IrrigationNZ news

SUMMER 2022

Growing the perfect kiwifruit

IRRIGATION NEW ZEALAND

UNDERSTAND CHANGES TO THE RMA

A ROSE FOR VALENTINE'S

WATER AVAILABILITY AND SECURITY

GOULDS WATER TECHNOLOGY
a xylem brand

LOWARA
a xylem brand

Brown Brothers Engineers have all your irrigation pumping solutions.

Lowara
Z Series
6" 8" 10" & 12"
Submersibles

- Stainless steel
- Hard wearing
- Corrosion resistance
- High efficiencies
- Low running costs

Goulds
ISO Series
Single stage
end suction pumps

- Cast iron casing / Stainless impellers
- Flexible design
- Highly efficient
- Low maintenance

Call us today to see how Lowara & Gould's premium pump ranges can assist with your water requirements.

Brown Brothers Engineers Ltd

Ph: 0508 4 BBENG
www.brownbros.co.nz

11/21

DELIVERING PUMPING SOLUTIONS® since 1908

CONTENTS

REGULARS

4 **From the Chair:** Keri Johnston

5 **From the Chief Executive:** Vanessa Winning

7 **IrrigationNZ: Strategy**

8 **IrrigationNZ: Out & About**

9 **View from Here:** Karen Adair on Catchment Groups

10 **View from There:** Tony Oakes, Australia

14 **Technical Matters**

22 **IrrigationNZ Partner: Anderson Lloyd** – Changes to the RMA explained

44 **IrrigationNZ: Submission Updates**

46 **Seasonal Climate Outlook:** February–April 2022

48 **Irrigation in Pictures:** Irrigated land in New Zealand

49 **Product & Services Directory**

FEATURES

12 Ron Cocks, and Innovation Awards soon to open for nominations

17 Water Availability and Security – the way forward

24 **Cover Story:** The important role water plays in growing kiwifruit

27 Freshwater research news

28 The perfect rose – made with love and water

32 Zimmatic™ Trailblazer Sustainable Irrigation Award winners

34 Julian Raine: Growing across sectors

36 MGI: Harnessing the power of irrigation races

39 Realtime recording of groundwater to enhance knowledge

40 Scheduling using satellite data

42 Finding the key to perfect apples

48 Next Level course for women in food and fibre

IrrigationNZ news

Editor: **Ella Stokes**
Mobile 027 208 6371
Email estokes@irrigationnz.co.nz

Advertising:
Email admin@irrigationnz.co.nz

Administration & Subscriptions:
Email admin@irrigationnz.co.nz

Irrigation New Zealand
PO Box 8014
Wellington 6143

Design: Rosie Fenton

Printing: Caxton Press

Distribution: New Zealand Post

Cover Photo: Phoebe Scherer

IrrigationNZ News is published by Irrigation New Zealand Inc four times a year. The circulation includes all IrrigationNZ members. The opinions expressed in IrrigationNZ News do not necessarily reflect the views of Irrigation New Zealand Inc. The information contained in this publication is general in nature with every effort being made to ensure its complete accuracy. No responsibility can be accepted for any errors or copyright breach that may occur beyond the control of the editor or IrrigationNZ. Permission must be sought from the Editor prior to reproduction of any material contained in this publication.

ISSN 2230-5181

IRRIGATION NEW ZEALAND
WATER | FOOD | FIBRE | LIFE

www.irrigationnz.co.nz

Understanding options and providing feedback

Ngā mihi o te tau hou – greetings for the new year. Summer is officially upon us, and 2022 is here, having been welcomed with cautious optimism.

For the primary sector, 2022 kicks off with He Waka Eke Noa emissions pricing consultation. It is really important that everyone takes the opportunity to understand the two pricing options that have been put forward and provide constructive, solutions-focused feedback. Workshops are being held around the country in February 2022, and the He Waka Eke Noa partnership is presenting its advice to the government in April 2022. Remember that the success of the He Waka Eke Noa programme will mean that agriculture is not brought immediately into the Emissions Trading Scheme (ETS), with pricing linked to a rapidly increased carbon price.

Here at home in South Canterbury, we have been getting rainfall regularly enough that the irrigation season has been very slow to start, but the outlook from now on is for hot, dry weather. It is a privilege to have access to water for irrigation purposes. Making sure that we use water responsibly, at the rate and time that is needed, is one of our core responsibilities as an irrigation sector. We are incredibly lucky that for a country of our size, we have access to a vast amount of knowledge, support and innovation. I encourage you to make sure that you keep up to date with all the available resources on irrigation, talk about what you are doing and why, and lead and inspire each other to grow, adapt, and be the best irrigators you can be.

For IrrigationNZ, 2022 is a year of opportunity. There is much focus on the challenges that the greater primary sector is facing, and there is no doubt that there is plenty on the agenda. We are an organisation with an eye on the future, putting forward constructive and solutions-focused options that achieve practical outcomes for our members and stakeholders, all while ensuring that our environment, communities and people are looked after.

Thank you all so much for your support. The board and team are looking forward to working with you all in 2022.

Noho ora mai,

Keri Johnston, Chair of IrrigationNZ

Onwards and upwards in 2022

2022 is going to be remembered for the way we recover. For how we set ourselves up to be more resilient to health-related and environmental impacts. While amongst it now, there is possibly worse to come for our nation, given the lack of penetration from Covid to date. It may be hard to contemplate what we have to do for the next 20 years, when we are currently looking at how we will ride out this year. But that is exactly what our sector needs to be doing. We can get distracted with the here and now, and that's expected, but we need to plan and map our journey in order to take as much control as we can in an environment that is constantly changing.

The fundamentals of irrigation, farming, growing, etc haven't changed – we need water, sun, and nutrients, at the right time, in the right place. We need consumers desiring our products, and we need support services, processors, and global economies enabling distribution. These are the things we can focus on for 2022.

Number one for IrrigationNZ is ensuring we have adequate water capture and storage, and the best understanding of precision water use and conservation. Last year brought a move in the right direction. We are beginning to get more recognition on the importance of those three components of irrigation, and are starting to see a change in the narrative around their importance. The Ministry of Primary Industries (MPI) paper on water availability and security is a good step, and there is more understanding in some key areas of policy making about what we do, and who our members are. We have much more work to do, and we need all of us working together on industry-wide improvement. This will demonstrate how we can achieve the outcomes desired by our communities and customers.

> "Number one for IrrigationNZ is ensuring we have adequate water capture and storage, and the best understanding of precision water use and conservation."

This summer – which to date has been warm and dry (I write this in January, fully expecting once committed to paper the rain will turn up) – demonstrates nicely the importance of planning, future-proofing, and investment. We have a changing climate, with last year being the warmest on record, with the most weather events. We need to both respond to current issues, and prepare for further changes. We have excellent overseas examples to learn from, where water is much more scarce, and where it has been better harnessed. We are seeing investment in irrigation technology from Israel, Australia, and the US into our almost unique pasture-based irrigation market, where they are wanting to learn from us.

New Zealanders are renowned for looking at problems and finding practical, implementable solutions. 2022 is a great time to harness this strength to invest for a future of more extremes and uncertainty.

2021/22 demonstrated the international desire for our food and fibre, and that will continue as the world recovers and continues to look for healthy, sustainable, and natural products. However, we can't sit back and wait; we have to keep being at the head of the pack, improving our environmental impact and our product quality. Water is our most important resource and we work closely with our communities, iwi, and local and central government to achieve improvements in productive use, drinking water, and environmental outcomes. We have an opportunity to aid and assist our next generation of food and fibre producers by working collaboratively, listening to even our harshest critics, and making improvements where we can. We can do this. We are already on the journey, and some of the outcomes I am seeing from the schemes and independent irrigators are inspiring.

Vanessa Winning
Chief Executive, IrrigationNZ

RUBICON™

Technology that lets you know when to irrigate and how much to apply.

- Crop thermal imaging
- Microclimatic mapping
- Next generation satellite data
- Soil moisture monitoring
- LoRaWAN network for IoT
- Scheme network connectivity

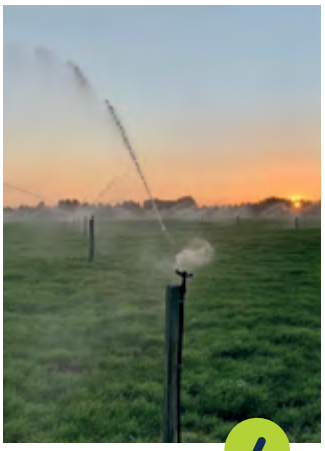
Next-Gen FarmConnect
Scan for a first look

FarmConnect®

326 Burnett Street Ashburton **email** enquiry@rubiconwater.com **ph** 027 644 2288

IrrigationNZ: Strategy



VISION

Water for food, fibre and community wellbeing; for this generation and the next.

PRIORITIES

Lead – set the standards for our sector, add value to our membership, encourage innovation and technology continually looking for ways to improve our performance.

Influence – advocate and build relationships with a united, solutions-focused voice, using robust information, and starting the right conversations.

Empower – working with and connecting people and organisations who can be part of making our communities resilient, thriving and prospering.

OUR VALUES

Credible – we own our actions and are committed to implementing the highest standards.

Problem Solving – be the go-to and can-do people, inspire and motivate, embrace and drive change.

Connected – build relationships, collaborate, share knowledge and ideas, seek to partner with others to get things done, building wide networks of influence.

Future-Focused – the ability of future generations of New Zealanders to meet their water needs, as well as ensuring our organisations long-term success.

OUTCOMES

Recognised as the experts in water management, use and application.

The importance of irrigation is understood by all New Zealanders.

Representing irrigation in Aotearoa New Zealand.
Members know what to do and how to do it.

Advocating to ensure practical regulations are achieved in the best interest of irrigators and New Zealand.

In trusted partnership with the community.

IrrigationNZ: out & about

FISH SCREENS ON IRRIGATION WATER INTAKES

Fish & Game Officer Mark Webb inspects the first demonstration site on the Awakino River, a major milestone for the Fish Screen Project.
Find out more about fish screens on page 15.

HARVEST

January, February, and March are busy months for a lot of farms because it is harvest season for many crops around New Zealand. Here ryegrass is being harvested in Mid Canterbury in early February.

KERI JOHNSTON FEATURES IN USA'S IRRIGATION LEADER MAGAZINE

IrrigationNZ Board Chair, Keri Johnston, was on the cover of the January issue of *Irrigation Leader* magazine. *Irrigation Leader* is an American publication that highlights the people and issues associated with irrigation, and provides a forum for irrigators and engineers to share solutions and technology.
You can read the New Zealand editions of *Irrigation Leader* online at irrigationleadermagazine.com

AGRIKIDS IRRIGATION ACTIVITIES

We have created some great interactive activities for AgriKids events, which have begun and will continue in the coming months at Young Farmers events around New Zealand. These activities support understanding the significance of irrigation in the production of food. Youth education is an important part of helping young people understand the importance of irrigation, including how vital it is to water at the right time in a plant's growing cycle.

Catchment groups thriving with MPI's support

View from Here with Karen Adair, Deputy Director-General of Agriculture and Investment Services at the Ministry for Primary Industries (MPI).

One of the most rewarding aspects of my job is pulling on my gumboots and getting out on-farm to see the positive impacts of our investment programs.

I lead Agriculture and Investment Services at the Ministry for Primary Industries (MPI).

Our mahi centres around supporting farmers and growers across Aotearoa New Zealand. That includes extension services which fund a growing number of community-led catchment groups, and work with Māori agribusinesses to explore different uses for their whenua.

We also co-invest in projects driving innovation through the Sustainable Food and Fibre Futures (SFF Futures) fund. Since the inception of the fund in October 2018, MPI has allocated $160.2 million for 171 applications.

Our work supports the government's *Fit for a Better World* roadmap to grow our food and fibre sector exports by an extra $44 billion in ten years, and restore freshwater environments to a healthy state within a generation.

One of the community-led groups we fund is Thriving Southland. It has been allocated $5.9 million over three years and has 33 catchment groups helping to improve land management practices.

I had the opportunity to meet group members in July last year, when I visited Southland to catch up with farmers. We discussed intensive winter grazing and the benefits better practices can have on freshwater quality.

A winter crop cultivation trial involving several Southland farms is gathering data and will provide useful information to assist farmers in meeting Essential Freshwater regulations.

More than 170 catchment groups, involving more than 5,000 farmers nationwide, are now receiving on-the-ground support backed by MPI funding.

The funding helps them access expertise and tools to improve their environmental and economic sustainability and wellbeing.

In the past two years, about $29 million has been invested in catchment groups through MPI's extension services and Jobs for Nature programmes. A further $14.7 million has been allocated through the One Billion Trees programme and the SFF Futures fund.

Rebecca Hyde from the Hurunui District Landcare Group, with farmer Pip Hunter.

Another group to benefit from MPI funding is the Hurunui District Land Group (HDLG) in North Canterbury. It has been allocated almost $4.4 million over three years.

The funding will see 100,000 native trees planted on sheep, beef, and dairy farms across the district. HDLG has employed three full-time catchment coordinators who are working with 270 farms covering more than 280,000 hectares of farmland. It's on track to be supporting 300 farms by mid-2022.

A distinct part of the group's work is providing one-on-one support to farmers. To date, it has assisted farmers develop more than 125 Farm Environment Plans (FEPs).

The plans are useful to lift farmers' understanding of the environmental challenges and opportunities on their property. They are also helping farmers to produce nutrient budgets, calculate their agricultural greenhouse gas emissions and understand changing environmental regulations.

The number of catchment groups receiving support through MPI funding will continue to grow. In September last year, funding was announced to support farmer-led catchment groups in the Manawatū, Rangitīkei, and Wairarapa districts in the lower North Island.

The Wairarapa Pūkaha to Kawakawa Alliance (WaiP2K) was allocated $1.1 million over two years to support five existing farmer-led catchment groups and enable up to ten more to be established.

Local coordinators, at a catchment or sub catchment level, will be recruited from within each community and be responsible for the coordination of the catchment group. Workshops will cover mapping, stream health monitoring and predator control. Individual farm plans will be developed to feed into wider catchment plans.

Farmers' hunger for knowledge from a trusted source is helping to drive the growth of catchment groups. Our investment includes funding for coordinators, which is the biggest and hardest cost for these groups to cover.

MPI is co-funding a conference organised by the NZ Landcare Trust in Wellington on 9–10 May 2022 (National Catchments Forum) that will highlight the achievements of catchment groups across the country.

From development era to advanced technology: Managing water through changing environments and circumstances

View from There with Tony Oakes, Agricultural Engineer and Consultant in Australia.

Kerang, located 280 kilometres northwest of Melbourne, Victoria, was a great place for a graduate engineer to start work in the irrigation industry in 1980. All the normal features that you would expect of an irrigation region are on display; channels, drains, green pastures and crops, together with the associated support industries. However, the striking feature of the landscape, from whichever road you take into town, is the impact irrigation has had in the low-lying areas – salinised soils, dead trees, salt bush and lignum. The Kerang region and most of the landscape further down the Murray River basin is underlain by very saline groundwater, a feature of geological history. These conditions make sustainable irrigation management challenging and are a constant reminder of the delicate balance between production and sustainability. An example of the management challenges within the region was the requirement to use Murray River water and the irrigation system to "freshen" the Loddon River which otherwise was too saline to use for the town's drinking water. Another unique feature of the region is the extensive modification of natural creeks and ephemeral lakes that convey water, primarily from the Murray River at Torrumbarry on a long journey as far as the plains north of Swan Hill. In addition to conveying and storing water for irrigation, this modified environment has been a haven for water sports and wildlife, hosting the world renown Ibis rookeries and being a favourite location for duck hunters.

My employer, the State Rivers and Water Supply Commission (SR&WSC) was established by the Victorian government in 1905 to develop the state's water resources, with a prime focus on irrigation development and closer settlement. The SR&WSC had a proud history of design and construction, but the completion of Dartmouth Dam in 1979, the largest dam in the Murray Darling Basin with a constructed capacity of 4,000 gigalitre (GL), signalled the demise of the major development era. The death of fruit trees in the Shepparton region in 1974 placed a renewed focus on the mitigation of water logging and land salinisation. The initial response was on engineering solutions to reduce groundwater levels by both government and landowner owned pumps. This broadened in the 1980s to whole farm planning, facilitated by the technology enabled evolution of laser graded irrigation layouts, and surface drainage capture and reuse dams. The emphasis changed from extracting the excess from irrigation to reducing the accessions to the groundwater.

Flood irrigation at its worst – Kerang Irrigation Area, 1980.

Against this background it was unsurprising that the Victorian government chose to allocate its share of the water made available by Dartmouth Dam to new private diverters from the Murray River, between Swan Hill and the South Australian border. This initiative was supported by a major hydrogeological investigation to identify land that would be suitable for irrigation development that would minimise the mobilisation of ancient saline groundwater to the river. This led to the development of high value agriculture (olives, grapes, and nuts) adjacent to the river, supported by best practice pressurised irrigation systems.

Following nearly a decade of reviews in Victoria by the Public Bodies Review Committee, which amongst many other things consolidated the number of agencies dealing with urban water and sewage, in 1984 the government replaced the SR&WSC with the Rural Water Corporation. This decision was motivated by the need for the irrigation sector to become financially independent and to improve productivity and performance. This marked the end of the development era with a focus on organisation transition to improve customer service and reduce costs. Apart from a continuing focus on finance, assets, environmental sustainability and the introduction of water trading, there was a major focus on improvements in the way the water delivery systems were operated.

The role of the field employee, known as the water bailiff, who was historically responsible for the entire operation and minor maintenance of their section of network, was redefined. Centralised Communication and Planning was introduced where farmers placed requests (orders) for water by phone, on telephone answering machines. These orders were processed and scheduled by centrally based water planners with the support of a minicomputer-based system which streamlined central communication and administration with customers. Dedicated field operators implemented the required computer-generated equipment settings, known as running sheets. This changed approach resulted in significant productivity (labour) savings and improved customer service as planning at a larger scale

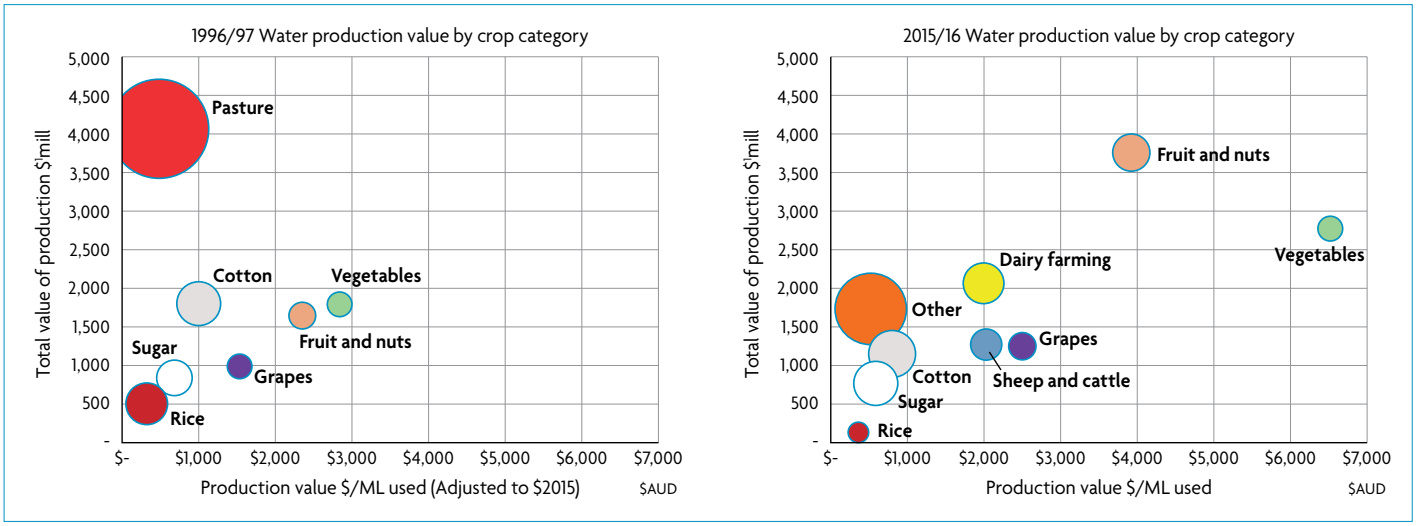


Figure 1: Changes in water use productivity. *(Source: Paqua Consulting and Australian Bureau of Statistics)*

enabled superior delivery schedules to be determined. Software enabled simple performance metrics on service to be computed providing managers with feedback on customer service. Despite these improvements, staff still only worked daylight hours, except for during weather-based emergencies, and much water was lost due to outfalls from the canals because of the relative infrequent and approximate nature of manual operation. By the mid 1990s actuated gate and supervisory control and data acquisition technology could be economically implemented at key sites and the potential for large scale implementation was apparent.

Throughout the 20th century the volume of water extracted from the environment for irrigation kept increasing, resulting in the cap on diversions in the Murray Darling Basin being introduced in 1995. The landmark 2000 study by consulting company SKM highlighted that in Victoria on average 3358 GL was diverted from the environment into the irrigation systems with 980 GL per annum lost, with channel outfalls and meter error the major contributors. With growing community recognition that too much water was being removed from the environment for irrigation, improving irrigation water use efficiency was critical to enabling environmental allocations to be secured. The Murray Darling Basin Plan, signed into law in 2012, was the mechanism for formalising environmental allocations. The plan seeks to find a balance between all water users.

Rubicon's Total Channel Control® technology, which had been developed in partnership with the University of Melbourne, was implemented in two pilot systems in the 2002/2003 irrigation season; at Murchison in the Goulburn Murray Irrigation District (GMID) in Victoria, and Coleambally, a farmer owned cooperative in southern NSW. The pilots involved the replacement of all channel-regulating equipment and farmer outlets with solar powered control and measurement devices, connected via a wide area radio communication system to a software system that autonomously operated the network. Farmers interacted with the software using interactive voice response technology on standard analogue telephones. In addition to scheduling and confirming orders in real time, change of order flow rate and change of finish time transactions were made available and all could be facilitated with two hours' notice. Despite the technology and change management challenges, the pilot systems stopped the waste by eliminating the outfalls whilst at the same time providing a consistent and reliable flow to farmers, which could be requested at short notice. Further implementations of the technology were undertaken to acquire water balance information across the systems and to allay technical concerns about whether the system would operate at larger scale.

With the onset of the millennium drought, the deteriorating condition of the irrigation systems, and the loss of water and revenue due to water trading down the river to higher value crops, it was apparent that the constructed irrigation network needed a major overhaul. Investors in high value irrigated agriculture needed water on demand and the constructed channel systems needed to be improved. In 2006 the Food Bowl modernisation project was conceived to invest AUD$1 billion (B) in system improvements to the GMID. This was subsequently expanded to AUD$2B with the federal government's commitment in January 2007 of AUD$10B to water projects, subsequently extended to AUD$13B. In October 2020, the federal Minister for Resources and Water announced the completion of this project – the largest irrigation modernisation project in Australia's history, delivering 429 GL annual water savings.

Accurate measurement within the system and on farms has provided the ability to close the water balance loop. The new delivery infrastructure is supported by soil moisture sensors, weather monitoring stations and demand prediction software. This empowers the farmer with the knowledge of when to best irrigate, with the comfort of a flexible and reliable flow. Automated surface irrigation technology is now providing a cost-competitive alternative to sprinkler and drip irrigation technologies for efficient application, capitalising on the sunk investment of laser graded surface irrigation layouts and harnessing the power of gravity to minimise operating costs. With such technologies, there is confidence that the salinity issues referred to earlier can be managed. These technologies and policy changes have been effective in scarce water resources moving to higher value crops, as illustrated in Figure 1.

So, what might the future hold? Science is suggesting that much less water will be available in the future. Average annual inflows in the Murray Darling Basin in the past 20 years have decreased by 51 percent, compared to the 100 years before. Meeting the target environmental allocation sought by the Basin Plan, without removing further water from agriculture, is becoming increasingly difficult. Irrigators can be proud of the contributions they have made, and technology should facilitate further improvements. However, there will be increasing pressure to examine the significant water losses from areas like the Kerang Lakes and Lake Alexandrina that were converted from ephemeral to perennial lakes to make low-cost irrigation distribution systems. Whilst such readjustments may be costly and challenging, they may be necessary to meet planned environmental targets.

Tony Oakes is an agricultural engineer who worked for the Victorian government rural water agencies for 15 years. In 1995 he was one of the five founders of Rubicon Water, now a publicly listed global technology business that provides solutions to improve the efficiency of agricultural water use. He now consults for the company on a part time basis supporting Rubicon Water's global expansion strategy, with his prime focus on Central Asia.

IRRIGATION NEW ZEALAND

WATER | FOOD | FIBRE | LIFE

Ron Cocks Memorial Award

Nominations open 1 April 2022

Nominations will open 1 April 2022 for IrrigationNZ's Ron Cocks Memorial Award, which recognises outstanding leadership within the irrigation industry. The deadline for nominations is 31 July 2022.

The Ron Cocks Memorial Award is presented every two years to acknowledge a person who has made a significant contribution to irrigation in New Zealand. J.R (Ron) Cocks was a Mid Canterbury farmer who was recognised as a pioneer, visionary and leader in farming affairs. His greatest legacy was leadership in water issues. The Ron Cocks Memorial Award acknowledges his legacy and encourages others to follow his leadership.

The criteria for the award include;

- **duration of service**
- **quality of service**
- **actual achievement**
- **level of voluntary input, and**
- **leadership.**

The Ron Cocks Memorial Award will be presented at the IrrigationNZ Annual General Meeting and Awards Ceremony in November 2022. For further information and for nomination forms, visit www.irrigationnz.co.nz/AboutUs/Awards/RonCocks

2022 Ballance Innovation in Irrigation Awards

A $2,500 cash prize will be awarded for 'The Best Innovation, Discovery or Achievement that makes a positive contribution, impact or benefit to irrigation in New Zealand'. This award is to celebrate, encourage and promote innovation and the positive things being undertaken in our communities with and as a result of irrigation. It's about ordinary people doing extraordinary things on farms, in schemes, in business, or supporting service industries.

Key Dates:

1 April 2022	Entries and Nominations open
11 July 2022	Nominations close
31 July 2022	Entries close
8 August 2022	Judging commences
November* 2022	Announcement of winner and presentation of award at the IrrigationNZ Annual General Meeting and Awards Ceremony

**Exact date of ceremony to be confirmed.*

Entries are reviewed on potential for the new knowledge to have a positive impact on irrigation through technology development or in a manner that will enhance the economic, social, cultural or environmental aspects of irrigation.

For award information and entry forms visit the IrrigationNZ website.
www.irrigationnz.co.nz/AboutUs/Awards/InnovationInIrrigation/Overview

agri-nutrients Ballance®

Technical matters

By Stephen McNally, Principal Technical Advisor, IrrigationNZ.

The 2021/22 irrigation season is bringing plenty of climate challenges to the irrigation sector, including extreme wind, rain and even fire events across our various irrigation regions. This is on top of constraints in the international and local equipment supply chains, which impact the ability to meet ongoing demands for new system development and the inevitable repairs that occur throughout the season.

For some design and service companies this busy development period comes on the back of two or more previous years of land use change driving the need for reliable irrigation water supply and rapid infrastructure implementation. The demand on the skilled people in our industry to keep up with the pace of development as well as respond to the legislative and regulatory environment leads to some significant resourcing gaps for employers.

IrrigationNZ is working across policy, technical and training activities that all interlink with the multifaceted activities of our members.

In this regular column I provide you with a summary of our outputs.

THE DAM SAFETY REGULATIONS IN NEW ZEALAND

The sharing of expert knowledge with MBIE (Ministry of Business, Innovation and Employment) on the draft Dam Safety Regulations is advancing steadily. These regulations aim to identify water storage structures that trigger embankment height and "held back" water volumes where the consequence of failure could impact human life, environment, cultural features, or critical infrastructure.

Through our technical input on calculation tools and risk assessment methods we hope to see this legislation land as efficient and effective, directed correctly to structures that genuinely need attention through implementation of dam safety improvements. However, we are confident pragmatism will see a sensible timeframe established for the adoption of the legislation and that low risk structures used in irrigation storage and distribution canals will be eliminated from any significant cost burden.

THE WATER SERVICES REGULATOR – TAUMATA AROWAI

The Department of Internal Affairs (DIA) is involved with an on-going assessment of how local authority entities manage their potable, waste and stormwater infrastructure assets and renewals program; commonly known as the Three Water Reforms. It is important to recognise the somewhat separate issue that the Water Services Bill is addressing for the supply of safe drinking water to rural communities from bores and other surface water systems. The Drinking Water regulations came into effect in November and IrrigationNZ is working actively with Taumata Arowai, the drinking water regulator, on how small rural water suppliers will need to address their safety obligations. Remember there are seven years until most existing small rural suppliers will need to be registered and compliant, which gives us the necessary time to ensure safe treatment or barriers systems are pragmatically designed and implemented.

NATIONAL ENVIRONMENT STANDARD FOR DRINKING WATER

The National Environmental Standard for Sources of Human Drinking Water (NES-DW) from the Ministry for the Environment opened for consultation on January 10 and closes on March 6. IrrigationNZ will be working with our members to make a submission on this important legislation that looks to manage risk within catchments where water is being taken for drinking supplies. This legislation is being developed in parallel with the activities of the DIA and Taumata Arowai but takes a different and apparently complementary approach to the impact of land-based activities on catchments.

There are a few things that will need our attention, particularly the possible restrictions on land-based activities (such as use of synthetic fertilisers and agrichemicals) and development of new groundwater bores within source

water risk management areas (SWRMA). The Ministry for the Environment (MfE) case studies indicate they see minimal impact on landowners, but we will need to consider this in practice. There is a suggestion that the NES-DW could be deemed across existing water take consents, i.e. applying the SWRMA approach and standards retrospectively.

The demarcation point between the two policies (Drinking Water Services and NES-DW) is the physical point of water take; seemingly the NES-DW is looking "back upstream" to possible sources of contamination whereas the Taumata Arowai approach views the options for ensuring safety of drinking water in infrastructure "after the point of take".

THE RESOURCE MANAGEMENT (MEASURING AND REPORTING OF WATER TAKES) REGULATIONS AMENDMENTS 2020

We are very pleased to confirm that the New Zealand Water Measurement Code of Practice has been updated and the November 2021 version was uploaded to the IrrigationNZ web page. This update corresponds to the 2020 amendments of the original 2010 regulations. The amendment introduced a staged timeline requiring holders of consents to take and electronically submit their records to their council. The work program coordinated for IrrigationNZ by Vicky Bloomer of Drop Consulting brought together the contributions and expert opinions of MfE, regional councils and Accredited Blue Tick companies to review the refreshed Code of Practice. This guidance document helps to underpin the principles of the Blue Tick accreditation program to ensure expectations of all parties operating in this area are clear.

FISH SCREENS ON IRRIGATION WATER INTAKES

A further significant milestone has been reached with the installation in early December of the first demonstration screens at a site in the Awakino Valley. A Bossman screen was installed, and initial fish exclusion trials conducted over the first few days of the system settling in period. While this is early days for the particular installation site, it was possible to make some early assessments of effectiveness, and the project team is pleased with the indicators. However, as with all new systems, some minor recommendations were made for remediation on work that was completed, largely on the way the screen worked in conjunction with the intake and bypass set up.

Subject to further fish trials, and after microscope inspection, the main observation was that no fish went into the irrigation water and no fish were injured or damaged by moving through the screen set up.

Initial fish exclusion trials with the water starting to flow.

The Bossman screen being settled into the channel.

The installation team, led by Bridget Pringle, reported it was a challenging but rewarding couple of days in the field, manoeuvring rocks in the channel to get the water flowing effectively, and capturing the various sizes and species of fish required for the trial.

The farmers were very engaged and brought their kids to investigate progress each day – they love the river and are very proud to be part of the project and to support its intent. Further trials are being scheduled at the site over the course of the irrigation season.

FERTIGATION, OR THE ADDITION OF SOLUBLE NUTRIENTS TO IRRIGATION WATER

Many irrigators are considering this technology to meet the restrictions on synthetic nitrogen use in what is known as the 190kg N cap. IrrigationNZ and its industry partners have now finalised the analysis of two years of field trial results and incorporated this material into an updated fertigation guidance document. This document, along with an online training module launched in November 2021, will help with the decision processes farmers and designers need to address in adopting this technology. The guidance provides insights into matters such as chemical compatibility, back-flow prevention, and injector selection options.

THE WATER AVAILABILITY AND SECURITY ADVISORY GROUP

IrrigationNZ was one of the industry bodies that provided expert information to the Ministry for Primary Industries (MPI) officials in the Water Availability and Security (WAS) initiative. The full WAS report was launched by MPI along with information sessions to many interested parties across regions and productive sectors in New Zealand. Water storage can be demonstrated to have a major benefit on freshwater management, giving the ability to underwrite reliable food and fibre production. Key to establishing efficient water storage and situation infrastructure is focusing on efficiency of water use, demand management, and ensuring storage is supported within the regulatory context.

IRRIGATIONNZ TECHNICIAN AND ENGINEER, A CAREER PATHWAY AND COMPETENCY PATHWAY

On-going discussions between the industry and training providers have allowed more detail to be put in place on this new training initiative being developed by IrrigationNZ and industry partners.

Training for each competency will be a mix of smaller block courses with online learning and on-the-ground training. The fundamentals of the practical aspects of the job are covered, so that an employee can 'work the tools' safely and knowledgeably. Much of the formal content will draw on our trans-Tasman partners in Irrigation Australia, who have a series of highly experienced trainers keen to pass on their expertise to our industry. The advantage of this approach is the common elements that exist in our two irrigation environments, along with the potential for having recognised roles and competencies across the two countries.

ONLINE WATER METER VERIFICATION TRAINING – MARCH 2022 – SIGN UP NOW!

New for 2022 is our upcoming Online Water Meter Verification training. This course is for those people completing their Water Meter Verification workbook who are looking for formal training to assist them in successfully reaching completion.

The class provides five hours of online tutoring, spaced over three weeks. You will learn about regulations, basic metering installation requirements, understanding the different verification equipment types and methods of use. You will also be taught about error and uncertainty, where it can arise, and how to manage it.

To find out more and to sign up visit the Online Water Meter Verification Training and Workbook event in the events calendar of our website: www.irrigationnz.co.nz/EventsAndTraining

To view the latest course and training dates, head to the Events and Training section of the IrrigationNZ website: www.irrigationnz.co.nz/EventsAndTraining. Alternatively contact us on email via admin@irrigationnz.co.nz.

A full course of 14 students attended the Certificate in Irrigation System Performance training held in Lincoln, Canterbury in February. The course involved a mix of in-class and online learning as well as in-the-field practical training on system performance.

Course tutor Vicky Bloomer, from Drop Consulting, said "it was great to have such an interactive and enthusiastic group on the course, coming from an array of different backgrounds within the industry".

This course has been funded through the Targeted Training and Apprenticeships Fund (TTAF) fees-free initiative for students. The course has been very popular and as such another course is being scheduled in May. **The upcoming May course will be the last Certificate in Irrigation System Performance that will be eligible for full TTAF funding.**

To find out more please visit www.irrigationnz.co.nz/EventsAndTraining/Irrigators/CPA

At right: Photos from the training held in Lincoln in February. Bottom photo: Sarah Hayman (right) and Steph Wright complete the bucket testing segment of the course.

Water Availability and Security – the way forward

Capture and storage: Reliable water = reliable food

By Stephen McNally, IrrigationNZ Technical Advisor.

In October 2021 the Ministry for Primary Industries (MPI) – Manatū Ahu Matua released the Water Availability and Security (WAS) in Aotearoa New Zealand report and a companion technical national scale assessment of the current state of water availability across New Zealand. *Both documents are available to be downloaded from the MPI website at: www.mpi.govt.nz/water-availability-and-security.*

These two documents were the culmination of extensive research undertaken and commissioned by the WAS team within the Agriculture & Investment Services – Tapuwae Ahuwhenua Business unit. This work was led by Mike Jebson, supported by several MPI officials and technical experts working in collaboration with a WAS Advisory Group. This group included experts in regards the food and fibre sector, Treaty, Māori agribusiness, infrastructure investment, local government, environment and irrigation, including Vanessa Winning and Stephen McNally of IrrigationNZ.

The WAS report and its accompanying data analysis is highly encouraging. It makes a clear statement on the importance of reliable water supplies for New Zealand primary sector activities and rural communities. It also provides a wakeup call concerning the emerging challenges these sectors are already facing due to declining availability and security of water caused by climate change and other factors.

For MPI the context for this work was the fundamental importance of access to freshwater for food and fibre production and processing:

- to maintain, develop and expand the horticulture sector
- to increase the productivity and sustainability of whenua Māori
- for new product development and high value processing
- to provide for a broader range of land use options and improved practises for farmers and other producers to reduce biological emissions
- to adapt to climate change and enhance the resilience of rural communities.

Addressing New Zealand's water availability and security challenges will be critical to ensuring the food and fibre sectors are at the fore-front of a post-Covid export-led recovery and to lead the way to a more sustainable economy.

Continued over...

THE GLOBAL CONTEXT

New Zealand food and fibre producers have a critical role to play in meeting consumer needs within the ever-increasing demands of the local market within a global context.

United Nations population and land use statistics show the staggering rate of human population growth we have experienced. Back in 1964 there were just 3.5 billion people on Earth. Data shows we have grown as a global community to around 7.7 billion and the forecast rate of growth will see 9.8 billion by 2050[i]. That's just under a three-fold increase in the lifetime of many New Zealand farmers and growers.

In keeping with global trends, while more young people are entering the farming industries, the long-term trend of increasing age of farmers and farm workers in New Zealand continues. Comparable data from the USA shows that the number of farms is decreasing through amalgamation and the average size of a farming enterprise is increasing. More young people are directly involved in decision making around land use and farming practises. Thirty-six percent of all producers are female and 56 percent of all farms[ii] have at least one female decision maker. Farms with female producers making decisions tend to be smaller than average in both acres and value of production. Female producers are most heavily engaged in the day-to-day decisions along with record keeping and financial management.

Global population growth provides opportunities and presents challenges. All those people need feeding! We know there are significant differences in the way people access food to meet basic dietary needs. Where the socioeconomic situations allow consumer choice, the UN data shows even in heavily populated counties there is a rising proportion of an affluent middle class with increased discretionary spending ability[iii]. Food becomes a major part of this social change. Discerning consumers are looking for a varied diet, but fundamentally looking for safe, nutritious, affordable, and accessible food.

OUR PRODUCTIVE CAPACITY

Our own country's statistics show us New Zealand has about 14 million hectares of productive land.

The UN FAO informs us that a full "westernised" diet which is favoured by the affluent middle classes – including high quality vegetables, animal proteins, sugar, fats, meat, and dairy – takes about 1.3 hectares per person to produce all the ingredients per year[iv].

Extrapolating this mixed dietary model to our varied productive land uses, from meat to vegetables to dairy to beverages, suggests we could feed about 10–11 million people.

Given New Zealand only has a population of just over 5 million people that means a productive capacity surplus. Thus, where we have solved the problems of market access and post-harvest transport and shelf life, we are providing components of peoples' diets across about 40 million people around the globe.

For New Zealand farmers and growers that means our contribution to the supply chain needs to be produced reliably to meet these market demands.

i. *https://www.un.org/en/development/desa/population/events/pdf/other/21/21June_FINAL%20PRESS%20RELEASE_WPP17.pdf*
ii. *https://www.farmprogress.com/farm-life/average-age-us-farmer-climbs-575-years*
iii. *Asia-Pacific Sustainable Development Journal, Volume 27, Issue 1, Jun 2021, p. 1–20*
iv. *https://plantricianproject.org/food-math-101/footnotes*

THE IRRIGATION ADVANTAGES

What we know is that irrigated land is more productive per hectare than non-irrigated land. This is largely due to season-on-season harvest reliability where irrigation ensures soil moisture available to plants is not the limiting growth factor. For New Zealand, our rainfall supplemented with strategic use of irrigation means the ability to maximise the productive capacity of soils within a generally advantageous climate.

DEMAND FOR IRRIGATION IS EXPECTED TO RISE

Because of rising temperatures and changes to rainfall patterns due to climate change there is a growing demand to supplement rain-fed production with irrigation in order to maintain good growing conditions. This increases pressure on water resources at the same time the availability of run off river water sources and groundwater resources are expected to decline.

Irrigated food production in New Zealand is therefore an important contributor to both local and international consumers' basic dietary needs, and for many allows for their discretionary food consumption choices.

The recent market demand and grower response to move away from pasture-based systems towards horticultural products is not necessarily going to reduce water demand. It may, in fact, mean a higher demand for reliable water across a broader seasonal profile, but is no less complex to achieve than for pasture systems. Water storage is a critical element in this land use change.

New Zealand has had irrigation schemes since the Department of Works developments of the 1930s. Irrigated land in New Zealand now accounts for approximately 900,000 hectares of productive land, across many production types of food, fibre and beverages.

Some of the original water-race based schemes are at the end of their useful asset life, some having been nursed along well past their design life by dedicated scheme management organisations. However, as the need for reliability and security of supply presses in on farming enterprises, many of the older schemes are

underway with replacement and major refurbishment projects, mostly looking at taking canals and races into piped systems.

With a few notable exceptions, very few irrigation schemes in New Zealand have been based on man-made storage. Most are run off rivers relying on catchment yield reliability.

IrrigationNZ is aware of the benefit of industrialised agriculture and the role irrigation has played in helping meet the world food demand, but all human communities have an environmental impact including upon the land used to produce food.

Newer irrigation schemes developed from the 1980s to the early 2010s have more and more been driven by water use efficiency, demand management and reducing environmental footprints. They recognise the balance between the capture and storage of the right amount of water needed for food production, and maintaining the ecological integrity of the water source. The change in approach to irrigation schemes has coincided with more farmer-owned developments which are privately funded, and less substantial public capital funding.

WATER AVAILABILITY AND SECURITY – A STRATEGIC APPROACH NEEDED!

Over recent decades the government has provided significant financial support for investigations into developing water infrastructure projects from concept towards being investment ready. In a few cases the government has provided short-term capital support. The support has been provided from the Sustainable Farming Fund, Community Irrigation Fund (launched by Jim Anderton), then the Irrigation Acceleration Fund (which produced the Good Practice Guide to Irrigation Developments), then Crown Irrigation Investments Ltd (heavily focused on a return on investment analysis), and most recently the Provincial Growth Fund (under ex-Minister Jones). Under the current government, direct funding for 'regional scale' irrigation infrastructure such as storage dams has somewhat slowed down, apart from some legacy commitments in the Kanoa programme. However, there has been some funding (grants and/or loans) provided for a small number of community scale water infrastructure projects (irrigation/storage/aquifer recharge), and for water resource investigations in certain regions to support economic development, including the development of whenua Māori.

The WAS report of 22 October 2021 was a significant statement. The report shines a spotlight on the declining state of water availability and security in New Zealand due to climate change and other factors. It makes a strong case for the need for a strategic response to these emerging challenges for the primary sector and the broader community. This response involves improved management of both demand and supply of our precious water resources.

The report gained strong support from MPI senior members and from the Minister for Primary Industries. In the pre-release period it was widely promoted, and reviewed by many other government agencies.

The 2021 WAS report recommends, among other things, the reframing of future investment in water infrastructure and management using Te Mana o Te Wai principles. These focus on the use of multiple purpose/multiple benefit models developed by central and regional government, Iwi/Māori, food and fibre sector organisations and community interest groups. This would include optimising the use of existing infrastructure (e.g. hydro generation dams, municipal supplies, etc.) to improve water availability and security for multiple uses.

This is tempered by an ongoing obligation on all water users, including the primary sector, to first demonstrate consistency in approaches to water use efficiency and demand management. This ensures water is used appropriately and that any new storage is sized to meet acceptable and justifiable needs without excesses.

Public acceptance and support for storage relies on further developments being seen as genuinely multifaceted, addressing the needs of multiple users of freshwater, and complementary to community visions. Typical multiple uses will include storage for a reliable supply of human drinking water, recreation (such as boating), energy production, supplementing environmental flows, and/or including enhanced wetland habitats in storage design. Stock drinking water, industrial, and firefighting water supplies are also likely beneficiaries of a community approach to water storage. This can also include the

Continued over...

Water Availability and Security – Executive Summary

Ko te wai te oranga o ngā mea katoa. Water is the life giver of all things.

Water is a precious taonga, essential to our people and the world we live in. The quality, availability and security of fresh water is critical to food and fibre production and processing, community resilience, our identity as New Zealanders (Māori and non-Māori), and the health of te taiao – the natural world on which we all depend.

The 'Fit for a Better World – Accelerating our Economic Potential' (FFBW) roadmap recognises access to reliable sources of water provides transformational opportunities to diversify and unlock the potential of our land and processing industries so that our food and fibre sector, and the communities they support, are more sustainable, resilient, and successful in a world experiencing significant change.

While Aotearoa New Zealand is traditionally viewed as a green and water rich country, current climate change trends show a country getting warmer and drier (with some regional variations), and more prone to climate extremes (floods and droughts). The frequency of these events is increasing rapidly. The declining natural availability of water, combined with the need to halt further degradation of our natural waterbodies and operate within environmental limits, pose significant challenges for the availability and security of water for the food and fibre sector and rural communities.

The responses of the past will not be sufficient for the future challenges and uncertainties we face. Aotearoa New Zealand will need a strategic focus and serious investment to better manage this increasing challenge and to capture the transformational opportunities, so the food and fibre sector continues to lead the recovery in a post-COVID world.

This discussion paper marks the end of the exploratory phase of the Ministry for Primary Industries (MPI) Water Availability and Security (WAS) initiative. It sets out to:

i. acknowledge the complex and dynamic systems we are working within;
ii. highlight the direction of change based on what we currently know; and
iii. provide a compelling argument for the recommendation to act strategically – and to act now.

A transition towards land uses that have a higher economic and lower environmental footprint, and improved community resilience, will require increased water security. This will require a strategic response that addresses and integrates approaches that consider the current and future supply, demand, and priorities for the use and protection of freshwater and the resources dependent on it.

As part of both demand and supply management there needs to be a better integration of practices and technologies to monitor, measure, and manage water to improve efficiency and climate proof water availability and security. Where demand responses are not sufficient to ensure water security there is a need to consider the role of supply solutions such as investment in water storage, ground water recharge and water distribution to supplement natural sources of freshwater.

In the context of Te Mana o Te Wai[a] (TMoTW), where new, repurposed, or updated water infrastructure (e.g. storage including ground water recharge and distribution) is being considered to address water availability and security challenges there is:

- a need for multi-benefit infrastructure that supports a range of needs such as ecosystem health and drinking water while also enabling a sustainable food and fibre sector, and,
- a need for dynamic adaptation pathway planning, flexible investment and governance structures and new investment models around multi-purpose storage as water needs and priorities of use vary over time.

Based on a technical assessment of water allocation, availability, security, and financial viability[b] – Northland, Waikato, Bay of Plenty, Gisborne, Hawke's Bay, Otago, Greater Wellington, Tasman, and Manawatū-Whanganui have been identified as having the greatest potential to grow the food and fibre sector by improving water availability and security. However, this growth needs to be carefully considered and placed within the context of Te Mana o te Wai (TMoTW) to incorporate wider community needs and expectations.

For this to occur MPI WAS recommend:

i. MPI establishes a Water Availability and Security Partnership comprised of central and local government, iwi/Māori, food and fibre sector organisations, science providers, and community interest groups.
ii. The Water Availability and Security Partnership develops an action plan and business case for the design and implementation of a national water availability and security strategic approach that will work within the framework of TMoTW.
iii. The action plan needs to be supportive of the food and fibre sector, guide practice change, and future science and technology (e.g. improving or developing technology and new systems related to efficiency, recycling, etc. and incorporating mātauranga Māori), and coordinate investment in water infrastructure (distribution and/or storage).
iv. Any further investment in water availability and security made by government should use Te Mana o Te Wai as the guiding framework and focus on the use of multiple purpose/multiple benefits models.

a. As expressed in the National-Policy-Statement-for-Freshwater-Management-2020

b. Water Availability and Security: National Scale Assessment – MPI Technical Paper No. 2021/18 – Aqualinc Research Ltd – July 2021

role of water storage dams in reducing risks downstream due to flood attenuation.

This multi-faceted approach where all users are considered in the design and planning stages is somewhat new. There is a level of uncertainty about how it can be implemented equitably, but inevitably these factors need to be addressed to gain community support.

IS THERE A PRESCRIPTION FOR A SUCCESSFUL IRRIGATION SCHEME DEVELOPMENT?

The short answer is no. There are many factors that need to align to give it the best chance. Under a previous government, MPI commissioned the Irrigation Acceleration Fund Good Practice Guidelines. Stephen McNally was one of the lead authors. While that document is still seen as a comprehensive catalogue of approaches to infrastructure projects, changes in legislation and community expectations have seen a shift in some development priorities.

Success will come from a self-determining community, with genuine active participation. This success is often led by a strong, articulate, active and visible champion.

Environmental outcomes are not an afterthought! Make this an early decision-making criterion and understand what Te Mana o Te Wai means. It is not just a Māori world view, but also articulates what most New Zealanders want for their water, land, and community.

A successful project needs an early, clear consenting pathway which considers the community expectations that are often encompassed in regional plans and regulations. The MPI WAS strategy may help frame regional rules better in the future, enabling storage and distribution infrastructure to meet water availability and security realities.

Analysis of projects across New Zealand and globally show that effective communication is a foundation success element. You only need to look at the International Association of Public Participation scale of successful consultation; the lower end of engagement being a letter drop, the top end being a fully inclusive round table collaboration where all parties address the problem and possible solutions. This active participation is likely the longest path, needing energy and commitment, but having the highest likelihood of success.[v]

The issue of funding needs to be addressed early. A multi-faceted financial vehicle will be needed, acknowledging the life cycle of investors who will want to participate and exit at different stages.

A project must be technically sound, particularly regarding hydrological and geotechnical aspects. While sometimes difficult to manage, a well-documented peer review process is important for the robustness and defensibility of any decision made.

A project team should take a formal approach to risk management, including allocation of risks to the parties best able to deal with them.

In alignment with a risk approach is the multi-criteria analysis of information that needs to be considered for a project. Stick to a set of criteria against which decisions are made, and avoid being reactive and abandoning early decision frameworks. This may mean leaving options "alive" on the table longer in order to avoid drilling down too early or blinkered solutions.

Look at the benefits of a staged development. Does all the storage need to be established at the start? Users won't necessarily be present for many years, while some develop their own enterprises around water use. Staging is likely to better reflect the rate of uptake, and may help with cash flow.

THE PATHWAY TO WATER AVAILABILITY AND SECURITY

The next step proposed by the MPI WAS report is establishing a strong and clear water resources management strategy. This goes alongside the country's existing environmental and social strategies. Having a water strategy is kind of the missing link for a primary producer country like New Zealand.

The full report is able to be download and reviewed by all interested parties at: www.mpi.govt.nz/water-availability-and-security.
There are two documents: 1. Water Availability and Security in Aotearoa New Zealand – Supporting the sustainability, productivity, and resilience of the food, and fibre sector – MPI Information Paper No. 2021/04 ; and 2. Water Availability and Security – National Scale Assessment – Aqualinc Research – MPI Technical Paper No: 2021/17.

v. https://cdn.ymaws.com/www.iap2.org/resource/resmgr/pillars/Spectrum_8.5x11_Print.pdf

Changes to the Resource Management Act (RMA) Explained

Environment Select Committee recommends Government proceed with reform.
By Sarah Eveleigh, Partner, Anderson Lloyd.

For many years there has been debate about whether perceived issues with the Resource Management Act 1991 (RMA) could be resolved by further amendments to that legislation, or whether replacement of the Act is necessary.

Following recommendations of an independent Resource Management Review Panel, the government announced, in early 2021, its intention to repeal the RMA and replace it with three new pieces of legislation:

- *The Natural and Built Environments Act (NBA)* – the primary replacement for the RMA
- *The Strategic Planning Act* – providing for development of long-term regional spatial strategies
- *The Climate Adaptation Act* – a targeted piece of legislation addressing issues associated with managed retreat from climate change effects.

At the end of June 2021, a parliamentary paper containing explanatory material about the NBA, and an exposure draft of key parts of the bill, were released and referred to the Environment Select Committee. While it is usual for a full bill to be referred to a select committee, the exposure draft process was used to test and improve the contents of the bill before it goes into the formal parliamentary process. The Environment Committee was tasked with providing feedback on the exposure draft and collating a list of ideas for making the new system more efficient, proportionate to scale/risk, affordable, and less complex.

The Environment Committee received over 3,000 submissions and heard evidence from over 300 submitters. Its report was released in November 2021. It recommended the government proceed with development of the NBA and generally supported the direction of the exposure draft, while making limited recommendations for amendments to drafting and more general comments on matters to be addressed in the full bill.

Key elements of the bill contained in the exposure draft, and addressed by the Environment Committee, are summarised below. Consistent with the recommendations of the Review Panel and statements by Minister Parker, the Environment Committee's recommendations reiterate and further strengthen the intended policy change away from the management of effects, and towards prioritisation of protection, restoration, and positive outcomes for the environment.

PURPOSE

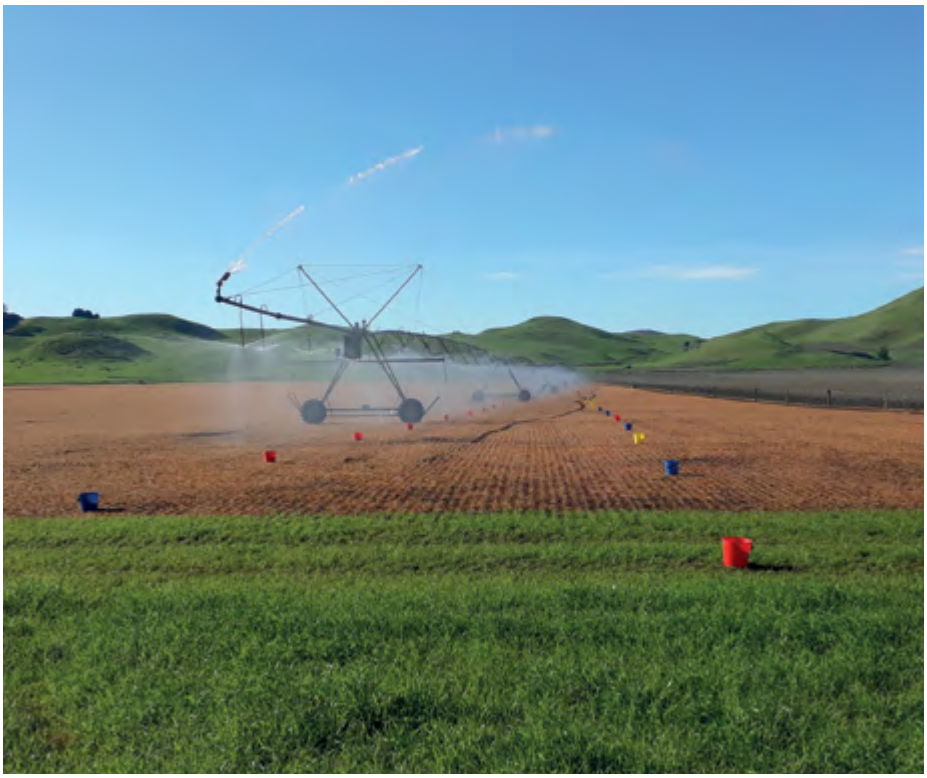
- The purpose of the NBA is both to enable Te Oranga o te Taiao to be upheld, including by protecting and enhancing the natural environment; and to enable people and communities to use the environment in a way that supports the well-being of present and future generations. Te Oranga o te Taiao is described as incorporating the health of the natural environment; the relationship between iwi/hapū and the environment; the interconnectedness of all parts of the natural environment; and the relationship between the health of the environment and its capacity to sustain all life.
- The Environment Committee recommends that amendments be made to the purpose clause to reflect that environmental limits have priority in the system, and use more directive language to require protection of the natural environment. It also recommended that more work be done to develop the concept of Te Oranga o te Taiao, including by clarifying that all New Zealanders have relationships with, and responsibilities to look after, the natural environment.

ENVIRONMENTAL LIMITS

- The NBA would require that limits are set to protect the ecological integrity of the environment or human health. Limits are to be set for air, indigenous biodiversity, coastal waters, estuaries, freshwater, and soil through the National Planning Framework and Natural and Built Environment (NBE) Plans (discussed below).
- The Environment Committee recommends provisions that also enable use of transitional limits and environmental targets. In addition to setting a time-bound pathway towards achieving an environmental limit, this would address concerns that use of environmental limits could create a 'race to the bottom', rather than promoting protection and restoration of the environment as intended by the reform.

ENVIRONMENTAL OUTCOMES

- A key policy change sought through the reform is a move away from managing effects and towards achieving positive outcomes for the quality of the environment. The exposure draft provided a list of 16 discrete environmental outcomes, to be promoted through the National Planning Framework and NBE Plans. The drafting of the outcomes, and the potential for conflict between them, was a focus of submissions to the Environment Committee.
- The Environment Committee recommends consolidating the outcomes under the headings of natural environment, cultural values, climate change and natural hazards, and well-functioning urban and rural areas. The drafting has been simplified, with a number of specific directions consolidated into fewer high level outcomes. More directive and consistent drafting is also recommended, regarding directions to



protect, restore, increase/decrease, enable and provide for identified matters.
- Recommended environmental outcomes of particular relevance to the irrigation sector include:
  - reduced risks arising from, and better resilience of the environment to, natural hazards and the effects of climate change
  - enabling enough development for housing, business use, and primary production to meet the diverse and changing needs of people and communities
  - the ongoing and timely provision of infrastructure services.

NATIONAL PLANNING FRAMEWORK (NPF)

- The NPF is to provide direction on the integrated management of matters of national significance, and matters for which national or subnational consistency is desirable.
- The Environment Committee recommends that:
  - the purpose of the NPF be expanded, to clarify that this includes resolving conflict between environmental matters (including the environmental outcomes), and setting environmental limits and strategic direction.
  - the NPF should include:
    - relevant considerations that decision makers must have regard to when setting environmental limits
    - mandatory content on all environmental outcomes
    - stronger direction on resolution of conflicts between environmental outcomes. This would include a requirement for the Minister to have regard to whether it is appropriate for conflicts to be resolved at a national level through the NPF, or at a regional level by NBE Plans.

NATURAL AND BUILT ENVIRONMENT PLANS (NBE PLANS)

- These will replace current regional and district plans. The NBA will require one consolidated plan for each region (approximately 14 NBE Plans for the entire country), to provide a framework for integrated management of the environment. NBE Plans would be developed by a joint planning committee, including representatives of regional and district councils, mana whenua and the Minister for Conservation.

SYSTEM EFFICIENCY

In respect of the system efficiency, the Environment Committee made a number of high level recommendations, including that:
- capability and capacity within the system be boosted
- existing definitions and concepts be retained as far as possible, to improve certainty and reduce the need for legal action
- dispute and conflict resolution be approached in a less adversarial, and more inquisitorial way
- digital tools be coordinated and improved.

The Environment Committee report reiterates the intention that environmental limits are set, and conflicts between environmental outcomes are resolved, at the NPF and NBE Plan level, and not through subsequent resource consent applications. As we have experienced through the National Policy Statement for Freshwater, directive policies and imposition of limits at a national level can be determinative and leave little, if any, room for consideration of case-by-case merits of subsequent consent applications. As national and regional planning provisions become more directive, participation in those processes becomes increasingly important. However, that can be challenging for individual submitters, and we consider there will be advantages in industry representation or collective groups leading participation and representing the views of members in those processes.

The Environment Committee's report will inform further development of the NBA bill. It is anticipated that complete bills for the NBA and Strategic Planning Act will be released in early 2022, and will be passed into law by the end of 2022. Consultation on the Climate Adaptation Act is scheduled to occur through 2022, ahead of release of that bill in early 2023. Each bill will be referred to select committee, and there will be further opportunities for public submissions through those processes.

Sarah Eveleigh specialises in resource management law. She advises clients on a broad range of matters including consenting, compliance, planning processes and due diligence, with particular expertise in freshwater management and agribusiness. Sarah has acted for water suppliers, statutory bodies, public interest groups and individual farmers on regional plan changes relating to water management, rural land use and nutrient management, and on consenting of water storage and irrigation schemes. She has been practising in Christchurch since 2006.

LEARN MORE: The important role water plays in growing kiwifruit

Horticulture is the art of cultivating plants to produce food, flowers, fruits, nuts, vegetables, herbs, and more. We caught up with Sandy Scarrow and Phoebe Scherer, who are horticulture consultants based in the Bay of Plenty, also working throughout Northland and Gisborne. We asked them about growing kiwifruit and the role irrigation plays in doing so.

Sandy Scarrow (left) and Phoebe Scherer (right).

How did you become involved with kiwifruit irrigation?
We got involved in soil moisture monitoring and received irrigation recommendations from a colleague in Motueka who had formed a relationship with Sentek, an Australian company with some very good soil moisture monitoring equipment. At the time, growers were using either tensiometers or kicking the dirt to inform their irrigation decisions. Neither of these strategies provided good answers for them.

What do your roles involve?
We offer a range of services for soil moisture monitoring. One service is the supply of fully autonomous, telemetry soil moisture monitoring technology which allows the grower to access their soil moisture data from the cloud at any time, anywhere. This allows the grower to see the impact of any rainfall, drainage, and crop use to inform their irrigation decisions in real time. Another product allows for similar data access but relies on Bluetooth technology rather than telemetry to download the data. Either the grower can do this, or we can do this as a part of a weekly service package during the irrigation season. Our original service offer was a weekly visit to the grower's property to "plunge" the sites to read the soil moisture at that time. This service gives the grower a record of soil moisture down to a depth of one metre. From this data we provide recommendations regarding how much water the grower needs to apply as irrigation.

What experience do you have with kiwifruit irrigation?
Fruition, the company we work for, has been offering this service for the past 20 years. The basics of monitoring soil moisture and making recommendations based on crop conditions, forecast rain and grower targets remain core to our business. Technological advances improve our methods.

What considerations do you make before designing/developing a kiwifruit irrigation system?

We don't design irrigation systems. We work with what the grower already has in place, and try to optimise its use.

Understanding soil characteristics in terms of its water holding capacity and drainage properties goes a long way to helping inform what type of irrigation set up would be the most effective for your orchard. Whether there is any significant variability in soil characteristics across the orchard can sometimes help inform where to place different irrigation zones which can be turned on and off independently from each other.

We have used our technology to help growers decide if they need an irrigation system. There are some growers who have thought that water was not a limitation for them. For some this is true, but we have found that for some this is not the case. Crop volume and quality is seen to have been limited in times of extreme dryness.

What are the crop water requirements for kiwifruit?

Water requirements for kiwifruit vary depending on the time of year. Typically, we irrigate from October through to March, depending on the soil moisture. To achieve good dry matter results it is recommended that growers work a dry-out strategy coming into harvest, so irrigation recommendations taper off as harvest season approaches. Kiwifruit is thought to have a Crop Factor of one. That is, it is recommended that you replace the water lost through evapotranspiration (ET) with either irrigation or rainfall. Other crops have different crop factors which may mean you apply more or less than ET.

Water quality is important. There are some nutrients that may be applied in the water that, in elevated levels, can be toxic to the kiwifruit plant. Surprisingly to some growers, boron is an example of this. There may be a need to limit irrigation if there is excess boron in the irrigation supply.

What growing requirements are specific to kiwifruit?

Young kiwifruit vines need good supplies of water to grow and develop, and this needs to be directed towards the smaller root ball of the young vines to be most effective. The financial impact of not getting this right can be very high, particularly with the high price growers are paying for the Gold3 licence at present. What many people are not aware of is the increasing importance of irrigation if the orchard has a high water table or challenging anoxic soil conditions. Kiwifruit as a vine is intolerant of water logging, therefore its roots may die in waterlogged soil. This root death results in fewer roots available to accept the water needed, necessitating more careful management of irrigation to this limited root zone.

What are the factors you feel are most important with your development?

The initial expenditure on irrigation is only a small part of the overall cost of the development. It is best to design for the optimum; a system that will provide water in volumes that can provide overhead frost protection. However, before spending money on this it is best to determine whether there is the possibility of gaining consent to use either surface water or groundwater. Some regional councils have over-allocated their water supply. Depending on the source of water, sprinklers are the best delivery system, although drippers are preferred where flow rates are low.

What are the challenges, short falls, or commonly made mistakes you often come across when it comes to kiwifruit irrigation systems?

Growers may jump the gun and install irrigation systems without considering the volume of water needed and the availability of that water. Kiwifruit typically requires more water than is economically viable to buy from municipal supply. Instead a more reliable supply of water is from surface water or groundwater. We advise talking to your

regional council representatives about the availability of water in your catchment area, and whether there is a realistic possibility of gaining a consent for water that you require. If the consented volumes are limited, then you need to consider water storage options such as tanks or ponds.

What has been one of your biggest achievements/most important learnings associated with kiwifruit irrigation development?
One of the biggest take-aways from working in kiwifruit irrigation is that you are only seeing half of the picture when looking above the ground. You start to understand so much more about your vines once you can see what is going on with the root system. Continuous soil moisture monitoring technology allows us to pinpoint root activity at different depths, identify when the vines experience the onset of stress, and monitor movement of nutrients throughout the soil profile. Soil moisture monitoring is a valuable tool for any grower to consider when contemplating irrigation.

Do you have opinions on how changes in the local climate will impact your irrigation system decisions, establishment, and operations?
For all regions growing kiwifruit, we know that climate change is resulting in more intense periods of rainfall but also extended drought. For years the Bay of Plenty has considered 90mm average monthly rainfall something to be relied on. Furthermore, our good soils have meant that the rainfall is held in the soil for plant use. Reliable rainfall is no longer the case. As a result, growers need to consider irrigation systems that will meet the needs of their plants during periods of extended dryness. Where consented water volumes are limited, this may mean relying on water storage systems.

Drill and drop probe for soil monitoring.

Freshwater research news

The Waterways Centre for Freshwater Management is a teaching and research centre based at both the University of Canterbury (UC) and Lincoln University (LU). The Centre offers a Postgraduate Diploma, Masters and a PhD in water resource management, and teaches both undergraduate and postgraduate water papers at both universities. Now in its 11th year, the Centre has growing numbers of academic staff, postgraduate students, and research projects. It is refreshing the water resource management postgraduate qualifications for 2023.

Among active research streams at the centre is Dr Leanne Morgan's groundwater research group, made up of Ministry of Business, Innovation and Employment (MBIE) funded projects in sea level rise. Irene Setiawan (PhD candidate, LU), Amandine Bosserelle, and Connor Cleary (PhD candidates, UC) are looking at the impact of sea-level rise on coast aquifers and communities. Another MBIE funded project is looking at groundwater recharge from braided rivers, with Alice Sai Louie (PhD candidate, UC), Christy Songola (Masters candidate, LU) and two additional Masters student projects completed in 2021.

Another project, in collaboration with GNS Science, explores hindcasting a groundwater system to pre-European conditions, incorporating indigenous records of natural conditions, with Tara Forstner (PhD candidate, UC).

The Waterways Centre director, Professor James Brasington, specialises in geospatial modeling of rivers systems. He has developed a state-of-the-art airborne lidar facility at Waterways, using the first sensors of their kind in the southern hemisphere. James supervises several students who are using geospatial data to model river processes, addressing issues such as the impact of flood harvesting on sediment processes (Justin Rogers, PhD candidate, UC), and the use of machine learning to model flood inundation (Martin Nguyen, PhD candidate, UC). He also supervises postdoctoral researcher Justin Stout (UC) who is about to start on a two-year MBIE funded project that aims to develop new lidar and image processing technologies to derive seamless, high fidelity models of the river and coastal systems. James is also leading work on another five year MBIE programme (Future Fish) that aims to understand the effects of climate and land-use change on river dynamics and the associated impacts on both native and exotic fish communities. He is advertising for a new postdoctoral researcher and PhD student to work on this exciting project.

Dr Ed Challies works in the field of water policy and governance. Ed's work is currently funded through the Our Land and Water National Science Challenge, MBIE Endeavour Fund, and Freshwater Improvement Fund. His work addresses catchment groups and community-based management in urban and rural contexts, and social-ecological feedback in freshwater management. His recent and current PhD supervision covers research in urban water governance (PhD candidates Rachel Teen and Tyler McNabb, UC), flood resilience (PhD candidate Unnathi Samaraweera, UC), and social practices of water use (PhD candidate Julie Clarke, LU).

Two new academic staff have joined Waterways in early 2022. Dr Shelley MacDonell is a hydrological scientist whose work focuses on headwater catchments, aimed at better understanding of water delivery to catchments, including timing and source contributions. Dr Issie Barrett completed her PhD in restoration ecology, investigating scenarios where communities remain degraded following successful habitat and water quality restoration. Her passion is the practice of river restoration and Karina Kelly (Masters candidate, UC) will be undertaking her research in this area.

Other students and research projects are also underway in 2022, which are a reflection of the work being done by industry, academia, and government to find answers to New Zealand's freshwater management issues.

The perfect rose – made with love and water

‘Roses are red’ goes the saying, and irrigation is an integral part of achieving that, according to an Auckland rose grower. And it’s even more important when Valentine’s Day rolls around.

Theo Van Lier and his son, Harry, own Van Lier Nurseries, which is north of Auckland. Across two separate sites, totalling three hectares undercover, they grow 48 different rose varieties and several complementary flower types. Roses are picked and packed every day; up to two million roses a year. Theo said, “We couldn’t grow flowers without irrigation. We just couldn’t do it.”

Van Lier Nurseries supply flower auctions in Auckland and Wellington, as well as florists and wholesalers.

This time of year is the busiest for them with mid-February bringing Valentine’s Day “and everyone wanting roses”. This means there is not much down time over Christmas and New Year’s, due to pruning to make sure everything is ready for the big day, which soon rolls into Mother’s Day in May, which is almost as big as Valentine’s Day, Theo said.

“Our target for Valentine’s Day is five times more red roses than we normally do in a week. We make sure we gear up as much as we can.”

The art of growing flowers has been part of the Van Lier family for many years. Theo’s parents immigrated from Holland in the early 1950s. After working in horticulture they started their own nursery in Glen Eden, before moving the operation in the ‘60s, to Massey, norwest of Auckland. By 1967 the nursery was well established, with seven glasshouses. By 1985 that had doubled to 14.

After studying at Massey University in the early ‘80s, Theo travelled through Canada and Holland, working in horticulture. On his return to New Zealand, he began working for the family business and purchased it from his parents in 1987. In the early ‘90s he installed a bore for irrigation to ensure flower growth. In 2000 he purchased a site for a second nursery in Riverhead. The Riverhead property had a bore,

Aerial shot of the Riverhead nursery when first built, with the dam (right).

Theo (left) and Harry celebrate 50 years as a limited liability company.

"It's quite an intensive system, so we ensure any water that runs off is sterilised, mixed in with new water, the fertiliser level is re-measured, and it gets re-used."

however after experiencing the effects of Auckland water shortages he put in a 4 million litre collection dam. "When purchasing our second property the main things we considered were having the ability to supply heating for the glasshouses and also a water supply."

Many aspects of their business have changed, including markets, development, and technology. However, one thing that has remained the same is the need for irrigation, and over time they have continued to improve their irrigation systems.

Theo said the roses are grown in a partial hydroponic system (a production method where the plants are grown in cocous bags and irrigated) where they are irrigated ten times a day in summer. This is done through a drip irrigation system, with the aim of each plant receiving 80–90ml of water on the first cycle in the morning and then 40–50ml per plant for the cycles thereafter. Fertiliser is also applied through this system. "It's quite an intensive system, so we ensure any water that runs off is sterilised, mixed in with new water, the fertiliser level is re-measured, and it gets re-used."

At the Riverhead site, water for irrigation not only comes from a bore. Rainwater is directed from the top of the glasshouses into their 4 million litre storage dam and into two tanks, each with a capacity of 1.58 million litres.

"We need to make sure we are using our water as best we can to make sure we still have enough in times of drought."

Theo said the amount of water each plant receives is adjusted depending on the age of the plants, which have a five to seven year life cycle, and they also weigh the plants to understand their water capacity.

Covid has presented challenges, such as having limited access to resources, and struggling to get staff. Theo said it had also been positive for their business, because with fewer imports coming into the country rose prices have improved in the local market.

"We struggle to compete with countries that have no government compliance costs, cheap labour sources, and temperate climates enabling them to grow massive amounts at low cost. We just can't grow to that scale."

Theo said over the years they have become more and more aware of using their land efficiently, from introducing water recycling to constantly adapting to technology.

"Our irrigation system is now all online and we can regulate what we are giving every plant. It's very different to how it used to be, both for me and my parents."

When asked, he said he enjoyed growing things, mostly the young plants.

"There is a need for good quality young plants, as you have to replace crops every five to seven years. Propagation and looking after them from the start is something I specialise in and enjoy."

As for future goals, Theo said they were expanding their nursery at Riverhead, which has been a real challenge due to struggling to get resources. They are looking forward to seeing the results, as well as working the family into the business.

From high-strength steel to our ReinCoat® galvanizing to industry-leading warranties, count on Reinke for innovative irrigation solutions to maximize your fields' productivity season after season. All backed by your local Reinke irrigation dealer.

Learn more at reinke.com or visit Reinke New Zealand on Facebook.

Reinke

Good soil management the key to sustainable irrigation for award winners

ZIMMATIC BY LINDSAY
TRAILBLAZER
Sustainable Irrigation Awards

Understanding soil types and managing soil biodiversity is key to sustainable irrigation and a successful farming operation, according to Canterbury mixed cropping farmer Angus Aitken.

Angus and his wife Elise are the Supreme Winners of the 2021 Zimmatic® Trailblazer Sustainable Irrigation Awards.

They farm a 550 hectare mixed cropping property in Waiau that grows a variety of produce, from sweet corn to red clover for lamb finishing.

The Aitkens have a consent to draw water from a nearby Waiau River tributary to irrigate the property and they use a small storage dam and a two-pump shed system. While technology plays a large part in sustainably managing their irrigation system, Angus says they are also focused on managing their soils and soil structure through methods like no till farming.

"I think for a long time the focus has been on what's above ground and what you can see on the surface of your paddocks. But we are learning that understanding your soil characteristics and protecting the biodiversity in your soils can also help with water infiltration, crop performance and sustainable water use."

Angus says they are keen to use their win to generate discussion among farmers about sustainable water use.

"We support the national policy on protecting our waterways. While we don't own the water, we have a right to use it responsibly. It's for everyone's benefit that we use it sustainably to produce food," says Angus.

The Aitkens' operation has variable water requirements across crops. They use FieldNET's variable rate irrigation feature, which allows them to vary application depths by 1-degree sectors. This ensures they direct water where it's needed most, depending on their soil types, run off and drainage areas, and crop growth stages. In the future they plan to invest in Zimmatic Precision VRI technology

"We support the national policy on protecting our waterways. While we don't own the water, we have a right to use it responsibly. It's for everyone's benefit that we use it sustainably to produce food."

Angus Aitken, son George and wife Elise. The Canterbury couple have been named the Supreme Winners of the 2021 Zimmatic Trailblazer Sustainable Irrigation awards. *(Photo: Jess McGhie)*

"We are only at beginning of our journey and have a lot more to learn. We're not the only farmers trying to change things, but together over time I'm confident we can demonstrate that it is possible to run profitable and productive farming operations, while protecting our waterways."

for individual sprinkler control and EM survey the property to map soil variability.

They use Lindsay's FieldNET™ remote irrigation management system and CropX soil moisture sensors to measure and understand the constantly changing conditions and variability on their land.

"It's one of the reasons I see a bright future for farming. The technology is continuing to improve all the time and it's only helping us be more efficient and more sustainable," says Angus.

The technology allows quick, on farm decisions to be made, such as altering the Aitkens' water application depth or shutting down irrigation pivots straight away to avoid a fault.

"We can prioritise crops such as corn that need more water, and pull back on watering crops such as red clover, which can handle dryer conditions. Our farming model and soil type allow us to extract the most out of our limited water resource and make strategic decisions on where to direct the water," says Angus.

The Aitkens employ two full time staff members and the technology allows everyone involved in the farm to be a part of managing the water resource by using the FieldNET™ and CropX Apps available on their phones. These Apps provide real time data about where the water is going and how much is being used.

The Aitkens' operation is part of an irrigation collective in the Waiau area. The collective is audited by independent assessors every year to ensure they have current farm environment plans and are employing good management practices.

"We are certainly not perfect!" says Angus. "We are only at beginning of our journey and have a lot more to learn. We're not the only farmers trying to change things, but together over time I'm confident we can demonstrate that it is possible to run profitable and productive farming operations, while protecting our waterways."

JUDGES COMMENTS

Joining the Aitkens as finalists this year were Simon and Lou White (Hawke's Bay) and Richard and Annabelle Subtil (North Otago).

Head judge and IrrigationNZ Chair Keri Johnston commended all three couples saying their calibre was outstanding and each of them had different strengths.

"We are so fortunate to have such high-quality entrants again this year," she says. "It was an incredibly close competition and they should all be congratulated. As judges, it is great to have such amazing finalists, but it did make our job that much more challenging!

Keri says the Aitkens' approach to irrigation was refreshing.

"It was well thought out and they have a willingness to try new things, learn and grow as food producers. They are also motivated to be a part of the greater conversations that need to happen around the future of irrigation in New Zealand and its role in ensuring that we have thriving and resilient communities.

"They are not afraid of the regulatory challenges that the sector faces, but rather see them as opportunities that are just part of farming. In their view, it's all about how you look at it.

"While the Aikens are still early on in their journey, they have a sound plan and a vision. As a family, they have a proactive approach and a positive attitude. I am confident they will be great role models for the irrigation sector. Our sincere congratulations to them both."

CATEGORY AWARDS

The judges were impressed with the Aitkens' use and adoption of technology to manage and schedule irrigation, which is why they were also awarded the ***Sustainable Irrigation Management Award*** sponsored by Irricon Resource Solutions.

"They had a great understanding of the science of irrigation and are always open to doing things better," says Keri. "They are also about to trial an area of sub-surface irrigation and it will be really exciting to see the results of this."

Richard and Annabelle Subtil were deserving winners of the ***Environmental Stewardship and Community Award*** sponsored by Farmers Weekly. The couple farm fine wool sheep and run beef breeding and fattening operation on Omarama Station, a 12,000 hectare High Country property in the Mackenzie Country.

The Subtils believe sustainable irrigation management is about implementing a development that increases productivity and profit, without having detrimental downstream effects on local water quality. Environmental stewardship and community involvement have always been a priority. The couple are involved in a variety of water-related projects both on the Station and in the community.

Simon and Lou White were awarded the ***Opportunities and Diversification Award*** sponsored by Vantage NZ. They farm Ludlow Farms – 835 hectare mixed arable cropping, sheep, and beef finishing operation in Otane near Waipawa.

For the Whites, sustainable irrigation management is about future proofing their business for another generational transition. This philosophy has led to the diversification of their business by producing their own brand of hemp. They have invested in technology and advanced machinery to irrigate in the most sustainable way and as a tool for making the best decisions.

For more information about the Zimmatic™ Trailblazer Sustainable Irrigation Awards visit

www.irrigationtrailblazer.com

Zimmatic™ is a registered trademark of the Lindsay Corporation.

Sharing the story of growing across sectors

From milk and hops to boysenberries and feijoas, a Nelson farmer and orchardist has had a hand in growing them all, and says irrigation plays a big part in making it possible.

Julian Raine grew up on a dairy, sheep, and beef farm called Oaklands, which is between Stoke and Richmond in the Nelson area. Although his grassroots were and still are here, he also grows a range of other things, especially those you may find in your fruit bowl. He said that while there has been a lot to learn about growing different crops, he believed some principles applied across them all.

"If you can grow one crop you can grow another, especially when you have the help of irrigation. However, you have to learn what the different varieties require. Horticulture is more intensive and there is less margin for error. Pasture, in comparison, is more forgiving. The basic skills remain the same."

Julian's family has lived at Oaklands for over 179 years. They shifted away from the sheep part of their business in the early 2000s. The 460-hectare property now supports a dairy herd of 100 cows, as well as finishing dairy beef and 100 hectares of forestry blocks. There is also a quarry on the farm. The business owns a second dairy farm, milking 400 cows, which is located at Motopiku, about 50 kilometres further south of the home farm. Julian became interested in horticulture after he left Lincoln University in the 1980s.

They have diversified over the years into a variety of sectors, around 200 hectares of apples, 30 hectares of boysenberries, and 10 hectares of gold kiwifruit; all of which are irrigated through various systems.

In 2013 they got into retail milk, and have reduced their number of cows to 100. They developed Oaklands Milk, which is available for delivery through Nelson and Marlborough, and Aunt Jean's Dairy, which is available throughout New Zealand. When looking at the possibility of exporting their milk it proved difficult, so they explored the option of adding value by creating ice cream. The cream is now used for their ice cream brand, Appleby, which started in 2014, and was the idea of Julian and fellow farmer Murray King. It is produced at their own factory which was built in 2018. The name Appleby is after part of the Waimea Plains where Murray King's home farm is. The ice cream is available in New Zealand and also exported to Singapore, Australia, and Taiwan.

This season's kiwifruit gold crop.

> "We want people to see we care for our stock and the environment, recycle what we can as well as reduce our carbon footprint as much as possible. We get a lot of school groups as educating children is important."

One of their big drivers, aside from financial, is helping consumers understand where their food comes from, and that it starts its journey well before the supermarket shelf, Julian said.

"Food doesn't start in the grocery store; people have a disconnect with their food, and we have an opportunity to improve that understanding."

It was 2015 when Julian decided they needed to open their farm gates to the public. They now have a KPI of having 350 visitors through their farm each year.

"We want people to see we care for our stock and the environment, recycle what we can as well as reduce our carbon footprint as much as possible. We get a lot of school groups as educating children is important."

Water has been a key component of allowing diversification, Julian said.

They have developed both their pastoral and horticultural irrigation over the years, and its management has changed significantly.

"Twenty years ago we had a shovel looking at crops and soil, and now it is all computer modelling relying on sensors, which takes

everything into account. As a result we save a lot of water – I believe we're saving 30 percent compared to past water use."

Julian said that due to climate conditions and the expanding need for water he has witnessed significant restrictions for irrigators on the Waimea Plains over the years. This has motivated him to be involved in the development of the Waimea Community Dam over the last 20 years.

Waimea Water is a joint venture initiated between Tasman District Council and the irrigators on the Waimea Plains to create the Waimea Community Dam. The dam is 53 metres high; the lake created by it will hold 13 billion litres of water, be 220 metres long, feed underground aquifers, and supplement the Waimea River. It is one of the region's most important infrastructure projects ever, and the largest dam built in New Zealand for over 20 years.

"Within the next 12 months we will have the dam commissioned, which will mean a lot for the Waimea Plains. It will take out climatic vagaries and allow access to water at critical times of the year."

"The climate throws all sorts of changes and challenges at us, and having the ability to manage crops is a powerful asset we hold."

Irrigation at Motupiko.

Julian's engagement beyond the farm gate includes his involvement with HortNZ. He joined the HortNZ board in 2013. After two and a half years he became chairman, a role he held for five and a half years.

"To me, it was important to give back to the sector. Horticulture has been good to us, and it's good to bridge the gap as a grower collective. You can't do it on your own, but you can do it together."

Julian said, "Seeing people and hearing of people enjoying our product from our brand is the best success."

When it comes to running several businesses, Julian said they couldn't have been successful without their great team. "People are the greatest asset."

Harnessing the power of irrigation races

South Canterbury irrigation scheme, Morven Glenavy Irrigation Company Ltd. (MGI), has gravity-driven water transport races that gradually drop around 100 metres over the course of their flow. There is significant untapped energy in that flowing water, and to take advantage of it, MGI is implementing a pilot project with recently installed hydropower units. We caught up with MGI Chief Executive Officer Craig Evans to find out more about it.

What is your role at MGI?

I have worked at MGI for about six and a half years. Over that time, the internal capability of the scheme has grown so we can self-perform more of our work inhouse. Environmental services have grown significantly, mostly in association with the increased complexity of Farm Environment Plans. The combined MGI and Waihao Downs Irrigation (WDI) schemes have changed from having a growth-oriented focus to a resilience focus.

Tell us about MGI.

MGI is a long-established irrigation scheme in South Canterbury. It was formed in 1989 when the government privatised the former Redcliffs (built in the 1930s) and Morven Glenavy (built in the 1970s) irrigation schemes. The combined schemes have a long and successful operating history, and some of the lowest operating costs in New Zealand, assisted by a reliable supply of water from the Waitaki River. The scheme still has about 160 kilometres of gravity canals, but there are now five distinct pumped areas and piped networks as well. The scheme has grown to about 29,000 hectares of irrigation and there are approximately 48,000 hectares of total land under MGI Farm Environment Plan management. MGI also manages the Benmore Irrigation Company (4,100 hectares).

What are some of the challenges facing the scheme?

The growing complexity of various environmental regulations is a challenge, although we have been coping very well so far. The groundwater and surface water quality in the scheme is fairly good compared with other areas, and there is a general trend of improvement. MGI has been investing in scheme upgrades that improve operational and water efficiency. These investments should improve our position when we go into resource consent renewal in 2028.

When did the conversation about hydroelectricity first start and why?

MGI has always had an innovative culture and a drive to be leaders in environmental management. The company has long had an interest in renewable energy, but not a clear pathway to develop it. Most traditional hydroelectric technology requires a drop (fall) to operate. The Emrgy hydroelectric turbines which we have installed are designed for "run of canal", where only a minimum flow and velocity is needed. The turbines harvest the kinetic energy from the moving current. So, when Emrgy contacted MGI in 2020, we were interested to learn more. The technology is largely proven in the USA, so there was little reason not to commit to initial pilot deployment of six turbines, with the potential to expand in the future.

Turbines during installation.

Where are the hydroelectric turbines in the scheme? What are their complexities?
There are six hydroelectric turbines, each capable of producing about six kilowatts (kW), in the main race of the scheme. This pilot deployment was chosen for the main race because it has the largest water velocities and flows in the scheme. It has a flow of up to 11 cubic metres per second (m^3/s). The six turbines are at two locations in order to supply electricity directly to two farm irrigation pumps. Farmers are the beneficiaries of the electricity production and are partners in the turbine deployment. In addition to harvesting energy from the flowing water, the turbines double as weirs. This assists to lower the water velocity immediately upstream, making conditions more suitable for the operation of the farmers' river screen in the canal.

Four of the turbines are in a high-density polyethylene (HDPE) lined section of the canal, so we had to figure out how to install them around the liner. After considering many ideas, we ultimately decided to pour concrete foundations in the canal for the turbines to sit on. The concrete base provided a feature for the HDPE liner to be battened onto, keeping the turbines completely independent of the liner. The turbines sit on the concrete pad held by their own weight.

The lower two turbines were installed directly onto the cobble-bottomed canal, in a steeper sloping section of canal where the water velocities are higher. Although the canal had been operating for about 50 years, the placement of the turbines modified the flow so that the current began to undercut the concrete base of the turbine module, and some slumping occurred. This was unexpected. It may have been better to lay geotextile first. As soon as we were able to turn off the water we lifted the turbines out and poured another concrete pad, which successfully resolved that problem. Ordinarily the turbines should be able to sit directly on the substrate bottom of a canal, but the high flows, slope, and velocity at this location meant that additional engineering was required.

It has been an unusual irrigation season, with periodic rainfall and shutdowns, so it has been difficult for Emrgy to complete the commissioning of the turbines. Ordinarily their engineers would calibrate the production from the turbine generators through the inverters. The stop-start flows and the need to perform remote commissioning, due to COVID, has been a big challenge. Emrgy are having to use local contractors as their eyes and ears, and their commissioning engineers are working remotely from the USA.

What will these installations achieve? What plans do you have for the future?
The pilot-scale deployment gives the scheme and our farmers the opportunity to see the turbines running first-hand, and to monitor actual power production. Once the economic feasibility of the turbines is proven in the scheme, consideration will be given to more turbines supplying power to the MGI-owned pump stations. Farmers can consider their own turbines for cowsheds and private irrigation pumps.

Twin turbines installed in the main race at Rotoma Farm.

For best results... look for the tick!

Designing or upgrading your irrigation or effluent system?
Using an accredited company means your irrigation infrastructure and practice will be efficient, targeted and sustainable.

IRRIGATION DESIGN ACCREDITATION

With more emphasis on irrigation efficiency than ever before, choosing an accredited Irrigation Design company is an easy way to ensure that the irrigation system you install today meets both regulatory and industry performance benchmarks. Accredited Irrigation Design companies have industry trained professionals and excellent product knowledge to ensure that every drop counts.

FARM DAIRY EFFLUENT DESIGN ACCREDITATION

Dairy farm effluent was once considered a waste product, now a reliable source of nutrient that enables dairy farmers to reduce their overall nutrient costs. Farm Dairy Effluent Design accredited companies have the expertise to design and build a dairy effluent system that meets the expectations of regional rules throughout New Zealand.

WATER MEASUREMENT ACCREDITATION

Councils are aiming for national consistency in water metering, measurement and the reporting of water use data. Engaging 'blue tick' accredited companies will help ensure work is in line with manufacturers' specifications, meets industry best practice, and ensures accuracy in the reporting of data back to councils for future decision making.

IrrigationNZ are proud to support our Accredited companies, leading the industry in irrigation design, and product service and delivery.

Find a full list of accredited companies at

www.irrigationaccreditation.co.nz

IRRIGATION NEW ZEALAND
WATER | FOOD | FIBRE | LIFE

Realtime recording of groundwater to enhance knowledge

Developing a clearer understanding of groundwater behaviour on the Hekeao Hinds Plains is important when it comes to informing the decision making of the Mid Canterbury farming community. The introduction of another real-time monitor is a further step towards achieving that.

Mayfield Hinds Valetta (MHV) Water is a farmer-owned cooperative that delivers water for the purpose of irrigation, and manages the environmental compliance for over 58,000 hectares of farmland in Mid Canterbury, between the Ashburton and Rangitata rivers.

In late 2016 MHV commenced an independent groundwater monitoring program of 30 bores. Through collaboration with the Hekeao Hinds Water Enhancement Trust (HHWET), local farmers, Te Rūnanga o Arowhenua, and the Hinds Drains Working Party (HDWP), MHV is now spearheading the largest independent groundwater monitoring program in New Zealand. They are routinely monitoring the water quality of some 150 bores across the catchment on a quarterly basis, as well as approximately 70 surface water sites.

> "By having telemetered real-time data, MHV is able to monitor the results straight away, which will help increase our understanding of the local hydrology immensely."

Working with Hydrometrics Ltd (a division of Lincoln Agritech Ltd), MHV recently installed a GW50 optical nitrate probe in a shallow, disused well on an MHV shareholder's farm. It will automatically take nitrate readings daily and upload the data to the cloud.

MHV Senior Hydrogeologist, Justin Legg, said existing sensors across the plains, on farms, and as part of HHWET, already provided valuable information. More information available from as many locations as possible further informs our knowledge.

He said when groundwater was tested annually the nuances and interplay between rainfall and land use were missed. MHV tests quarterly, which is a marked improvement on annual testing, and having real-time sensors allows us to see the effects in real time.

"The application of this type of technology is a game changer," said Justin. "By having telemetered real-time data, MHV is able to monitor the results straight away, which will help increase our understanding of the local hydrology immensely."

The location was selected based on the results that MHV has collected over the last 18 months, the location of existing sensors, and a review of the geology and soils in the area. The groundwater system is complex and is not a one-size-fits-all across the catchment. Having real-time sensors allows us to understand the system intimately at that location, Justin said.

The key to this project has been cooperation and collaboration between different groups, as noted by Justin. "It has been great to have this initiative supported by Hydrometrics and local farmers".

MHV are likely to further evolve their real-time monitoring and sharing of data across the existing sensors in the catchment.

Justin Legg, MHV Senior Hydrogeologist (Left) and Darcy Arker, Hydrometrics technical services manager.

Scheduling irrigation using satellite data

Remote sensing has potential when it comes to calculating crop coefficients to enable accurate irrigation decision-making, but more research is needed. By Tony Benny for Our Land and Water National Science Challenge (CC BY-4.0).

APPLICATION OF REMOTE SENSING IN SPATIAL IRRIGATION SCHEDULING

Participants: Organic vegetable farm, Hororata, Canterbury

Project team: Cindy Lowe and Andrew Curtis (Water Strategies), Kelvin Hicks (farmer), and Hamish Brown (Plant & Food Research)

Report: Application of remote sensing in spatial irrigation scheduling (ourlandandwater/RPF2020)

TECHNICAL INFORMATION

Project aim: To use the SWAN Systems™ platform, an automated water balance model, alongside remote sensing data to calculate crop coefficients throughout the irrigation season to assist with irrigation scheduling.

- The trial was conducted on an organic vegetable farm at Hororata, Canterbury on a milling wheat crop and a table potato crop.
- Soil moisture meters and rain gauges were monitored every 15 minutes, and two infrared radiometers were installed to measure canopy cover.
- Limited satellite coverage of New Zealand and too many cloudy days made it difficult to provide accurate scheduling decisions.
- More frequent and reliable high-resolution satellite coverage became available late in the trial.
- Data was sufficient to develop a proof of concept to calculate crop coefficients and assist in irrigation scheduling of the crops. Additional work is required to develop the research into a commercial product.

Irrigation management consultant, Cindy Lowe, dreams of the day she will not have to install soil moisture sensors for clients, and can instead advise them when to irrigate by using crop coefficients derived from satellite imagery. "I think we're very close to that. It will come; it's just getting that data that's the sticking point," she says.

While the science of calculating crop coefficients using remote sensing has been around since the 1970s, a robust commercial product is not yet available. This is partly due to the lack of available high-resolution satellite imagery.

Water Strategies led an Our Land and Water Rural Professionals Fund project to assess the viability of using the data collected by satellite, together with suitable software to interpret that data, to give irrigation scheduling recommendations.

While the trial showed promise, patchy satellite coverage of New Zealand, combined with too many cloudy days when a suitable satellite was overhead, made it difficult to provide accurate irrigation scheduling decisions based purely on satellite imagery for the entirety of the growing season.

"The technology is there but the frequency is not. That's the problem," says Cindy. "If we had good, reliable daily data we could make it work."

In the latter stages of the trial, more frequent satellite passes became available. These provided better, more timely data but there is still more work to do to create a commercially viable model for New Zealand.

One practical output was achieved from the project – a method of calculating crop coefficients for any crop based on crop growth stages. Cindy says, "We have the capability to calculate crop coefficients for any crop based on the methodology we worked through with Plant & Food Research, not just milling wheat and table potatoes."

TWO PROBLEMS

Soil water management can make a huge difference to the profitability and sustainability of a farm. Applying the correct amount of water at the right time is one of the most challenging issues facing growers, especially arable growers.

Crop sensing can automate the process of physically checking the growth of crops to

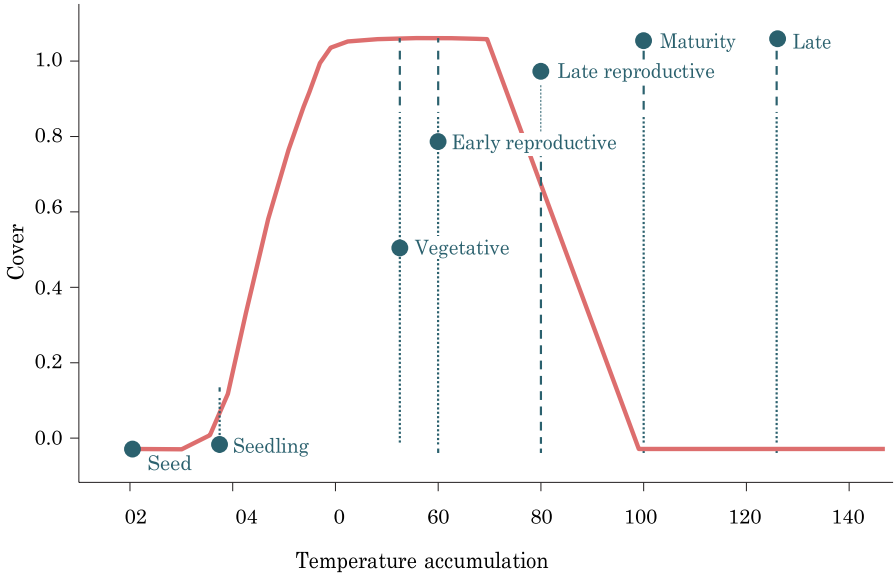


Figure 1: Crop coefficient curve shows increase as a sigmoidal function of thermal time until the canopy is closed, then a linear decrease as the crop matures.

determine how much water is needed.

Irrigation scheduling has typically been limited to one-point measurement in a paddock, using a soil moisture sensor. There are two main problems with this approach, particularly for arable growers who often have multiple crops under one irrigation system:

- First, to gather more useful results a grower would require one soil moisture sensor per paddock, which gets expensive
- Second, soil moisture monitoring measures what's readily available to the plant but doesn't provide any forecasting.

The aim of the project was to use the SWAN Systems™ platform, an automated water balance model, alongside remote sensing data to calculate the crop coefficients throughout the irrigation season.

CROP COEFFICIENTS

Crop coefficients are almost synonymous with the amount of canopy cover. The development of the canopy follows a predictable pattern, with cover growing as temperature increases over time until the canopy is closed, then decreasing as the crop matures (see Figure 1).

Crop coefficients can be derived for any crop if relevant temperature data is available, from the sowing date, harvest date, the stage at which the crop is established (seed or seedling), and harvested (vegetative, early reproductive, late reproductive, maturity or late).

"Essentially, the satellite measures canopy cover and then that's converted via various equations, to tell you what stage the crop is at," explains Cindy. "You can do some irrigation scheduling by working to the averages. Nine times out of ten you'll get it roughly right, but a lot of the arable farmers are looking to go beyond 'roughly'."

METHODOLOGY AND RESULTS

The trial was conducted on an organic vegetable farm at Hororata, Canterbury where the two crops (winter milling wheat and table potatoes) were studied.

An AquaCheck soil moisture sensor was installed, which measured soil moisture and soil temperature at 100, 200, 300, 400, 500 and 600 mm depths, along with a Davis rain gauge. All sensors were monitored using Halo Systems telemetry. Two SI-111 infrared radiometers were installed in the potato paddock to measure canopy cover. This data was recorded using a Campbell Scientific data-logger.

Satellite data were obtained through SWAN Systems™ via the Sentinel-2 and Planet satellites and DataFarming via the Planet satellite. Note that the Planet data only became available late in the season (from February 2021). The location of the sensors is shown in Figure 2.

While sparse satellite data hampered the project, a reasonable model of crop cover was obtained. However, the approach is not commercially viable without being automated and integrated into a software platform. For example, the combination of the SWAN Systems™ water balance model, alongside weekly high-resolution satellite data, has the potential to provide farmers and growers with more accurate irrigation scheduling information.

> Soil water management can make a huge difference to the profitability and sustainability of a farm.

NEXT STEPS

High-resolution (0.8m) satellite data will be available daily via Planet for the 2021–22 irrigation season, and it will be possible to continue refining the crop coefficient calculations. Water Strategies intends to investigate the potential to extend this research project given the improved data availability.

SWAN Systems™ are currently working on an update to automatically calculate crop coefficients from remote sensing data, which should be available for the 2021–22 irrigation season. Testing this update in New Zealand conditions and further refining the integration of NDVI data would be useful.

Cindy says the trial was a success, despite the limited satellite data available during the growing season, because when reliable data came on-stream in February it showed what was possible. Now she would like access to research done on crop coefficients in New Zealand to help streamline the model.

"The next stage is getting all the crop growth stage data that's filed in various people's filing cabinets at government institutions out and into something useful. They've done a lot of crop coefficient work already so we can interpret some of that data. The technology's definitely coming, and hopefully in five or so years it will be viable in New Zealand," she says.

Figure 2: Farm map.

Finding the key to perfect apples

Differences in fruit yield and quality among apple trees within an orchard is one of the biggest challenges for growers. Could more targeted water and nutrient application for trees on lighter soils reduce this variation? By Delwyn Dickey for Our Land and Water National Science Challenge

REDUCING VARIATION IN APPLE TREE YIELD THROUGH TARGETED WATER AND NUTRIENT APPLICATION

Participants: 23 hectare (ha) apple orchard, Kono Horticulture, Motueka

Project team: Greg Dryden (Fruition Horticulture), Mike Nelson (Fruition Horticulture) and Dr Ken Breen (Plant & Food Research)

Report: What are the opportunities to reduce variability in apple tree productivity through targeted (sub-block) water and nutrient application? (ourlandandwater/RPF2020)

TECHNICAL INFORMATION

Project aim: To see if trees on different soil types on the same apple orchard blocks would benefit from a more targeted water and nutrient supply and reduce the difference in yield and fruit quality.

- Sand made up about half of the Hau stony sandy loam, slightly less in Riwaka medium sandy loam, and Riwaka silt loam between 35-45 percent.
- Electromagnetic (EM) soil survey results showed differences in soil composition.
- Chemical analysis found little difference in nutrient supply among the soil types and all samples.
- Too much water and nutrients were being added to show any benefit from soil type variation, but benefits may arise if inputs are reduced.

Current orchard management sees a one-size-fits-all approach to irrigating the fruit trees without considering the different water- and nutrient-holding properties of the various soils across a block.

The vineyards and orchards that make up the horticultural food basket of the Nelson and Marlborough areas create a patchwork across the remains of huge river deltas. The rivers have meandered here over millennia on their way to the sea, distributing silt and clay, sand and gravel.

This makes for a complicated soil map in the area, where sweeping variations of soils can be found within the same orchard, hop or vineyard block.

For horticultural consultant and Fruition managing director Greg Dryden this can be challenging, as it leads to differences of yield and fruit quality in the various crops grown across the region. "Variation is probably one of the biggest limiting things in orcharding," he says.

Greg could see the potential when fellow consultant Mike Nelson and plant physiologist Dr Ken Breen of Plant & Food Research were keen to run a research project through Our Land and Water with funding from the Rural Professionals Fund.

They wanted to look at the potential for reducing tree variability within an apple orchard using targeted water and nutrient application. Any insights from the project could be applied across the region.

New Zealand already has an enviable international reputation for apple production, with the highest productivity per hectare in the world. Averaging around 85 tonnes of fruit per hectare annually, 400,000 tonnes of these apples are exported fresh each year with a value of NZD$876 million.

Having more fruit across the orchard reach maturity at the same time, along with reducing the amount of low-quality fruit which attracts a lower value and often ends up processed, could mean significant gains for the industry.

DOES ONE SIZE FIT ALL?

Current orchard management sees a one-size-fits-all approach to irrigating the fruit trees without considering the different water-and-nutrient-holding properties of the various soils across a block.

Was there a relationship between the various soil types and the health and productivity of trees growing across a block? If there was, could putting in an additional water/nutrient line through the orchard, to give more targeted supply, reduce the variability in fruit and justify the installation cost?

The more sand there is the less water the soil can hold, and the more frequently you should be irrigating, says Mike Nelson. He wondered if trees growing in an area of soil with a lighter texture could have suffered a wee bit every month, affecting their health and productivity compared to trees on more silt and clay soils which hold moisture better.

Kono Horticulture gave the team access to one of their apple orchards in the Motueka area and its production data. The 23 hectare block, planted up with 10-year-old 'Scilate' (Envy™) on 'M9' rootstock, had four soil types running through it. The lighter soils – Hau stony sandy loam, Riwaka medium sandy loam and a heavier Riwaka silt loam – were chosen to give a range of soil textures.

There were 20 plots within each soil type with about 21 trees per plot. The circumference of the trees' trunks in each plot was measured 20cm above the graft union to find the trunk's cross-sectional area (TCA), giving an idea of the historical vigour of the trees.

Soil moisture levels were monitored using Sentek continuous monitoring probes to 90cm on one site on each soil type.

Soil composition (texture) for each plot was found by mixing multiple samples taken in the top 15cm of soil, breaking particle bonds by vigorously shaking powdered detergent with water and letting the soil settle into its constituent particles of sand, silt and clay. Soil samples were also sent to Hill Laboratories for chemical analysis.

Next, an electromagnetic soil survey was undertaken (see Figure 1). Coarse soil texture like sand has low electrical conductivity, clay soils high, and silt soils medium conductivity. Measurements were taken at two depths (0.4m, 1.2–1.4m), with mean values for each plot derived from a 3m radius from the plot centre.

Plans to take yield data from the trees in the various plots were dashed after the area was pelted with hail in late December and management changed to help the trees recover. Fruit load was then estimated on 7–10 trees within each plot.

In February, when the trees were most likely to be struggling in the heat and dry of summer, a snapshot of the orchard block was taken by satellite using normalised difference vegetation index (NDVI) imaging (see Figure 2).

When plants are growing vigorously with lots of photosynthesis going on, they absorb visible light (especially red light) and reflect large amounts of near-infrared light. Stressed plants absorb very little red light.

In the images, lots of blue and green equates to vigorous growth while yellow, orange and red represent reduced photosynthesis, stressed trees and less vigorous growth.

Smaller trees growing in Hau stony sandy loam (left) produced more than larger trees growing in Riwaka silt loam (right).

VIGOUR ISN'T BETTER

The NDVI threw a bit of a curve ball. Instead of showing trees in stress on the sandier parts of the block, it actually showed little stress anywhere and a lot of unwelcome growth. There was likely an oversupply of water and nutrients to virtually the whole block, with management practises probably behind this. There is a tendency to oversupply to ensure there is no undersupply of water and nutrients.

The trees showing most vigour (blue) were those with the biggest trunks, indicating this oversupply had been going on for some time.

While big vigorous trees might sound ideal, they don't produce the most fruit. Big trees put more energy into shoots, leaves and branches, diverting nutrients away from the fruit, which has a negative impact on its colour, flavour and looks. Only the leaves around the fruit do the work to size that fruit up.

Bulkier trees also shade their lower buds. Orchardists are after fruit over the entire height and breadth of the tree.

Over a three-year period, the smaller stony Hau trees produced about 33 percent more fruit than the bigger silt loam trees, but had about half the biomass.

NEXT STEPS

While the trial did not show a need for targeted watering, it did point to a need to investigate reducing inputs of water and nutrients.

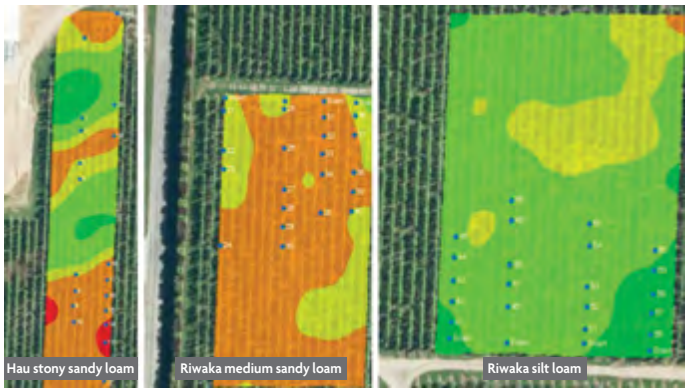


Figure 1: Electromagnetic (EM) survey mapping of the Motueka orchard showing variation in soil type as indicated by electrical conductivity (salt concentrations).

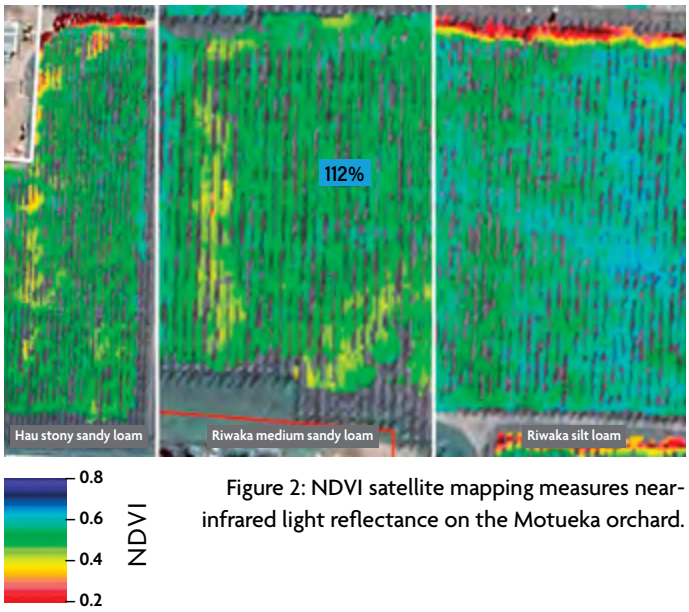


Figure 2: NDVI satellite mapping measures near-infrared light reflectance on the Motueka orchard.

IrrigationNZ submission updates

Recently IrrigationNZ has been busy filing submissions on relevant public or ministerial consultations. We have also worked on new schedules to engage with Crown Research Institutes and Universities where their work may relate to irrigation and/or freshwater. Our submissions reflect our specific expert knowledge, which is built on wide industry and policy experience.

We are involved with a program of wide collaboration with government agencies, regional councils, and freshwater end users. Our knowledge and relationships enable us to present soundly based commentary and recommendations on how regulations can be refined to allow practical implementation. We are focused on how our members can meet requirements for water resource efficiency and environmental management matters within their food and fibre production operations.

TRAINING AND EDUCATION

Our work in the past few months has rendered significant success in putting the career pathway workstream back on track. We have developed a full scope of qualifications needed for our members, and worked with domestic and overseas organisations to identify the available products and providers. This work will allow IrrigationNZ's incorporating better practices in improving the teaching and learning for our farmers, while achieving and maintaining strategic competitiveness in the sector.

Some of the key consultation and advocacy work performed by IrrigationNZ includes:

IRRIGATIONNZ'S SUBMISSION ON TRANSITIONING TO A LOW-EMISSIONS AND CLIMATE-RESILIENT FUTURE DISCUSSION DOCUMENT

We have made a separate but closely related submission on the government's undertaking of preparing New Zealand's first Emissions Reduction Plan. Our key points of submission encourage the government to support current initiatives within the industry that are already focusing on good management practices on land, fertiliser, and water. One key element for the future emissions management to consider is land use change to alternative farming systems. IrrigationNZ advocates that these farming types may rely more heavily on reliable water, which means efficient capture and storage infrastructure.

HE WAKA EKE NOA ENGAGEMENT ON PRICING AGRICULTURAL EMISSIONS

He Waka Eke Noa partnership is planning February 2022 conversations about emission pricing options with farmers. IrrigationNZ assesses the development of an alternative framework for pricing of agricultural emissions (by the end of April 2022) as a critical step in Aotearoa New Zealand's climate policy, given that nearly half (48%) of the greenhouse gas (GHG) emissions are from agriculture.

It is important that our members take the opportunity to understand the different pricing options being proposed prior to Christmas 2021. Either of these options is expected to be an effective and workable alternative to NZ ETS:

1. **Farm-level levy**
   Calculates emissions at farm level, enables a split-gas approach, revenue raised through the emissions levy is being invested back in agriculture, etc.
2. **Processor-level hybrid levy**
   Calculates emissions at the processor level, enables a split-gas approach, revenue raised through the emissions levy is being invested back in agriculture, etc.

These two options suggest rewarding efficiencies and discouraging inefficiencies directly in the agricultural sector or at farm scale. The regulation at farm scale is predicted to encourage and generate more compliance.

IrrigationNZ has provided initial thoughts in relation to the Primary Sector Climate Action Partnership – He Waka Eke Noa Discussion Document for group discussions. These thoughts have covered the benefits and costs of the various options that will be widely discussed with the public in February this year. He Waka Eke Noa needs to meet its agreed milestones for agricultural emissions pricing to be separate, and the factors involved in choosing each option need to be carefully considered. IrrigationNZ will keep you all posted as more comes to hand on the public engagement that will be undertaken.

RESEARCH, SCIENCE, AND INNOVATION TE ARA PAERANGI FUTURE PATHWAYS GREEN PAPER 2021

IrrigationNZ has been working on Research, Science, and Innovation Te Ara Paerangi Future Pathways Green Paper 2021 by the Ministry of Business, Innovation and Employment (MBIE) – Hīkina Whakatutuki. We have provided our input for strategies that may support research and science contribution to our industry. IrrigationNZ will continue engaging in further discussions with MBIE through webinars and meetings to address the questions more completely by March 2022. We have come up with several general statements of principle that cover the content of the submission document.

- IrrigationNZ supports the government's undertaking of understanding how New Zealand best positions its public research system for the future.
- With the focus on engagement, we want to understand the opportunities of research funding for the irrigation industry, and consultations on simplifying the processes of application.
- There are several principles that could guide the scope and focus of research priorities: these include focus on research that delivers long-term returns, investment at a higher level, and internationalisation strategies.
- A national research priority-setting process that would give effect to Te Tiriti will likely be aligned with the National Statement of Science Investment.
- To enable and protect Mātauranga Māori, we could develop an IrrigationNZ approach to Mātauranga Māori to support our own strategic approach to research.
- When considering funding, several core functions would need to be factored in, including addressing knowledge gaps, communication/education that extends capability and capacity, obligation to coordinate with and be supportive of private sector research.
- Better collaboration in R&D and science would depend on better laboratories, tools, software, conducive work environments, access to international partners without the burden of competitive funding rounds.
- We suggest that an integrated approach to research prioritisation and funding is applied to better support capability, skill, and workforce development.
- Building evaluation and communication capabilities that are appropriate means through which to deliver knowledge exchange and support impact generation.
- Consideration needs to be given to attracting and retaining a skilled workforce that can achieve global excellence.
- To assure there is strong focus on workforce outcomes, emphasis should be put on visibility of successful personal/skill growth and development.

SUBMISSION SCHEDULE

Organisation	Consultation type/name notes	Date completed / Date due	Status
Department of Internal Affairs	Consultation on proposed regulations – fees and charges for drinking water suppliers	27 August 2021	Completed
Ministry for the Environment	Freshwater farm plan regulations	7 September 2021	Completed
Ministry for the Environment	Stock exclusion and low-slope map regulations	26 September 2021	Decision not to progress with this one
Te Pūkenga	Te Pūkenga proposed Operating Model: Homai ōu whakairo for industry training programs	Late 2021	Decision not to progress with this one due to time
Ministry for the Environment	Managing our wetlands – initial submission made but additional stages due in 2022	27 September 2021 / 2020	Completed initial submission / on-going future stages
Ministry of Business, Innovation and Employment	Dam Safety Regulations, launch of regulations and roll out of guidance materials, IrrigationNZ involved with consultation group.	August / September 2021	On-going under confidentiality agreement
Ministry for the Environment / Ministry for Primary Industries	The Climate Change Response Act required an Emissions Reduction Plan (ERP); Transitioning to a low-emissions and climate-resilient future: emissions reduction plan discussion document	24 November 2021	Completed
He Waka Eke Noa partnership	He Waka Eke Noa (The Primary Sector Climate Action Partnership) Discussion Document on carbon pricing mechanisms, and on-going process	December 2021 / early 2022	Underway
Ministry for Primary Industries	Integrated Farm Plan Environment Group	TBC	On-going collaboration options
Ministry for Primary Industries	He Waka Eke Noa – Primary Sector Climate Action Partnership	TBC	On-going participation
Taumata Arowai	Consultation on the Water Services Bill small drinking water supplier acceptable solution	Early 2022	Waiting consultation framework
Ministry of Business, Innovation and Employment	Te Ara Paerangi – Future Pathways	March 2022	Waiting consultation framework

Seasonal climate outlook February–April 2022

OUTLOOK SUMMARY

La Niña conditions peaked in the equatorial Pacific during January, with a 75 percent chance for its continuation during the next three months. Aotearoa New Zealand's coastal waters continued to experience marine heatwave (MHW) conditions during January. Sea surface temperatures (SSTs) ranged from 0.9°C to 1.9°C above average. MHW conditions will continue to have an upward influence on air temperatures and humidity. Climate model guidance suggests the MHW will gradually ease during autumn.

Air pressure is forecast to be higher than normal to the south of New Zealand and lower than normal to the north of the country. This is expected to be associated with easterly quarter wind flow anomalies, consistent with the continuation of La Niña and an elevated risk for atmospheric rivers and ex-tropical cyclones in the New Zealand region.

Temperatures are likely to be warmer than average in all regions except for the east of both islands where average and above average temperatures are about equally likely. This will continue to influence periods of elevated humidity and warm overnight temperatures, though a reduction in westerlies may result in less hot days in the east. Rainfall is about equally likely to be near normal or above normal in all regions of the country. For the north and west of the South Island in particular, the seasonal rainfall signal will be influenced by a heavy rain event in early February, increasing the risk for flooding. Moderate-to-heavy rain may affect the North Island during the second week of the month. While high pressure and drier weather may return during the second half of February, another risk for heavy rainfall may arise in March. As of late January, NIWA's New Zealand Drought Index indicated that extremely dry conditions were occurring in several regions. Meteorological drought had developed in parts of Northland and Waikato. There is an elevated risk for atmospheric river and ex-tropical cyclone activity around New Zealand in the coming months. These systems can bring heavy rainfall and increase the risk for flooding. Weather-sensitive groups should keep a close eye on day-to-day forecasts. Soil moisture levels and river flows are most likely to be near normal in all regions of the country for the three months, although substantial deficits were occurring in some regions as of late January. Heavy rainfall events can lead to abrupt and rapid increases in river flows and soil moisture.

REGIONAL PREDICTIONS FOR FEBRUARY TO APRIL 2022

Probabilities are assigned in three categories: above average, near average, and below average. In the absence of any forecast guidance there would be an equal likelihood (33% chance) of the outcome being in any one of the three categories.

Northland, Auckland, Waikato, Bay of Plenty

- Temperatures are very likely to be above average (70 percent chance). Due to marine heatwave conditions, periods of excessive humidity and hot temperatures are likely to continue.
- Rainfall totals are about equally likely to be near normal (40 percent chance) or above normal (35 percent chance).
- An elevated chance for atmospheric rivers and ex-tropical cyclone activity may increase the risk for heavy rainfall events; however, extended dry spells will also continue to be possible.
- In late January, extremely dry conditions were occurring in parts of Northland, Auckland, Waikato, and western Bay of Plenty according to NIWA's New Zealand Drought Index. Meteorological drought had developed in parts of Northland and Waikato.
- Soil moisture levels and river flows are most likely to be near normal (45 percent chance).

Central North Island, Taranaki, Whanganui, Manawatu, Wellington

- Temperatures are very likely to be above average (70 percent chance). Due to marine heatwave conditions, periods of high humidity and hot temperatures are likely to continue.
- Rainfall totals are about equally likely to be near normal (40 percent chance) or above normal (35 percent chance).
- An elevated chance for atmospheric rivers and ex-tropical cyclone activity may increase the risk for heavy rainfall events; however, extended dry spells will also continue to be possible.
- In late January, very dry conditions were occurring about inland Manawatu-Whanganui according to NIWA's New Zealand Drought Index.
- Soil moisture levels and river flows are most likely to be near normal (50 percent chance).

Gisborne, Hawke's Bay, Wairarapa

- Temperatures are about equally likely to be above average (50 percent chance) or near average (45 percent chance). Due to marine heatwave conditions, periods of high humidity and warm overnight temperatures are likely. A reduction in westerly winds may lead to less hot days than normal, however.
- Rainfall totals are about equally likely to be near normal (40 percent chance) or above normal (35 percent chance).
- An elevated chance for atmospheric rivers and ex-tropical cyclone activity may increase the risk for heavy rainfall events; however, extended dry spells will also continue to be possible.
- In late January, abnormally dry conditions were occurring across the region according to NIWA's New Zealand Drought Index.
- Soil moisture levels and river flows are most likely to be near normal (50 percent chance).

Tasman, Nelson, Marlborough, Buller

- Temperatures are likely to be above average (55 percent chance). Due to marine heatwave conditions, periods of high humidity and hot temperatures are more likely.
- Rainfall totals are equally likely to be near normal (40 percent chance) or above normal (40 percent chance).
- An elevated chance for atmospheric rivers and ex-tropical cyclone activity may increase the risk for heavy rainfall events, such as during the first week of February when flooding is possible. However, periods of high pressure may also cause extended dry spells.
- In late January, abnormally dry conditions were occurring across the region according to NIWA's New Zealand Drought Index.
- Soil moisture levels and river flows are most likely to be near normal (55 percent chance).

West Coast, Alps and foothills, inland Otago, Southland

- Temperatures are very likely to be above average (65 percent chance). More frequent offshore winds may increase the frequency of hot days along the West Coast.
- Rainfall totals are equally likely to be near normal (40 percent chance) or above normal (40 percent chance).
- An elevated chance for atmospheric rivers and ex-tropical cyclone activity may increase the risk for heavy rainfall events, such as during the first week of February when flooding is possible. However, periods of high pressure may also cause extended dry spells.
- In late January, very dry conditions were occurring in central and southern Otago, eastern Southland, and Stewart Island according to NIWA's New Zealand Drought Index.
- Soil moisture levels and river flows are most likely to be near normal (50 percent chance).

Coastal Canterbury, east Otago

- Temperatures are about equally likely to be above average (50 percent chance) or near average (45 percent chance). Due to marine heatwave conditions, periods of high humidity and warm overnight temperatures are likely. A reduction in westerly winds may lead to less hot days than normal, however.
- Rainfall totals are about equally likely to be near normal (40 percent chance) or above normal (35 percent chance). Predominant onshore winds may influence more cloud cover and drizzle.
- Soil moisture levels and river flows are most likely to be near normal (50 percent chance).

This is an extract of the Seasonal Climate Outlook published by NIWA.

Women in food & fibre – are you ready to lead change for the people and places you care about?

Next Level is a six-month leadership and governance development programme that will empower you to make a positive impact in New Zealand's primary sector and rural communities.

It's about understanding your motivating factors, building the mind-set and skills to lead, and setting yourself on the road to achieving your goals.

Next Level is designed for change-makers and aspiring leaders across the sector; from farmers and growers, to women in support and service industries, and community-builders and executives.

The programme combines individual learning and support from:

- professional facilitators and personal executive coaches who are highly experienced in executive leadership, governance, and personal development
- your cohorts-for-life – a group of like-minded women who grow to trust each other and support each other on the journey ahead.

Over six months we will support you to:

- clarify your direction
- develop deeper confidence and self-belief
- gain the tools to influence and lead positive change.

Throughout your Next Level journey, you will learn the theory and psychology of leadership and communication, and how to turn that knowledge into real-world impact in your areas of interest.

The Agri-Women's Development Trust (AWDT) designed Next Level after a review of its research, existing programmes and international best practice. The focus is on the creation of a strong support structure which addresses the challenges women often face when taking their skills to the next level.

The result is a programme that finds and fosters your strengths through an innovative mix of face-to-face group interaction (across two two-and-a-half day modules), individual online learning, executive coaching, and facilitated online group sessions.

2022 LOCATIONS AND DATES

Location	Module 1	Module 2 + Graduation
Wairarapa	5, 6, 7 April	27, 28, 29 September
Online	10, 11, 12 May	18, 19, 20 October
Christchurch	7, 8, 9 June	1, 2, 3 November

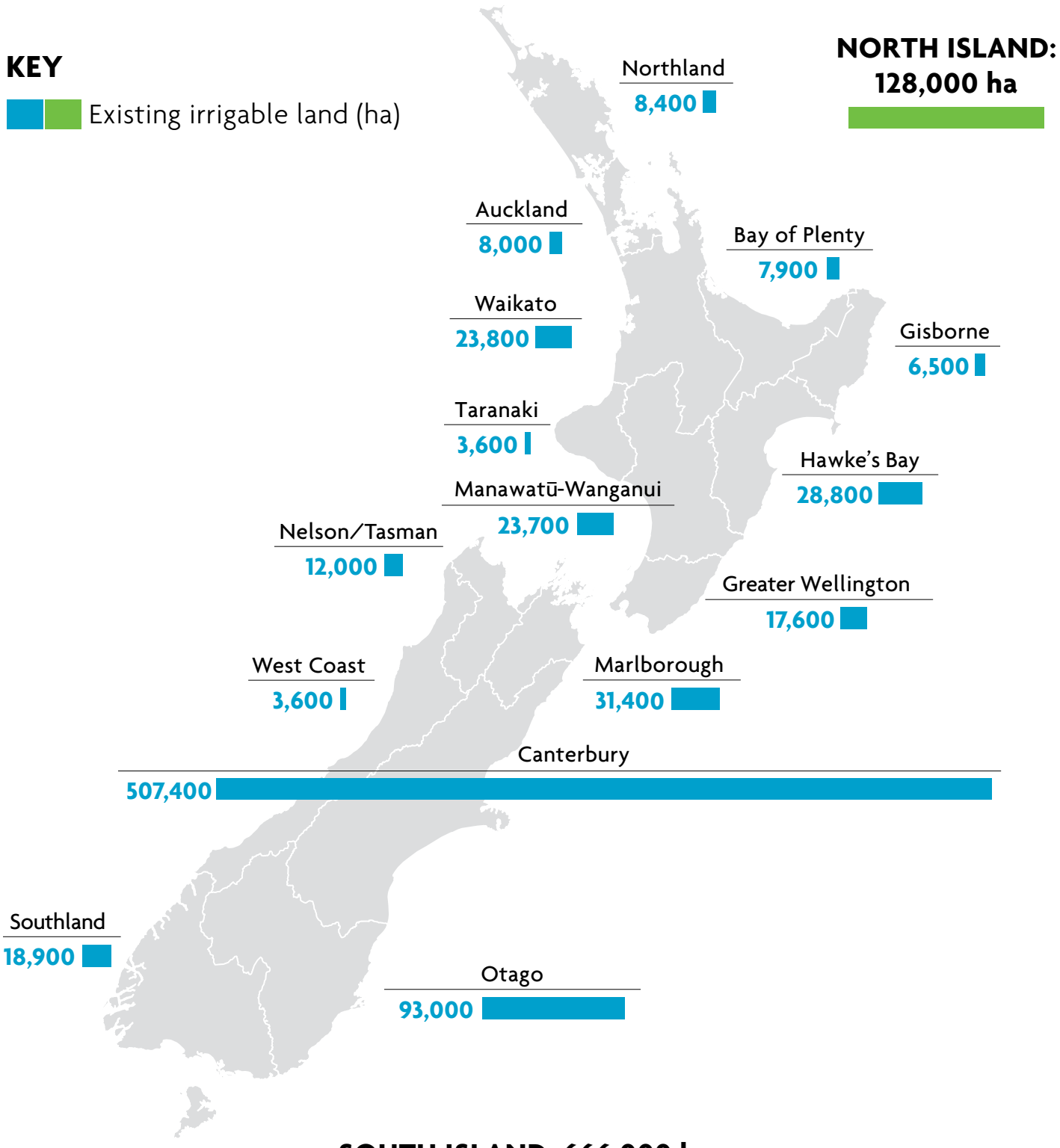
Learn more and register at www.awdt.org.nz/next-level

AWDT
Agri-Women's Development Trust

Participants in Next Level in Christchurch, 2021.

PRODUCT & SERVICES DIRECTORY

TOTAL IRRIGATED LAND IN NEW ZEALAND = 794,000 HECTARES



Source: Statistics New Zealand, Ministry for Primary Industries (2019). Updated with IrrigationNZ knowledge.

COULD YOU BE WISER WITH YOUR WATER?

WaterForce has the knowledge and technology that just might help you find those efficiency gains.

How would a reduction in water allocation affect your business? The challenges of global warming and a finite resource undoubtably add risk to your business. The question is what can you do now?

WaterForce has the toolkit and the expertise to help you find good efficiencies in water use.

Everything we do stands the test of time. Because when it comes to water – and the skills to use it wisely – we understand that you can't afford to waste a single drop.

We understand irrigation, we understand the industry and we have a passion for helping clients find that important balance between water use and profitability.

Talk to our team today about the latest water-saving technologies, and how we can help future-proof your business against the uncertainties of water.

CONTACT YOUR LOCAL WATERFORCE BRANCH

Call 0800 436 723
or visit **waterforce.co.nz**

WATER MEASUREMENT | MAINTENANCE | COMPLIANCE | FROST PROTECTION | TECHNOLOGY

WaterForce
wise with water

Innovative solutions that get the *job done*

ZIMMATIC™ BY LINDSAY

Innovation is at the root of everything we do.

Talk to your local dealer today to find out how Zimmatic's innovative irrigation solutions can help you get the job done.

ZIMMATIC

Built for today to keep pace with tomorrow.

www.lindsay.com/irrigateanz