this venue reminds us of the varying components of the hydrological cycle in a large number of ways, including both groundwater and geothermal, surface flood risk potentials, summer low flows and water quality issues in both the streams and large lakes. Indeed it is rare to find all these phenomenon in one location and the conference theme "Water: Above, below and beyond" is very pertinent to the challenges faced in this city and many other parts of NZ.

All your contributions either by way of poster or oral papers, and the networking opportunities are particularly pivotal to producing hydrological solutions; more so as we face and plan for the impacts of climate change. This presents a valuable responsibility for our society. The conference committee trusts you will find the programme challenging and informative.

Ngā mihi nui

Peter Blackwood, *Conference Committee Chair* 

#### **Conference Committee Members**

- Peter Blackwood (BOP Regional Council) Chair
- Helen Creagh (BOP Regional Council)
- Magali Moreau (GNS Science)
- Wayne McGrath (NIWA)
- Linh Hoang (NIWA)
- Ingrid Pak (BOP Regional Council)
- Mitch Green (BOP Regional Council)
- Tracy Young (On-Cue Conferences)



# Of all the treasures of the earth, none is more precious than water.

O ngā taonga katoa o te whenua, ko te wai te mea tino ohooho o ngā mea katoa.

www.boprc.govt.nz/freshwater



## NZHS President's Welcome

Welcome to Rotorua in the beautiful Bay of Plenty Region. It is a pleasure this year to be able to host our conference in Rotorua, this after a break of 12 years. There have been two New Zealand Hydrological Society (NZHS) conferences held in Rotorua previously, one in 1976 and the other in 2007.

The conference theme this year is: **"Water, above, below and beyond – Challenges facing civilisation"**. Water is a vital resource and is fundamental to human survival. It is intricately liked to every aspect of the planets ecosystem and the impacts of its use are multidimensional and directly affects our civilisation past, present and future. As professionals with a diverse interest in the water resource field it is our privilege and duty to contribute in the research and holistic management of this precious resource for our community.

I would like to compliment the Conference Committee for putting together an excellent programme. The range of the papers is diverse and this combined with the quality highlights the strength, depth and scope of the work in the hydrological sciences. I am personally looking forward to hearing the many great papers on offer and look forward to the ensuing stimulating discussions. The NZHS annual conference provides a unique opportunity for hydrological colleagues to be able to meet and share their knowledge, experience and research

I hope your stay in Rotorua will be enjoyable and memorable and you take the opportunity to see some of the many attractions both in Rotorua and the beautiful Bay of Plenty Region. Rotorua itself is well known for its geothermal activity sourced to the Rotorua Caldera and has many geysers, hot springs and hot mud pools!

Thank you to all the sponsors for the ongoing support of our Society's conference and the Society itself. The organising Committee supported by the symposium organiser's On-Cue have put in some hard work since early 2019 to make this event possible, a big thank you for all your efforts. I wish everyone a great conference, and am looking forward to the opportunity to meet as many of you as possible

Joseph Thomas President NZHS

## **General Information**



#### **Registration Desk**

If you require any assistance throughout the conference please see the conference organisers at the Registration Desk in the main foyer of the Energy Events Centre.

#### Internet

Network: Energy Events Centre User Name: NZHS Password: 2019

#### Setup

- Double click the wireless icon in your status tray
- Click View Wireless Networks
- Highlight Energy Events Centre
- Click Connect

#### **Once Connected to Wireless**

- Open up your browser ie Windows Explorer, Firefox etc
- An Events & Venues log in page will open
- Enter your guest user name (case sensitive)
- Enter your password (case sensitive)
- Click log in

#### Please Note

- Guest user name and password is cap sensitive
- 3 failed attempts and you are locked out for 5 minutes
- There is a time out period if it is not used, you will need to re open your browser and log back in



#### Name Tags

Delegates are requested to wear their name tags to all sessions and social functions. Committee members will have green lanyards and student helpers will have red lanyards. Please ask the committee or student helpers for directions or local knowledge if required.

On the back of your name tag – the coloured dots indicate what you are registered to attend.



#### **Cell Phones**

Please ensure that cell phones are turned off, or on silent, during all presentations.



#### Parking

Free parking is available all day in the Energy Events Centre car park.

#### No Smoking

There is no smoking allowed inside the venue.

#### 56)

#### **Conference Contact Number**

For assistance during the conference, please call Tracy Young from On-Cue Conferences on 021 164 7820



#### **Public Transport**

Eleven bus routes cover the city with the outermost stops at Ngongotaha to the northwest, Hemo Road to the south, and the airport out to the east.

The buses run Monday to Friday every half hour from 6.45am, ending 6.50pm at the latest. Saturday, Sunday and Public Holidays services run hourly. Times differ depending on the route.

Visit www.baybus.co.nz/rotorua to see a full list of bus routes and timetables.

#### 🚓 Taxis

#### Rotorua Blue Bubble Taxis

Phone: 0800 228 294 (free phone) or 07 348 1111

The Rotorua airport is approximately 15 minutes' drive from the conference venue.

#### Dietaries

If you have advised us of your special dietary requirements, these have been forwarded to the caterers and will be available on a separate table individually marked.

If you have any dietary requirements that we are not aware of, please see the Conference Organisers at the Registration Desk on arrival at the conference.

Loading Presentations

Please take your presentation on a USB stick to the Dynamics AV desk in the foyer – this should be done at the start of the day that you are scheduled to present on.



#### **Poster Presentations**

Poster session will be on Wed 4<sup>th</sup> Dec after lunch, 12–2pm. Posters are located in the main foyer area and will be on display all week. Poster numbers can be found on page 22 as well as the conference website.

Please put your poster up on arrival. Posters should remain up all week and be removed at lunchtime Thursday.

## **General Information**



#### **Conference** App

The conference committee are excited to advise that you can access all of your conference information, including presenter abstracts on the conference app.

Your login information was sent to you last week, if you haven't downloaded the app yet, just follow these instructions:

- Go to the app/play store and search for eventsair, download the app
- Once downloaded, enter the event code nzhs2019
- Login: your email address (used for conference registration)
- PIN: check the back of your name tag for your PIN

You are now set up to see the latest conference programme, receive alerts and set up your own personalised agenda for the week. You will also be able to earn points and go in the draw to win the conference prize, to be awarded at the conference closing ceremony, Thursday 5 Dec at 3pm. The winner must be present to collect the prize.

#### **Medical Information**



#### New Zealand Emergency Services

Ambulance, Fire and Police. Dial 111 from any public, private telephone or mobile phone in New Zealand.



#### Rotorua Police

Phone: 07 349 9554 from within Rotorua. The police station is located at: 1190-1214 Fenton Street, Rotorua.



#### Rotorua Hospital

Phone: 07 348 1199 The Lakes District Hospital: Arawa St, Rotorua 3010.

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#### Rotorua Doctors & Medical Centres

Eruera Medical Centre: 1325A Eruera St, Rotorua 3010 Phone: 07 347 8418

Central Health: 1181 Amohia St, Rotorua 3010 Phone: 07 347 0000

Kuirau Surgical Services: 1239 Ranolf St, Rotorua 3010 Phone: 07 348 8049



#### Chemist/Pharmacy

Lakes Care Pharmacy: 1155 Tutanekai St, Rotorua 3010 Phone: 07 348 4385 Hours: 8.30am – 9.30pm every day

#### **Session Chairs**

Please can all session chairs be in their room at least 5 minutes prior to the start of the session. Please familiarise yourself with the AV equipment. If you have any questions, locate the student helper or AV technician, who will be close by. It is very important that presentations do not run over their allocated time so please ensure presenters start and finish on time.

#### Exhibitors

88

Don't forget to visit and chat with the exhibitors, located in the main foyer. Check the app for more details about our exhibitors and how you can be in to win the conference prize!

## Rotorua City Map





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Welcome Function Blue Baths, Queens Drive, Government Gardens, Rotorua

#### **Student Function**

Abracadabra Cafe & Bar, 1263 Amohia Street, Rotorua







#### **Conference Dinner**

Skyline Rotorua, 178 Fairy Springs Road, Fairy Springs, Rotorua



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#### Conference Dinner Bus Stops See page 10 for more details



## **Conference Venue Floor Plans**

#### **Rotorua Energy Events Centre Floor Plan**



#### Main Foyer/Exhibitor Area Floor Plan



#### **EMERGENCY INFORMATION**

The energy events centre has an automatic fire safety evacuation system, with activation you will hear through our sound system. On activation you will be requested to evacuate the building immediately.

Warn others in the immediate area as you evacuate.

Proceed immediately to your allocated assembly point via the nearest exit your assembly point is – "In front of the energy events centre in the car park."

Follow all instructions given by the designated energy events centre fire warden/duty manager- who will be identified by an orange vest and green helmet.

Always walk quickly and calmly to the place of safety.

In the event of an earthquake drop, cover, hold. When the shaking stops exit to the car park.

## **Social Functions**

#### **Welcome Function**

WHEN: Tuesday 3 December, 5:30-7:30pm

#### WHERE: The Blue Baths, Queens Drive, Government Gardens

This function gives you the opportunity to re-connect with colleagues from around NZ and make new connections with those who have recently become part of the Hydrological Community.





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## **Social Functions**

#### **ENVCO Student Function**



WHEN: Wednesday 4 December, 7:00pm

#### WHERE: Abracadabra Cafe & Bar, 1263 Amoha Street

This informal function gives students the opportunity to network in a relaxed environment. Bar snacks and a complimentary drink will be provided, thanks to Envco Global, the function sponsor.





Quality cases, comprehensive coverage of environmental issues



#### Water Management, Science and Technology

SECTION EDITOR: Ronlyn Duncan Manaaki Whenua Landcare Research

# cse.ucpress.edu

## **Conference Dinner**

#### **Conference Dinner**

WHEN: Thursday 5 December — Buses depart from 6pm (see below) WHERE: Skyline Gondola, 178 Fairy Springs Road (Dinner from 6:30pm) TICKETS: \$120 + GST

#### **THEME: Vegas**

Enjoy a unique dining experience at one of Rotorua's most popular attractions set atop Mt Ngongotaha. Tickets include transport to the venue, a gondola ride to the top, buffet dinner, drinks and live entertainment – not to mention stunning views across Lake Rotorua.

Dressing to the theme is optional but the Vegas theme gives you the chance to go all out and dress to impress. Sequins and cufflinks recommended.







#### **Conference Dinner Buses**

#### **Bus One**

- 6:00pm Rydges 272 Fenton St
- 6:10pm Copthorne 330 Fenton St
- 6:15pm Jet Park Motel 237 Fenton St
- 6:20pm pick up any extras at Millennium
- 6:30pm arrive Skyline

#### Bus Two & Three

- 6:00pm Millennium 1272 Hinemaru St
- 6:10pm Novotel (if you are staying at the
- Ibis please use this pick up) Tutanekai St6:30 arrive at Skyline

Return at 10:30pm and 12 midnight from Skyline to drop off points.



## Field Trips

NZHS Field Trips are held on Friday 6th December departing the Energy Events Centre at 9am

#### **Eastern Bay of Plenty Field Trip**

#### AM:

- Depart for Ngongotaha area
- Flooded April 2018
- Causes of flooding
- Flow paths
- Areas seriously flooded
- Remedial possibilities

#### Morning tea & presentation:

- · Located at Okere Gates, Lake Rotoiti
- Presentation on lakes level management and water quality.

#### 12-12:30 PM:

• Lunch at Pikowai Beach – an idyllic location.

#### PM:

- · Located at Matata
- 2005 debris flow through a housing area
- Edgecumbe Flooding 2017
- Flood event
- Remedial works
- Lessons learnt

#### **Return:**

Approx. 3:30pm to Rotorua via the airport









NZHS Field Trips are held on Friday 6th December departing the Energy Events Centre at 9am

#### Groundwater and Land use in the Lake Rotorua Catchment

#### AM:

- Kurau Park and the reestablishment of natural groundwater levels in the Rotorua groundwater system
- · Utuhina Springs and groundwater supply/RLC

THE UNIVERSITY OF

- Ngontotaha Stream: pristine to turbid
- · Lake Rotorua groundwater system: geology, land use and the Mamaku Plateau

#### Lunch:

· Group meal in at Awahou Marae, north of Ngontotaha

#### PM:

- · Awahou Spring complex, Ngati Rangiwewehi and the kaitiaki flows project
- Hamurana Springs
- The Lake Rotoiti diversion wall
- Return to Airport/City









# Programme



NZHS CONFERENCE Rotorua | 3-6 December

Monday 2<sup>nd</sup> December

water: ABOVE

BELOW and beyond.

Challenges facing civilisation

Workshops S

SIG workshop

Tuesday 3 <sup>rd</sup> December			
7:30am	Registration Desk Opens		
8.30am	Official Opening – Hon. Steve Chadwick; Mayor of Rotorua Pohiri / Welcome / Health & Safety		
9.00am – 9.45am		Keynote Speaker: Kingi Biddle – Te Araw	<i>v</i> a
9.55am – 10.30am		Morning Tea	
Room	Bay Trust Forum	Skellerup Room	Opus Int Room
Theme	Modelling development, prediction and data assimilation (1)	Water quantity and quality (2)	Extremes, hazards, impacts, and the effects of climate change (3)
Session Chair	Kelsey Montgomery	Paul White	Peter Blackwood
10.30am - 10.50am	Canterbury flow naturalisation tool <i>Michael Kittridge</i> <i>Environment Canterbury</i>	Water trading: is it already happening? What are the advantages? Are the requirements for widespread uptake easily met? <b>Doug Booker</b> NIWA	Flood hazard assessment of Ophir, Otago Magdy Mohssen Otago Regional Council
10.50am – 11.10am	On regional groundwater models as tools for informing management: an example of effective and efficient decision-support modelling (Wairarapa Valley; NZ) <b>Brioch Hemmings</b> GNS Science	Mangawhai groundwater quality: unravelling the saltwater intrusion and low-temperature geothermal puzzle <b>Robert Reeves</b> GNS Science	Inundation warning system demonstration <i>Graeme Smart</i> <i>NIWA</i>
11.10am - 11.30am	Aerial electromagnetic surveys to characterise the subsurface environment of the Waiotapu Stream & Upper Piako River catchments <b>Roland Stenger</b> Lincoln Agritech	Protecting coastal aquifers from saline intrusion <i>Amandine Bosserelle</i> <i>Golder Associates (NZ)</i>	Responses of a high altitude wetland to late-Holocene environmental changes in Taveuni, Fiji <i>Kunal Singh</i> <i>University of the South Pacific</i>
11.30am – 11.50pm	Predicting Wairau plain groundwater storage – progress on the operational aquiferwatch tool(box) <b>Thomas Wöhling</b> Lincoln Agritech	Update on the development of the new groundwater research programme at GNS Science <i>Conny Tschritter</i> <i>GNS Science</i>	Flooding and atmospheric rivers over the last 40 years Hamish Prince* University of Otago
11.50pm – 12.10pm	Data fusion – merging model results with telemetry data to create design water levels, real-time monitoring and virtual sensors <b>Douglas Graham</b> DHI Water and Environment	The importance of groundwater data collection and predictive modelling for land development in areas of shallow groundwater <b>Carl Steffens</b> Pattle Delamore Partners	Evaluation of the use of stormwater attenuation on urban flooding <i>Phanida Phukoetphim</i> <i>Whangarei District Council</i>
12.10pm – 12.30pm	100% carbon-free power in non- normal hydrological years: the role of water in New Zealand and the world <i>Earl Bardsley</i> University of Waikato	Behaviour of the Waiwera aquifer under pressure <b>Abigail Lovett</b> Earth & Environmental Science Ltd.	Impacts of climate change on the return periods of extreme precipitation and dry spells in New Zealand <i>Francesco Comola</i> <i>Risk Management Solutions Ltd</i>

12:30pm – 1.30pm	Lunch – Main Foyer		
12.30pm – 12.45pm	Great Journal Articles – <b>Richard Hawke</b> <i>Journal of Hydrology (NZ) editor</i> To be followed by Panel Discussion – Bay Trust Forum: <b>All Welcome</b>		
12.45pm – 1.30pm	Student Mentoring Session – Bay Trust Forum		
Room	Bay Trust Forum	Skellerup Room	Opus Int Room
Theme	Modelling development, prediction and data assimilation (4)	Water quantity and quality (5)	Sediment quality and quantity (6)
Session Chair	James Griffiths	Abigail Lovett	Andrew Hughes
1.30pm – 1.50pm	Quantifying groundwater abstraction in the face of imperfect data <i>Helen Rutter</i> <i>Aqualinc</i>	Understanding the effects of Eiffelton irrigation's targeted stream augmentation <i>Philippa Aitchison-Earl</i> <i>Environment Canterbury</i>	Event-scale soil-erosion and sediment- transport model for predicting water quality in rivers John Dymond Manaaki Whenua Landcare Research
1.50pm – 2.10pm	Targeted stream augmentation and managed aquifer recharge modelling within the Waimakariri irrigation limited command area <b>Cameron Jasper</b> Pattle Delamore Partners	Reducing nutrient losses through improving irrigation efficiency John Bright Aqualinc Research	Four decades of suspended sediment yields at Glendhu <b>Sarah Mager</b> University of Otago
2.10pm – 2.30pm	Validating the SPHY model glacier module for the Rakaia River catchment <i>Wilco Terink</i> Environment Canterbury	Increasing regulation efficiency for the reduction of nitrate discharges from agriculture <b>Theo Sarris</b> ESR	Southern Alps in suspension: particle size of suspended material of alpine rivers <b>Sophie Horton</b> University of Otago
2.30pm – 2.50pm	Spatial modelling of groundwater nitrate-nitrogen concentrations in the Southland region <i>Ewen Rodway</i> <i>Environment Southland</i>	Solutions for improving water quality on high country farms in New Zealand <i>Henry Lissaman*</i> <i>University of Otago</i>	Storm event sediment source tracing for temporal and spatial analysis <i>Simon Vale</i> <i>Manaaki Whenua Landcare Research</i>
2.50pm – 3.10pm	Quantifying streamflow depletion from groundwater abstraction in the Selwyn river <b>Doug Booker</b> NIWA	Nutrient transport and water quality of Barkers Creek catchment, South Canterbury Hamish Graham Environment Canterbury	Quantifying links between catchment erosion processes and sediment-related water quality in rivers <i>Hugh Smith</i> Manaaki Whenua Landcare Research
3.10pm –		Afternoon Tea	
3.40pm	Pay Truct Forum	Skollorun Room	Onus Int Room
Thoma	Medalling development prediction	Water Quality and Quantity (8)	Sediment Quality and Quantity (0)
Ineme	and data assimilation (7)	Water Quality and Quantity (8)	Sediment Quality and Quantity (9)
Session Chair	Michael Kittriage	Clare Maginness	Saran Mager
3.40pm – 4.00pm	When groundwater strikes: mapping shallow groundwater risks <b>Tara Forstner</b> Tonkin + Taylor		The effect of the fine particulates and particle size on nephelometric turbidity <b>Christina Bright*</b> University of Otago
4.00pm – 4.20pm	Simple integrated surface water– groundwater contaminant transport model Channa Rajanayaka NIWA	Denitrification imprint on nitrate in oxygenated groundwater <i>Michael Stewart</i>	Comparability of the output of ISO 7027 compliant turbidity sensors <b>Andrew Hughes</b> NIWA
4.20pm –	Generalizing flow duration curves for	Impact of wetland extension on	Continuous turbidity as a proxy for water
4.40pm	bias correction of river flow forecast <b>Daniel Lagrava</b> NIWA	ecosystem health <i>Kalyan Chakravarthy</i> DHI Water and Environment	quality at NIWA benchmark river sites <b>Robert Davies-Colley</b> NIWA
4.40pm – 5.00pm	Wol	An Assessment of Nitrate Trends in Groundwater across Canterbury: Results from a Science Fair Project Helen Rutter Aqualinc Research	Suspended Sediment Particle Size Measurement Using A Laser-Diffraction Gauging Instrument, with Implications for Measuring the Sand Component of the Suspended Load <i>Murray Hicks</i> <i>NIWA</i> Gardens
7.30pm			



NZHS CONFERENCE Rotorua | 3-6 December

Wednesday 4<sup>th</sup> December 8.00am **Registration Desk Opens** Keynote Speaker: Graeme Campbell - GWRC 9.00am – 9.45am 9.45am -Housekeeping and Notices 9.50am **Bay Trust Forum Skellerup Room Opus Int Room** Room Theme Drinking Water (10) Irrigation, drainage recharge and Catchments and Communities (12) allocation (11) **Session Chair** Tim Kerr **Roland Stenger** Paul White 9.50am -Can we store water below ground Better spatial characterisation of Water we do about the river? A mixed 10.10am to provide reliable water supplies, evapotranspiration and rainfall recharge methodology to understanding water Oreti Basin, Southland? estimates to groundwater using remote quality and management in a Southland Clare Houlbrooke catchment sensing multispectral techniques at Wallbridge Gilbert Aztec lysimeter sites Jessica McIntyre\* Frederika Mourot University of Otago **GNS** Science 10.10am -Particulate matter - effects on Using vulnerability assessments to design Upscaling of point-scale groundwater 10.30am filtration of drinking water supplies recharge measurements using machine a "big river" flow study in a catchment sourced from groundwater learning: a Canterbury case study involving multiple Hapu James Dommisse **Markus Pahlow** Gail Tipa Tipa and Associates Stantec University of Canterbury 10.30am -Morning Tea 11.00am Room **Bay Trust Forum Skellerup Room Opus Int Room** Data: monitoring, visualisation Groundwater and Surface water Groundwater and Surface water Theme and management (13) Interaction (14) Interaction (15) **Session Chair** Helen Shaw Katie Coluccio Clare Houlbrooke South Canterbury collaborative An improvement in a rainfall-runoff Kopuatai wetland water level 11.00am 11.20am hillslope project equation management Matt Dodson Ali Shokri **Catherine Sturgeon** Environment Canterbury Waikato University Jacobs NZ 11.20am -Instrumentation and Chrystalls bend stopbank seepage Update on carbon dating of Christchurch 11.40am characterisation of the South assessment, Otaki groundwater Canterbury collaborative hillslope Ella Boam Michael Stewart project field site WSP Opus Tom Johns Environment Canterbury 11.40am – Using fuzzy cognitive maps to Estimation of ET through signal Groundwater storage that feeds the 12.00pm visualize and utilize Matauranga processing of daily streamflow Wairau river and streams in the Wairau Māori and science in freshwater fluctuations Plain management Muhammad Waqas Sarwar\* Uwe Morgenstern Gail Tipa Waikato University **GNS** Science Tipa and Associates 12.00pm -12.30pm LUNCH

water: ABOVE

Challenges facing civilisatio

BELOW

12.30pm – 2.00pm	POSTER SESSION		
Room	Bay Trust Forum	Skellerup Room	Opus Int Room
Theme	Modelling development, prediction and data assimilation (16)	Water contamination / restoration (both surface and groundwater) (17)	Extremes, hazards, impacts, and the effects of climate change (18)
Session Chair	Channa Rajanayaka	Murray Close	John Hansford
2.00pm – 2.20pm	Modelling groundwater flow in the Wanaka- Cardrona alluvial aquifer <b>Neil Thomas</b> Pattle Delamore Partners	Insider information on bioreactor functioning and identifying improvements for the removal of nitrate from artificial subsurface drainage from pastoral agriculture <b>Greg Barkle</b> Land and Water Research	Tile drainage effects on hydrological responses <i>Lennie Palmer</i> <i>WSP Opus</i>
2.20pm – 2.40pm	SWAT+ application in a typical dairy farming catchment in New Zealand <i>Linh Hoang</i> <i>NIWA</i>	Environmental implications of end-of-life tyres on groundwater and their reuse in civil engineering applications Laura Banasiak ESR	Design rainfall regionalisation using a non-stationary GEV <b>Trevor Carey-Smith</b> NIWA
2.40pm – 3.00pm	Regionalisation of the New Zealand SWAT model <b>Aroon Parshotam</b> Aqualinc Research	Denitrification wall trial in a gravel aquifer: results from year 1 <i>Lee Burbery</i> <i>ESR</i>	Rivers in skies: bringing snow to the Southern Alps Rasool Porhemmat* University of Canterbury
3.00pm – 3.20pm	Effective representation of the geology in groundwater models of stratified heterogeneous aquifer systems–an example from the lower Manawatu catchment <i>Hisham Zarour</i> <i>Stantec</i>	Mei te vai ki te vai: catchment nutrient and hydrological processes and their influence on Muri Lagoon, Rarotonga, Cook Islands <b>Zoe Pattinson</b> GHD	Climatology of vapour transport associated with New Zealand droughts <b>Morgan Bennet*</b> University of Otago
3.20pm – 3.50pm	Afternoon Tea		
Room	Bay Trust Forum	Skellerup Room	
Theme	Drinking Water (19)	Groundwater and Surface water Interaction (20)	
Session Chair	Magali Moreau	Ali Shokri	
3.50pm – 4.10pm	National assessment of source protection zones for drinking water <i>Tim Kerr</i> <i>Aqualinc Research</i>	Mapping groundwater discharge into a large coastal lagoon in New Zealand <b>Katie Coluccio*</b> Waterways Centre for Freshwater, Canterbury University	
4.10pm – 4.30pm	Defining drinking water supply source protection zones - a case study for the Horizons region <i>Nic Love</i> <i>Pattle Delamore Partners</i>	Coastal aquifer systems: facies and groundwater flow <b>Paul White</b> GNS Science	
4.30pm – 4.50pm	Technical guidelines for drinking water source protection zones Hilary Lough Pattle Delamore Partners	Impact of the Kaikōura earthquake on river and groundwater interactions Samwell Warren WSP Opus	
5.00pm – 6.00pm	N	ZHS AGM   Bay Trust Forum   Energy Events	Centre
From 6.30pm		ENVCO Student Function   Abracadabra	



NZHS CONFERENCE Rotorua | 3-6 December BELOW and beyond.

water:

ABOVE

Thursday 5 <sup>th</sup> December			
8.00am	Registration Desk Opens		
9.00am-	Keynote Speaker: Catherine Moore - GNS		
9.45am –		Housekeeping and Notices	
9.50am			
Room	Bay Trust Forum	Skellerup Room	Opus Int Room
Theme	Extremes, hazards, impacts, and the effects of climate change (21)	National Scale Studies (22)	Water contamination / restoration (both surface and groundwater) (23)
Session Chair	Lennie Palmer	James King	Greg Barkle
9.50am – 10.10am	Climate change - a high level assessment of the impact on future water supply John Hansford Tonkin+Taylor	Te whakaheke o te wai: improving understanding of groundwater flow pathways in New Zealand <b>Peter Johnson</b> GNS Science	Microbial transport through variably saturated heterogeneous intact alluvial gravel vadose zone cores Laura Banasiak ESR
10.10am – 10.30am	Operational Flood warning Guidance for Disaster Newscasters Jongkook Lee Ajou University, Korea	Spatial and temporal pattern of natural hazards in New Zealand <b>Carlotta Scudeler</b> Risk Management Solutions	Development of synthetic DNA tracers for tracking water contamination <i>Liping Pang</i> ESR
10.30am - 11.00am	Morning Tea		
Room	Bay Trust Forum	Skellerup Room	Opus Int Room
Theme	Modelling development, prediction and data assimilation (24)	National Scale Studies (25)	Water contamination / restoration (both surface and groundwater) (26)
Session Chair	Christian Zammit	Graeme Smart	Lee Burbery
11.00am – 11.20am	Comparing satellite and modelled estimates of hydrological fluxes James Griffiths NIWA	2018 National survey of pesticides, glyphosate, and emerging organic compounds (EOCS) in groundwater <i>Murray Close</i> <i>ESR</i>	Non-faecal sourced E.coli investigation of landfill leachate <b>George Hampton</b> Jacobs NZ
11.20am – 11.40am	A surface water network method for generalising streams and rapid groundwater model development <i>Mike Toews</i> <i>GNS Science</i>	New Zealand aquifers digital map <b>Magali Moreau</b> GNS Science	How important is the shallow groundwater pathway for contaminant exports from artificially drained pastoral land? <i>Greg Barkle</i>
11.40am – 12.00pm	Predicting unimodal water retention curves of fine texture soils from traditional particle size distribution data Joseph Pollacco Manaaki Whenua Landcare Research	A national groundwater redox status map for New Zealand <i>Scott Wilson</i> <i>Lincoln Agritech</i>	Is small-scale managed aquifer recharge able to achieve big outcomes? learnings from the Hinds-Hekeao plains. <i>William Dench</i> <i>Wallbridge Gilbert Aztec</i>
12.00pm – 12.20pm 12.20pm –	Applications of the integrated surface-groundwater model TOPNET- GW Jing Yang NIWA	Creating a groundwater isoscape for New Zealand <b>Rob van der Raaij</b> GNS Science Lunch	Are changes afoot below? Assessing groundwater ecosystem response in a climate of change. <i>Louise Weaver</i> <i>ESR</i>
1.20pm			

Room	Bay Trust Forum	Skellerup Room
Theme	National-Scale Studies (27)	Data: monitoring, visualisation and management (28)
Session Chair	Magali Moreau	Matt Dodson
1.20pm – 1.40pm	Update on groundwater mapping, monitoring and modelling activities in the New Zealand water model. <b>Rogier Westerhoff</b> GNS Science	The risk management solutions New Zealand flood model: development, validation, and application <i>Carlotta Scudeler</i> <i>Risk Management Solutions</i>
1.40pm – 2.00pm	Implementation of catchment scale surface water take as part of the New Zealand water model <i>Christian Zammit</i> <i>NIWA</i>	Water data: local government in an 'agile' world <i>Helen Shaw</i> <i>Environment Canterbury</i>
2.00pm – 2.20pm	Update on the New Zealand water model-hydrology project <i>Christian Zammit</i> <i>NIWA</i>	Detection of rating shifts at hydrometric stations <i>Matteo Darienzo</i> * <i>IRSTEA</i>
2.20pm – 2.40pm	A stable isotope map of New Zealand's surface waters <b>Bruce Dudley</b> NIWA	Communicating national scale river flow forecasts: flood event case studies and stakeholder feedback <i>Kelsey Montgomery</i> <i>NIWA</i>
2.40pm – 3.00pm	Nationwide estimates of renewable of non-renewable groundwater volumes in New Zealand <b>Rogier Westerhoff</b> GNS Science	
3.00pm – 3.30pm		Conference Close
6.00pm	Conference Dinner – Skyline Rotorua – Buses depart 6pm - Dinner from 6.30pm	

Friday 6 <sup>th</sup> December	
9.00am	Field Trips – depart EEC car park



## Poster List A–K (Wed–4 Dec, 12–2pm)

Poster Presenter Poster Title Poster Theme	Poster Number
Aitchison-Earl, Philippa Tracking Consented Irrigated Area Through Time Water Quantity	26
<b>Bardsley,</b> Earl Detecting Changing Temporal Infiltration Patterns After Forest Clear Felling: Propo Geological Weighting Lysimeter Experiment Climate Change	1 osal for a
<b>Clague</b> , Juliet Gaining Community Buy-in Ahead of Skytem Flights Community	4
<b>Dao,</b> Ngoc Hieu A Novel Nonparametric Approach to Estimating Joint Exceedance Probability for C Hydrological Hazards Hazard	5 Correlated
<b>Egbadon,</b> Emmanuel RNA Stable Isotope Probing – A Useful Tool for Identifying Active Microbial Comm Undertaking Aerobic Methane-Driven Denitrification Nutrient	9 nunities
<b>Esmaeil Nia,</b> Saeid Development of an Agent-Based Model for Monitoring Rainfall Between two Telec Antennae Recharge	<b>19</b> ommunication
<b>Glover-Clark</b> , Georgia The controls on spatial and temporal variation of water table depth and soil moistudrained agricultural peatlands Water Quantity	27 Ire content in
<b>Griffiths</b> , James Framework for mapping on-farm water pollution using satellite and UAV remote se Nutrient	10 ensing
<b>Gusyev,</b> Maksym Combining Environmental Tritium and Modelling of Hydrologic Systems on Large Decision Making and Climate Change and Land-use Assessment Climate Change	2 Scale for
<b>Hector,</b> Ross Well Head Protection: Essentials for Secure Water Drinking-water	6
<b>Karaminik,</b> Yasaman Toward Moderating Lake Taupo Operational Water Level Variation Water Quantity	28

## Poster List L–R (Wed–4 Dec, 12–2pm)

Poster Presenter Poster Title Poster Theme	Poster Number
<b>Ledwith</b> , Kevin Dewatering Assessments Using Analytic Element Models Water Quantity	29
Legg, Justin Hay Bales, Waratahs and Wire – A #8 Approach to Farm Scale Integrated Water an Management Nutrient	11 nd Resource
<b>Lynds</b> , Jamie Quantifying Human Impacts on Drought in New Zealand Water Quantity	30
<b>Majeed</b> , Mohammed Possibility of Pumped Hydro Storage Using Lakes Hawea and Wanaka in Central O Water Quantity	31 Dtago
<b>Montgomery,</b> Kelsey Evaluating National-Scale River Flow Forecasts for NZ River Flow	24
<b>Morgenstern,</b> Uwe Quantifying Actual Denitrification in Groundwater Systems Nutrient	12
<b>Mourot,</b> Frederika Farm Nutrient Losses to Groundwater in the West Matukituki Valley, Lake Wanaka Nutrient	<b>13</b> Catchment
<b>Neverman,</b> Andrew A Catchment-Scale Modelling Framework to Test the Feasibility of Land Manageme Achieving Proposed Sediment Attribute Bottom Lines Sediment	<b>14</b> Int Scenarios for
<b>Nguyen,</b> Anh A Framework to Assess the Reliability of a Multi-Purpose Reservoir Under Uncertai Water Quantity	<b>32</b> inty in Land use
<b>Pham,</b> Hoa Does Meteorological Drought Have Immediate Effect on Low Flow in Northland Riv River Flow	<b>25</b> ers?
<b>Pollacco</b> , Joseph Beerkan-Estimation-of-Soil-Transfer Parameters Method Predicting Hydraulic Para Retention and Hydraulic-Conductivity-Curves: Kosugi Soil Hydraulic Model Without Data Water Quantity	<b>33</b> m. of any Water Using PSD
Rajanayaka, Channa Impact of Climate Change on Crop Water Demand and Growth Climate Change	3
<b>Rosado,</b> Carlos Can we Detect Offshore Fresh Groundwater in Christchurch? Water Quantity	34

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## Poster List S–Z (Wed–4 Dec, 12–2pm)

Poster Presenter     Poster Num       Poster Title     Poster Theme	ber
<b>Scott,</b> Lisa Developing a Triage Tool for Assessing Discharges in Community Drinking-Water Supply Protection Zones Drinking-Water	7
<b>Shrestha</b> , Jayandra Development and Assessment of a Sediment Management Routine for the Soil and Water Assessment Tool (SWAT) Sediment	15
Silveira, Fabio Wetland Upgrade Monitoring Programme in Christchurch Water quantity	35
Smith, Hugh Tracer Selection and Source Discrimination for Geochemical Sediment Fingerprinting Sediment	16
Smith, Hugh Predicting Spatial Patterns in Bank Erosion for Catchment Sediment Budgets in New Zealand Sediment	17
<b>Srinivasan,</b> M.S. A Review of European Field Lysimeter Research: Learnings From Austrian Lysimeter Workshop Recharge	<b>20</b> วร
<b>Vale,</b> Simon Quantifying Sources of Overbank Sediment Deposits in the Lower Oroua River Using Sediment Fingerprinting Sediment	18
White, Paul Remarkable Record of Rainfall Recharge at Kaharoa, 2005 to 2019 Recharge	21
Yang, Yang Bias Correction for Simulated Soil Moisture Using MOS: Linear Regression Vs. CDF Matching Recharge	22
<b>Yeo,</b> Sarah Hydrochemistry of Groundwater in Dunedin, New Zealand Water Quality	8
<b>Zammit,</b> Christian Snow Water Equivalent at Niwa's Snow and Ice Network Sites – Challenges for Snow Models Recharge	23



In order of presentation time

## Tuesday—3 December, 9:00am



#### **Kingi Biddle**

#### Te Arawa

Tēnā koutou katoa. My name is Kingi Biddle. I am from the Waka of Te Arawa, Mataatua and Tainui.

I have spent my working life involved in Communication. Whether it be in Radio, Television or Public Speaking, I have a heart to share messages with people, and helping them learn to share their korero too.

My greatest achievements are being a husband, Dad, son, brother, relation and friend. My biggest faith is in the goodness of people. Our ability to overcome with a spirit that unites us all.

In my korero I will be talking about how Maori see wai – the water in the hope that you will see the water in a totally different way

Me he Whare Hukahuka – ka pakeke haere taku tu – great captains are known in the roar of the ocean

Ka nui te mihi

#### Wai: More than 2 bits of H and an O

Tena koutou katoa, unfortunately no-one has invented a pair of glasses that allows you to see the world as the Maori do. It is my honour to be able to share stories so you can see what we see.

Water is life, life is water. Why do Maori revere water? Why do Maori love water? Why do Maori cry for water? These questions will be answered.

But wait, there's more - much more ...

In my Kingi-note speech – you will hear the water speak.

## Wednesday—4 December, 9:00am



#### **Graeme Campbell**

#### GWRC

Graeme has had 30 years of experience working with communities to mitigate the effects of natural hazards primarily related to flooding, cyclones and tsunami. He is currently the Manager of the flood protection department of Greater Wellington and has been in that position for the last 5 years. Prior to that Graeme was the Manager of AC Consulting Group Ltd's River Marine and Civil Works business unit, working extensively within New Zealand, the Pacific and Asia. Work undertaken has included pre and post disaster assessment, hazard mapping, mitigation assessment including structural and non structural solutions and implementation of mitigation options. The involvement of the community in the decision making process has formed a key part of all of the projects giving Graeme experience in working with individuals, communities, asset managers, local and regional councils as well as politicians at a national level.

Graeme's experience specifically related to the rivers in New Zealand includes extensive geomorphologic studies of the Waipaoa, Rangitiki, Waikanae, Otaki, Hutt and Ruamahanga Rivers. These studies have included analysis of river alignment change from historical survey and aerial photography, bed level surveys, gravel balance analysis, hydraulic modeling, design of edge protection works, environmental investigations and other river specific assessments.

## Water Above and Below Ground – Challenges facing Civilisation

Graeme Campbell will be making this address as the Convenor of the New Zealand River Managers Special Interest Group (SIG). This group has representatives from all Regional Councils and Unitary authorities across the Country with responsibility for managing many of the rivers and streams that flow through our communities.

The challenges facing communities managing our rivers and streams are changing rapidly. Climate Change will greatly alter water flows both above and below ground and we will need to the agility to adapt our management approach as a result. As well as the need to adjust to a changing climate, our society's expectations for how rivers are managed are changing and our approach to management will need to adapt to a wider range of outcomes rather than the narrowly focused economic and productivity outcomes of the past.

In my presentation I will introduce how the New Zealand River Managers SIG is preparing to meet these challenges and the support that will be needed to achieve a more sustainable approach to holistic river management. Understanding the interconnectedness of our water systems will play a key role in helping to us to adapt over time, as will our understanding of the relationships between those water flows and the ecology that relies on them. A need to work together across Government, Business, Landowners, Maori and community will be essential if we are to make the necessary changes in time.

## Thursday—5 December, 9:00am



#### **Dr Catherine Moore**

#### GNS

Dr Catherine Moore is a groundwater scientist and modeller. Most recently she has led the groundwater modelling team at GNS Science in New Zealand and been working at CSIRO in Brisbane, Australia. She has more than 25 years' experience in local government, groundwater consultancies and research organizations. Her modelling interests include the development of pragmatic tools for robust decision-support modelling, quantifying model predictive uncertainty, identifying cost-effective data acquisition and monitoring strategies, and optimising model-data assimilation. Some of her current work is focussing on mathematical and empirical explorations of appropriate model complexity to enhance decision support.

## Decision support, uncertainty quantification, and model complexity entanglement

Groundwater models are regularly built to support the making of important decisions in water management. Despite the importance of this application, the performance of a model in a decision support role has been largely neglected as a metric for appropriate model complexity. By examining models in this context, a consistent framework for assessing the costs and benefits of model complexity in decision making is provided. Central to this is uncertainty quantification which enables the risks relating to decisions to be characterised. Explicitly or implicitly, this entails the assessment of whether a potential impact is consistent with the known aquifer properties and processes (expert knowledge) and historical observations.

Unfortunately, model design strategies for assimilating expert knowledge and historical data simultaneously in a model are challenging since models must avoid both the perils of model complexity, long run times and numerical instability, and the perils of model simplification, errors in uncertainty estimates and predictive bias. Such model simplification errors can be created or exacerbated through history matching, where data, even when carrying important information, can be misleading if it is viewed through the lens of an imperfect model. A successful strategy in this context will ensure that prediction-specific complexity is retained, while those parts of a model that are of secondary importance to management-critical predictions are simplified.

All models are necessary simplifications of the real-world, therefore we cannot escape the need to consider the issue of appropriate model complexity in decision support models. However, real-world abstractions and simplifications can be seen as strategic design features through which a decision-support role is enabled rather than as model deficiencies.



## Delegate List A-F

Aitchison-Earl Allman Bailue Ball **Bardsley** Barrett Beaumont Bennet Bidwell Binstead Booker Borrer **Bradbury Bright** Bright Broughton **Burbery** Cantwell **Carey-Smith** Clague Close Coluccio Comola Cox Croft Curtis Dally Dao Darienzo Davidson **Davies-Colley** Dempsey Dodson Dommisse Drayton Dudley Dymond Eastern Ede Egbadon Esmaeil Nia Everett Forstner

Philippa Chris Kate Graham Earl Isobelle Stefan Morgan Vincent Stacey Doug Susan Jassalyn Christina John Andrea Lee Rose Trevor Juliet Murray Katie Francesco Simon Kade Jay Vanessa Ngoc Hieu Matteo Peter Robert David Matt James Michael Bruce John Stuart Mike Emmanuel Saeid Kate Tara

Environment Canterbury Pattle Delamore Partners Ltd Golder Associates (nz) Ltd FTS University Of Waikato Trustpower West Coast Regional Council University Of Otago Vincent Bidwell Consultancy Horizons Regional Council NIWA Greater Wellington Regional Council Auckland Council University Of Otago Aqualinc Research Ltd Groundwater Solutions International Institute of Environmental Science Ltd. (ESR) **GNS** Science NIWA Lincoln Agritech Ltd ESR Waterways Centre, University Of Canterbury **Risk Management Solutions** Private Bag 1930 Geotechnics **GNS** Science Cardno University Of Waikato Irstea Marlborough District Council NIWA University Of Auckland Environment Canterbury Stantec RMS NIWA Manaaki Whenua - Landcare Research Jacobs Marlborough District Council University Of Canterbury The University Of Waikato **BOPRC** Tonkin + Taylor

## Delegate List G-K

Gabites Gardner Garnett Gerry **Glover-Clark** Graham Graham Gray Green Griffiths Gusyev Hadfield Hampton Hansford Hao Hector Hellberg Hemmings **Hicks Hitchcock** Hoang Horrell Horton Houghton Houlbrooke **Hughes** Huirama Ingram Jamieson Jasper Karaminik Keane Kerr King **Kirk** Kittridge Koh

Suzanne Rochelle Amber Jessica Georgia Douglas Hamish Gareth Mitch James Maksym John George John Tingting Ross Bodo Brioch Murray Michelle Linh Graeme Sophie Karen Clare Andrew Manawa Simon Dennis Cameron Yasaman Alasdair Tim James Anthony Mike

Sung Soo

Environment Canterbury Bay Of Plenty Regional Council Horizons Regional Council Auckland Council University Of Waikato DHI Water & Environment Environment Canterbury Genesis Energy Bay of Plenty Regional Council NIWA ICHARM, PWRI Waikato Regional Council Jacobs New Zealand Ltd Tonkin & Taylor Limited University Of Auckland Aqualinc Research Limited Tauranga City Council **Gns Science** NIWA Trustpower NIWA Graeme Horrell Consultancy Limited University Of Otago **GNS** Science Wallbridge Gilbert Aztec NIWA NIWA Ministry for the Environment Canterbury Water Management Strategy Pattle Delamore Partners Ltd University Of Waikato Keane Associates Ltd Aqualinc Research Ministry For The Environment GHD Environment Canterbury

Waikato Regional Council

## Delegate List L-R

Lagrava Ledwith Legg Lester Levy Lissaman Long Lough I ove Lovett Lynds Macky Maginness Majeed Martin Mcintyre Medwin Mercer Mohssen Montgomery Morgenstern Morrow Mourot Nam Neverman Nguyen O'Neill Osbaldiston Pahlow Palmer Pang Parshotam Pattinson Payne Pelzer Pham Phipps Phukoetphim Pollacco Ponomareva **Porhemmat** Price **Prince** Rawlinson Reeves Rodway Rosado **Rutter** 

Daniel Kevin Justin Andrew Amir Henry Lauren Hilary Nic Abigail Jamie Graham Clare Mohammed Adam Jessica Rachael Raelene Magdy Kelsey Uwe Francie Frederika Seong Andrew Anh Sarah Susie Markus Lennie Liping Aroon 70e David llka Hoa Regan Phanida Joseph Anastasia Rasool Mackay Hamish Zara Rob Ewen Carlos Helen

NIWA Tonkin & Taylor Aqualinc Research Ltd Watercare Services Limited Otago Regional Council Otago University Ministry For The Environment Pattle Delamore Partners Ltd Pattle Delamore Partners Ltd Earth & Environmental Science Ltd. University Of Otago Macky Fluvial Consulting Ltd Pattle Delamore Partners Ltd Manukau Institute Of Technology Environment Canterbury University Of Otago Bay Of Plenty Regional Council Horizons Regional Council Otago Regional Council NIWA **GNS Science** Greater Wellington **GNS** Science Mote Ltd Manaaki Whenua - Landcare Research University Of Canterbury **Environment Southland** Northland Regional Council University Of Canterbury WSP Opus ESR Aqualinc Research Ltd GHD Mercury Ministry For The Environment Northland Regional Council Taranaki Regional Council Whangarei District Council Manaaki Whenua Landcare Research Scott Technical Instruments University Of Canterbury- Christchurch University Of Auckland University Of Otago **GNS** Science **GNS** Science **Environment Southland** Environment Canterbury Aqualinc Research Ltd

## Delegate List S-Z

Salmi Sarris Sarwar Scott Scudeler Sharplin Shaw Shokri Shrestha Shrestha Silveira Singh Singh Smart Smith Smith Smith Southerwood Stead Steffens Stenger Stewart Sturgeon Terink Thomas Thomas Thornburrow Thorpe Tipa Toews **Tokelove** Trompetter Tschritter Vale van der Raaij VanNess Viljevac Vodjansky Wadsworth Ward Warren Weaver Westerhoff Whalen White Wöhling Worts Yeo Zarour

Bertrand Theo Waqas Lisa Carlotta Remalia Helen Ali Bikesh Jayandra Fabio Kunal Pooja Graeme Fiona Francis Hugh Susan Eddie Carl Roland Mike Catherine Wilco Joseph Neil Blair Hugh Gail Mike Adam Vanessa Conny Simon Rob Kurt Zeljko Eugene Val Daniel Samwell Louise Rogier Maureen Paul Thomas (Eddy) Chris Sarah Hisham

Water Technology Pty Ltd ESR Waikato University Environment Canterbury Risk Management Solutions (RMS) GHD Environment Canterbury Waikato University Otago Regional Council University Of Canterbury University of Canterbury The University Of The South Pacific The University Of Auckland NIWA Environment Southland Riley Consultants Ltd Manaaki Whenua - Landcare Research Yaku Consulting Ltd Meridian Energy Ltd Pattle Delamore Partners Ltd Lincoln Agritech Ltd Aquifer Dynamics Jacobs New Zealand Ltd Environment Canterbury Regional Council Tasman District Council Pattle Delamore Partners Ltd Pattle Delamore Partners Ltd Retired Tipa And Associates Ltd **GNS Science** Sigma Consultants **GNS** Science GNS Science Manaaki Whenua Landcare Research **GNS** Science Environment Canterbury Soil & Rock Consultants BBO Marlborough District Council University Of Auckland WSP Opus **ESR GNS** Science Environment Canterbury **Gns Science** Lincoln Agritech Ltd **GNS Science** University Of Otago Stantec







# aqualinc

### WATER FOR LIFE through world-class management

Aqualinc is a leading New Zealand water management consultancy. We work closely with primary industries and government agencies to achieve world-class water and land management, demonstrating our passion and expertise through pioneering scientific and engineering research, developing and applying smart technology, and providing independent consultancy services.

#### WATER & LAND



At Aqualinc, we use measured data and, through sophisticated modelling, help our clients predict the impacts of changes to the management of catchments, rivers and aquifer systems, and/or impacts imposed by climate change. This allows our clients to explore, and select, solutions and options that best manage water quality and quantity in their region.

Our team is one of New Zealand's leading providers of specialist services in groundwater and surface water, providing solutions to improve the management of land and water. We provide expert services in groundwater and surface water modelling, allocation management, aquifer testing and well development, source protection, groundwater level and quality monitoring, and surface water monitoring.

Aqualinc interprets and models data from a point scale to a national scale, to enable councils and other stakeholders to assess the effects of short-term climate variability and longer-term trends on resources and assets. In the face of climate change, we can use this information to help guide councils in terms of resilience to hazards and better understand implications for resources.

As irrigation water demand increases, historical approaches, and the use of arbitrary daily and/ or annual demands, are no longer adequate. Through science and proven modelling approaches, Aqualinc develops more appropriate irrigation allocation guidelines for regions. These guidelines provide for more efficient water and land use, decreased effects of nutrient leaching on groundwater and waterways, and increased socio-economic benefits from irrigated land.

Farming profitably within environmental limits requires a high level of monitoring and data handling, together with the assessment of compliance with resource consent conditions, and liaison with regional councils. Aqualinc develops and audits farm environment management plans, provides advice and prepares consent applications, monitors soil moisture, undertakes flow meter verification, and uses telemetry and web-based data feedback reports for irrigation scheduling and compliance monitoring.

If you need help or advice in any of these areas, please call Aqualinc Research Ltd / Christchurch 03 964 6521 / Ashburton 03 307 6680 / Hastings 06 873 4045 www.aqualinc.com