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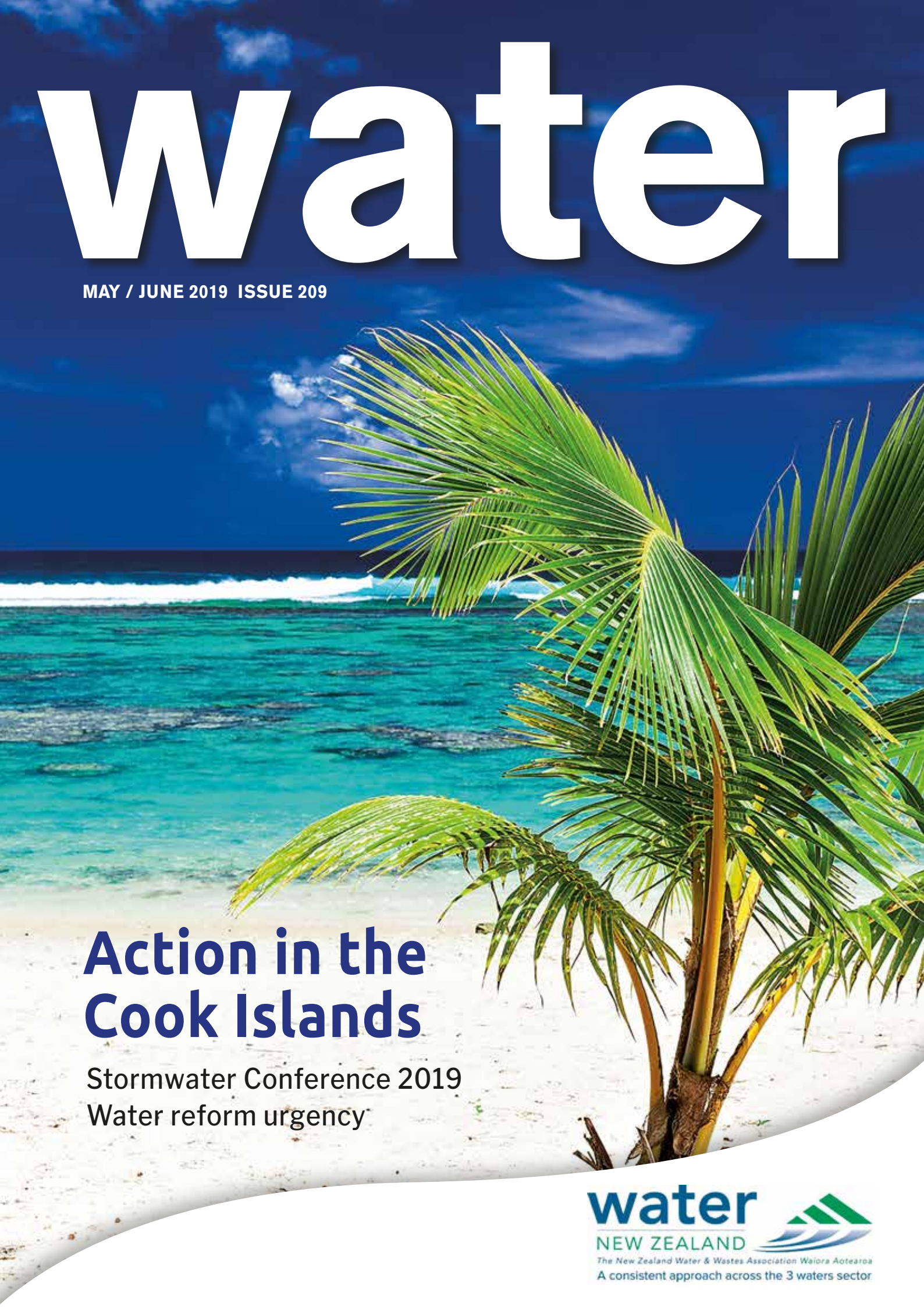
MAY / JUNE 2019 ISSUE 209



Action in the Cook Islands

Stormwater Conference 2019

Water reform urgency

water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa
A consistent approach across the 3 waters sector

WATER JOURNAL
Managing Editor: Alan Titchall
P +64 9 636 5712, M +64 27 405 0338
alan@contrafed.co.nz
Contrafed Publishing
Contributors: Mary Searle Bell
Advertising Sales: Noeline Strange
P: +64 9 528 8009, M: +64 27 207 6511
n.strange@xtra.co.nz
Design: Contrafed Publishing
Suite 2,1, 93 Dominion Rd
PO Box 112357, Penrose, Auckland, 1642
P: +64 9 636 5715
www.contrafed.co.nz
Distribution: Pip Donnelly
P: +64 4 472 8925

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A consistent approach across the 3 waters sector.

The official journal of Water New Zealand – New Zealand's only water environment periodical. Established in 1958, Water New Zealand is a non-profit organisation.

Changing times in the three waters space

This month I have decided to share some personal observations around my working environment in the areas of Wastewater, Water Supply and Stormwater.

Kelvin Hill,
President, Water New Zealand

During the course of the past month I have been involved with a team of people in preparing evidence as part of a renewal of a wastewater resource consent hearing process.

This process is both time consuming and expensive given the technical and legal expertise required to support this process.

I recognise and acknowledge the importance of the detailed process approach that needs to be taken in such circumstances, especially when discharging treated wastewater into a water course albeit via a wetlands first.

However, I have been left wondering if there is not a better way to go about the re-consenting of such infrastructure.

Applying more stringent water quality discharge conditions by requiring my council to upgrade its treatment processes has resulted in improved water quality into the receiving environment, but such action does not address the cultural issues of iwi regarding treated wastewater being discharged into a water body.

Three separate consents have been sought for the plant operation odour discharges to air, water discharges and plant location, with a 35 year term being applied for. At the time of going to print the outcome of the process was still pending.

On reflection, I wonder how many similar processes must be underway for resource consents around the country relating to existing wastewater treatment plants, and whether similar issues regarding time and cost, and addressing complex 'cultural' issues and more stringent discharge standards have been faced by others.

Our resource consent process also involved the investigations into alternative discharge options. A working group consisting of iwi representatives, community members, technical experts and staff started the review process nearly three years ago.

We still have some way to go in finalising a preferred alternative land based option and work is still underway regarding this. In any chosen option the working group had to recognise that the treatment plant will receive wastewater for treatment everyday for 365 days of the year in conditions of rain, hail or shine and all outputs must be discharged into the receiving environment. Any alternative discharge option will need to factor this into the design and will ultimately still need to go through a consenting process to gain acceptance.

So any preferred option taken through a detailed process may fail to deliver an outcome. There are many contributing factors that need to be taken into account in obtaining a suitable site, including gradient, soil structure, closeness to water tributaries and notable cultural sites, available land, distance from treatment plant – to name a few.

I assume that other councils will also be following a similar process as they seek resource consent extensions to operate their wastewater plants.

I am aware that with further changes proposed to the National Policy Statement – Freshwater Management, and work underway looking at further standardising consenting processes, that some synergies and collective learnings are likely to be captured in the future.

This is very important because, in the meantime, our local communities are often paying a significant cost and reinventing the wheel each time there is a consent renewal process.

Changing subjects, I finally got around to printing some holiday photos from last year's holiday in the UK. The Yorkshire Dales country town of Ambleside in particular caught my eye, not so much for its panoramic beauty or clarity of subject matter, but more to do with the words painted on a wall of a small pub:

In Wine, there is Wisdom.
In Beer, there is freedom
In water, there is Bacteria.
Benjamin Franklin

What struck me at the time was the significance of the short saying and the linkage to the importance around providing good quality drinking water that is safe to drink.

This is not something we should take for granted in New Zealand.

In fact the importance placed on operational staff in undertaking this activity is sometimes forgotten about until we have an event that triggers a boil water notice or an outbreak of illness in the community.

That said, it must be recognised that having a workforce that is competent and qualified with relevant skill sets for their positions in the three waters space is very important. Such responsibility is not only on those individuals at the work face, but also on the employer to ensure his staff are offered and given such opportunities to gain sector competency and training.

Which leads me into the reason for reflecting on Benjamin Franklin's words.

There are significant challenges around water industry capacity and capability and available training currently within the three waters sector. As such Water New Zealand is committed to taking a leadership role in working with the sector to implement a formalised structure and registration process for training and ensuring competency.

It should also be recognised that holding a mandatory qualification in your level of expertise in the three waters sector should be both relevant and achievable to meet legislative requirements of that subject matter.

In the case of potable water supply this means providing a level of confidence to the consumer that your water is safe to drink.

The 2019 Stormwater conference

"Wow" this year so far has flown with May 1 signalling that it's Stormwater 2019 conference time.

This year's conference was held at the Grand Millennium in Auckland and did not disappoint providing opportunity to participate in industry forums, gain industry knowledge, and listen to emerging technology and research from overseas.

The Stormwater conference organising team did a great job in providing another informative programme and need to be congratulated for running such a professional event.

The challenge facing most councils in New Zealand is the environmental impact on its waterways as growth and tourism increase each year.

Gaining insight into how others are dealing with stormwater management can be invaluable. In particular I enjoyed listening to Craig McIlroy, Head of Healthy Waters from Auckland Council, who provided insight into the ever changing environment within his organisation around turning a stormwater utility into a Heathy Waters Department.

The "Future Waters" green stormwater infrastructure strategic direction is very relevant to many parts of the New Zealand growth areas. The trail for green stormwater training programmes in New Zealand is being driven by Auckland Council and is a great initiative. I am sure we will hear more about this in future issues of this journal.

At Water New Zealand, we're delighted to welcome Troy Brockbank to our board as a co-opted member.

Many of you will know Troy. He was named Young Water Professional of the Year at the 2018 Annual Conference and Expo and he's played a very big role as Deputy Chair of the Water New Zealand Stormwater Group.

Troy has certainly had a sterling career both in New Zealand and overseas through combining his talent, energy and commitment to stormwater innovation and his Maori culture. He will be a huge asset to the board of Water New Zealand.

It's very pleasing to see our younger members taking advantage of the networking opportunities that we offer through various Young Water Professionals groups around the country.

We are looking to increase our ties across the Tasman to provide further opportunities for collaboration and information sharing.

We are in the planning stages of sending one of our young members to Sydney to represent us on the Australian Water Association YWP group and there'll be another opportunity at our annual conference in September for closer collaboration.

We're hoping that a young member of WSAA (Water Services Association of Australia) will be here for the Annual Conference and Expo in September. So keep an eye out for more on these and other opportunities.

Well – I sign off and leave you to spend more time reviewing the contents of this issue of our Water New Zealand journal. **WNZ**

Nga mihi nui,
Kelvin.

Fresh ideas aplenty at Modelling Symposium

Outgoing Modelling Group Chair Vicki Koopal reports from the group's annual symposium in March.

The Annual Symposium organised by the Water New Zealand Modelling Group was held at the CQ Hotel in Wellington on March 13-14 this year.

More than 50 attendees from around the country and further afield enjoyed a wide range of presentations and a great opportunity to network with their peers.

The symposium opened with a keynote address from Phillip McFarlane (WSP Opus), standing in for Martin Osborne from WSP Opus and the CIWEM Urban Drainage Group.

This presentation highlighted the changes we have faced as modellers over the years and concluded with some thoughts on the future of modelling. We continued with guest speaker Alastair Barnett, who gave an informative talk on the estimation of peak discharges.

In the afternoon, attendees had the opportunity to visit a sewer flow monitoring site that Mott MacDonald operates for Wellington Water.

The site is in Berhampore and has been operating since July 2014. The Health and Safety procedures that staff follow were explained and the different equipment used for flow monitoring was demonstrated, as were the checks that were being carried out at the time. Delegates were able to see the checks being carried out in the manhole and the monitoring equipment set up. The site visit was illuminating and a very exciting addition to the programme.

The first day concluded with networking drinks and dinner where many debates and lively discussions were had.

The keynote speaker on day two was Nick Brown from Auckland Council who shared some of the processes behind its 'Safe Swim' website and the public response to it.

Aside from the keynotes and field trip we had a wide range of presentations on all things related to water, wastewater, and stormwater modelling from councils and consultants.

Topics included using models in strategic planning projects, detailed wastewater modelling of a proposed tunnel system, and river flood modelling.

There was a presentation around developing a story map to share modelling results, which tied in nicely to last year's symposium, sharing of the benefits of a good relationship between modellers and operational engineers, and the ever-popular use of drones for optical bathymetry.

This year's symposium had a multitude of well-presented papers and attendees left with plenty of new ideas to think on and implement in their workplaces.

Further information on the Modelling Group can be found on the Water New Zealand website:

www.waternz.org.nz/Modelling

Modelling Group field trip.

Conference attendance opportunity

This year, as part of the 5S Society Young Water Professional Conference Attendance Prize, we're providing an opportunity for two YWPs to come to the Annual Conference and Expo in Hamilton this September.

This is a great chance for two young professionals to become better informed, motivated and networked.

If you'd like to take the opportunity to broaden you knowledge of the water environment, find out about latest developments in management and engineering and meet others involved in all sectors of the water industry, go to our website for more information and to see if you are eligible for one of these scholarships.

Applications close at 5pm Friday, June 28.

www.waternz.org.nz/5sYWP

Watercare expands sphere of services

In an almost one billion dollar deal, Auckland's Watercare will take over water services for a large part of the Waikato region.

Council controlled organisation (CCO) Watercare will deliver Waikato District's drinking water, wastewater and stormwater services from July 1.

Waikato District Council mayor Allan Sanson admits it's biggest supplier contract ever signed in the region.

"We're the first one in the country to make any moves like this in this respect to try and do things differently." He claims it result in nearly $30 million of savings over the next decade."

Watercare already has a water and wastewater treatment plant in Tuakau, and has been providing services in Tuakau and Pokeno before Franklin was separated in the Auckland super-city amalgamation.

The staff on the ground won't change, but they may have a different badge, Sanson says and "it will not be another CCO".

However, the mega-deal could have a far reaching impact on the way communities across the country manage the assets generations of ratepayers have shelled out for, he adds.

Water New Zealand welcomes new board member

Troy Brockbank (Te Rarawa, Ngati Hine, Ngapuhi) will join the Water New Zealand board as its new co-opted board member.

Troy has over 10 years professional experience in the water industry across engineering consultancies, civil contractors and suppliers. In addition, Troy will also contribute his Maori cultural understanding of water to this new board role, working alongside the board to bridge Te Ao Maori and Te Ao Pakeha.

He is a qualified civil engineer, a water practitioner, and Kaitohutohu Matua Taiao/Senior Environmental Consultant at WSP Opus. Troy was also the recipient of the 2018 Beca Young Water Professional of the Year award at last year's annual Water New Zealand conference (WATER Journal Issue 207 – Looking after tomorrow's water) and is the Deputy Chair of the New Zealand Stormwater Group committee.

He is passionate about empowering the water industry to incorporate Maori values and perspectives into our professional capacities, bridging the Maori and engineering worlds. Combining the best of both for the protection of water now and for future generations.

"Wai (Water) is the essence of all life and the world's most precious resource. It's of high importance to Māori, as it is the life giver of all things, a precious taonga (treasure), part of our whakapapa (genealogy), part of our identity," he says.

"For Maori, the health of the water is connected to the health of the people. We are one and the same. If the water is unhealthy, we are unhealthy."

Water is the life giver of all things – Ko te wai te ora o nga mea katoa.

The Managing Water Loss conference in February this year aimed to upskill water supply staff and others in the area of water loss assessment and management. It was attended by around 50 professionals and hosted by Auckland-based consultancy Thomas Consultants. The focus, 'how water utilities manage real water losses' was backed up by four case studies; Kapiti Coast District Council, Wellington Water, a Christchurch based example, and experience from the former Waitakere City Council.

The special guest presenter was Tim Waldron from Australia who has a long career involving water loss management. The event training was carried out by Richard Taylor with assistance from Tim Waldron (Australis) and Charles Chapman (Detection Services), and with case studies presented by Albert Hoffman (pressure management at Horowhenua DC), Bruce Franks (Arthur D Riley – real-time daily data from a small, fully-metered system near Christchurch), and Ben Thompson (demand management, and managing real losses at Kapiti Coast DC). Eric Skowron (Jacobs) gave a very good presentation on 'Big Data NRW Assessment'. Professor Kobus van Zyl, who has recently taken up a position at the University of Auckland, was a last minute addition to the programme.

Reform through a new Water Services Act?

Among options in an Environmental Defence Society 340 page synthesis report are major changes to the delivery of our water and waste-water services.

The EDS report floats, among other options, new legislation that would see the delivery of both waters becoming the responsibility of regional, arm's-length, Crown entities under a new Water Services Act.

It also stresses that, before we jump to any solutions, we need a robust debate about what the role and function of local government is, and at what level do communities of interest reside? Either way, the system needs to deal better with funding issues.

The society's 340 page synthesis report, the culmination of 18 months of research and engagement, takes a first-principles look at how our resource management system could be improved.

It examines four fundamental questions: What do we have a resource management system for? How do we see ourselves in relation to our natural and physical surroundings? What roles should the system play in pursuing society's aims? And what will the future require from our resource management system?

Over the course of 2019 it will develop a preferred model, as well as a transition pathway, following feedback from interested parties.

Three potential models presented in the report include:

Retaining the RMA as a single statute for managing both the natural and the built environments, and extending its jurisdiction into the exclusive economic zone and continental shelf (currently subject to separate legislation). This model would also require local authorities to create spatial plans to guide integrated decision-making under the RMA, the Local Government Act (LGA), the Land Transport Management Act (LTMA), and other relevant statutes, all of which would remain as standalone pieces of legislation.

Splitting the RMA into a Planning Act and an Environment Act. The Planning Act would incorporate the infrastructure planning and funding components of the LGA, the LTMA and the proposed Housing and Urban Development Authority Act. It would also provide for an enhanced system of spatial planning. The Environment Act would absorb the protective elements of the Fisheries Act 1996, Forests Act 1949, heritage legislation, and the Environmental Reporting Act 2015. There would be a separate Allocation Act, which would deal with the current resource allocation functions of the RMA, Crown Minerals Act 1991, and Fisheries Act. It would include the integration of conservation and species protection law into a single Protected Areas and Species Act and an overhaul of local government arrangements; including the establishment of regional-level unitary councils, the decentralisation of land transport planning, and the compulsory creation of regional council-controlled organisations for the provision of water and waste-water services, as well as a stronger Environmental Protection Authority (EPA) to deal with environmental regulation.

Four core statutes. A new Environmental Protection Act and a new Resource Stewardship Act, along with the LGA and the LTMA. These core instruments would be subject to an over-arching Environmental Strategy Act. This would impose strict bottom lines for protection, which would be created by a strengthened EPA with better resourcing.

At the launch of the report in February, Environment Minister David Parker indicated that his Government is committed to significant changes to the resource management system and that work on fundamental reform will start this year.

He also says the EDS report provides; "Solid foundations on which to build our ideas about the future resource management system. The Government's approach to the resource management system reform will be informed by this work."

EDS Senior Researcher Dr Greg Severinsen says we very rarely see the kind of appetite for first principles reform and blue-skies thinking that we have now.

"We have cross-party interest in change and a recognition that the present system is not delivering adequately for town or country."

In terms of water delivery, one option for the new system would be to align water services and infrastructure through the spatial planning process mentioned above.

More radical changes could also be possible. For example, local government funding could be reconfigured to come primarily from a regional GST, and the tax system could be gradually reconfigured on the basis of an environmental footprint tax.

The EDS' Policy director and co-author of the report, Raewyn Peart, says the report deliberately stops short of rushing to a single preferred model.

"We want to encourage people to use our report and think carefully about options rather than jump prematurely to a particular solution. That's been part of the problem – too many ad hoc changes that have produced muddled and incoherent legislation.

"The next and final phase of EDS's work will build on the analysis and options in the synthesis report and select and flesh out what a preferred model should look like.

"We will also chart a practical pathway for reform for Parliamentarians and the public to consider. That work will be the subject of the final report due at the end of 2019."

So far the report has the backing of the Auckland Employers and Manufacturers Association, Infrastructure New Zealand, and the Property Council.

It's expected that David Parker will report to his Cabinet on scope and process in the near future and, after that, engage with key stakeholders to ensure; "Multiple perspectives are heard before final decisions are made."

To see the full report and the 40 page summary, go to the EDS website http://www.eds.org.nz/our-work/rm-reform-project/

Urgent need for better regulation

Water New Zealand says the Government needs to move quickly to set up a new independent drinking water regulator, following revelations that E. coli bacteria was discovered again in Martinborough's drinking water supply.

This happened just days after an independent review found significant shortcomings in the design, operation and management of the town's water supply.

Water New Zealand Principal Water Quality Advisor, Jim Graham says it's clear that, more than two years after the Havelock North contamination crisis, the drinking water supply system in our country is still putting people at risk of serious illness.

"We need a strong independent regulator that will ensure that supply authorities meet their obligations to supply safe drinking water to their communities."

Tt's concerning, he says, that a recently released review into the contamination event in the south Wairarapa town back in January found 11 intervention points that could have prevented the earlier incident occurring.

Training initiatives on the boil

Water New Zealand's education and training initiatives are gathering pace. At the end of March there was a call for registrations of interest from people or organisations who could deliver continuing professional development (CPD) courses and these have been compiled into a database.

Another database has been prepared to collate details of those who have registered into the programme and it is anticipated that before long people will be able to join the programme.

Work is continuing on a website for the programme. It will be pretty basic to begin with but will provide information about the programme, the courses that are available and how people can register.

The Water Industry Professionals Association (WIPA) is a joint initiative between the Water Industry Operators Group (WIOG) and Water New Zealand, however it is an independent entity set up to run the operator registration and CPD programme.

WIPA has an independent registration board, but the administration of the programme is undertaken by the association under a service level agreement. WIPA was originally set up by WIOG, Water New Zealand and Connexis, but for a number of reasons never managed to get started.

However, a CPD programme was one of the things our industry indicated a need for when the association undertook a review of training at the end of 2018.

It has been a little slow in getting started, but as always there have been a number of hurdles and hiccups to manage, but WIOG and Water New Zealand are committed to making it happen.

Great turnout for Canterbury YWP event

The Canterbury Young Water Professionals (CYWP) had their first event for 2019 on 6th March. The event saw a great turnout of young professionals from across the region and everyone took the opportunity to network and learn from the speakers.

The event included five short presentations from across the different fields in the industry; Marcia Ho (Aurecon) presented on the life of a consultant, Parsa Mohajeri (Lincoln University) gave insights from is PhD studies, Alicia Paulsen (Selwyn District Council) talked about the realities and opportunities of working for local government, Kathryn Russell (CDHB) gave an overview of her role as a Health Protection Officer and Drinking Water Assistance Programme Facilitator, and finally Awab Yaghi (Fulton Hogan) gave some very useful insights into the life of a contractor.

The CYWP group is planning more exciting events for 2019 so keep updated through the Pipeline e-mails and Linked-In page (search for Water New Zealand – Young Water Professionals Group).

For more information get in touch with Jules (jules.scott-hansen@wsp.com).

Joint Water New Zealand and CIWEM forum

Water New Zealand's stormwater group and the Chartered Institute of Water and Environmental Management held an evening event in Wellington in March. It was hosted by Wellington Water. There was a big turnout for our speakers: Dr Trevor Carey-Smith of NIWA and David Wilson of The Urban Engineers, whose presentations initiated some great discussions.

Trevor kicked off with an interesting overview of the recent update to NIWA's high intensity rainfall design system (version four). He pointed out differences between this version and the last and discussed research into climate change and how it has been incorporated into the methodology and subsequent outputs.

This is the second, joint Water New Zealand and CIWEM event held in Wellington and we'd love to host more. If you have any ideas or suggestions please contact Louise Algeo or David Wilson.

Louise.algeo@wsp-opus.co.nz or David Wilson david@theurbanengineers.co.nz.

water NEW ZEALAND
The New Zealand Water & Wastes Association Wairora Aotearoa
A consistent approach across the 3 waters sector

Venue: Quality Hotel Elms, 456 Papanui Road, Christchurch

Subjects and speakers include:

- **Fire supply responsibilities Chris Mak (AON)**
- **Backflow training and design Nick Fleckney**
- **Backflow Testing Standards 2019 – Jon Lewis**
- **Roles and responsibilities of an IQP**
- **Incorporating new technology into backflow testing**

The cost of the conference will be $550+GST per delegate.

Includes a conference dinner on 8 August and transport to an off-site venue.

$500+GST Early Bird special rate available for bookings received before 1 July 2019.

On-site accommodation can be booked at a special conference rate of $165 GST inc. per night direct with venue.

There will also be a special prize given for the delegate showing an example of the worst cross connection.

To register and to take advantage of the Early Bird special, please visit: **www.waternz.org.nz/backflowconference**

Tropic fever

An exciting opportunity has seen ex Water New Zealand president Brent Manning pack his bags, leave his family in Taranaki, and head to Rarotonga for a year to establish the country's first dedicated water entity. **By Mary Searle Bell.**

The lure of a year on a tropical island, coupled with the unique opportunity to set up a brand new water organisation, was irresistible to Brent Manning. Before relocating to Rarotonga late last year, Brent had spent six years as the infrastructure manager for the South Taranaki District Council. It was an interesting job which he enjoyed, but a 'second tier' position and he was ready to step up a level.

"A colleague contacted me out of the blue and presented me with this amazing opportunity to be CEO of To Tatou Vai [which translates to Our Water] in the Cook Islands," he says.

To Tatou Vai is being set up by the Cook Islands government to manage and operate Rarotonga's water supply. It was established as a limited liability company and will operate as a corporate entity, keeping an arm's length from the government.

Brent, as CEO, reports to a board of five independent directors, however, the company's mandate and funding comes from the government.

"To Tatou Vai was registered as a company about two years ago but will only begin operating as a water supply authority later this year," Brent says. "A lot of work has been done already and more is underway to get to that point.

"Funds from New Zealand and China, along with other aid contributions, and the Cook Islands government itself, have been put towards a project called Te Mato Vai, which is an upgrade project for Rarotonga's entire water supply."

Work on the project began in 2011 with the replacement of watermains by a Chinese contractor. Currently, McConnell Dowell is the lead contractor upgrading the island's 10 water treatment sites. Several of these are nearing completion with commissioning to start mid-year.

Final works to ensure all watermains are fit-for-purpose and watertight are also underway.

Brent's aim is to have To Tatou Vai ready to go by July 1. With office and depot facilities already hired, he is now focusing on hiring his team.

On the human side, Brent was the first employee engaged. Subsequently, he has increased the number of staff to six, with the intention to hire another 20 people before that July deadline.

"I need to employ planning and asset engineers, back office and customer service staff, a business analyst and operations manager," he says. "I have one Cook Island-born, New Zealand trained and experienced water technician returning to the islands to join the team, which is fantastic.

"The rest of the water staff I have employed so far are effectively trainees. We are embracing the New Zealand training framework and qualifications, and I currently have a New Zealand expert with me here to talk about training for the staff.

Fancy living on a tropical island?

Brent says that anyone interested in discussing job options and opportunities with To Tatou Vai should call him on +682 54479

Far left: Brent and a McConnell Dowell treatment supervisor surveying one of the water intakes on Rarotonga. Above: The first staff of To Tatou Vai, from left, water technician trainees, Henry Nootai and Steve Underhill; CEO Brent Manning, executive assistant Ringi Tumutoa; and Tukurangi Hosking Jnr, office administrator.

"My brief is to build the capacity of the company, and training is a key element of that."

One of the key advantages of being the one setting up the new business is the ability to hand-pick a team.

"The staff I have onboard so far are great people; they're really enthusiastic and excited – like me," says Brent.

"Starting from scratch is also allowing us to implement a whole new workplace culture. While things like 'island time' are understandable with the temperatures we get here and we don't want people thrashing themselves in the heat, we are expecting people to do an honest day's work. And I have to say, the work ethic I have seen so far has been heart warming.

"The people in general are friendly and have been very welcoming, which makes it easy. The heat and humidity are a challenge and you have to be mindful of things like the risk of Dengue fever from mosquito bites, which you wouldn't think about at home.

Brent's contract in Rarotonga is just for a year. He describes it as very much a transition role. The intention is for him to find a replacement CEO later this year, however, there is the potential for him to stay longer.

"The company will have full responsibility for the water from source to customer, and ultimately, the island will be able to run the business without overseas input.

"My family is still in Taranaki, which is hard. I return home to see them from time to time, and they will visit me mid-year. It's very beautiful here but also small. It's a long way from home," he says.

Brent is also missing his mountain biking. The loop around Rarotonga is a flat and easy 32 kilometres for this avid cyclist, however the mountainous interior is simply too steep to ride in and he is having to find other pursuits to fill his spare time.

"I'm learning the language. Cook Island Maori is very similar to New Zealand Maori, which is handy. For example, the word for water here is 'vai', and at home it's 'wai'.

He says the levels of knowledge and understanding on the island about water treatment and quality is low, and part of his role is to inform his board about water. The current water supply comprises a pipe coming from a weir, and there's no real treatment. Following heavy rain, the water is very discoloured.

"Water sampling shows the microbiology of the water supply is not good. By the end of the year, with the treatment plants up and running, this will be substantially improved."

The new plants will treat the water through coagulation, flocculation and filtration. Reservoirs are also being built to ensure continuity of supply during the dryer months. The water will also be disinfected and there will be community consultation and education around this.

"It will be a big change for the island – a positive change. They'll be able to drink the water without the risk of getting sick.

"I don't think they fully appreciate what a well-run water supply will do for the public's health and the economy – especially considering it's heavily tourism based.

"It's worth noting that the Cook Islands has recently had its status changed from a developing nation to a developed one, and with that comes the expectation of maintaining higher quality infrastructure. To do this requires finance and people with the necessary skills."

Brent is very excited by the challenges this year will bring: "To set something up from scratch is a rare opportunity. To be able to influence the whole organisation – how it operates and will function – is thrilling." **WNZ**

Water supply action in the Cook Islands

Water New Zealand's principal adviser, water quality, **Jim Graham,** recently visited Rarotonga to provide advice on a new project aimed at bringing safe drinking water to the Cook Island's most populous island.

With such a high tourist profile you would think that Rarotonga would have a safe drinking water supply, but surprisingly it doesn't. That, however, is about to change.

There are two major projects currently underway at the moment to upgrade the Rarotonga water supply and a former Water New Zealand board president is at the heart of it. The projects will ensure that both residents and visitors to Rarotonga will have safe water to drink.

Te Mato Vai is a $90 million project to upgrade the water supply. This includes replacing the island's mains, which has been problematic, upgrading existing surface water intakes and 10 new water treatment plants.

McConnell Dowell is the main contractor for the project, which has been designed by consultant Mott MacDonald and managed by a locally based project management unit, which includes engineering staff from GHD in New Zealand. The first treatment plant will be completed by the end of May (this month).

The To Tatou Vai project will see a new water supply utility take over the operation of the upgraded water system from the project management unit. Brent Manning is the chief executive of this project and is currently putting together a team of about 26 people to take on this task.

Recently I spent a week at Rarotonga assisting Brent by providing some knowledge building sessions to the To Tatou Vai staff and providing advice on a number of aspects of water supply – one of which was how best to put in place a routine water quality monitoring system, including setting up a laboratory for bacteriological analysis.

It's a challenging task as analysis has shown the water source – 10 streams which flow from the mountainous interior of the island, is very poor. Results indicate E. coli levels in excess of 2400 mpn. Rainfall can be very heavy for short periods of time and the streams rise and fall quickly with associated turbidity changes.

Compounding the challenges, the treatment plants are located in places where there is no mains power. The design is necessarily pretty simple and includes large clarifier tanks and AVG filters followed by disinfection. In addition the access road to one of the sites fords the stream 19 times.

I also met with and briefed the five independent Board directors of To Tatou Vai on the risks inherent in operating a water supply. The Board in their governance role are highly engaged and key to the success of the project.

There will be ongoing engagement of the Board in public consultation (on the need for disinfection), enabling legislation (a water authority Act, and a separate infrastructure Act) and the adoption of a Cook Islands drinking water standard – a first for the Cook Islands and something that Brent, I and others have contributed to.

The importance of the projects cannot be overstated. Safe water is essential to any community and Brent, who is highly organised and practical with his military and water management background, brings the necessary skills, experience and enthusiasm to the job.

To Tatou Vai is seeking to recruit and employ water professionals, including people prepared to relocate to Rarotonga. Anyone wanting to know more should email: brent.manning@cookislands.gov.ck **WNZ**

Far left: Large clarifier tank.
This page: A new intake structure.

Stormwater 2019

Mō Āpōpō – Stormwater : The Next Generation


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1. The 2019 Stormwater conference attracted over 350 delegates.
2. James Sturman, Aurecon, speaking about digital tools for public engagement.
3. Keynote speaker Richard Batiuk from Coastwise Partners, USA.
4. Kalyan Chakravarthy, and Greg Whyte, DHI Water & Environment.
5. Noel Roberts, Water NZ; Claire Seeny; and Mike Hannah Stormwater360.
6. MC Te Radar.
7. Muhammad Akhter, University of Auckland.
8. The conference opened with a powhiri from Ngati Whatua-O-Orakei.
9. Paul Halliday, Kapiti Coast District Council.
10. Jennifer Leslie, environmental Scientist Pattle Delamore Partners; and Joel Mason, Pump Value Specialists.
11. Chris Digman (keynote speaker); Hannah Breeds; David Hogg; and Bryan Peters – all from Stantec.
12. Shilla Singh (chemistry) and Rajan Dhaka, sampler, Eurofins.
13. Jon Tomcett, Erosion Control.
14. Steffan Robertson, Humes.
15. Anton Carr (South Island) and Ivo Van Dael (North Island) Stormwater360.
16. Shelia Pauti, Bloxam Burnett and Oliver; Ting Powell, E2 Environment; and Marcia Ho, Aurecon.
17. Carl Gorissen, senior technical sales, Teltherm Instruments; and Scott Speed, Healthy Waters, Auckland Council.
18. Annette Davis NIWA.
19. Joey McKenzie, Port of Tauranga.
20. Andrew Gass, Auckland City Council.


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Awards night

The Conference dinner was held at the magnificent St Matthew-In-The-City in Auckland's CBD.


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1. The Stormwater360 Innovation Award winner was Jesse Teat from Tussock Innovation. It was picked up by Dr Aisling O'Sullivan (left) and presented by Mike Hannah, Stormwater360.
2. The Stormwater Paper of the Year was awarded to "Water sensitive urban design can be cost effective and low maintenance" by Jonathan Moores (NIWA), Sue Ira (Koru Environmental), Robin Simcock (Manaaki Whenua Landcare Research), and Chris Batstone (Batstone Associates). The award was by presented by keynote Chris Digman from Stantec UK (middle) and accepted by Troy Brockbank and Emily Afoa.
3. The Stormwater Professional of the Year winner was Mark Pennington of Tonkin and Taylor and was presented by Bronwyn Rhynd, CKL.
4. MC Te Radar in action.
5. Young Stormwater Professional of the Year winner was Josh Irvine of WSP Opus (right). His award was presented by keynote Rich Batiuk of Coastwise.
6. The iconic Mike King was the after dinner speaker.


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Talking green infrastructure

Dwane Jones, the director of the Center for Sustainable Development and Resilience at the University of the District of Columbia based in Washington, DC, United States, was a keynote speaker at the 2019 stormwater conference in Auckland. He talks with Water New Zealand board member Troy Brockbank about his passion, learnings and his work with the Auckland Council.

Could you explain your background in green infrastructure for our readers?

My background is in urban design and planning. I was introduced to green infrastructure about 20 years ago when I participated in a small meeting at the University of Maryland at College Park. I then began employment at North Carolina State University in the Department of Biological and Agricultural Engineering as a Low Impact Development + Green Infrastructure expert.

I taught and conducted research on green infrastructure at this university for 10 years. We developed some certification programmes, which I believe became precursors for the National Green Infrastructure Certification Program (NGICP).

From left: Water New Zealand President Kelvin Hill; Dawne Jones, director of the Center for Sustainable Development and Resilience, University of the District of Columbia; and Troy Brockbank, WSP Opus.

Can you elaborate on the NGICP and how it will be implemented here in New Zealand?

This programme was first launched in Washington DC by DC Water and partnering organisations, including the Water Environment Federation, which is a non-profit association of about 22,000 members worldwide that focuses on water issues.

From this partnership it was decided that is was advantageous to develop a certification credential in the construction, inspection and maintenance of low-impact green infrastructure.

There was substantial interest in green infrastructure, but there were also many questions about the industry—questions that focused primarily on construction, inspection, and maintenance of these practices. There was a need to standardise the skillset to develop a 'portable' credential that can be utilised nationwide for the construction, inspection and maintenance of green infrastructure. And that programme is now the National Green Infrastructure Certification Program (NGICP), which is rapidly advancing internationally to places like Canada, Spain, Brazil, and, here in New Zealand of course.

Some elements of the NGICP will need adjustments to better align with the local context, but this is to be expected. There are some minor differences, nuances, user terminology, and landscape and climatic differences that we want to account for in the New Zealand version of the NGICP.

The Auckland Council has already taken a lead role in developing the next steps. Over the past two days we had a 'train the trainer' course for selected individuals here in New Zealand. We have provided them with toolkits, modules, quizzes and exams and other information to help them launch the programme here with the council under James Reddish [WSP Opus] who will lead individuals and groups in meeting to help them execute a training plan.

National Green Infrastructure Certification Program (NGICP)

The National Green Infrastructure Certification Program (NGICP) is a USA based certification programme that offers a credential for the construction, installation, inspection and maintenance of Green Infrastructure (GI).

This programme is designed to meet international best practice standards and provides a base-level skill set for entry level workers, and verifies that they have the required knowledge to build, inspect, and maintain sustainable GI systems. The NGICP is a tool that can be used to meet a wide range of needs, including professional development for existing GI professionals and as part of a larger workforce development to provide candidates with the technical skills necessary to enter the green workforce.

The certifying body is Water Environment Federation (WEF), which is a not-for-profit technical and educational organization of 33,000 individual members and 75 affiliated member associations (including Water New Zealand) representing water professionals around the world.

The NGICP Certification Council is charged with setting up the programme governance for the NGICP, and is supported by a Technical Advisory Group, overseeing the development of the technical components of the NGICP, and a Strategic Advisory Group, developing the vision and the implementation plan for the national (USA) rollout of the NGICP. www.ngicp.org

Green infrastructure defined

The National Green Infrastructure Certification Program (NGICP) (2017) defines Green Infrastructure (GI) as:

"Stormwater management practices that protect, restore, or mimic the natural water cycle are referred to as green infrastructure (GI). Some of these practices use trees and vegetation (i.e. rain gardens and green roofs) while others do not (i.e. rain barrels and permeable pavement).

"However, all green infrastructure does work to capture and store precipitation near where it falls so it can be managed in a way to deliver environmental, social, and economic benefits."

The NGICP's role

The NGICP trains and certifies people who work with green stormwater infrastructure (GI). It provides the base-level skill set needed to properly construct, inspect and maintain what in New Zealand we are calling water sensitive infrastructure.

The certification programme has been running successfully for two years in the US and includes:

- professional development for existing water sensitive infrastructure professionals;
- workforce development to give people the technical skills necessary to enter the green workforce and earn a liveable wage.

This training is designed to meet international best practice standards. It focuses on core concepts that apply all around the world and encourages the addition of locally-specific information.

In the field of water sensitive urban design, low impact design and green infrastructure (GI) – there are a lot of terminologies now. What is your take on this, and do you have a preference when it comes to descriptions for these practices?

Good question. I enjoyed a conversation I had this morning regarding 'water sensitive' infrastructure. Our role is to standardise terminology as much as possible because, depending on where we go in the US and beyond, there is varying terminology in terms of what things are called and what they mean. We use the term 'green infrastructure, which includes a defined set of factors, but there are also local nuances in terminology at the local level.

Are there differences in costs of green infrastructure compared with traditional infrastructure?

The differences in costs vary, depending on geography, availability of materials and labour force, and other factors. The US Environmental Protection Agency has published studies that show long term performance and costs in GI practices can be lower than traditional practices, but again, it depends.

What are some of the challenges and risks of construction, operation, inspection and maintenance of GI practices?

Not having a standardisation of processes and practices and not having a skilled workforce that understands how GI functions and how to maintain the asset.

The asset must be correctly maintained. Just like a brand-new automobile needs servicing as the manufacturer specifies, it is similar with GI. Otherwise we lose the lifespan of the asset and the financial investment. There are also the overall environmental and social impacts of improper maintenance.

GI designers and engineers need to be cognisant of these issues. While the core of the NGICP is focused on construction, inspection and maintenance workers, the information is not limited or exclusive to this group. We have trained professionals, academics, engineers, landscape architects, planners, and others in green infrastructure.

Is the NGICP working in the United States?

Yes, it is. We are seeing it work from all levels from societal to financial and environmental impacts.

We are currently conducting a study to determine what exactly some of these localised GI impacts are and use them as a model for other sectors of society.

From your experience and what you have heard at the conference do you think we are on the right track in terms of GI? Will it be smooth sailing?

Absolutely. Having spent two days with numerous stakeholders from the Auckland Council and others, we have identified some gaps and a plan of action to move forward.

As to the second part of your question, you will need to be intentional and strategic on how to approach GI and also do it with some urgency. You also need 'partnerships' to advance the cause. **WNZ**

Stormwater Conference winning paper

Water Sensitive Urban Design cost-effective and low maintenance.

By Jonathan Moores, Sue Ira (Koru Environmental), Robin Simcock (Manaaki Whenua Landcare Research), and Chris Batstone (Batstone Associates). This paper was presented at the conference by Jonathan Moores, the Group Manager of NIWA's Urban Aquatic Environments Group. The full paper can be found on the Water New Zealand website.

At the 2018 Water NZ Stormwater Conference we introduced the 'Activating Water Sensitive Urban Design (WSUD)' research project, part of the Building Better Homes Towns and Cities National Science Challenge.

We described the results of surveys and workshops with WSUD practitioners and set out a plan for a programme of research activities to support WSUD uptake. Some 12 months on, this paper summarises our progress across a wide-ranging, but linked, suite of research to progress three main 'quick win' areas.

Through focused case-studies we have investigated costs, assessed benefits and explored operations and maintenance requirements; these being leading themes expressed by practitioners in conversations on barriers to the adoption of WSUD.

We have found that WSUD can be a cost-effective alternative to conventional approaches to stormwater management. It can avoid some costs of building hard infrastructure and the hidden costs of deferred environmental remediation, while delivering better 'bang-for-buck' in removing stormwater contaminants.

On the benefits side, we have demonstrated that the reasons for adopting WSUD can extend well beyond those of hydrological and water quality management, for instance by enhancing the terrestrial environment and contributing to the well-being of urban communities.

In complementary research, the project has started to investigate how WSUD in New Zealand values, recognises, and provides for Te Ao Maori and how it could do better (described in a complementary paper at the 2019 conference).

We have developed the 'More Than Water' tool to help assessments of projects reflect the costs and benefits advantages of adopting WSUD approaches, for instance to support project planning and consultation.

We have found that problems around WSUD maintenance are linked to inadequate consideration at the design stage and inadequate recording of the location and condition of WSUD assets at 'handover', especially those in public spaces.

Together, these have led to acceptance of defective devices and a lack of maintenance. Based on observations at our case-study locations, we have developed guidance on the design of low-maintenance WSUD and checklists for acceptance.

In addition, we have reviewed financial incentives employed overseas, finding that, while there is no 'silver bullet,' a tool box of approaches is available to incentivise the uptake of WSUD in this country.

The research effort has been supported by continued conversations with WSUD stakeholders. These have included targeted discussions with the roading and asset maintenance sectors and engaging with Melbourne's WSUD community to learn from the experience of researchers and water managers there. A wide range of learnings from that city's transition appear to be relevant to New Zealand, with the importance of effective governance, leadership and collaboration at the top of the list.

The findings of our research are being delivered through workshops for our WSUD community, including a workshop and linked site visit as part of this conference. Outputs are also posted on the project web site.

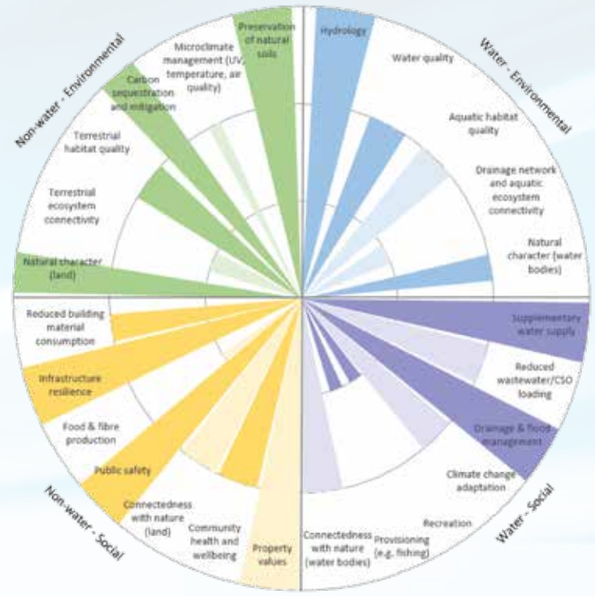
Looking beyond the current project, these outputs include an assessment of longer-term research needs to help WSUD to deliver outcomes that urban Kiwis value.

The maintenance tables for wetlands, rain gardens, swales and green roofs include three models reflecting differences in maintenance frequency to meet different objectives:

- **Amenity** – this approach focuses on high frequency maintenance to ensure devices are aesthetically pleasing all year round as well as functional from a stormwater perspective. This type of maintenance is likely to occur in areas which have high public amenity values (e.g. Wynyard Quarter in Auckland, Waitangi Park in Wellington, etc.);
- **Functional** – this approach focuses on undertaking landscaping maintenance during the growing seasons, coupled with the optimum level of drainage maintenance to ensure that the drainage function of the practice is not compromised through lack of ongoing maintenance.
- **Bare minimum** – this approach focuses on doing the absolute minimum amount of maintenance each year, whilst still allowing for some compromised level of functioning of the practice. Weed infestation and plant die-off is likely to occur.

This three-fold approach acknowledges that the two key drivers of maintenance costs are the frequency of the maintenance and the unit cost of the activity. While the bare minimum approach provides for the lowest maintenance frequency, the unit rates for this level of maintenance are higher than those for the amenity and functional levels.

The reason for this is that it takes a maintenance person



MTW tool: output of an illustrative assessment of WSUD benefits.

longer to weed, remove litter, landscape and maintain vegetation every six months than if they were doing it monthly or bi-monthly, as the level of weed infestation and sediment/litter accumulation is likely to be far greater.

The 'bare minimum' also has a higher risk of much more expensive remedial works being required. As a result of these various influences on maintenance costs, the 'bare minimum' approach can be less cost-effective then the 'functional' approach.

The findings of the project are being delivered through workshops for our WSUD community of practice, including a workshop and linked site visit as part of the 2019 Stormwater conference. The outputs described in this paper are also posted on the project web site.

In addition, the project team will also deliver an assessment of longer-term research needs to continue the journey of activating WSUD in New Zealand.

Feedback from WSUD practitioners will be sought at our workshops on what these further needs are.

Still with energy to burn

Mary Searle Bell profiles industry veteran Ian Garside.

As a youngster, Ian Garside was told by his father that if he didn't work, he'd end up a dustbin man. His English working class background helped engender a strong work ethic, and his father's 'encouragement' made Ian think hard about his future career.

"I'd always loved water and was a keen sailor, so by the time I was 12 or 13 years old, I had decided I'd like to work with water," he says.

After leaving school he completed a bachelor's degree in environmental science before studying for a masters in engineering hydrology.

"My master's thesis paved the foundations for my career," he says. "As a part of my studies, we visited various hydro installations in Scotland in the middle of winter. It was raining, and the water cascading over the dams was fascinating. However, the engineering behind it was even more interesting."

Ian's thesis was around wastewater overflows from sewer systems. This qualified him to work either for a water authority or as a consultant – he chose to work for a water authority, which at that point, in the UK, wasn't privatised.

"I started work and commented to my first boss, Eddie Castle, that now that my master's was done, the hard work was over. He, with his worldly wisdom said, 'No, no it isn't. It's just beginning.' That really resonated with me. Eddie taught me that the more you put into your career, the more you get out.

"As a result, I became involved in the industry, starting by joining Wapug (now part of CIWEM) and regularly contributing technical papers."

In 1990, as the UK water industry was being privatised, Ian took a new role with the Water Research Centre, where he did work for all the major water companies in the UK. After a few years based in the south of England, he became homesick so headed back north to a role with Montgomery Watson, working for Northwest Water.

"My job there was the technical pinnacle of my career," he says.

"The Urban Pollution Management Manual had resulted from implementation of the EU wastewater directive. Its aim was to reduce wastewater overflows to rivers.

"My job was to lead a team of people to see if the manual worked. We tried to make it work, we tried to break it. And we did. I then helped revise the manual and contributed to the second edition.

"I then had the choice to do it all again using the new manual, or to do something else entirely.

"About that time, my wife and I had found out that we were unable to have kids, so we had no major ties to the UK and decided to move abroad. New Zealand had just won the America's Cup and were to host the next event, which presented the opportunity to help make the Waitemata Harbour pristine and beautiful and free from wastewater overflows.

"Watercare wanted to reduce the wastewater discharge into the harbour, which is what I'd been doing at Montgomery Watson. I was hired to help construct a computer model to predict wastewater overflows to the harbour. Project Storm started in 1998 and I undertook technical direction of phases two and three of the project, which involved the analysis of the Watercare trunk sewer network and the construction of a fully calibrated hydraulic model.

"Computer network modelling was very new at that time, so, in 1999, a few of us got together and set up a special interest group for modelling as part of the NZWWA [now Water NZ].

"There were about a dozen of us in the group, and we each took our turn as chair. I was chair from 2003 to 2007 and really enjoyed it – I liked being able to boss people about and make the decisions!

"After I hung up that particular hat, I then volunteered to be the modelling special interest group representative for the modelling stream at the Water New Zealand conference, which enabled me to provide a link between the group and the wider membership."

In 2012, Ian was appointed chair of the Water NZ technical committee, which he has been serving on since 2007.

"The technical committee allows me to read interesting technical papers and stay connected with that side of the industry. It's fascinating to be in and amongst those people,' he says.

While this work has enabled to him to keep his finger in the pie of technical work, his career has shifted to one that is more people-focused.

"After the America's Cup I joined Beca and with them, I did a series of projects all around the country. I realised I was a better people manager than a technical manager so I moved into the commercial side of the business."

In 2012, Beca was appointed to assist the Waipa District Council with the first three years of their 2012-2022 Long Term Plan (LTP). Ian was asked to go and sit in their office to manage their programme of works for the 2012-15 LTP.

"I was working with Robin Walker and Lorraine Kendrick there and worked out how to deliver the programme of works. We had a lot of fun and a lot of laughs along the way, which is how it should be.

"However, the legacy of our work in Waipa was that they now have the confidence to deliver their programme of works in-house and are in the middle of their 2019-21 LTP."

Ian's next memorable project with Beca was for Taswater. He was appointed as technical director of a strategy study to examine the impact of combined sewer overflows on the Tamar River adjacent to the Launceston CBD. Ian, as an international expert, was interviewed on state TV and radio to present the results of the study, which demonstrated that wastewater overflows weren't impacting the river.

After the Tasmanian project, Ian decided it was time to move on. Jacobs had approached him, asking him to establish an office in Hamilton to cover the Waikato and Bay of Plenty regions He then moved on to become their director of operations – water, responsible for the operation of Jacobs' water business throughout New Zealand.

The nationwide part of his role utilises his skills as a people person.

"Jacobs recognises the fact I know everyone," he laughs.

"I've had lots of governance type roles countrywide; I've done a lot of travelling, which I enjoy."

Ian's work in and for the industry saw him invited to join the Select Society of Sanitary Sludge Shovelers five years ago – an accolade that came as a total surprise to him but one he is very proud of.

Looking forward, Ian is keen to help others develop their careers in the industry.

"I enjoy the enthusiasm of youngsters, and I like to help channel it," he says.

"It's very rewarding.

"One of the challenges leaders have is to listen to what the next generation has to say, and to embrace new technology.

"This was me at the turn of the century with modelling, and there were a lot of sceptics around who couldn't see what would come out of it.

"I may be 50 but I feel like a 25 year old – I have energy to burn." **WNZ**

Urgency called on water reform

The Ministry of Health is failing the public says Dr David Skegg, who urges organisations such as Water New Zealand to press the Government to get on and implement the recommendations from the Havelock North Inquiry, or say why if they intend doing anything different. **BY MARY SEARLE BELL**.

It was the hope of many in the water industry that the Havelock North outbreak of campylobacteriosis would prompt the changes necessary to ensure drinking water supplies are always safe.

However, just last month, the public health was once again threatened when E. coli was found in Martinborough's water supply. Epidemiologist and public health physician, Dr David Skegg says this "illustrates again the risks resulting from the shocking lack of action since the Havelock North Inquiry".

Dr David Skegg.

The Department of Health (now Ministry) was established in direct response to the influenza pandemic, which saw 9000 people die from the infectious virus between October and December of 1918.

It is the role of the ministry to lead the country in creating precautionary safeguards, and as such it is charged with preventing, limiting and supressing infectious and other diseases. Consequently, David reasons, waterborne pathogens such as Campylobacter and E. coli should be eliminated from the nation's water supplies.

David has recently published a book, 'The Health of the People', in which he argues that the Havelock North outbreak highlights weaknesses in our health infrastructure.

He writes, "The term 'public health', as used internationally, should not be confused with publicly funded treatment services. In New Zealand people often talk about 'the public health system' when they are actually referring to public hospitals."

David says public health includes measures to prevent diseases, to protect people from environmental hazards, and to promote health in a positive sense.

"Decisions by central government are key to most of the measures influencing our health prospects," he says.

While high-quality health treatment services will always be essential, David says society must also invest in public health measures, "because these can often produce greater and more cost-effective improvements in health and prevention of suffering." Whether that be regulations around the sale of alcohol and tobacco, sugar tax or the treatment of water supplies.

He argues that decisions about public health should be based on the best available information, and that the trade-offs between health and other social objectives should always be transparent. However, as his book explains, neither of these assumptions can be relied upon in 21st century New Zealand.

The report of the Havelock North Drinking Water Inquiry of 2017 was damning: "These findings point to a widespread systemic failure among water suppliers to meet the high standards required for the supply of safe drinking water to the public. The industry has demonstrated that it is not capable of itself improving when the standards are not met."

There had been a "complete failure of leadership and stewardship" by the ministry. David agrees, saying the one overriding explanation for New Zealand's poor performance in public health is a chronic lack of commitment and leadership from the centre.

"The Ministry of Health contains able and dedicated individuals, yet for some years the organisation has failed to provide effective leadership in public health," he says. "It is all very well having keen professionals in public health units around the country, but with a population no larger than that of Melbourne, New Zealand needs a coordinated, national approach."

There are a number of barriers to success, however, and David says foremost is the simple fact that preventive measures often do not bear fruit until years have gone by.

As a result, New Zealand has been slow off the mark to prevent a number of preventable illnesses. He cites cancer caused by asbestos, saying New Zealand failed to regulate against it until 1978, nearly 50 years after the first reports on the health problems associated with asbestos were published.

"In the case of the Havelock North epidemic, the government inquiry concluded that the Ministry of Health was incapable of providing leadership and commitment to ensure that citizens received water that was safe to drink. I believe a similar 'vacuum of leadership' is hindering progress in many other areas of public health," David says.

In the early 1990s, a Public Health Commission (PHC) was created to improve coordination and provide a national focus for public health. David was invited to chair the PHC Implementation Group and its subsequent Board of Directors. As a result, he is qualified to speak to the merits of having such an independent unit and the lessons to be learned from the short life of the PHC, which was merged back into the Ministry of Health after three years.

David writes that the objective of the PHC was to improve and protect the public health. It was to do this by monitoring the state of public health and to identify public health needs, advising the Minister on matters relating to public health, and purchasing, or arranging for the purchase of, public health services.

"The commission also drew extensively on the expertise of outside bodies, including people in university departments around the country."

Unfortunately, politics got in the way. David explains that the PHC was derailed by a "political storm" that followed the commission's early drafts of four policy advice papers on alcohol, tobacco, food and nutrition, and food safety, which conflicted with the commercial interests of the likes of the Dairy Board, Wine Institute, and Tobacco Institute.

Later arrangements to replace the PHC were increasingly weak and unfocused.

"Most of the expertise in public health has been lost, and those professionals who remain have been scattered across the various 'business units' of the ministry. What this means is that there is no longer a critical mass of public health specialists to address the many challenges threatening the health of New Zealanders," David writes.

He says the ministry is "overwhelmingly concerned with the provision of personal health services, to the detriment of public health initiatives".

There is no doubt that national leadership on public health is required, and David told Water New Zealand that "effecting change will require rebuilding the public health capacity in the Ministry of Health AND setting up a separate agency focused on public health".

However, he concludes that "improving and protecting health normally requires political will."

Therein lies the root of the issue. Politicians continue to choose to prioritise winning votes over standing strong on issues that, while unpopular to some, are in the best interests of the public health of the nation. **WNZ**

Watercare prepares for challenging climate

Watercare's head of sustainability, **Chris Thurston** and its infrastructure policy planner, **Mark Bishop**, explain Watercare's new climate change strategy.

Climate change predictions include temperature increases, drought, increased frequency of severe storm events and rising sea levels.

Add in the fact that an unstable ecosystem can also lead to major economic insecurity, loss of habitats, and mass migrations there is a lot to consider.

For those of us that provide essential life services, every aspect of our operation is potentially impacted by these effects. From the planning and design of our infrastructure to the way raw water is sourced and treated, or, how wastewater is processed and discharged.

Watercare recently launched its climate change strategy. The journey, however, began back in 2003, with significant upgrades at the Mangere wastewater treatment plant resulting in a reduction of the organisation's total greenhouse gas emissions by 80 percent.

Public recognition of climate change has increased over the intervening years.

In December 2015, the Paris Climate Agreement was ratified and in the local policy context, Auckland's long-term spatial plan (the Auckland Plan 2050) acknowledged that climate change is a key challenge facing Auckland.

In March 2017, weather events revealed just how vulnerable Auckland is when the 'Tasman Tempest' struck.

Record amounts of rain pounded the Hunua Ranges, sending silt and sediment into the dams, exacerbated by man-made deforestation in the area.

The Ardmore water treatment plant struggled to process the unprecedented levels of sediment in the water and Auckland was asked to 'Save 20' while operators got to grips with the crisis.

That year we set out to develop a climate change strategy for the organisation. We realise, as a business and a country, that this is one of the largest challenges we face and we are committed to taking responsibility to do our bit.

The strategy has two broad focuses – becoming a low-carbon organisation and adapting our organisation to be resilient in a changing climate.

The release of NIWA's (December 2017) *Auckland region climate change projections and impacts* report was essential to the strategy. This was jointly commissioned by Auckland Council, various CCOs and the Auckland-based district health boards. It provided a back-bone of data and projections to explore.

We conducted a series of largely internal adaptation focused workshops where we concentrated separately on drinking water (water sources, treatment, conveyance and demand) and wastewater (treatment, conveyance, discharge assimilation and demand).

We focused on understanding two key NIWA climate change projections. One scenario focuses on trying to keep global warming to within two degrees this century by implementing global climate change strategies.

The other is the projected increase in temperature if those strategies aren't introduced. From this we moved to identifying our potential vulnerabilities to our water and wastewater systems and the relevant actions that would improve our resiliency.

We have trialled the use of a planning approach called 'dynamic adaptive pathways' to transform the vulnerability results into a framework of action. Adaptive pathways are a planning method of 'optioneering' and provide short, medium and long-term actions that can change course depending on impacting factors.

They are particularly useful when decision makers are facing problems containing deep uncertainty such as climate change.

For the strategy itself, we have established a series of portfolio areas that will increase our understanding through monitoring, research and modelling to plan for an uncertain future.

These currently have a 2025 horizon, but will be dynamic as more information is gathered. We are also using this approach to look at planning options for specific assets such as a wastewater treatment plant, where we can build a picture of the climate change issues that could impact a specific location and then adapt our planning now and for options in the future (with typical response being either accommodate, protect or abandon).

In both of these examples we are valuing flexibility, so that we can choose a different pathway depending on the actual conditions as we gain more information (i.e. sea level rise at a point in time).

We learnt a lot along the way:

- It's essential to have board/executive management buy-in and commitment up front.
- Start with understanding the various climate change projections first and then move to identifying vulnerabilities as there is always a temptation to jump straight to actions.
- Provide very clear summaries of the previous workshops before starting a new one and use the same people to build knowledge and engagement.
- We developed a 'virtual team' of internal staff to run the process. This drew in interested and diverse staff with complementary skill sets from across the organisation. This approach also helped to 'seed' this work within the organisation and helped reduce the silo effect that can develop between departments.
- We can't face this challenge on our own. A major vulnerability that was consistently identified was our reliance on various external parties – so called 'third-party dependences'.
- Be aware that the implementation of a strategy is often its greatest challenge.

One of the best things we did was hold an internal climate strategy launch for all staff. We invited a series of speakers from outside of the organisation, as well as our own staff to talk about what climate change is and how we're tackling it.

There was huge interest and it was generally agreed that the speaker with the most impact was a maintenance planner/estimator based at our maintenance service headquarters, who spoke about the impact of climate change on his homeland of Kiribati.

It was a deeply personal insight that suddenly made climate change seem very important indeed.

This Hunua dam photo was taken during the Tasman Tempest when an extreme rain event caused silt to wash down into the dams, creating major problems for the Ardmore Water Treatment Plant. Watercare believes the 'Tasman Tempest' deluge of March 2018, was caused by 'climate change'.

Five steps to creating a climate adaptation strategy

1. Get formal buy-in to kick off the strategy and ensure the organisation is aware that it's being developed.
2. Develop localised projections on climate change impacts, or alternatively use national or neighbouring projections as guidance.
3. Invite a wide range of your people to understand your organisation's vulnerabilities to future climate changes.
4. Socialise the climate issues and your approach widely, making it tangible for staff.
5. Be ambitious and take action, even when facing uncertainty or a lack of information.

As for the future, the strategy provides a company-wide approach that will continue to evolve.

A number of activities have already been initiated including a native revegetation programme in the Hunua Ranges (140,000 native trees planted so far); solar power pilot schemes at a pump station near the Pukekohe wastewater treatment plant; Redoubt Road water reservoir and the Wellsford wastewater treatment plant; conversion of 30 percent of pool fleet cars to electric vehicles and a commitment to energy neutrality at major wastewater treatment plants through energy generation from biogas.

Long-term, Watercare is aiming for NetZero emissions by 2050, aims to reduce operational greenhouse gas emissions by 45 percent by the year 2030 and reduce infrastructure construction emissions by 40 percent by the year 2025.

The strategy highlights 14 portfolios of work that focus on meeting the mitigation and adaptation goals. These range from updating climate modelling to understanding long-term treatment resilience, planting and carbon sinks.

Watercare has written its strategy to sit alongside the Auckland Climate Action Plan (ACAP) that is being coordinated by Auckland Council.

Watercare is also a signatory to the climate leader's coalition, a group of 82 companies across New Zealand who are committed to measuring and reporting their greenhouse gas emissions, setting targets and working with suppliers to reduce emissions. **WNZ**

Rain and flooding in this country

An historical perspective on flooding in New Zealand sourced from archive.stats.govt.nz, NIWA, and Teara.govt.nz.

Floods are the most frequent and costly natural disasters in our country. Between 1968 and 2017, the country experienced over 80 damaging floods.

The Insurance Council of New Zealand calculated that industry payments for flood damage between 1976 and 2004 averaged $17 million per year in 2004 dollars. But this covers just part of the actual cost – for example, government expenditure on civil defence responses during flood emergencies alone averages about $15 million per year over the same period.

Early floods

Floods have cost an uncounted number of lives. Maori history tells of a pre-European flood in the Tutaekuri area of Hawke's Bay in which a party of 50 men, women and children were drowned by the rising of two streams.

The early European settlers failed to realise the intensity of rainfall here and how rapidly rivers could rise. The first European settlement alongside the Hutt River was washed out, pushing our first European immigrants in 1839 to what is now Wellington City.

Our broad gravel-bed rivers are particularly deceptive. Although usually shallow enough to wade across, in flood their currents become powerful. By 1870, sudden rainfall bursts and swollen rivers were responsible for 1115 recorded drownings, which became known as 'the New Zealand death'.

A god's revenge

Maori legend includes a story of a great flood. Tawhaki, god of thunder and lightning, was almost murdered by his brothers-in-law. When he had recovered, Tawhaki took his warriors and their families, and built a fortified village on top of a mountain. Then he called to his ancestors – the gods – for revenge, and they let the floods of heaven descend.

The earth was overwhelmed by the waters and the entire population perished. This was known as Te hurihanga i Mataaho (the overwhelming of Mataaho – one of the places that were destroyed).

The causes

The heaviest rain commonly accompanies tropical cyclones, depressions and frontal systems. Extra-tropical cyclones, such as the storm of 28 January 1936 (considered this country's worst storm in the 20th century) and Cyclone Bola in 1988, have caused major floods, but such storms reach New Zealand only infrequently.

As our Earth warms, some climatologists expect more frequent intense rainfall, but rainfall intensity in New Zealand is, historically, very variable from year to year and from location to location.

Except for Northland and Hawke's Bay, extreme rainfall is expected under NIWA's predictions to increase over most of the country, with an increase of up to 20 percent possible in the south of the South Island by the end of this century if the high emissions scenario predicted comes true (Ministry for the Environment, 2016).

For the majority of locations around New Zealand, there is no clear evidence that intense rainfall events changed between 1960 and 2016. However, intense rainfall increased at some sites and decreased at others.

How it is measured

Between 1960 and 2016 at the 95 percent confidence level, the proportion of annual rainfall occurring in intense events in the 95th percentile (the climate normal 1981–2010 average is used to determine the 95th percentile range) decreased at four of 30 sites (Auckland, New Plymouth, Rotorua and Taupo) and increased at two (Napier and Timaru); annual maximum one-day rainfall amounts decreased at four of 30 sites (Auckland, Hamilton, New Plymouth and Taupo) and increased at two (Dunedin and Timaru); and decreasing trends in both measures of intense rainfall have been found at sites located in the northern and central North Island.

Annual maximum one-day rainfall total is a measure of the maximum amount of rainfall that fell in a single day during a year. This measure provides information on the magnitude of intense rainfall events based on 30 regionally representative climate stations.

Data for most sites are available from 1960 to 2016. However, the data record is shorter for 10 sites : Auckland (1963), Gore (1972), Hokitika (1964), Kerikeri (1982), Masterton (1993), Queenstown (1969), Reefton (1961), Rotorua (1964), Taupo (1977), Whangaparaoa (1987).

Detecting trends in rainfall intensity is difficult because of the naturally high variability and low frequency of events.

The variability is caused by day-to-day weather patterns as well as inter-annual and inter-decadal climate variations to which New Zealand is particularly susceptible.

Our worse wet weather events over the past century: The Great Storm of 1936; Nationwide snowstorm 1939; Giselle 1968; The Big Blow of 1975; Bola 1988; Fergus 1996; Drena 1997; Lower North Island floods 2004; Winter Weather Bomb 2008; and Wilma 2011. **WNZ**

Visions for Water sensitive cities

Jack Turner and **Dr Emily Afoa** of Tektus Consultants, who are members of the Stormwater Group of Water New Zealand were among the 244 delegates that included other water and environment professionals from New Zealand. This is their report.

The fourth Water Sensitive Cities Conference was hosted by the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) in Brisbane back in March.

The purpose of the CRCWSC is to; *"research interdisciplinary responses to water problems, synthesise diverse research outputs into practical solutions, and influence policy, regulation, and practice to promote adoption"*.

The CRCWSC vision for a water sensitive city is one having high resilience, productivity, sustainability and liveability.

The CRCWSC model, and substantial Australian experience gained as a result, is world leading in the activation and implementation of water sensitive design. There has been significant investment in the research programme across the water industry – including government agencies, universities, and consultancies.

We wanted to learn first-hand from those leading the field and to immerse ourselves in their knowledge and energy. We saw great leadership within the programme and wanted to understand how lessons learned on Australia's transition pathway to implementation of Water Sensitive Urban Design (WSUD) could apply in the New Zealand context.

Our involvement in the piece of work; "Te Ao Maori & Water Sensitive Urban Design", presented at the Water NZ Stormwater Conference in Auckland this month (May 2019), provided additional motivation to attend the conference.

This work supports research investigating the activation of WSUD as part of our country's "Building Better Homes Towns and Cities" National Science Challenge. We aimed to reflect on how the findings of a recent Melbourne trip – the home of the CRCWSC – by three researchers in the team informed the "Discovery Phase" research and to understand the representation of Australian indigenous values in their transition to becoming Water Sensitive Cities.

As Professor Zhiguo Yuan (The University of Queensland) described in his welcome message; "Water management is a complex problem and needs multidisciplinary and integrated solutions."

Technology is only one part of the solution – we need to collaborate, build relationships, and engage stakeholders to fully realise the solution. The apparent effectiveness of the CRC model stood out to us – practitioners across the industry are working together to achieve big goals and overcome challenges on the path to change, supported by the programme funding.

The buy-in across multiple disciplines, in public and private sectors, was reflected in both presenters and attendees – engineers, scientists, urban planners, architects, and public agency representatives, among others, were all speaking the same language and looking toward the same aspirational goals.

The first keynote, Caroline Stalker, Design director (Urban) and Principal for Arup Australasia, spoke on 'Designing the 21st century city in nature: prospects for a high(er) density urbanism', posing the question – why we are still designing 20th Century cities?

Caroline presented ideas to reconnect natural systems within high density areas and demonstrated links to physical and psychological health with increased urban greening, looking to transition from transit-oriented design to landscape-oriented design.

Caroline posed we need to work with a robust private sector, presenting options to demonstrate built-in commercial value, for example lift building podia and integrating layered and connected green space below.

The second keynote, Adam Fennessy PSM (EY Partner – Advisory, Government and Public Sector and Oceania Lead Partner for Future Cities) spoke on 'Resilience thinking in unlocking the complexities of cities – the complementary roles of the public and private sectors', building on the theme of private sector involvement in creating cities of the future.

He encouraged attendees to reimagine the water structure – utilising innovation and advancement in data and technology. Solutions to complex challenges require new thinking that's based on collaboration, providing the example of public–private investments in infrastructure.

Integration across all three waters

The conference encompassed a range of platforms, including research outputs, tools to inform design and decision making, workshops, field trips, and case studies.

There was a strong focus on integration across all three (infrastructure) waters and linking social with environmental drivers.

City cooling was one theme of the conference with robust discussion around thermal impacts and urban heat island concepts. Discussion included reframing how to value these concepts – for example, the cost per unit to buy water to irrigate street trees may appear prohibitive when considered only in the context of aesthetic or amenity values.

However, this can be reframed as buying urban cooling – a noticeable reduction in temperature due to healthy canopies and evaporation from planted systems provides a social benefit

that exceeds aesthetic or amenity values alone. This progressed further through several presentations with research on broad and high canopy trees throughout the urban footprint, highlighting the range of benefits (including water and temperature) and the need to specifically plan for and enable these trees. For example by designing and allocating up to for metres by four metre areas for large root growth, which is particularly relevant in the context of Auckland's Urban Ngahere (Forest) Strategy (March 2019).

Water mass balancing was also a common thread throughout conference streams – emphasising the benefits in understanding the whole water cycle in detail to realise all inputs and outputs – beyond just rainfall and runoff.

This culminated in the release of a mass balancing tool, designed to compare development scenarios at different site to catchment scales. The CRC programme links this further with architect-led research on exemplar urban redevelopment typologies to facilitate improved mass balancing and water sensitive design outcomes.

The overall content of the conference schedule presented a comprehensive and well-articulated research programme led by strong and consistent leadership, and based on genuinely collaborative and clear research streams spread across local and state governments, universities, small to large consultancy companies, and public and private development entities.

The CRCWSC programme is generating world-leading research and guidance to facilitate the transition to water sensitive cities, actively supporting participating cities in their transformative journey.

Conference speakers called for a rejection of business as usual, with a focus on integrated and hybrid solutions, systems and business models, to fully transform future cities. The CRCWSC comes to the end of its current term in June 2021. A bid for a new CRC was launched – Transformative Cities CRC: Harnessing the power of water, based on a vision for healthy people and places, thriving protected ecosystems, sustainable efficient resources use through adaptive infrastructure, and innovative strong economies. The Transformative Cities model looks to extend beyond water, weaving in broader elements including energy, waste, transport, food, housing and health; reframing thoughts from waste to resource and facilitating efficient resource use through circular economies.

As the Australian model looks to build on the Water Sensitive Cities research and to extend beyond water alone, New Zealand has the opportunity to learn from the experiences "across the ditch". We should continue to strive to embrace interdisciplinary practice and embed water as a key driver to create healthy and resilient urban environments. Emphasised by learnings at the CRCWSC conference, we pose the first steps could be to overcome silos within the industry – starting with how we view "three waters" (i.e. infrastructure) and the natural environment, recognising that water in all its forms is inherently connected through the water cycle and should be viewed holistically.

This reflects the CRCWSC conference theme of Urban Metabolism to view cities as a metaphoric living organism, rather than compartmentalising urban form and function. Nature designs high-functioning systems without wasted resources – how can this concept change our approach in New Zealand?

While we have not been confronted by water scarcity and urban heat to the same degree as our Australian neighbours, conference themes of urban intensification, urban metabolism, city cooling, and resources, innovation and efficiency demonstrated these are relevant in our local context – especially in the face of stressors such as population growth and climate change.

Australian indigenous values and relationships with water and country were touched on through the conference. In our opinion, this is a strength that practitioners within the New Zealand water industry should continue to embrace. As we increase our understanding of te ao Maori and build capacity within the industry – both public and private sectors – this will only strengthen the uptake of WSUD and support our transition to water sensitive cities.

Overall, the conference was a fantastic experience and we returned to Auckland motivated to support the uptake of WSUD and to reinforce collaboration across industry to achieve improved urban and rural liveability in our towns and cities.

We recommend this conference to other water industry professionals and look forward to following how Australian agencies and developers apply the CRCWSC research leading to positive outcomes and continue their journey into the next phase of Transformative Cities.

It is inspiring to see what is possible with strong leadership, a supportive and collaborative framework, and the courage and commitment to challenge and change the status-quo. **WNZ**

Cooperative Research Centres Programme

For context, the Australian Commonwealth Government Cooperative Research Centres (CRC) Program(me) was established in 1990 to support industry-led collaborations between industry, researchers, and the community.

It brings together researchers in the public and private sectors with the end users and aims to foster high quality research to solve industry-identified problems through outcome-focused collaborative research partnerships – complete with long-term funding for up to 10 years per CRC. The CRC programme also specifically encourages and facilitates small and medium enterprise (SME) participation in collaborative research.

The present definition of a CRC is: "A company formed through a collaboration of businesses and researchers.

"This includes private sector organisations (both large and small enterprises), industry associations, universities and government research agencies such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and other end users.

"This team of collaborators undertakes research and development leading to utilitarian outcomes for public good that have positive social and economic impacts."

The CRCWSC was set up in July 2012 and has since developed Australian-wide as well as international connections to convert effective and innovative ideas on water sensitive cities into practice.

What made this ongoing transition from research to implementation apparent was the excitement shared by Professor Tony Wong, chief executive, CRCWSC, at the growing proportion of the conference attendees – 40 percent – who were external to the CRC; an ever-increasing proportion as the CRCWSC matures.

Diluvial design

This is the second half of a feature on Bells Creek (March–April, 2019 issue), a complex flood mitigation project in Christchurch. **By MARY SEARLE BELL.**

Christchurch is a low-lying city and, as a result, has always had areas that have been prone to flooding during heavy rainfall. This only got worse following the Canterbury earthquakes, thanks to land subsidence and damage to waterways and drainage infrastructure.

Subsequently, the Christchurch City Council's Land Drainage Recovery Programme (LDRP) was set up in 2012 to address the issue of flooding and restore flood risks to pre-earthquake levels. The LDRP has prioritised properties most at risk and has been working to develop sensible area-wide solutions that offer the most benefit to the most people.

The Bells Creek catchment in Woolston was identified as an area at greater risk of flooding due to ground subsidence. It's an area of around 160 hectares of commercial and residential land. The catchment includes all flows draining to the Ferry Road stormwater main, Moorhouse Avenue, Fitzgerald Avenue and part of the CBD.

Historically, Bells Creek discharged through a large gravity pipe outfall into the Heathcote River near the intersection of Richardson Terrace and Ferry Road. However, due to subsidence of the land in the upper part of the catchment during the earthquakes this was no longer as effective at draining the catchment, especially during high tide and/or high river levels when the pipeline is completely submerged.

In an effort to reduce flooding in the area, a new pump station has been constructed to direct water flow from Bells Creek into the river during a large storm event. The existing gravity outfall remains operational as a bypass during regular flow conditions to allow fish passage into the catchment and reduce the demand on the pump station.

Additional works were also undertaken in the upper catchment to mitigate the flooding in this area as the pump station at the outfall alone was not enough to mitigate the increased flood risk this far up the catchment.

This project provided the city with a unique opportunity, says Peter Christensen, CCC's project technical lead. "Bells Creek is a significant source of contaminants in the Heathcote River and we identified the opportunity to retrofit a large-scale stormwater treatment device at the pump station site that would remove contaminants and reduce adverse environmental effects downstream."

The Bells Creek project was divided into three separate construction contracts to speed up delivery – an initial works package of stormwater pipe upgrades in the upper catchment (delivered by John Fillmore Contracting), one for the flood mitigation works in the upper catchment and a third for the pump station and stormfilter at the bottom of the catchment (both delivered by Brian Perry Civil). The design of the project was undertaken by WSP Opus and Beca.

At the top of the catchment, Edmonds Park, a sports field, has been lowered by a metre with timber retaining walls installed along two sides and a manually operated weir installed to form a flood detention basin. This allows the field to be flooded when heavy rain and flooding is predicted (typically during a 'one-in-10-year' sized storm event). A small pump station keeps the groundwater under the sports field under control and

Richardson Terrace Pump Station February 2018.


Stormfilter structure water testing.

allows the water on the field to be pumped to the adjacent Bells Creek following a storm event.

The creek has been realigned through Linwood College to enable it to be connected to the Edmonds Park Basin. The new box culvert portions give the school more buildable area, while the naturalised waterway sections enhance the area.

Midway down the catchment, a disused sports field owned by the Ministry of Education was purchased by the council. The 2.75 hectare site has been transformed into a stormwater basin and urban forest. Planted with kahikatea, matai, and totara trees to stabilise the ground, as well as lower-level wetland species, the new facility has pathways and boardwalk bridges to allow the public to enjoy the park.

Council biodiversity team leader Dr Antony Shadbolt, says the forest will be an amazing legacy project for the city providing enjoyment for future generations. He believes it is the first of its kind in New Zealand.

"I can't think of anywhere else where this has been done. It's important to seize these opportunities when they arise to re-establish networks of native forests.

"In 50 to 100 years' time, invasive predators should have been largely eradicated or at least greatly reduced, and if this is achieved we will likely see large numbers of bush birds coming back. It's also important for people to have accessible areas of nature within the city, allowing them to regularly interact with nature, to hear birdsong and be invigorated by the touch, sound, smell and ambience of a native forest. It will also be very useful for education."

In the 1950s, the portion of Bells Creek through Woolston Park was buried in a large concrete culvert. The project has opened up a section of the existing culvert and constructed a debris screen to prevent large debris getting to the pump station and damaging it.

At Richardson Terrace, as Bells Creek discharges into the Heathcote River, a new pump station has been constructed to assist with discharging flows from the catchment. The pump station will receive peak stormwater flows from the catchment, when the existing gravity pipeline is at capacity, and pump the water into the Heathcote River.

The new filtration device associated with the pump station is expected to reduce the amount of dissolved metals by 20 percent, and almost halve the amount of sediment. Stormwater360 joined the project team to assist in the design and supply of a StormFilter to treat the first flush stormwater runoff.

The water treatment system comprises 570 StormFilter cartridges, making it Australasia's largest proprietary stormwater treatment device, and possibly the largest in the Southern Hemisphere, says Troy Brockbank (at the time with Stormwater360). He describes the system as the best, practicable solution for the space available.

The council purchased a large residential property to construct the pump station and stormwater treatment device on. Karissa Hyde, project manager with Octa Associates, says it was a tricky site to work on – its size constraints, location in a residential area, and close proximity to the river made digging the seven-metre-deep hole difficult, especially as, in places, the excavation was as close as one metre from the boundary and around the existing 1.8-metre-diameter gravity pipeline, which remained operational throughout construction.

"Being so close to the river, the groundwater was high, which made excavation more difficult," says Karissa. "The contractor developed an effective temporary works design to control the flow of water into the excavation and provide safe working conditions for all involved.

"The high groundwater level and soft ground conditions also meant that the structures were designed with substantial concrete foundations with compacted gravel rafts underneath to reduce the impact of future earthquakes on their performance. Flexible joints and other seismic resilient design features were also incorporated to improve the performance," she explains.

"However, the largest delays and added expense came when we discovered additional contaminated soil. We expected some contaminated material as there were old asbestos pipes on the site, however, when we excavated around the existing gravity outfall pipe and the riverbank there were a lot of contaminants in the soil, including coal tar. This all had to be excavated and transported to Kate Valley Landfill for disposal."

Further delays occurred when the pipes for the outfall arrived three months late.

"It has been a very complicated project with lots of interconnected parts together on one small site," says Karissa. "We had lots of different parties working together to deliver the project."

"There's been a bit of heartache and stress for those of us working on it, and we thank the local residents for their patience and understanding while we work in their neighbourhood.

"But, overall it's been worth it. It was a really interesting project to work on and what we have managed to deliver will be really good assets for the city for generations to come." **WNZ**

Digging deeper to mitigate nitrate impacts in freshwater

The first recorded trial of woodchip denitrification wall technology applied to a gravel aquifer setting is underway in Canterbury. **By Dr Lee Burbery,** who is a senior scientist at crown research institute, ESR, and also part of the ESR Groundwater Team that works out of the ESR Christchurch Science Centre.

In 2013, in her role as Parliamentary Commissioner for the Environment, Jan Wright described nitrate as the elusive water pollutant.

It has subsequently been included as a chemical attribute in the National Objectives Framework provided in the National Policy Statement for Freshwater Management (2017).

As Regional Councils go about setting load limits for freshwater catchments, the agricultural industry is confronting the challenge of farming within nutrient limits.

Reducing nitrogen losses through improved land-use and farming practices is by far the most effective way for cutting N in the environment, but whether this will be sufficient to meet water quality goals remains doubtful, especially when one considers the time-lag associated with nitrate transport in the subsurface.

Accepting there will always be some nitrate leaching and legacy effects, there is scope for end-of-pipe nitrate mitigation technologies to play a role in freshwater catchment management. Constructed wetlands, riparian planting and denitrifying bioreactors all fall within this category.

Denitrification wall technology

Denitrification walls are a specific class of denitrifying bioreactor and target treatment of shallow groundwater nitrate. Also referred to as denitrifying permeable reactive barriers (PRBs), they involve emplacing a reactive porous medium in the path of a plume of nitrate-contaminated groundwater. In effect they function as engineered groundwater nitrate filter systems.

The idea is that contaminated groundwater permeates through a barrier constructed with a substrate to fuel denitrification reactions that convert groundwater nitrate into benign dinitrogen gas.

Research on denitrifying PRBs started in North America in the early 1990s and reactive substrates that have been trialled include zero-valent iron, wood (chip/sawdust), compost, leaves, pecan shells – in one example, mixed with dog food! Assuming it can stimulate denitrification reactions then other factors that affect choice of substrate are its permeability, longevity – both in terms of reactivity and hydraulic function – and cost.

Woodchip has proven to be an ideal reactive substrate for denitrification wall construction because it is a readily available, relatively low cost solid organic material that degrades relatively slowly and therefore provides a "time-release" carbon source. Optional chip sizes mean its permeability can be matched to the site hydrogeological conditions.

Some of the pioneering work on woodchip denitrification walls was undertaken in New Zealand. Between 1996 and 1999, Dr Louis Schipper (now at the University of Waikato) piloted several field-scale examples, all in volcanic alluvium of the Waikato region.

His field trials provided a proof of concept, whilst also demonstrating some of the difficulties of emplacing the reactive material below the water table in a cost-effective way, without compromising the hydraulic function of the aquifer.

Denitrification walls are regarded as an expensive nitrate-mitigation option and best-suited for tackling point source pollution, although there conceivably are situations where they might be applied for intercepting broader-scale nitrate pollution in shallow aquifers.

When one considers PRBs are buried structures that require no on-going maintenance and, if designed appropriately, provide 100 percent nitrogen mass removal from groundwater passing through them, then their cost as a nitrate-mitigation tool is comparable to that associated with a constructed wetland.

Trialling denitrification wall technology in a gravel aquifer

Alluvial gravel aquifers represent the most important groundwater systems in our country. They are important for drinking water supply and, being inherently related to a river, they generally have strong connection to surface water, supporting the flows in spring-fed streams etc.

In many places they mark flat-lying land suitable for farming – the Canterbury Plains being a good example. Because they are often unconfined systems, overlain by thin, well-draining soils that are prone to leaching nitrogen, they are extremely vulnerable to nitrate pollution.

Furthermore, most alluvial gravel aquifers lack electron donors to provide any natural attenuation of groundwater nitrate. Alluvial gravel aquifers are characteristically very permeable and heterogeneous – constructed from complex mixed deposits of gravel, sand and silt.

Much of the flow (and by default mass transport of any pollution) is transmitted through complex connected channels of open gravel media (with only small amounts of fine material). The gravel facies can be so open they facilitate very fast flows (that in Canterbury have been measured up to hundreds of

metres/day) and a habitat for groundwater macrofauna, of which fairly little is known.

The Institute of Environmental Science and Research (ESR) is working on a project examining whether, in practice, denitrifying bioreactors might offer a viable N-mitigation tool for New Zealand agricultural systems, in gravel aquifer settings.

A significant component of the project is piloting a woodchip denitrification wall in a shallow gravel aquifer setting. All previous denitrification wall examples have been limited to sandy aquifers, where groundwater velocities have been of the range of a few centimetres to metres per day.

The field-scale pilot study builds on the knowledge gained from published studies and years of bench-scale tests conducted in the lab to examine the properties of potential PRB fill, suitable for use in gravel aquifer systems.

For the purposes of conducting a field pilot study, Silverstream Reserve, North Canterbury was selected as the study site owing to its site accessibility, shallow water table condition and nitrate-impacted groundwater. At 7mg NO3-N/L, groundwater nitrate concentrations at the field site are not excessively high or warrant the expensive of remediation, but are adequate for the purpose of conducting a practical field trial.

A secondary objective of the research project is to advance application of hydrogeophysics, as a non-invasive method for hydrogeological characterisation. Southern Geophysical has consequently used ground penetrating radar and electrical resistivity tomography (ERT) to examine subsurface conditions at the site, including precise determination of groundwater flow direction, and measurement of groundwater velocity.

These are two important parameters required to inform PRB design. Preferential flow paths through what are assumed to be stacked beds of interconnected open framework gravel facies were identified using ERT carried out in conjunction with salt tracer tests. Using time-lapse ERT, groundwater velocities through these transmissive units are estimated to be in the order of 50 metres per day.

The Canterbury Regional Plan does not permit burial of organic matter below the water table, hence a woodchip PRB in Canterbury requires resource consent.

Having obtained such consent, in November 2018 a team comprising Hick Bros Civil Construction, Paul Johnston Civil, Road Metals. and Canterbury Woodchip Supplies assisted with construction of the experimental woodchip PRB that measures 25 metres long, five metres wide and three metres deep.

Sheet-piling proved a necessity to stabilise the open trench and also enabled the hole to be drained, which aided with emplacement of wood and gravel in a controlled manner. While working under dry conditions facilitated uniform mixing of the wood and gravel, thereby improving the likelihood the PRB will function effectively, the cost of sheet-piling was the limiting factor in terms of construction costs.

The PRB at Silverstream Reserve is effectively two separate, co-joined cells. Each cell contains a 50/50 binary mixture of woodchip and gravel. Gravel was included in the denitrification wall to provide some structural integrity and reduce the chance of hydraulic failure over time.

Denitrification walls are a specific class of denitrifying bioreactor and target treatment of shallow groundwater nitrate.

The exact composition of the wood and gravel components in the two cells differs. One contains "chipped" wood and well-sorted 20-40mm diameter gravel rounds. The other contains "hogged" wood and well-graded gravel that is sediment excavated from the site, screened of material less than 20 mm in diameter.

This latter condition represents a 'free-feed' scenario, which under most circumstances would be a more cost-effective approach to PRB construction than depending on imported aggregate. The objective is to compare how the two different mixtures fare over time.

The issue of pollution swapping

While the objective may be to treat nitrate in groundwater, augmentation of the aquifer with organic carbon poses a set of environmental problems in itself and the viability of woodchip denitrification walls rests also on assessment of pollution-swapping phenomena.

With the anoxic, electrochemically reductive conditions the woodchip PRB induces that drive denitrification, come also a set of other hazards of which mobilisation of metals such as iron, manganese and arsenic from the greywacke alluvium are one.

Evolution of the anoxic plume of 'treated' groundwater at the Silverstream Reserve site is being monitored from an array of 50 monitoring wells. Emission of potent greenhouse gases nitrous oxide and methane is another pollution-swapping phenomenon that is under study, as is an examination of how the denitrification wall affects the local groundwater ecology.

Based on pre-existing examples, expectations are from the outset, the reactivity of the woodchip denitrification wall to drop off rapidly, as the labile organic carbon fraction of the wood initially is consumed and leached.

Given the high fluxes in the shallow aquifer at Silverstream Reserve, this state of pseudo-equilibrium is expected to be attained within the first six months of operation, after which a slow gradual decline in performance is anticipated, as the woodchip decomposes.

At least at this stage, after three months of operation, the woodchip PRB at Silverstream Reserve appears to be working effectively.

On the down-gradient side of the wall, there is no measurable nitrate in the groundwater, suggesting 100 percent mass removal.

The absence of nitrite or ammonium in the plume of 'treated' groundwater tends to indicate nitrate-losses are via denitrification, as anticipated and not by the alternative nitrate reduction pathway of dissimilatory reduction to ammonia (DNRA).

Hydro-geophysical methods will be used to examine the hydraulic function of the wall and quantify mass fluxes through the reactive barrier. **WNZ**

Nitrate increases colorectal cancer risk

A new study from Aarhus University now shows that there is an increased risk of colon and rectal cancer in connection with nitrate in drinking water at concentrations far below the current drinking water standard.

The drinking water standard for nitrate in drinking water in Denmark is determined based on recommendations issued by the WHO. Research at Aarhus University suggests that the drinking water standard should be reconsidered.

Nitrate in groundwater and drinking water, which primarily comes from fertilisers used in agricultural production, has not only been subject to decades of environmental awareness – it has also been suspected of increasing the risk of cancer.

This largest epidemiological study ever carried out in this area now shows that there is a correlation when the amount of nitrate in the drinking water is far below the current drinking water standard. These results have just been published in the scientific journal *International Journal of Cancer*.

Risk of cancer even with small amounts of nitrate

Researchers have calculated how much nitrate Danes have been exposed to where they lived and compared this to information about cancer diagnoses in Denmark.

They managed to follow 2.7 million Danes during the period 1978-2011 and their study is based on nitrate analyses from more than 200,000 drinking water samples, making the study the largest and most detailed in this area.

"Each year, approximately 5000 Danes contract colorectal cancer, which can have many causes," says Jorg Schullehner, PhD from the Department of Public Health at Aarhus University.

"Our study shows that nitrate in drinking water may be one of them. In the study, people who were exposed to the highest concentration of nitrate in drinking water (above 9.3mg per litre of water) had a 15 percent greater risk of getting colorectal cancer compared to those who had the least exposure (less than 1.3mg per litre of water).

"The current drinking water standard is 50mg nitrate per litre of water, but the increased risk of cancer could already be

seen at concentrations greater than approximately 4mg nitrate per litre of water."

Schullehner is the man behind the research results together with researchers from the Geological Survey of Denmark and Greenland (GEUS) and the National Centre for Register-based Research at Aarhus University.

The drinking water standard in Denmark and the EU complies with the recommendations of the World Health Organization WHO. These recommendations have been determined in order to avoid cases of 'Blue Baby Syndrome', where nitrite poisoning prevents oxygen saturation in the body. This syndrome only affects infants and very rarely occurs in Denmark.

Standards should be reconsidered

The research results confirm a suspicion that has long been held; that nitrate increases the risk of colon and rectal cancer.

The health risk arises when nitrate is converted into carcinogenic substances that are known as N-nitroso compounds in the body. Colorectal cancer is one of the most common forms of cancer in Denmark and the third most frequent worldwide (New Zealand has one of the highest bowel cancer rates in the world – Ed).

"The conclusion in our study is in line with the findings of several international studies, which indicates that the drinking water standard ought to be lower in order to protect against chronic health effects and not only acute effects such as Blue Baby Syndrome," says Professor Torben Sigsgaard from the Department of Public Health at Aarhus University, who has also been involved in the research project.

"With identical results from different studies, this points towards a need for reconsidering the drinking water standard."

Nitrate concentrations

Research from GEUS shows that over the last decades, nitrate concentrations have been reduced at the public waterworks from which the vast majority of people in Denmark get their water.

"Nitrate concentrations are low in the majority of public waterworks. Today, the problem is mainly concentrated in the small private wells, as well as places with high nitrate leaching and where the local soil – and geological conditions mean that nitrate can more easily be leached to the groundwater. It therefore makes sense to focus our efforts here," says Jorg Schullehner.

Based on an article called: *"Nitrate in drinking water and colorectal cancer risk: a nationwide population-based cohort study"* published in the International Journal of Cancer.

Jorg Schullehner can be contacted at Aarhus University, Department of Public Health Mobile: (+45) 9133 3653, email: jorg.schullehner@ph.au.dk.

Nitrate
at a glance

Nitrate (NO_3) is a compound that is formed when nitrogen combines with oxygen. The main adult intake of nitrate is from food rather than water; but sometimes high amounts of nitrate get into drinking water.

Typical sources of nitrate include; fertilisers, animal wastes, particularly in areas of intensified farming, unreticulated sewage disposal systems, industrial waste and food processing waste. Nitrate is highly soluble in water, making it readily transported through the soil to groundwater.

High levels of nitrate can pose a risk to babies less than six months old who are formula fed and the unborn foetus of pregnant women. Adults with specific rare metabolic disorders (deficiency of glucose-6-phosphate dehydrogenase or methaemoglobin reductase) may also be at risk.

What are the health effects?

Nitrate is converted into nitrite by bacteria in the gut. This nitrite combines with foetal haemoglobin in the foetus or infant less than six months old preventing oxygen from binding and being distributed around the body.

Symptoms include blueness around the mouth, hands and feet, hence the name 'blue baby' syndrome and in severe cases can affect breathing and be life-threatening.

By six months of age infants have only mature haemoglobin that does not bind to nitrite. This allows oxygen to freely bind to haemoglobin and 'blue baby' syndrome does not occur. Fully breastfed infants are not affected as nitrites do not enter the breastmilk. Very few cases of 'blue baby' syndrome have been reported in New Zealand, though nitrates in groundwater have been rising in the last 20 years.
Source: www.cph.co.nz

Drinking Water Standards for New Zealand set a Maximum Acceptable Level (MAV) of 50mg/L for nitrate, which is equivalent to 11.3mg/l nitrate-nitrogen. Some laboratories report nitrate levels whereas other report nitrate-nitrogen.

Nitrate is difficult to remove from water. Common household cartridge or carbon filters, boiling water and chemical treatments (e.g. chlorine) will not remove nitrate.

There are three methods that do remove nitrate from drinking water: distillation, reverse osmosis and anion exchange. These processes are expensive and potentially unreliable.

Will the amount of nitrate in my well be constant or will it change?

Nitrate levels do vary over the year. Often we find results are highest in spring (following rain and snow melt). Also in areas where there is extensive irrigation, high nitrate levels have been found in late summer.

The Kiwi risk

Mike Joy, a senior researcher for the Institute for Governance and Policy Studies at Victoria University of Wellington and Michael Baker, a professor of public health at the University of Otago, have made public reference to local standards.

www.victoria.ac.nz/news/2019/01/drinking-water-study-raises-health-concerns-for-new-zealanders.

A recent Fish and Game New Zealand investigation of drinking water supplies in the Canterbury region found that nitrate levels in drinking water sourced from groundwater in areas of intensive farming and horticulture are already high and rising, they say.

"The findings are consistent with data from the regional council Environment Canterbury. The latest groundwater report showed that half of the wells they monitor have values greater than 3ppm nitrate-nitrogen, more than three times the Danish study›s trigger level for colorectal cancer risk.

Christchurch City Council data show that of 420 samples collected during five years from 2011 to 2016, 40 percent exceeded 0.87ppm.

"When nitrate enters waterways, it accelerates algae growth. Freshwater scientists have long been pushing for nitrate limits to curtail algal proliferation, but restrictions have been slow and in some regions non-existent," says Joy.

"An important coincidence is that the Australian and New Zealand guideline for healthy aquatic ecosystems for nitrate is at 0.7mg/l nitrate-nitrogen, close to the level required to stay under the colorectal cancer risk value found in the Danish study.

"The Canterbury region exemplifies the problems resulting from the failure of central and local government policy in New Zealand to protect both ground and surface water.

"These failures cannot be blamed on a lack of awareness as these outcomes were predicted decades ago. For example, in 1986 the Ministry of Works predicted the nitrate contamination we now see as a consequence of regional irrigation schemes.

"It made it clear that alternative drinking water supplies would have to be found for Canterbury residents." **WNZ**

What the Courts are saying about water

By **Helen Atkins**, partner, and **Rowan Ashton**, solicitor, of Atkins Holm Majurey.

Water news has dried up a little in the past few summer months of drought, and so we take this opportunity to have a look at recent case law decisions made where the Courts have considered questions relating to water matters.

In this article we consider the Courts' comments on the definition of a 'riverbed', the Court's approach to a water bottling consent in late 2018, and a slew of interesting sentencing cases which look at questions of quantum of fines arising from breaches of the Resource Management Act 1991 (Act) in relation to water permissions.

Definition of 'riverbed'

Dewhirst Land Company Ltd v Canterbury Regional Council [2018] NZHC 3338, 2018 High Court, Christchurch, Gendall J

The High Court has recently had cause to consider the meaning of the term "bed" as applied to a river. Mr Dewhirst (as Director of Dewhirst Land Company Ltd) sought to develop part of his land along the Selwyn River.

However, Council informed Dewhirst that the area was within flood control vegetation lines contained in a local Bylaw making it part of the river "bed" and the proposed works could not occur. Dewhirst did not accept this and cleared vegetation up to the point he believed to be the edge of the riverbed and created a gravel bund along the line of the bank.

Dewhirst Ltd was subsequently prosecuted and pleaded guilty for works undertaken without proper consent. Dewhirst did, however, dispute the area of the river bed which was relevant to the scope and scale of the offending.

The RMA defines "bed" in relation to any river as the space of land which the waters of the river cover at its fullest flow without overtopping its banks. The key issue for the High Court was the meaning of the words "fullest flow without overtopping its banks" within that definition.

The Council considered that this definition included the area that would be covered by a 1 in 50 year flood – a very wide interpretation, that was adopted by the District Court.

However, the High Court disagreed and found that the words "usual or non-flood" were implied by the definition. This is a much narrower approach meaning the river's fullest usual flow is that which occurs over a reasonable number of river activity cycles (years), but does not include flood waters. In essence, the High Court found that the river bed is the bank-to-bank area between the "reasonably observable banks" of a river during its usual and non-flood flow.

This decision has been appealed to the Court of Appeal by the Council, with the appeal expected to be heard later this year. Council says the decision to appeal is to clarify the meaning of the term 'riverbed' for all landowners, communities and river users – particularly in areas where banks are not easily identified such as Canterbury's braided rivers.

Water bottling consent

Aotearoa Water Action Inc v Canterbury Regional Council [2018] NZHC 3240, High Court, Christchurch, Churchman J

Canterbury Regional Council granted Cloud Ocean Water Limited and Rapaki Natural Resources Limited (together the "Applicants") consents to take and use water from an aquifer for bottling for commercial resale. This decision was taken to the High Court by way of judicial review by Aotearoa Water Action Incorporated.

In defence, the Applicants argued that a prior consent granted to their predecessor enabled them to take water for commercial bottling and that even if the new consents granted (which are the subject of the judicial review proceedings) are invalid they can still take water under the prior consents. This decision is a preliminary decision regarding the scope of the original consents granted to the predecessor.

The site was for many years a wool scour, and the original water permit was sought to enable the take and use of ground water and the description of the activity in the Application for this resource consent was to "take water from three wells for meat processing and other purposes".

The original application described how some of the water was used for refrigerant cooling with an estimated 15,000m^3 a week of the water used for that purpose overflowing from the reservoir and into the Kaputone Stream, and the water use for the original consents was described as: "The water is for industrial use, including meat and animal waste processing".

Other than refrigeration cooling, no separate industrial use was mentioned. The expiry date of the consent is 2035. This is one of the original consents which was transferred to the Applicants – the other consent which was transferred was described as enabling the take of groundwater "for industrial use".

The Court made preliminary declarations as to whether commercial water bottling is within the scope of the original consents originally granted to the predecessor.

In arriving at a conclusion on this question the Court applied the test of whether an ordinary member of the public would have concluded that industrial bottling was contemplated as arising from the prior consents, and made the finding that 'an ordinary member of the public reviewing the relevant applications for consent would not have concluded that the water to be extracted would not be used for the purposes of cleaning and refrigeration in the case of the freezing works and scouring wool in the case of the wool scour, but bottling water for human consumption to be exported overseas.'

The Court held that commercial water bottling was not within the scope of the original consents.

In addition, the Court held that in determining the scope of the prior consents the Court is entitled to consider the purpose for which water was to be used, even when the consent on its face, was not ambiguous and did not refer back to the application or supporting documentation, and that the use of such extrinsic material to determine the purpose of consent is permitted.

The takeout here is that the purpose for which water is taken is highly relevant in consideration of transfers of water take consents.

Sentencing decisions

We cover several sentencing decisions arising from the Courts in recent months.

We consider that these sentencing decisions are of interest not only to those in the water industry but also to a wide range of New Zealanders, including farmers and those passionate about what the implementation of measures for cleaner waterbodies looks like in practice.

In our review of these cases, we look briefly at the facts, at the sentencing principles considered by the Judge and the application of these principles to the facts at hand, at the maximum fine available and at the final quantum arrived at by the Judge.

Waikato Regional Council v Devon Park Ltd [2018] NZDC 26396, District Court, Hamilton, Judge Harland

Sole director and shareholder of Devon Park, Mr Gordon, pled guilty to six separate and different charges of contravening the Act from 1 June 2015 through to 15 November 2017:

1. Discharge of a contaminant to land where it may enter water (horse stable waste)
2. Unlawful damming and diversion of a watercourse
3. Unlawful placement of a structure in a river bed
4. Unlawful use of land (earthworks without erosion and sediment controls)
5. Discharge of a contaminant (soil and sediment) to water
6. Breach of an abatement notice by failing to install appropriate Continuous erosion and sediment controls.

The maximum penalty for each of these charges is $600,000, meaning the total fine available to the Court to impose is a fine of $3.6 million.

The Court considered that the effects on the receiving environment were "very high", principally resulting from the leachate discharge and the ecological effect arising from the soil and sediment discharging into the waterways with the elevated nitrogen and phosphorous levels.

Furthermore the Court considered that Devon Park's excavation and earthworks resulted in the land becoming unstable, and made it highly susceptible to erosion.

The Judge held that Gordon's behaviour in the earthworks he was undertaking was 'extremely reckless', even if his actions were motivated by a genuine desire to provide an aesthetically pleasing usable place on the property for friends and family.

After allowing a deduction of 25 percent for the guilty plea entered, the Judge awarded costs against Gordon of $85,000, the majority to be paid to the Regional Council (which is standard practice for fines under the Act).

Otago Regional Council v Civil Construction Ltd [2019] NZDC 869, District Court, Queenstown, Judge Dwyer

Civil Construction Limited was sentenced for discharging contaminants (silts and sediments) to land in circumstances where they may enter water, a charge to which they pled guilty. Unlike other cases we look at here, the defendant sought a discharge without conviction.

Judge Dwyer noted that the Court may only grant such a discharge if it is satisfied that the direct and indirect consequences of conviction would be out of all proportion to the gravity of the offence.

While Judge Dwyer found this to be at the less serious end of the scale

of seriousness that was not to say the offending was trivial, and he determined that the consequences of conviction are not out of all proportion to the seriousness of the offending, therefore did not grant discharge without conviction.

The maximum penalty is $600,000.

In reaching the conclusion, Judge Dwyer had particular regard to the following factors;

"First, this was a substantial discharge. Although the volume has not been calculated, it was generated by earthworks undertaken over a 10 to 15 hectare development site which overwhelmed sediment control measures, was conspicuously visible in streams and flow paths from the site, flowed for a distance of a kilometre or so to the river and was again conspicuously visible in the Clutha for a distance of up to 500 metres from the point of entry;

Second, the sediment was generated from development works undertaken on a large sloping site over the winter period when heavy rains might reasonably be expected and where run-off flowed naturally to the river. The need for a high standard of design and subsequent management of the works would or should have been apparent to the developer, its advisors and the contractors undertaking the works;

Third, fines should be set at a level such that they are not simply a licensing fee payable as part of the cost of doing business."

For Civil Construction's actions which Judge Dwyer saw went 'beyond simply putting things into the order that they should have been' he allowed a 15 percent reduction, ending with a penalty of $25,500.

Canterbury Regional Council v Aitkens Road Dairies Ltd [2019] NZDC 3190, District Court, Christchurch, Judge Borthwick

In this case Aitkens Road Dairies Limited pled guilty to a charge that an employee discharged a contaminant (dairy effluent) from an over-spilling solids pond onto land which may have resulted in contaminant entering groundwater.

This was caused by effluent flowing five metres overground instead of being piped to the pond, due to the pipe becoming detached. Further discharge was caused when the underground pipe between the solids pond and effluent dam became blocked, resulting in an overflow into the effluent dam.

The maximum penalty is a fine not exceeding $600,000.

Judge Borthwick considered that the principle of deterrence should factor into her sentencing decision:

[21]...For this offending, I find that there needs to be a strong general deterrence, even though, in this case, any effect is likely to be localised. A prudent farmer would have recognised the risk of discharge if the infrastructure were to fail particularly during a period of higher than normal rainfall and would have responded with an effective remedy.

Following a reduction of 25 percent for prompt guilty plea, the quantum was set at $30,000.

Southland Regional Council v Horizon Flowers NZ Ltd [2018] NZDC 24896, District Court, Invercargill, Judge Dwyer

In this case Horizon Flowers NZ, a tulip growing company, applied for resource consents for water takes. However regardless of the fact that some of these applications were returned as incomplete, and some were not fully determined or granted, Horizon Flowers proceeded to take water from the Winton Stream catchment unlawfully.

Following this unlawful activity a resource consent was granted allowing abstraction, with a condition providing that water could not be taken when the flow rate in the Otapiri Stream and Oreti River was less than a certain amount of cumecs per second. However, Horizon Flowers continued abstraction when the water bodies were below this flow rate. Further breaches followed, including extraction occurring where there was no water take for the particular property.

The Court made the following general observations regarding New Zealand's approach to water allocation:

[16] The first is that the Resource Management Act 1991 seeks to safeguard the life supporting capacity of our waters and related ecosystems. Section 6 of the Act provides that preservation of the natural character of our rivers and their protection from inappropriate use is a matter of national importance. The term "river" includes streams including very small, sometimes intermittently flowing streams such as some of the streams involved in this case, as I understand it.

[17] In order to protect these waterbodies regional councils are given the power to set minimum flows in them and control the rate at which people take water from them. That is what the Southland Regional Council has done through its Regional Water Plan. Put in its most general terms, the Regional Water Plan seeks to ensure that enough water is left in our rivers and streams at all times so that they can function as they are naturally supposed to do. This means that the rights of people to take water from rivers for irrigation and the like are secondary to the needs of the rivers which are to be preserved and protected. If there is insufficient water available to meet the requirements of both a river and persons wanting to irrigate, it is the irrigators who miss out, not the river.

[18] The second observation is that the terms of regional water plans and/or resource consents to take water, are frequently complex. That is because water ecosystems themselves are often complex and regional councils have to balance the needs of those ecosystems with the reasonable needs of farmers and others to be able to use water which is essential for agricultural and horticultural production. Notwithstanding that complexity, persons who use water for commercial purposes have an obligation to familiarise themselves with the relevant rules and controls and to understand and comply with them. The essence of the submissions which have been made on the Defendants' behalf is that they did not breach the rules deliberately but rather as a result of misunderstanding them or misunderstanding or misinterpreting the resource consent which was held by Horizon. I simply make the point that even if that is accepted, it is not a defence to the charges.

While allowing a reduction of 25 percent due to promptness of a guilty plea, the Judge considered that there was a 'high degree of carelessness on the part of the Defendants', and allocated total fines of $53,400 for Horizon Flowers and $21,375 for the manager responsible. **WNZ**

MAXIMISING AD WASTEWATER OPPORTUNITIES

Supplied by HRS Process Solutions.

The wastewater treatment sector has used both aerobic and anaerobic treatment for many years. However, in terms of the generation of energy from anaerobic digestion (AD), New Zealand's wastewater sector is underperforming compared with other countries such as the United Kingdom and the USA.

Our country currently has just 10 wastewater AD plants, contributing to the 2.71 petajoules (PJ) of biogas energy produced each year.

By contrast, in the UK there are 163 wastewater AD plants, from a total of 635 biogas facilities nationwide, which account for 28 percent of the country's total AD capacity.

Thanks to efficiency increases, the sector delivered a 25 percent increase in power production from a 12 percent increase in capacity between 2010 and 2015.

In the United States, 48 percent of all wastewater is treated by anaerobic digestion, with a third of water treatment plants producing biogas.

Plenty of potential

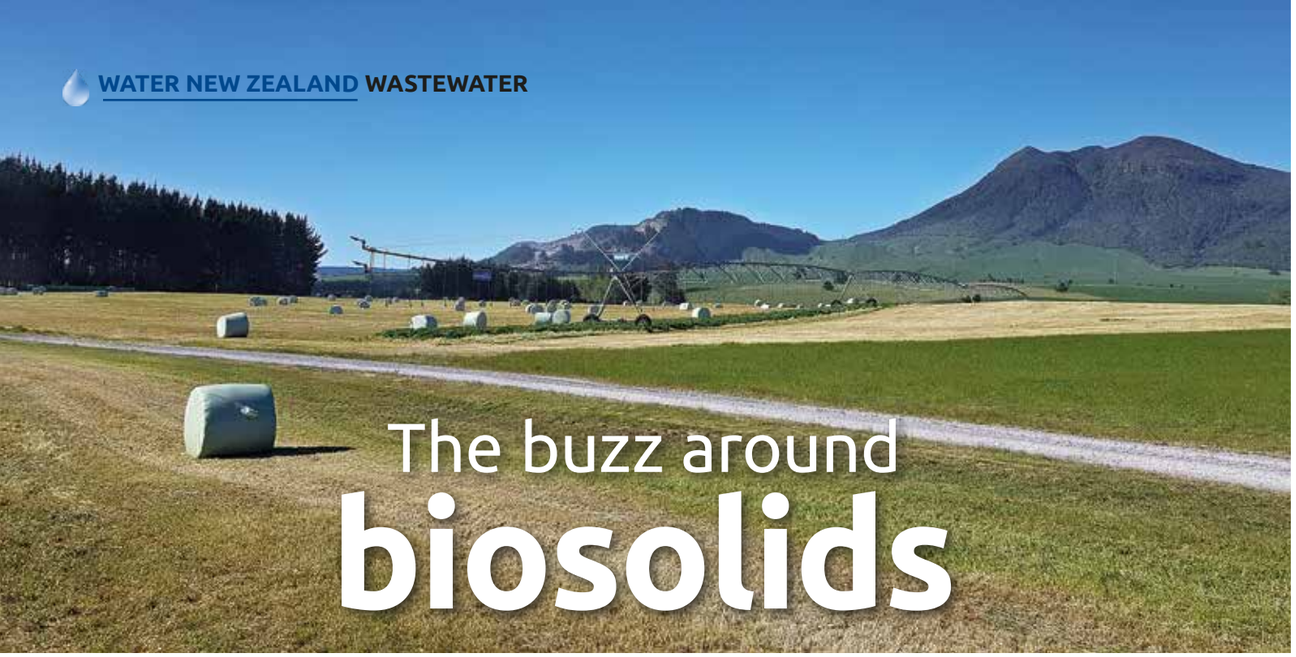
Many commentators overlook the potential of the wastewater and sewage sectors in terms of increased energy generation, but with 135 wastewater treatment plants nationally, there is a huge opportunity to increase energy production from our wastewater sector. In addition, there is the potential to increase the efficiency of those plants which already use AD, not least as some of the oldest wastewater AD facilities are now in a position to upgrade and take advantage of the latest technology.

Take the heat

In many cases, the economic decision about whether to invest in AD will depend on the overall efficiency of the final project. Techniques such as heat recovery using heat exchangers enable a resource that would otherwise go to waste, to be used to pre-heat feedstock or digesters to improve gas production efficiency. Equally, the heat can be used for pasteurisation and concentration processes, increasing the value of the digestate co-product produced.

A well-designed system could recover and utilise 40 percent of the heat produced by a wastewater AD plant. This free heat provides a useful bonus when evaluating any investment in AD, and is something that potential developers should consider from the beginning of their planning process. **WNZ**

The use of anaerobic digestion (AD) in wastewater treatment is increasing around the world.



The buzz around biosolids

The water industry has started to look to biosolids reuse again with renewed interest, says **Rob Tinholt**, the Resource Recovery manager at Watercare.

This year's Australian Biosolids Conference in February sold out, with record attendance. Three days later a biosolids event in Auckland attracted 100 attendees from as far afield as Queenstown, Dunedin, Christchurch, Wellington, Palmerston North and Kaikohe.

Biosolids are estimated to make up about three per cent of waste that goes to category A landfills, but with New Zealand looking at a zero-waste future and associated changes to landfill levies, that's likely to change.

Politicians and our communities are starting to become more interested in the end-fates of our waste products and they will expect to see us as an industry provide more visibility about our footprint, and that includes what happens after we dispose of our waste.

Two historic challenges for applying biosolids to land have been metals and pathogens. Utilities, including Watercare, are reporting reductions in metal concentrations over the past 10 years as successful trade-waste management and the off-shoring of some industries takes effect. Pathogens can be readily pasteurised to safe levels by vermicomposting, thermal drying, or thermal hydrolysis.

Regions like New Plymouth and Taupo are already producing and marketing products made from biosolids and Watercare and other utilities are planning to follow the same path.

At Watercare's Rosedale Wastewater Treatment Plant we have committed to a thermal hydrolysis upgrade which provides us with a pasteurised product that is safe to handle, improved digestion which doubles the capacity of our digesters, more energy, reduced total solids, improved dewaterability, and reduced odour.

The real benefits are that not only do we have a smaller volume of biosolids to haul, we have a product that will have market appeal.

The long-standing biosolids-to-land history of the USA, UK, and Australia, as well as some of our own regions, provide insights as to how we can achieve success.

Fifteen years of New Plymouth's success

New Plymouth is one of our best-known biosolids stories. In 2000, the council's thermal dryer was commissioned and it has since processed approximately 160,000 tonnes of wet biosolids, creating a sterile, safe, easy-to-handle fertiliser in pellet form.

The product is bagged and sold to the public by Bioboost via retail outlets under the brand BioBoost. The remainder is sold by Bioboost in bulk to horticulture, sports turf and agriculture. Since commissioning, almost 100 percent of New Plymouth's biosolids have been applied to land. Graham Morris, New Plymouth's Process Engineer Operations says that Bioboost has been so successful that the Council is committing to a complete renewal of the thermal drying facility.

Taupo's smart innovation

Taupo's wastewater asset manager Michael Cordell says the council has had a successful programme of growing feedstock on its own farmland with irrigated effluent. The council has expanded this operation to include biosolids application to land that has lucerne grown on it. They recently harvested the first crop grown as a feedstock. The biosolids are digested and then vermicomposted with a blend of locally available timber processing waste. This programme has support from the local iwi.

Vermicomposting

Rotorua, Hamilton and Tokoroa all vermicompost their biosolids too. Vermicomposting does require a good cellulose source which the timber and paper industries provide. In turn, forestry provides a natural market for the end product.

Land rehabilitation

Palmerston North, Christchurch and Watercare have all found ways of rehabilitating land. Palmerston North is co-composting biosolids with municipal green waste and applying the end product as a final contour/landscaping layer on top of its landfill. Christchurch is also capping its Burwood landfill, while Watercare is rehabilitating an abandoned quarry adjacent to the Mangere Wastewater Treatment Plant with its biosolids.

Australian Biosolids Conference

The Australian and New Zealand Biosolids Partnership hosted the February Biosolids Conference in Brisbane. The conference theme was the circular economy with a focus on technology, soil research and good practice for land application of biosolids.

Keynote presenter Chris Peot, director of resource recovery at DC Water, kicked off the conference and shared the DC Water journey to creating and selling an accredited "AA" biosolids product to farmers, as well as community gardens and residents.

There were five New Zealand presentations out of a total of 32, including an invited speaker address given by Jacqui Horswell and myself, Watercare's resource recovery manager, providing an update of the New Zealand Organic Materials Guidelines.

Auckland biosolids event

Watercare invited Chris to Auckland to present at a regional event, which attracted interest from around the country. The event grew to include a site visit to Watercare's Puketutu Island

Taupo's bailing operation on a sunny day.

Rehabilitation Project and a workshop to discuss biosolids challenges and successes from around the country.

It is time to create structured conversations and information-sharing to help the water industry drive change in the way people think about biosolids.

There is currently a draft "Guidelines for the Beneficial Reuse of Organic Products to Land", which covers biosolids, and has been developed by Water New Zealand in association with the Ministry for the Environment, Ministry of Health, and the Ministry for Primary Industries (et al). These guidelines are aimed to make biosolids application to land more enabling. Once the guidelines are finalised, councils will need to go through plan changes or resource consents and make sure that stakeholders and the public are on board.

Although there may still be some opposition to the idea of using biosolids on land, doors will be unlocked by providing good information, sharing end user anecdotes, and ongoing input to research for both contaminants of concern and for the good that biosolids can do for soil and plants.

Keep an eye out for an invitation in pipeline for an industry conversation around June this year. A biosolids workshop is also in the planning for the September Water New Zealand conference. **WNZ**

Turning waste into resource

By **Jess Daly**, senior process engineer and **Gareth Hall**, senior associate at Beca.

Tauranga City Council's Te Maunga Wastewater Treatment Plant (WWTP) is taking the extraction of biosolids' value to the next level, with state-of-the-art technology and the largest screw press installation of its type in the southern hemisphere.

The plant currently serves around 80,000 people, treating wastewater from Mount Maunganui, Papamoa and a portion of wastewater transferred from Tauranga City via the Southern Pipeline.

Plans to expand the plant and changes in requirements and consents meant a new approach was needed. Since its construction in the mid-1990s, waste activated sludge from the plant has been pumped to an adjacent sludge holding pond for partial stabilisation, with de-sludging required about every five years.

A resource consent condition in the latest consents for the plant required the sludge pond to be decommissioned. This prompted Tauranga City Council (referred to as Council from here on) to review their biosolids strategy and develop a plan for managing biosolids from their treatment sites now and into the future.

Biosolids strategy review

Council's biosolids strategy review, undertaken in collaboration with Beca, considered technologies that would transform the waste biosolids into a useful product. The ultimate goal was to enable the beneficial re-use of biosolids as a fertiliser or fuel replacement, instead of landfilling.

The first stage of works in the strategy was to install a thickening and dewatering plant at the Te Maunga site. Subsequent works, including some form of sludge drying, are programmed in the Long Term Plan for the period 2022-2025.

An options study was undertaken to consider different sludge thickening and dewatering equipment technology. In conjunction with the Council operations team, gravity belt thickeners and screw presses were chosen, based on their all-round performance and efficiency.

Gravity belt thickeners were well known to the council, as they were already in use at their Chapel Street WWTP. Screw presses were preferred over traditional dewatering machines such as centrifuges, due to their much lower power consumption, lower operating speeds and maintenance requirements.

From pilot trials to full scale processing

Given the screw presses are a relatively new technology in our wastewater treatment plants, onsite dewatering trials were undertaken to confirm the performance expected. Waste activated sludge, without any primary sludge, is also more difficult to dewater so it was important the team at the plant understood the proper upstream sludge processing required for the screw presses.

Innovative filtration solutions were able to provide a screw press pilot trial unit for onsite trials. Waste activated sludge was pumped directly from the activated sludge bioreactor to plastic tanks, to simulate sludge thickening prior to being fed through the screw press pilot plant.

Best dewatering performance was achieved with a sludge feed of between 1.5 and 3.0 percent dry solids, and a higher sludge age with a resultant VSS:TSS ratio (volatile suspended solid to total suspended solid) of less than 82 percent. During trials, a cake with a dry solids component of more than 20 percent was achieved.

The lower than expected optimum solids feed resulted in a re-think of the planned sludge thickening process.

As a result, gravity tank picket fence thickeners were installed in order to match the optimal solids feed concentration, without the need to add polymer. Thickened waste activated sludge tanks were also included in the design to provide a buffer for the screw press feed, with further destruction of volatiles to decrease the VSS:TSS ratio as much as possible.

To achieve the 20 percent dewatered dry solids target, static as well as dynamic mixers and a coagulation injection system was implemented as part of the sludge conditioning process prior to dewatering.

The full scale dewatering plant consists of two screw presses, each with an optimal throughput of 600-800kg dry solids/hour. The presses were manufactured by IEA Derflinger GmbH in Austria and supplied by Innovative Filtration Solutions, with IFS advising the installation is the largest of its kind in the southern hemisphere.

The building that houses the presses has been integrated architecturally with the balance of the existing plant.

Dewatered sludge cake is conveyed to a live bottom loadout silo for storage prior to loading into a truck and trailer. Initially, one truck and trailer unit per day will be required to transport the cake to landfill. As noted previously, the long-term plan is to dry and beneficially re-use the biosolids which will remove the need for landfilling the cake.

Extracting value

Construction of the new thickening and dewatering facility began in early 2018, with the first sludge cake produced in March 2019.

The full-scale plant has now been running since mid-March 2019, producing cake with approximately 16 percent dry solids and using considerably less polymer than expected. The treatment plant is currently running at a lower sludge age and therefore higher VSS:TSS ratio than normal which is likely to be affecting performance.

Ongoing optimisation work is expected to increase the cake's dry solids component even further.

Through the innovative and iterative design process undertaken at the plant, and installation of cutting-edge thickening and dewatering technology, Te Maunga WWTP is stepping in the direction of extracting real value from its biosolids.

In coming years, the council is planning to trial and test a range of safe and sustainable biosolid beneficial re-use applications. **WNZ**

Screw presses were preferred over traditional dewatering machines such as centrifuges, due to their much lower power consumption, lower operating speeds and maintenance requirements.

Using sound data for three water decisions

Quake Centre manager at Canterbury University, Greg Preston, provides an update on progress of new evidence-based investment decision-making tools for three waters networks.

The Quake Centre has an interest in issues related to the investment, service delivery and resilience of underground infrastructure.

The centre has a number of activity streams ongoing including applied research and the development of guidelines, standards and tools with a focus on smarter ways of tackling problems from a coordinated, national perspective.

The aim is to assist local authorities to make local decisions based on sound data and in a way that reflects national best practice.

A couple of key projects are the furthering of our Asset Metadata Standards (NZAMS) and the creation of a National Pipe Data Portal.

The pipe renewals project is a collaboration between the Quake Centre, Water New Zealand and IPWEA. It is a joint venture project aimed at helping councils make better decisions on when to replace water pipes and potentially save millions of dollars.

The project has many facets and recently activity has merged with the development of the NZAMS. Its purpose is to develop and facilitate the implementation of common national data standards in roading, three waters and light commercial and residential buildings.

One of the major planks of the pipe renewals project and the NZAMS is the National Pipe Data Portal, which is a plan to allow data sharing across the country. Its purpose includes:

- The use of larger datasets to better understand the attributes of this country's pipe networks and to create improved models to manage these networks;
- Providing a national picture on the state of, and associated risks to NZ's pipe networks and developing ways of better managing asset data.

It is hoped that the Pipe Data Portal will become a layer of a national digital infrastructure model that will allow similar benefits to be shared across all of our country's assets. Creation of the portal is partly funded by the Building Innovation Partnership (BIP).

The BIP is a Quake Centre initiative that is funded by the Centre's industry partners (60 percent) and by MBIE (40 percent). Theme one (of three) of this initiative is focused on better investment decision-making with a focus on the three waters pipe networks. This theme is led by Theuns Henning from the University of Auckland. Currently five projects have been initiated. They are:

- Pipe condition technology assessment to review technologies for in situ assessment of pressure pipe condition;
- A national infrastructure model to develop digital twin and metadata standards for our infrastructure;
- Data, metrics and reporting for wastewater pipe networks to develop improved models for residual life, failure risk and costs of pipes;
- Holistic decision making for three waters to develop a framework for three waters investment decision making, including economic, environmental and social well-being;
- A strategic review on the procurement of three waters so as to understand the key issues faced by industry for the procurement of three water assets and benchmark practice.

Work on the portal to date

The Pipe Data Portal is a testing ground for a number of activities. Over the past summer, a group of Masters of Applied Data Science (MADS) students from the University of Canterbury undertook internships at councils around the country.

Three students worked with Christchurch City Council, Tauranga District Council and Auckland Council's Healthy Waters.

Their project aimed to: assess the quality of each council's storm water data internally and against an external standard; map each council's data to the external standards and federate the data by use of that standard; and visualise the data as a single entity and run some basic queries across the federated data set .

This project was proof-of-concept for the Pipe Data Portal. Its successful completion showed that asset data from disparate sources can be mapped and federated to a single view using a standards-based approach, and it is not necessary to change the data at source. The data can remain in its native form and environment. Any mapping, federation and analysis can be done on the fly whenever needed. The data analysis was done using a number of tools and scripts developed by the students. Federation, visualisation and simple queries were done in Nextspace's Bruce software.

The external standard that the MADS students work towards was the ß-Version of the National Metadata Standard. This is an evolution of the LINZ Standard for three waters published in 2017.

Some significant work has been done on this standard to improve its structure and correct some of the outstanding errors in the first publication. Much of this work was done by Graham Clark of Fulton Hogan.

The aim is to evolve this standard further by capturing any lessons learnt during the MADS project and also creating a working group to ensure review and applicability by a range of councils and organisations.

This will include a recommendation of what should be core data and what is considered supplemental. This will be in line with the International Infrastructure Management Manual on levels of maturity.

In the first instance this scope will be limited to reticulation assets as this is where the greatest value lies. It's also where there is the greatest need for a collaborative approach with other asset types. The aim is to publish version one around the middle of 2019 in line with the publication of NZTA's roading standard.

Planning for the future

Data is becoming an increasingly important asset for owners, managers and operators of three waters networks with a large knock-on effect to the rate payer and consumer. With this in mind the Quake Centre intends to keep facilitating the development and implementation of data standards across New Zealand.

We would like to have 80 percent of councils involved over the next two years and all councils and all three waters asset classes within five years. This is a big task in which we hope to have the continued assistance of our partners. Who knows – maybe central government may even help?

Investigating maintenance and operational data

In addition to the work undertaken to test the National Pipe Data Portal there were also a couple of MADS students based at Wellington Water. Their project involved analysing operation and maintenance data for a couple of the councils in the Wellington region.

The aim was to develop some analytics to compare maintenance and operations activity across a number of suburbs in regards to operation and maintenance data.

Despite limited data, these produced some results that were useful for Wellington Water and this work will continue as more data becomes available.

Wastewater renewals framework – gravity pipelines

One key output from the pipe renewals programme is the wastewater renewals framework – gravity pipelines guidance document. This has recently been published and is available from the Quake Centre's resource portal, or from Water New Zealand.

This guidance has been developed by Philip McFarlane from WSP Opus with input from a wide range of industry players.

The renewals framework developed in this document provides a structured process that organisations can use to plan renewals. The framework shows how organisations can use existing data in a meaningful way. Importantly, the framework can be scaled and modified to suit the needs of an organisation.

The renewals framework draws on processes and information described in the International Infrastructure Management Manual, New Zealand Asset Metadata Standards (NZAMS) and the University of Canterbury Pipeline Renewal Programme. While this document is closely aligned to the NZAMS, the advice provided can be applied independent of the NZAMS. **WNZ**

For more information contact: Greg.preston@canterbury.ac.nz.

Saving energy costs with blower packages

Kaeser Compressors explains the cost and energy efficiency gains that can be made with complete blower packages.

Aeration is a central part of the treatment process at a wastewater plant. It is also a major contributor to energy costs. As a result operators are always looking for ways to revamp, replace or modify the blowers and their packaging in order to improve the aeration stage.

Understanding what makes an efficient and cost-saving blower system is therefore paramount.

Blower packages assembled by sourcing components from a variety of suppliers is still quite common and usually a result of adding to the blower as new requirements arise. As an example, a blower is determined to be too loud, so a new silencer is sourced. Perhaps even a sound enclosure is purchased. However, this now means that being inside a box, the blower runs warm, so now the operating temperature must be monitored. Then perhaps it is determined that the blower needs to make more or less air, so a frequency controlled drive is installed. The needs grow and so does the package and its components. There are many versions of these packages in the field and while they may get the job done, there is no clear way to see how efficient they are.

Packaged rotary screw blowers include everything in one enclosure for optimum performance and energy efficiency.

With energy for aeration one of the highest operating costs to a WWTP (wastewater treatment plant) it is therefore essential to understand equipment efficiency in order to better control and manage these expenses.

The total package

Opting for a fully packaged blower solution is one way operators can meet all of their requirements in the most cost effective and energy efficient manner. Fully packaged blowers have been available for some years now however different manufacturers have different levels of packaging. Most include the basics; full cabinet enclosure, motor, drive, inlet/outlet silencers, and basic instrumentation.

Some manufacturers go a step further and have onboard sensors and controls. Packaged blowers from Kaeser for example include a full sensor kit that monitors several points on the machine for pressure and temperature.

This information is fed back into the onboard controller which not only monitors these points, but also makes calculations for differential pressure and temperature. The machine is then able to provide alarms or warnings, notifying the user of impending problems. It can even turn the machine off to prevent catastrophic failures.

These machines are also fitted with motor starters or a frequency controlled drive. Here again, all of the devices feed into the controller, providing a central point for monitoring and operator interface.
A communication module can even be purchased which extracts all of this data to a plant program logic controller (PLC).

Saving energy costs

Significant energy cost savings in terms of specific performance (kW/m3/min) can be achieved with complete packaged blowers. Specific performance is the ratio for how much power it takes to generate the desired air flow.

When a decision is made on which blower to purchase an evaluation is done to compare all of the quoted blowers. Quite often the values are stripped down to the bare blower block performance before equal values are assigned to each blower for package losses in the form of motor efficiencies, silencer losses and so on.

This is done in order to ascertain how much each machine will cost to operate over a period of time.

The problem, however, is that while the blower performance is guaranteed, the package performance is not. Again this is because the end product is assembled from a variety of suppliers, where each of the suppliers it not able to guarantee an end result. However, when the end-user opts for a complete packaged blower system manufactured by one supplier, provided performance values can be guaranteed.

Optimised maintenance

Whether it is a blower made up of various supplier components or a complete packaged system, the maintenance requirements are the same, i.e. oil, belts, grease and air filters. The key benefit of complete packaged systems such as those from Kaeser, are the onboard controllers which keep track of the running hours and maintenance intervals. When it is time to change the oil, inspect the belts or filter, or grease the motor, the controller lets you know. And, in order to clear an alarm the user or maintenance person must log into the controller. All of this activity is kept as a log inside the controller, therefore should a problem occur, all data and activities can be accessed for future reference and troubleshooting.

Rotary lobe versus rotary screw blower packages

A rotary lobe blower package such as the ones manufactured by Kaeser, have all of the components required of a blower system; silencers, motor, air filter, belts, relief valves, sound enclosure, check valve, sensor kit, controller and starter (contactors or frequency controlled drive).

As all plants require all of these elements, every plant can benefit from this design. For most WWTPs these blowers will be running all day every day. Performance, reliability and longevity are critical to the plant's operation and compliance. A factory-engineered and developed machine has been optimised through years of experience to provide the best performance and highest reliability.

Furthermore, integrating the blower package into a plant's master control system allows for better product maintenance monitoring which can reduce downtime and repair costs.

The rotary screw blower package has the same scope of supply as the lobe blower package. All of the package design concepts and goals remain more or less the same – low noise, easy access to maintenance, and a small footprint – but a screw blower gives a decided boost in efficiency over any lobe-type blower design. Screw blowers offer the advantage of internal compression which can result in up to a 35 percent gain over lobe technology under certain conditions.

Screw blower designs are beneficial for all aeration processes, however they are best suited for a process with a constant fluid depth and with extended running hours. Constant fluid depths allow the user to accurately predict the efficiency gains and to realise the expected payback on the investment.

Variable fluid depth applications will see fluctuations in efficiency gains and intermittent duty systems will experience extended payback on the investment, both of which will extend payback periods. In these cases, it may be best to stick with the PD lobe machine.

If the effort required to install, wire, program and commission a blower is considered, the costs would easily surpass the cost of a complete packaged system. Additionally, the end product would not provide the same level of functionality or protection as the complete packaged system offers. A completed packaged system also gives the peace of mind that the end-user is getting the performance calculated during their evaluation process.

For more information visit www.kaeser.co.nz or phone 0800 447 820. **WNZ**

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