

water

MARCH / APRIL 2019 ISSUE 208

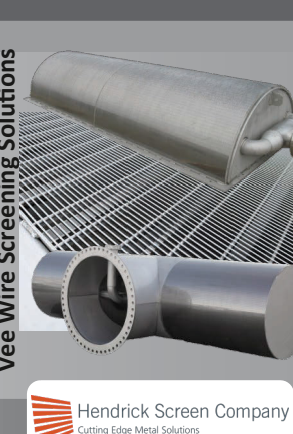
Stormwater 2019 The next generation

Embarking on major training initiatives
Wastewater and migratory birds
Pitching for a global conference

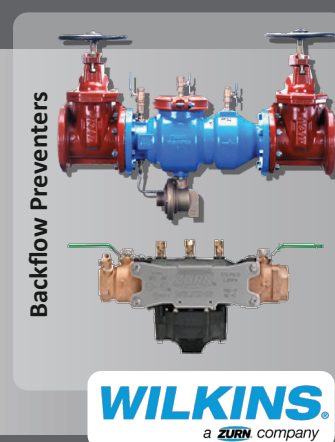
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A consistent approach across the 3 waters sector.



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.

Looking to the year ahead

Welcome to the first edition of *Water* for 2019. By the time you're sitting down reading this issue, the 2018 year will seem like a distant memory. But 2018 set the direction for the likely future of our sector.



Kelvin Hill,
President, Water New Zealand

Two notable items were unveiled by the Government in the last few weeks of the year while another was unveiled in February this year.

In November there were the Cabinet papers on the future of three waters. The first, *Future state of the three waters system: regulation and service delivery* focused on the Three Water Review and sets out the Government's roadmap for future decisions on three waters reform. The second Cabinet paper, *Local governance for community wellbeing* attempts to reframe local government and central government relationships.

The other announcement on urgent and minor changes to the Drinking Water Standards for New Zealand 2005 was released in December 2018 and, as this publication went to print, was still scheduled to come into force on March 1, 2019.

The main changes to the Standards focus on reducing the default level of treatment for protozoa to 3-log, a significant change and the requirements to monitor for total coliforms: and enumerate *E. coli* results.

Water New Zealand supports some of the changes, but has raised concerns about others and we asked that the implementation of the new standard be delayed until adequate consultation with the industry can be undertaken.

However, the Ministry has indicated that it won't be making any changes and that the March introduction date has remained. You can check on our website (www.waternz.org.nz) for the most up-to-date information on any new developments.

In February the Government announced proposed changes to vocational education and training. These include amalgamating polytechnics into a NZ Institute of Skills and Technology and having all vocational training delivered by that organisation.

It is also proposed that ITOs will be discontinued and new organisations called Industry Skills Bodies will take over some of their functions.

There is a consultation process but the Government wants to have the changes in place by January 2020. This is a very tight timetable for such significant changes. One thing is clear, vocational training is going to look very different and we will need to understand the changes so that we can ensure that the training the water industry needs gets delivered.

Most of us in the sector know that, in many parts of the country, there have been significant challenges around industry capacity and capability and concerns about lack of available training. We're pleased to announce that this year there will be a new independent Water Industry Education and Training Advisory Group to advise Water New Zealand and others on all aspects of water industry education and training.

Advice from this group will help establish what needs to be done to address these issues and how we'll get there. We'll keep you up-to-date with developments as new information comes to hand.

When I closed our Annual Conference last year I provided a short summary of what we might expect going into 2019, including the three waters reform.

I would like to update you on these and set the record straight over our position. We are sensitive to the fact that this is an uncertain time for many members, but it is important to remember that changes in any sector are part of a normal process and with change comes new opportunities.

I'm sure all of us agree that providing safe drinking water to our communities and national and international visitors is of paramount importance. The Havelock North Drinking Water Inquiry identified fundamental flaws in the regulations and the way drinking water is provided which, as we know, led to the outbreak. These are systemic problems across the country, not just restricted to Havelock North. In other words, the contamination outbreak could have happened in a number of other places and that's why there is an urgent need to address these issues.

It's also why we have been urging the Government to address the recommendations of the report without delay.

There is an urgent need for a new independent regulator with the knowledge, credibility and legal status to support water suppliers and, at the same time, enforce Drinking Water Standards. These drinking water standards need to be reviewed

and the Ministry of Health has a process for this underway. However, it is our view that the review of standards is a task for the new three waters regulator and, in the meantime, all the Ministry of Health should be doing is enforcing the existing standards.

We know that many small suppliers struggle to maintain quality drinking water and Water New Zealand is in favour of supporting them in the best way, including the re-introduction of the drinking water subsidy scheme or another similar approach.

While it is clear that the water sector is in need of reform, unpacking the complex system of water management, which has evolved over the years, is a difficult task. It is up to the Government to listen to all points of view and then come up with an effective, efficient and safe system that will be fit for purpose in the long term.

Hot off the press is our new 2018-19 National Performance Review.

This is our flagship benchmarking tool and covers entities that service 4.5-million New Zealanders – just over 94 percent of the country.

We thank all the participants who have given their time to provide this valuable information. If you haven't seen the latest edition yet, make sure you go to our website to take a look. The NPR is designed to provide us with the knowledge of how our services stack up in relation to our peers. It provides a great opportunity to identify what we can learn from each other

through knowledge sharing.

Water continues to be a dynamic sector to be part of and new advances are no exception. It's with this in mind that I'm very pleased to introduce a new Water New Zealand group.

The Smart Water Interest Group, or SWIG as it is known, will help us in the water industry navigate around the many advances in digital technology and management systems. It also aims to connect those of us with a shared interest in this important field.

So look out for more information on that over the coming months.

Other new groups emerging include a new group of Young Water Professionals that encompasses my region.

The Central North island Group of the YWP had their first successful meeting in Tauranga recently. Certainly the initial group of 15 attendees, who are all new to the region could see the benefit of networking and have already established a meeting schedule for the next 12 months, including a variety of interesting topics to explore.

So, if you're new to our sector and live in the Bay of Plenty, Hamilton and South Waikato regions this could provide a great opportunity for learning and networking. [WNZ](http://www.waternz.org.nz)

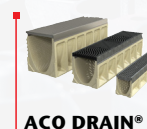
• For more information on any of our groups contact Vicki.McEnaney@waternz.org.nz

Nga mihi nui
Kelvin



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The lagarosiphon battle continues down south

More than \$200,000 is due to be spent this financial year to tackle the invasive plant pest lagarosiphon, with funding from Land Information New Zealand (LINZ), Otago Regional Council and Contact Energy.

"We are focusing our efforts this summer season on all of the popular recreation spots such as the Old Cromwell Town, beach and Bannockburn," says Marcus Girvan, Biosecurity Programme manager at Boffa Miskell, working on behalf of LINZ.

Work around the lake involved divers pulling out the weed by hand around boat ramps, herbicide spraying from boats and helicopters and using a cutter to slice the weeds away from the surface.

As featured in the September/October 2018 (pages 50-54) issue of *Water New Zealand*, Lagarosiphon spreads quickly and can grow up to five metres tall. It's hoped that by clearing areas such as the boat ramps the invasion of the plant may be kept in check.

"With so much weed in Lake Dunstan, preventing the spread of lagarosiphon to other waterways is absolutely critical," says Richard Lord, team leader Biosecurity Compliance at Otago Regional Council.

An inspection by NIWA showed where treatments for lagarosiphon have had an impact in the lake. At Northburn, Lowburn Boat Harbour and Lowburn Inlet lagarosiphon has been pushed back and native plants are starting to regrow.

Herbicide spraying at Old Cromwell had to be delayed due to heavy sediment in the water. Instead of spraying, Boffa Miskell cut the weeds



back in November.

Results from NIWA show that the herbicide diquat has been very effective in most parts of the lake, and doesn't harm native plants.

The work programme for Lake Dunstan is being led by the Lake Dunstan Aquatic Weed Management Group which includes LINZ, the Ministry for Primary Industries, NIWA, Contact Energy, Boffa Miskell, Otago Regional Council, Fish and Game, the Guardians of Lake Dunstan, Central Otago District Council, the Clutha Fisheries Trust and the Cromwell and Districts Community Trust.

Big interest in Hawkes Bay Stormwater Industry meeting

By Wolfgang Kanz.

A range of practitioners attended a Stormwater Industry meeting in Hawkes Bay back in November 2018.

The meeting, organised by the NZ Water Stormwater Committee, is hopefully the first of future annual meetings on the East Coast aimed at providing a platform for sharing of knowledge and experiences, and promoting continual improvement in the stormwater industry in this region.

The high level of interest was evident in the large number of presentations delivered –

a total of 10 presentations crammed into three hours.

Topics ranged from aspects of hard engineering, GIS tools, through to water sensitive design and strategic planning. It was clear from the discussions and presentations that all practitioners were passionate about the work that they do.

The good mix of local government (representing Gisborne, Wairoa, Napier and Hastings) and private practitioners (including ecologists, planners, scientists and engineers), some even travelling a long way from outside

the region to attend this meeting, translated into robust and positive discussions.

It was also great having almost equal representation from the public and private sector.

Practitioners were able to talk about the challenges they face, and likely solutions to address these.

Water New Zealand thanks all that attended for their contributions on the day. And a special thank you also goes to Morphum Environmental and Hawkes Bay Regional Council for sponsoring the meeting.

Wellington Stormwater Group discusses urban water

In November 2018, the Wellington Stormwater Group held a seminar focusing on the topics of setting a national vision for improving urban water stewardship, and learning from international best practice in water sensitive urban design.

Sarah Boone from the Ministry for the Environment presented on the new set of 'Urban Water Principles' that set out clear expectations for the type of considerations that all water professionals can reflect in their work.

These principles have been produced through a collaborative process with a working group of local government and private sector professionals and the Government is using the principles to help set the freshwater agenda for cities and towns.

This talk was complemented by an excellent presentation by Stu Farrant, who has recently returned from his Churchill Fellowship experience in Europe and the United States, where he observed many

different approaches to increasing the uptake of water sensitive urban design.

Stu highlighted the experiences of Portland, Seattle and Malmö as being leaders in the field, as well as discussing the experience of other cities which have strong parallels to our own.

Together these presentations set a clear tone for how the design of our own urban environments could move forward to join the ranks of these world-leading cities.

Stormwater 2019

Mō Āpōpō – Stormwater: The Next Generation

1–3 May 2019, Grand Millennium, Auckland

The Water New Zealand Stormwater Group conference and expo provides a forum to participate in the industry and share knowledge, experience, emergent technology and research, and help ensure that we all rise to the challenge of providing the best environmental outcomes for our waterways.

The conference provides an opportunity to:

- Learn about new and cutting-edge stormwater information
- Upskill in areas of stormwater science and management
- Cultivate technical knowledge
- Keep up to date with the latest innovations
- Create new business opportunities
- Build your corporate profile
- Network with peers

It has become one of the must-attend annual events for anyone working in the stormwater sector including:

- Regional Council and TLA staff
- Professionals from related disciplines
- Procurement Managers
- Academia
- Infrastructure providers

We look forward welcoming you in May 2019!

Register Now at:
stormwaterconference.org.nz

THANK YOU TO OUR PREMIER SPONSOR



Stormwater Conference keynotes

Sustainability has become an essential principle of Stormwater Management. Internationally recognised experts in sustainable solutions will share their knowledge and experience at Stormwater 2019.

Dwane Jones

Dwane is currently the director of the Center for Sustainable Development and Resilience (a start-up land-grant centre) at the University of the District of Columbia.

He is a leader and programme director with more than 15 years of combined experience in leadership, research, urban design, environmental planning and programme management

with government, academia, non-profit and community based agencies and international governments and universities.

He is also the founder and director of Elevate Leadership and Training, a professional firm specialising in launching and scaling start-ups, professional, leadership, and executive coaching, and green infrastructure.



Chris Digman

Chris is Technical director at Stantec and Visiting Professor at the University of Sheffield.

He is an expert in stormwater management, sustainable drainage (green stormwater infrastructure) and flooding and is a nationally recognised technical leader in urban drainage specialising in flood risk management (from rainfall and blockages), pollution



control, sewer solid movement.

He has led the development of one of the largest integrated urban drainage models and risk assessments across Glasgow. This project involved identifying areas to retrofit surface water management measures; the development of pilot proposals; and bespoke guidance to develop optimum solutions.



Craig McIlroy

Craig is Head of Healthy Waters at Auckland Council.

Since the Auckland Council amalgamation, the council's stormwater unit has gone through a continuous change process, transforming a stormwater utility into the Healthy Waters Department.

Underpinning this transformation has been innovation in organisational structure, clear translation of high

level objectives to on the ground delivery, clever use of data and analytics, as well as customer and community engagement.

Craig will touch on some of the organisation's achievements and showcase its new strategic direction "Future Waters" – which is relevant, not just in Auckland, but also nationally and to the wider industry.

Rich Batiuk


Rich Batiuk has recently retired after 30 years with the U.S. EPA Chesapeake Bay Program where, as associate director for Science, Analysis and Implementation, he led the integration of science into multi-partner collaborative decision-making in watershed management.

He was the principal architect of the Chesapeake Bay TMDL,

a ground breaking pollutant accountability system spanning six states and the District of Columbia.

Rich has led the development and expansion of one of the world's most comprehensive estuarine and watershed monitoring networks, designed to assess an array of water quality standards, environmental indicators and outcomes directly linked to management.







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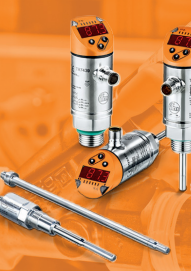



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Stormwater award innovation showcase

Innovation is becoming tantamount to good stormwater management and meeting future challenges.

It was with this in mind that Water New Zealand's Stormwater Group launched a new Innovation Award at last year's Stormwater Conference in Queenstown.

The first year's winner of the annual award is Mike Hannah from Stormwater360 for the LittaTrap – a catchpit insert that effectively captures gross pollutants before they can reach the ocean.

We asked Mike to tell us about the award and what advice he has for this year's entrants.

Why did you apply?

I believe innovation is the key to fix our stormwater problems. When I first heard about the innovation showcase, I thought it was a great idea and instantly started thinking of projects we were doing.

As a stormwater technology company we had to take the opportunity to demonstrate what we believe in. We have been developing the LittaTrap catchbasin inset for a few years now and the product was set to go globally. The innovation showcase was a perfect platform for us to tell all New

Zealand what our testing had shown and what we were going to do with the technology.

What has winning meant to you?

It was a great honour to be voted by our peers to have the best Stormwater innovation of 2018. This gave us a huge amount of confidence as we were set to launch the product into North America.

What advice do you have for people to apply this year?

Your innovation needs to be well thought through – both from the technical aspect and how it is applied in real life. It's a good idea to run your pitch past someone who knows nothing about stormwater and see what they have to say. Be prepared to take criticism and use this to make the innovation better.

How to be a 2019 winner

Pitch your innovative process or idea to a wide audience of stormwater professionals at the conference Innovations Showcase session.

Your pitch must be no more than five minutes long, and a panel of judges and the audience will then cast votes.



The Innovations Showcase is open to suppliers, research companies, academia, industry, businesses, contractors, consultancies and individuals.

What you need to know

The entry must involve a technology, product, service, or process aimed at solving a problem related to stormwater challenges we face.

At least one presenter must be available to attend the Showcase, being held at the 2019 Stormwater Conference & Expo in Auckland on May 3, 2019.

Entries/entrants must be prepared to provide documentation to validate any claims that are made concerning the intellectual property underlying their business plans, including any claims concerning the licensing of Third-Party IP.

Go to the Stormwater website stormwaterconference.org.nz to download the submission template and submit your innovation solution.

You can also contact James Austin on 04 473 8044, or waternz@avenues.co.nz if you have any questions.

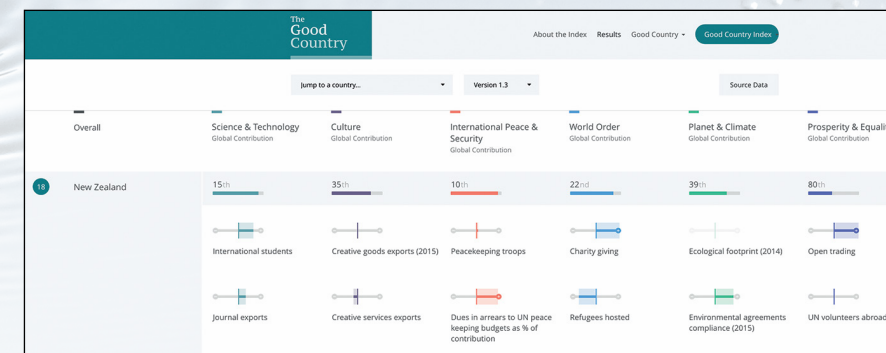
Smart Water a new Water New Zealand Group

We are all aware of the speed and breadth of advances in digital technology and information management systems.

However, not everyone in our industry is aware of the range and extent of the benefits available through use of this technology, and for many of those who are aware of the benefits, it is difficult to know where to start in achieving them.

The Smart Water Infrastructure Group (SWIG) has a vision for our water industry of becoming a global leader in the application of digital technology – not such a big stretch when you consider our country is ranked 12th for global contribution to science and technology according to the Good Country Index www.goodcountryindex.org/results#NZL.

The aim of the SWIG is to advance the combined knowledge of data technology



and systems within our water sector and to connect Water New Zealand members who have a shared interest in this topic.

We will do this by raising awareness of the benefits, risks, trends and innovations in the use of operational and infrastructure asset data.

As we're just kicking off we really need your feedback on how you feel about this

topic, how far down the smart water track your organisation is, what are the issues you face, your success stories, and even failures – they can be a great learning experience. We are currently putting together some case studies and thought pieces. • If you would like to contribute or have any questions please contact Vicki.McEnaney@waternz.org.nz.

Working for a sustainable future

By **Rosie Green**, Water New Zealand's summer intern.

With water playing such a vital role in the classic Kiwi holiday, what better way to spend my summer than swimming at Oriental Bay and working for Water New Zealand?

Taking on this internship halfway through my chemical engineering degree was one of the best decisions I could have made.

My time at the association has only reinforced my passion for sustainability and emphasised our country's need for it.

Among others, a few of the projects I got to work on include an excessive amount of Excel for the National Performance Review, a hygiene guide for water and wastewater reticulation workers, and updating the wastewater treatment plant inventory using

GIS mapping.

Each task came with its own learning curves (even if it was just patience) and I'm grateful for every one of them.

As someone who is passionate about the conservation of our environment, working on the National Performance Review gave me a great insight into the various ways councils approach sustainable resource management.

At such a critical time, this is something I'm hugely interested in. I have another two years left of studying at the University of Auckland, but my feet are itching to make my impact in paving the way for a 'sustainable' future.

For now, my current platform for promoting sustainability is the student-run



Rosie Green

club, Sustainable Future Collective (SFC).

Through SFC I hope to encourage other students to take an interest in how we manage our vital resources, such as water, as a means of creating a brighter future for generations to come.

The opportunity to be involved in the industry has given me some fantastic ideas for the year of events SFC has ahead and I can't wait to share what I've learnt.

My time at Water New Zealand has been invaluable.

Stormwater 2019

Mō Āpōpō – Stormwater: The Next Generation

1-3 May 2019, Grand Millennium, Auckland

Stormwater 2019 Awards

Recognising expertise and contribution to the sector

- Stormwater Professional of the Year
- Young Stormwater Professional of the Year
- Stormwater 2019 Paper of the Year
- Innovation showcase award

The awards will be presented at the conference dinner, 2 May in Auckland

Go to our website stormwaterconference.org.nz for more information and entry criteria

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Save our pipes from wipes

Tauranga City Council is hoping to see its “Save our Pipes from Wipes” campaign grow into a national movement in 2019.

The campaign, launched this summer, aims to raise awareness of the problems and costs that flushing of wipes are causing to wastewater pipes and the environment.

“Our neighbouring Western Bay of Plenty District Council is now on board and there has been a significant response from the local community on social media,” says Tauranga City Council Operational and Business Services team leader Cathy Davidson.

She says it’s clear that many people simply don’t realise how much damage wipes caused through blockages and

that blockages can result in wastewater overflows into the environment.

The councils aim to keep raising awareness through social media and education and are hoping that other councils will join the campaign.

“It’s clear from our campaign so far, that our community is outraged about this issue, and early data is showing a high awareness of the campaign which is great.”

In a recent Council survey of 122 customers, 79 percent of customers say they have seen the campaign and shared supportive comments on the initiative.

Some of the comments included:

- Absolutely nailed it TCC, put all over Social Media everywhere, some people do not

wish to be educated but hopefully we will get the majority.

- Brilliant campaign, ban the wet wipes, find a better solution.
- Great campaign, keep it going, it is about educating people.
- Great initiative TCC, 100 percent support.
- These should be taken off the shelves at the supermarket.
- This is all about educating the public, good stuff TCC.

Tauranga City Council has also approached Foodstuffs and hopes to build relationships with community supermarkets to look at ways to educate people at the point of sale as well as work towards the bigger goal of a change in packaging.

Water on the red planet doesn’t mean life

Scientists examining radar data from Mars between May 2012 and December 2015 think they have found a vast underground lake 1.5 kilometres beneath the surface at Mars’ southern pole and that the lake stretches 20 kilometres across.

While very excited about the find, alien life researchers are disappointed that a treatment plant has not also been detected (enough of that – Ed).

The discovery was found by using the Mars Advanced Radar for Subsurface and Ionosphere Sounding (Marsis) instrument on the Mars Express spacecraft, which sends out radar pulses that penetrate the surface and ice caps on Mars, and measures the radio waves when they come back to the spacecraft.

Scientists spent two years ensuring that their data wasn’t the result of some other effect and rule out any possible explanation other than water of some kind, and say the

data is similar to that seen when radars look at similar lakes of liquid found beneath the Antarctic and Greenland ice sheets.

Mars is even colder than the Antarctic and Greenland, which makes the discovery of liquid water surprising.

While it is not impossible terrestrial organisms can survive and thrive, in fact, in such liquid environments, the Mars’ water is likely to be a briny sludge and it is probably the salt that keep the icy water liquid.

There is nothing particularly special about the area where the water was found so it remains to be seen if more subsurface reservoirs of water will be found, similar to the network of subglacial lakes that exist on our own planet.

There is plenty of evidence of dry lake beds and river valleys on the surface of Mars indicating the presence of significant bodies of water in the past when the planet was warmer and wetter.

Central North Island Young Water Professionals meeting in Tauranga for the first time.



UPCOMING EVENTS

NZ Land Treatment Collective Conference	3-5 April	Invercargill
Trade and Industrial Waters Forum Conference	10-12 April	Dunedin
Water Service Managers’ Group meeting	11-12 April	Invercargill
Water New Zealand Stormwater Conference	1-3 May	Auckland
Australian Water Association “Oz-Water 19”	7-9 May	Melbourne
Water Industry Operations Group Conference	8-10 May	Christchurch

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Data for evidence based decision making

This fiscal year's National Performance Review (NPR) has just been released.

By **Lesley Smith**, Water New Zealand's technical coordinator.

Participants have jurisdiction that service 4.5 million New Zealanders, or just over 94 percent of our population, making us more confident than ever that we are providing a reflection of performance and trends in our country's water, wastewater and stormwater services.

The report has some new findings, repeats some recurring themes, and in some cases builds on what we already knew.

One issue that has not gone away is that of wastewater overflows. This year participants reported just shy of 4000 wastewater overflows with some interesting new findings on the causes of both dry and wet weather overflows.

Significantly we found that there is a strong relationship between the approach authorities use to track wet weather overflows and the number of overflows they record.

Participants relying on verbal reports recorded less than a fifth of wet weather related wastewater overflows compared with others who used calibrated hydraulic models. This probably won't come as a surprise.

Relying solely on public and staff to spot a sewage overflow amidst a torrential downpour is far less likely to pick up an overflow than a hydraulic model, calibrated using real world monitoring results. This failure to acknowledge reality is likely to be leading to significant underreporting of the real extent of wet weather sewage overflows.

Another new finding was that dry weather overflows are overwhelmingly being caused by network blockages. Some 1642 dry weather overflows were reportedly related to

blockages, while mechanical failures caused only 177.

More worryingly, the issue appears to be getting worse, with the median number of overflows reported growing from 0.4 per 1000 properties in 2015/16 to nearly 2 this year. This highlights the importance of industry efforts to reduce blockages caused by wet wipes, but we acknowledge this is just one part of the issue.

Consumer education, co-ordinated planning of pipes and trees and network cleaning are all part of a complicated web of network management issues needed to prevent overflows.

The time taken by the 48 participants involved in the report to collate and contribute their data is a demonstration that our country's water suppliers are invested in the continual improvement of their services.

Unlike some other international jurisdictions, participation in the NPR report is entirely voluntary and funded from participant's pockets. The NPR is initiated by and for water managers to provide them with knowledge of how their services are performing in relation to other organisations. It also provides an opportunity to identify areas where they can learn from their colleagues in other regions.

Over the past year information from the National Performance Review has been used to inform work underway by the Office of the Auditor General, the Productivity Commission and the Department of Internal Affairs.

With regulatory change looming it is more important than ever that discussion on the future shape of our service

arrangements is based on evidence. We are pleased to be able to offer data contained in the National Performance Review for this and applaud the transparency of the many participants who contributed data.

Data collected this year is presented in a report, providing a high level overview of how services are tracking nationally as well as a data portal for those interested in drilling into individual performance comparisons.

Both the report and data portal are freely available from the following web link www.waternz.org.nz/

NationalPerformanceReview. A password restricted area contains additional performance dashboard for participants.

It is well known that there is a variety of data capture systems in place at varying levels of maturity amongst water suppliers, meaning there is always a risk that performance comparisons will be comparing apples with pears. For this reason we encourage users of the data to contact water services managers before making decisions based on data in the report. We hope that you will find the NPR a conversation starter for understanding sector performance. **WNZ**

NPR key findings from the 2017/18 year

Public health and the environment

87% of properties connected to reticulated supplies, 85% to reticulated wastewater

- 633,911 resident days impacted by boiled water notices
- 492,079,511 cubic meters of wastewater treated
- 3987 sewage overflows reported

Resilience

- On average 1.471 days of water is stored in reservoirs
- Backup generation is installed at slightly over a third of water and wastewater treatment plants
- Only six authorities were meeting the inspection requirements of The New Zealand Fire Service Firefighting Water Supplies Code of Practice

Customer Focus

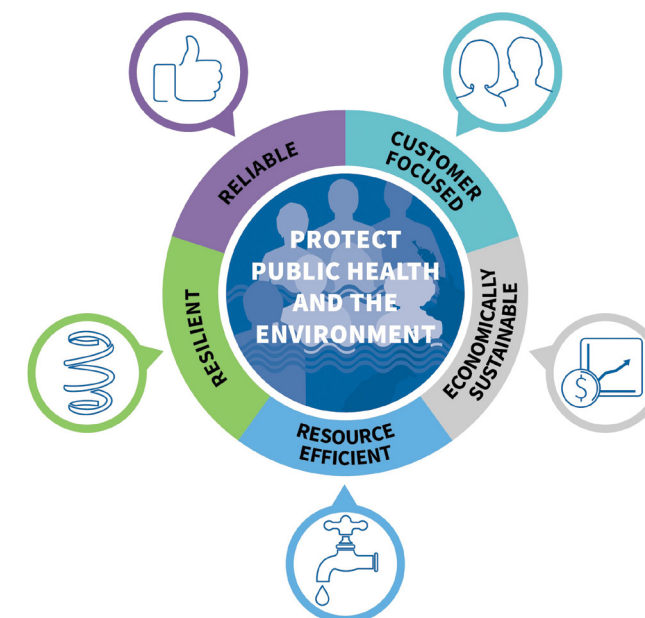
- Combined water and wastewater charged average of \$665 for large participants, \$975 for medium size participants and \$1026 for smaller participants
- The collection of customer focused data on attendance, response times, and complaints is improving

Resource Efficiency

- 25 of the 47 participants used water restrictions at some point in 2017/18
- Water meters were used at 82% of non-residential properties receiving water services and 47.6% of residential properties
- Average daily residential water consumption had a median of 263 litres/person/day
- 56% of Biosolids were sent to landfill
- Energy consumed by water and wastewater systems produced 230 kilo tonnes of carbon dioxide equivalent gases (approximately 0.3% of NZ's total emissions)

Reliability

- Median (of participant average weighted) pipe age of 34.0, 37.9 and 34.4 years for drinking water, wastewater and stormwater systems respectively



- Peak wet weather flows are typically two to three times average dry weather flows, however can reportedly be as high as 32 times
- 108,474,706 cubic meters of water was lost from participant networks, over 20% of the water that was supplied to them

Economically Sustainable

- Expenditure across all participants totalled slightly over \$2.1 billion, comprising \$1.1 billion on capital expenditure, \$800 million on operational expenditure and \$200 million on interest
- Capital expenditure to replace existing assets trailed depreciation by 40% for water supply, 38% for wastewater and 34% for stormwater
- In general, cost coverage is achieved for network operation, however, all costs (including depreciation) were not covered by 20 water services, 20 wastewater services and 23 stormwater services.



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Taking water industry education and training by the scruff of the neck

This year sees the start of some major new initiatives aimed at tackling some long running problems in water industry education and training.

Water New Zealand has taken on the role of providing leadership to the industry around water industry education and training.

That doesn't mean doing everything, but means taking on some initiatives, and assisting and working with others like the Water Industry Operations Group (WIOG) to make things happen.

The lack of training opportunities is a problem that's been causing difficulties in the water and wastewater sector for a number of years.

Water New Zealand Principal Water Quality advisor Jim Graham says the Havelock North Drinking Water Inquiry identified a lack of leadership across the industry, and this is particularly apparent in the areas of water and wastewater education and training.

He says this has a number of implications, not only risk to public health and the safety of water supplies, but has also made it difficult for water suppliers to attract and retain staff.

WIOG chair Nick Hewer-Hewitt agrees. There's been a big hole at the upper end of the skills training, he iterates.

"While the previous National Certificate in Water Treatment has recently evolved into an apprenticeship course through Connexis (the water industry's ITO), the big gap is at senior operators and supervisors level."

Nick says that beyond the apprenticeship programme there's now no formal training

framework available to deliver. This means there's no formal structure to show that senior operators and supervisors at water treatment plants are appropriately trained and qualified.

"Without a formalised training structure and a proper registration process, how do you determine that someone is competent?"

WIOG has made attempts to step into the training void by running regional workshops aimed at upskilling operators, but Nick says these are often hampered by a lack of real drivers in the industry for professional development.

"Effectively, this means staff get professional development purely on the goodwill of their managers and not because the industry compels it."

Underpinning this lack of training is the fact that there is no formalised registration process in the water sector – something that particularly irks Nick.

"Why is there a registration process for plumbers, drainlayers, and electricians who work on houses but nothing for the people charged with providing safe drinking water to the communities or protecting the environment?"

"How do you know if your staff are competent when there is no formalised registration framework?" he queries.

"People want a career path and they want industry recognition of their skills. If they don't get it they may leave, and that's what's been happening in the water sector."

A report commissioned by the Water

Industry Group (the group that advises Connexis on water industry qualifications), confirmed at the end of last year what the sector already knew – that there was a lack of education and training leadership, confusion about roles and responsibilities within the training environment, and a lack of clarity around expectations.

It also highlighted industry concerns about the lack of available training courses, particularly in water treatment at diploma level (drinking-water and wastewater).

The report has provided a springboard for a series of initiatives to be undertaken this year.

They include the formation of an Independent Water Industry Training Sector Advisory Group to be administered by Water New Zealand, but made up of water industry representatives. The group will advise Water New Zealand and others on all aspects of water industry education and training.

For example, advice from this group will feed into Water New Zealand's strategic plan for education and training which will set out what needs to be done and how it will be achieved.

The first major piece of work is the preparation of a competency framework that will set out the competencies required, initially for water and wastewater operators, but later for network operators, supervisors and managers.

"This will allow us to clarify what operators need to know and be able to do, along with where the education and training gaps are," says Jim.

Kiwi Fellow of CIWEM

The CIWEM New Zealand National Steering Group reports that Dan Stevens has been made a Fellow of the Chartered Institution of Water and Environmental Management.

Fellow is CIWEM's highest grade of membership, and is designed for those who have a significant level of experience in a senior role. Fellow status is considered an acknowledgement of achievement, and recognition that recipients are highly regarded by their peers, inspire future generations and elevate the status of the water and environmental sector.

Dan has been a member of CIWEM for over 25 years. He has a Diploma in Water and Environmental Management (DipWEM) and is a Chartered Environmentalist (CEnv) and Chartered Water and Environmental Manager (CWEM).

Dan has over 35 years' international experience in the water sector, specialising in three-waters master planning, system optimisation and advanced asset management. Dan moved to New Zealand from the UK in 2003 and is Business Director – Water with Beca, based in Christchurch.

Liam Foster, a Water Sector Leader with WSP Opus and member of the CIWEM NZ National Steering Group, says, "Dan is held in the utmost regard technically across Australia and New Zealand and his advice is often sought out deliberately from across the industry."

"He has always maintained a highly professional, conscientious and diligent



personality and upholds the trust of people around him.

"He has a depth of professional knowledge and experience and an ongoing commitment to furthering both his career and the careers of many young professionals throughout the global industry."

Dan says, "During my career I have been lucky enough to have worked with many parts of the water industry both rural and urban, gaining a wide understanding of the issues we all face."

"I have also been fortunate enough to engage with a number of dedicated water professionals around the world and I am always keen to explore mutually beneficial links with like-minded professionals in order that we can learn from each other and advance our collective knowledge. It is a great honour to be recognised by your peers in this way and is really quite humbling."

CIWEM is an international organisation with a membership base stretching over more than 90 countries and connecting a network of over 15,000 professionals worldwide.

Inaugural groundwater symposium beckons

Forty percent of the country relies on groundwater for drinking water supplies while irrigation from groundwater is estimated to contribute \$2 billion annually to our economy.

There are about 200 aquifers identified around our country that lie under more than a quarter of our land surface, and are estimated to hold over 700 billion cubic metres of groundwater.

The health of our surface waters can be directly linked to quality of groundwater resources. Yet our groundwater resources, like some of our rivers, are under stress.

Contaminants from farming, industry and waste threaten groundwater quality. The pollution is widespread and difficult to treat.

Scientists still know relatively little about the resource, particularly about how it may be affected by increasing demand, pollution and climate change. We need to build up our scientific knowledge to protect groundwater now and for future generations.

As the government embarks on huge reforms in the area of water, with the Three Waters review and the Essential Freshwater programme underway, it is critical that

groundwater is not forgotten, particularly in the face of new challenges such as emerging organic contaminants.

On April 5, 2019, ESR is holding GroundsWell 2019, the inaugural Groundwater Management and Research Symposium.

This will be held in Christchurch for people interested in groundwater science and management.

Everyone is invited to go along and participate in the discussion. Registration by March 25 through the Eventbrite website.

GROUNDWELL 2019: Symposium on groundwater management and research. Bringing the best minds together to discuss how we can improve the understanding and quality of groundwater in New Zealand

Join the conversation as we explore what needs to be done to improve the understanding, information, tools, and research capacity of groundwater in New Zealand.

Where: Bentleys at the University of Canterbury Students' Association Event Centre, 90 Ilam Road, Ilam, Christchurch 8041

When: Friday 5 April 2019 9.30am – 4.30pm

Register by: 25 March 2019 on www.eventbrite.co.nz at GroundsWell 2019
For more information email groundswell@esr.cri.nz



Why are our water tariffs out of whack?

A recent BRANZ report on our residential water use shows just how unaffordable water charges are here compared with those in other countries.

International studies of average water and wastewater bills as a share of average net disposable income compare our charges with those of other OECD countries, and we were ranked the sixth highest of 27 countries, and a whopping 50 percent higher than Australia.

The OECD also assessed the water costs as a share of income for households in the lowest deciles. New Zealand ranked 23rd of 29 countries, with 3.3 percent of income spent on water services. This was one percentage point higher than

figures for Australia and the UK and two percentage points higher than Canada.

Published late last year, the BRANZ report *Residential Water Tariffs in New Zealand* by Amber Garnett and Sandi Sirikhanchai draws heavily on Water New Zealand research.

Report authors note that because councils charge for water services through a variety of mechanisms, it is hard to compare how the supply of water is charged for across the country.

BRANZ also notes that plentiful rainfall and our country's low population density mean we have abundant freshwater by world standards. Annual rain and snowfall produce approximately 500,000 million cubic metres of water.

"Just two percent of that is extracted, but managing water is an expensive process."

The report notes that our water service charging is very different to that in many OECD countries, partly because universal metering of residential properties is limited here.

"While the most common way of charging for water in New Zealand is through a targeted fixed rate, none of the 184 OECD utilities examined in one survey charged this way. Some countries that did not appear in the survey do use a flat fee, however."

The most common model used in OECD countries is a uniform volumetric charge, often combined with a fixed charge.

World Water Day – march for water

Water New Zealand is supporting the Walk for Water Challenge in Auckland on March 22.

Walk for Water is organised by Engineers Without Borders (EWB) to help highlight the problems faced by almost one person in every three in the world who does not have access to safe drinking water.

EWB New Zealand CEO Dane Hart says 29 percent of the world's population do not have access to safely managed drinking water and the burden of carrying water for families falls disproportionately on women.

"In parts of Africa and Asia this burden means that women and girls walk, on average, six kilometres while carrying 20 litres on water.

"Lack of safe drinking water is directly attributed to the deaths of 30,000 people – mainly children aged under five – every week."

He says the Walk for Water Challenge participants will carry the weight and walk the distance that many women and girls are forced to do every day.

"We have been encouraging people to train for this event and have a think about the implications that spending large amounts of

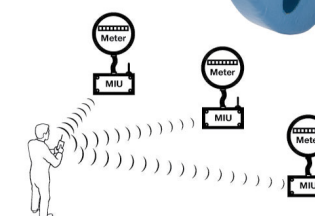
time each day carrying water might have on a family, and when they do so to communicate with their friends and family about what they think that might be like."

If you would like to support this go to the Engineers Without Borders website www.ewb.org.nz/ to find out more.



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Flooding risk exposed among councils

The Auditor-General's report *Managing stormwater systems to reduce the risk of flooding* raised concerns with Dunedin City Council, Porirua City Council, and Thames-Coromandel District Council about how they manage their stormwater systems to protect against flooding.

"The three councils had an incomplete understanding of the flood risks in their district or city. This leaves their communities vulnerable to being caught unaware by unanticipated floods," said the report.

"Gaps in their knowledge about their stormwater systems limits the three councils' ability to make well-informed and deliberate decisions, and have informed conversations with their communities about the costs of reducing the risks from flooding.

"All three councils were already aware of some of the issues we identified and are planning improvements. Some councils are further along in making improvements than others. However, all have more to do.

In our view, the historical underinvestment in stormwater systems in New Zealand creates a level of urgency for councils to address our five recommendations. Our main findings and recommendations are relevant to all councils. We have developed questions that councils can use to assess themselves, and for people to ask councillors about how their council is protecting their home from the risk of flooding."

Managing stormwater systems to reduce the risk of flooding.

Flooding is our most frequent natural hazard, it iterates.

"We found the three councils had an incomplete understanding of the flood risks in their district or city. Much of their assessment of flood risk has been in response to specific events or regulatory pressure, such as complying with resource consents.

"This reactive approach risks councils



focusing on reducing the effects of the most recent flood and being caught unaware by anticipated floods.

"In our view, the historical underinvestment in stormwater systems in New Zealand creates a level of urgency for councils to address our recommendations. Our main findings and recommendations are relevant to all councils. There is also an opportunity for councils to work together to address shared challenges."

For the full report, visit oag.govt.nz/reports.

Global water quality WHO designation

The World Health Organisation (WHO) has re-designated the University of Surrey as a Collaborating Centre for Protection of Water Quality and Human Health. WHO is the international authority on public health and water quality, and leads global efforts to prevent transmission of waterborne disease. Its Collaborating Centres are institutions designated by the WHO's director-general to carry out activities in support of the organisation's programmes.

Surrey's Robens Centre for Public and Environmental Health and Centre for Environmental Health and Engineering are together responsible for supporting and informing the WHO on its approaches to water quality monitoring and surveillance, providing guidance and tools for small water supply systems, and providing emergency response support. This work will see Surrey significantly contribute to the revision of the global guidelines to improve the quality of drinking water across the globe. The University of Surrey has been re-designated for five years and is one of only two WHO Collaboration Centres in the UK.

Aurecon's new team

Global engineering and infrastructure advisory company Aurecon says under the leadership of its newly appointed Global CEO William Cox, it has added two more female senior leaders to its global executive leadership team, with Louise Adams appointed as managing director New Zealand and Australia.

Louise Adams, previously regional director responsible for Aurecon's South Australian and Victorian practice (and the first female member of Aurecon's Global Board) is responsible for generating 80 percent of Aurecon's revenue.

Francoise Merit, previously chief financial officer (CFO) for Australia and New Zealand, has been appointed as Aurecon's Global CFO, with previous CFO Andrew Muller appointed as Aurecon's new chief operating officer (COO).

William Cox says; "Louise, Francoise and Andrew are seasoned, expert operators at the top of their fields, capable of leading the charge as we consolidate Aurecon's growth

and pursue new opportunities across digital, advisory and Asia.

"Louise and Francoise's appointments bring the number of women on our executive committee to three, reflecting Aurecon's commitment to increasing the number of female leaders as we continue to build a culture of diversity, innovation and digital excellence across Aurecon globally.

"Senior female leadership appointments are rare in the traditionally male-dominated engineering and finance industries, yet the benefits are immense. When you get different viewpoints operating in organisations, you unleash creativity, innovation and new solutions on old or intractable problems.

"This is particularly relevant at a time of enormous cultural change across the property, construction and infrastructure sectors as incredible new technologies help us plan, build and manage infrastructure and the built environment in ways never seen before, truly changing the way we engineer, design and advise".

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Time to lift the game around Onsite Wastewater Treatment

By **Noel Roberts**, Water New Zealand Technical Manager.

Water New Zealand is about to embark on the development of a Best Practice Guide for Onsite Wastewater Treatment Units in a bid to improve performance across the country.

This was one of the outcomes from an all-day workshop in Christchurch recently where industry leaders discussed the ongoing problems around the unacceptably high number of failing units, the lack of information to unwitting purchasers, a dearth of qualified installers, along with regulatory gaps in many parts of the country.

Information in Water New Zealand's latest National Performance Review shows that 700,000 Kiwis live with non-reticulated wastewater, so this is a significant segment of our population. Anecdotally we know that too many of these units are failing and it is something that too many councils have been turning a blind eye towards.

As a health issue, our lamentable approach in many areas to the small onsite wastewater systems has simply not been getting the attention it deserves, especially when you consider that we have one of the highest rates of campylobacter in the developed world – and it doesn't all come from chicken.

The link between unexplained food or water-borne poisoning and our laissez-faire approach in many parts of the country to things like overflowing septic tanks and wastewater units is surely worth investigating.

As well as direct contamination above the ground, in many parts of the country, residents on non-reticulated wastewater also rely on non-reticulated ground water from their own bores for drinking. There is an obvious risk of cross contamination. Let's not forget that the Havelock North Water Contamination Inquiry heard evidence that up to 100,000 people in New Zealand could be infected every year by drinking contaminated water. We simply don't know the extent of the problem.

One of the presenters at the workshop was Andrew Dakers, who is a member of the Management Audit Group for the On-site Effluent (OSET-NTP) National Testing Programme based in Rotorua.

OSET-NTP is a self-funding operation run by Water New Zealand, Rotorua Lakes Council and the Bay of Plenty Regional Council. It's been operating for the past 10 years and relies on funding from both manufacturers and "funding partners" such as regional and district councils.

The programme puts domestic and small commercial units to the test and reviews installation, management and operation manuals and other quality control measures such as noise level and structural integrity. Under the current system, manufacturers voluntarily submit their units.

But Andrew says that while the testing programme fulfils an important function, it doesn't tell the entire story.

Testing units in isolation misses other crucial parts of the system – like the overall design and situation including the land application to the different types of soil across New Zealand, where the unit is situated and so on. It also doesn't test for durability of tanks. Then there's the very important aspect of servicing and maintenance and whether that is being undertaken properly by competent and qualified people.

In other words, we need an approach that assesses the entire system. Currently a unit could pass with flying colours but be a total failure because of the way it's been installed and maintained, or that it simply wasn't the right unit for the particular environment.

Andrew referred to a culture of "tank think" driven by an industry that wants to make and sell tanks. He says we need to move beyond that to a whole system approach where individual site risks are measured and mitigated against.

Currently the risk for potential conflict of interest is high when providers give advice, sell products and then service them as well. Obviously there's no incentive to report on their own failures.

It's not surprising therefore that there is an under-reporting of system failures – not just in newly installed ones but also existing units. Homeowners, faced with an enormous fix up cost often hide problems or seek to find their own solutions.

This under-reporting means that councils are so unaware of the issues they simply don't see that there is a problem in their region. It's perhaps telling that there is a clear lack of interest amongst some councils in seeking detailed information about which units pass and fail the OSET testing. Only 22 local and regional councils support the OSET-NTP through its "funding partner" scheme despite the modest contribution required (between \$1500 and \$5000 depending on type of council) in order to get access to full test results. The bulk of the funding for testing is paid for by manufacturers.

On-site wastewater management is often a Planned Permitted Activity in the regional rules under the auspices of the regional councils.

This means that regional councils could ensure that their Regional Plans should require that the on-site treatment management system design, construction, installation, operation, management, servicing and monitoring is in accordance with AS/NZS 1547:2012.

Onsite wastewater management systems fall outside the Health Act's influence. They can be in some cases influenced by the RMA but normally only have their design and installation assessed during the building consent.

The responsibility for ensuring ongoing maintenance of onsite wastewater management systems then becomes the job



Failed onsite wastewater system land application. A serious health risk.

of district and unitary councils. Yet ongoing monitoring of maintenance is carried out in just three places in the country – Northland, and in pockets of Auckland and Rotorua.

It is clear that, as a sector, we need to come together to find much-needed solutions.

At the workshop, many spoke up about the need for a warrant of fitness for onsite wastewater systems – similar to a car WOF. There were also proposals for a national certification for installers and designers. Designing, installing and servicing units is a complex business because of the wide breadth of differing site specifications. Each site has its own unique features. It is not fair to leave it to purchasers to assess a designer's, installer's or service operator's competence. National certification would ensure that there is a more consistent approach and best practice applied.

As a sector, it is clear we need to continue to get messages through to our councils, but we also need to work with the sector – the consultants, designers, service agents and manufacturers.

Going forward, at Water New Zealand we will be developing a much-needed Best Practice Guide which could become a blue print for councils to set better practices and policies.

We also intend to reinvigorate the SWANS (Water New Zealand Small Wastewater & Natural Systems) group and support the workstream at the next Water Conference and Expo in Hamilton in September. There is a lot of work ahead of us but we recognise that this is an important part of our sector that has been ignored for too long. **WNZ**

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Waitangi Park, Wellington.

New principles lay foundation for healthier urban waterways

By **Sarah Boone**, senior policy analyst – Water Directorate, Ministry for the Environment.

New urban water principles were released in October 2018 and are the culmination of approximately 18 months of work by the independent Urban Water Working Group.

It is important to note that while these principles are the views of the working group, they contain a range of useful guidance for policymakers and practitioners alike.

The group is comprised of about 45 practitioners working in local government, the Three Waters sector, and the broader urban development and design sectors. Individuals were nominated by their peers (or self-nominated) for their relevant experience and knowledge, including Maori interest.

The Government has committed, as part of its Essential Freshwater Programme, to start addressing pressures, commonly referred to as symptoms of ‘urban stream syndrome’, to better provide for ecosystem health and other community values related to liveability.

Altered stream channels and piping can in some cases have counter-productive effects on urban resilience when piped networks and flow channels reach design capacity and overflow. This can cause damage to property, and in some extreme cases, pose a threat to human life.

It is clear that solving these issues are likely to take time, but a useful set of principles is a great start.

Urban Water Principles – Nga Wai Manga

The development of the following principles began with the concept of Te Mana me Te Mauri o Te Wai – this means that we owe the greatest obligation to that which ‘gives us life’.

Water, in this case, provides for the basic needs of our community and supports the natural and built environments that many of us call home.

While there are legacy problems related to how urban infrastructure networks and built environments have been developed to date we need to meet these challenges. We need a transformational change in the way that we interact with urban water.

The following principles help set a direction that will help align policy and action to start to address Te Mana O Te Wai or the Mana of the Water. The principles are:

1. Protect and enhance ecosystem health of all receiving environments. Use integrated planning to ensure that decisions made upstream protect downstream receiving environments, such as streams, lakes, wetlands and terrestrial ecosystems, groundwater, estuaries, and the ocean.
2. Co-design with nature an integrated and regenerative approach to urban development. Use nature-based or green infrastructure engineering solutions where possible to mimic or work with processes found in the natural environment. Retain, restore and enhance existing elements of the natural drainage system, and integrate these elements into the urban landscape.
3. Address pressures on waterbodies close to source. Urban water ecosystems are under increased pressure from a wide range of pollutants, modified flow characteristics and altered channel form. These pressures can be either acute (such as a spill or pollution incident) or chronic, created by the

cumulative effects of these pressures over time. Mitigating these pressures at or close to their source prevents degradation downstream.

4. Recognise and respect mana motuhake – the whakapapa and relationship that mana whenua have with water ecosystems in their rohe. Mana motuhake means the authority (mana) gained through self-determination and control over one’s own destiny. Mana whenua communities have this authority in their customary ‘rohe’ or territory and have special cultural relationships with ecosystems in these areas. It is important to proactively engage mana whenua in designing urban environments within their rohe so that they can have a meaningful role in shaping the outcome.
5. Identify and consider the community values for urban water and reflect them in decision-making. Communities often have strong aspirations and values for their urban spaces, including values for environmental sustainability, sense of place, and general amenity and liveability. Urban planning and design processes should create opportunities for communities to express their values and for decision-makers to reflect these goals in their decisions.
6. Optimise environmental, social and cultural benefits when investing in buildings and infrastructure. When considering options for investment, prioritise options that provide multiple benefits. Investment decisions should take lifecycle costs of buildings and infrastructure into account and generate an enduring well-being gain.
7. Uphold and foster kaitiakitanga and custodianship of urban water ecosystems. Everyone has a responsibility to care for the health of our urban water bodies. Because of this, it is important that all community members can connect with these water bodies and are encouraged and empowered to take direct action to maintain and restore ecosystem health.
8. Collect and share information to promote common understanding of urban water issues, solutions and values. Meaningful and transparent data and information is necessary to improve both the design and use of our urban environments. Improving access to quality information can support integrated catchment planning and water sensitive design, while information for urban residents and businesses on current and emerging issues and solutions can foster positive behaviour change and the acceptance of new policy and technology.
9. Increase resilience to natural hazards and climate change. To improve the resilience of urban communities, we need to design water sensitive systems and landscapes which reflect the environmental characteristics of the area and are resilient to natural disasters and change.
10. Conserve and reuse water resources. Drinking water, wastewater and stormwater are each valuable resources and we should reduce their consumption and/or production and maximise their reuse. This includes increasing water-use efficiency by reducing potable water demand and maximising the use of greywater and stormwater.

Source: www.mfe.govt.nz/publications/fresh-water/urban-water-principles-recommendation-of-urban-water-working-group

What’s next?

The Ministry for the Environment has a Water Taskforce which is working on a range of water-related aspects, and the principles are part of the overall approach to water which is focused on upholding Te Mana o Te Wai, a concept that is reflected in the National Policy Statement on Freshwater Management (NPS-FM), and will be further strengthened in updates to the NPS this year.

These principles are helping inform the conceptual thinking being applied to our urban development work stream and we are working with the Department of Internal Affairs to include the principles into the work of the Three Waters review.

The working group has committed to go beyond the principles by developing a set of specific good practices and exploring a broad range of policy options. The Working Group is expected to report back later this year with its recommendations.

This will help support both the Essential Freshwater programme led by the Ministry for the Environment, as well as feeding into the cross-agency Three Waters Review.

Improving stewardship of urban water bodies

The continuing growth and expansion of our major centres, the asset renewal that is likely to occur post the Three Waters review and other urban renewal projects offer an opportunity to start doing things differently.

We must use our collective influence to start seeing these principles applied to urban design projects at all levels of society.

These principles are the starting point for us to think differently about urban spaces, to design them in a way that increases biodiversity, liveability and people’s enjoyment of spaces while providing the necessities of urban dwelling – flood protection for example.

In addition to the principles, your input will be incredibly valuable on the work currently in development by the essential freshwater taskforce within the ministry. Environment Minister David Parker announced that the public would be able to have their say on a new National Environmental Standard for Freshwater Management and amendments to the National Policy Statement for Freshwater Management (Freshwater NPS) in 2019.

As water practitioners, your feedback will be fundamental in ensuring that the proposals will achieve their intended outcomes which are reducing contamination and increasing protection, including limiting certain activities that lead to the contamination of freshwater.

Minister Parker also committed to a two-stage process to improve the resource management system. The RMA is underperforming in some critical areas and needs fixing.

The first stage is well underway and will reverse some of the changes made by the previous government.

There will be a more comprehensive review of the resource management system later this year. Though the scope of the review is still being worked through, the aim is to improve the system’s ability to deliver for our environment and urban areas.

We expect that there will be an opportunity for public comment on this later this year also. [WNZ](#)

Monitoring plant water stress and helping NASA

The Centre for Space Science Technology (CSST) has a new role facilitating its first international space mission partnership, as a calibration and validation (cal/val) partner for the NASA Ecostress scientific mission that will measure the temperature of plants and use that information to better understand how much water plants need and how they respond to stress.

The Ecostress instrument, which is roughly the size of a refrigerator, is installed on the International Space Station. It captures temperature measurements of the Earth's surface and sends the data back down to Earth.

The New Zealand cal/val partnership brings together researchers from the University of Waikato, Manaaki Whenua – Landcare Research, and the National Institute of Water and Atmospheric Research (NIWA) to provide Ecostress with ground measurements from New Zealand.

Each of the New Zealand partner organisations manage ecological research sites throughout our country where tower-mounted sensors measure the exchanges of carbon dioxide, water vapour, methane, and other gases – exactly what is needed

to calibrate and validate space-based measurements from Ecostress.

By contributing to this mission, New Zealand researchers are playing a key role in both advancing scientific understanding of how plants use water; and enabling water managers, farmers, and policy-makers to utilise that data for better decision-making.

Ultimately, this information could be used to protect the world's vulnerable ecosystems while increasing agricultural yield and optimising forestry management.

About Ecostress

If someone in your care is sick, one of the first things you'll do is take their temperature. Our bodies have a natural "thermostat", and when our temperature deviates from this norm, we know something is wrong.

In the same way, plants carefully regulate their internal temperature to stay healthy, and we can measure this temperature from space to monitor their health and mitigate environmental stressors.

As plants open their pores to take in carbon dioxide for photosynthesis (i.e. grow), water is simultaneously released through

evapotranspiration. This helps them cool down, much as human sweat cools us down.

However, if plants don't have enough water to release, they can overheat. As a survival mechanism – for example, during a hot and dry afternoon – they may close their pores to prevent water loss and consequently halt growth.

So, plant vitality and yield are inextricably linked to heat stress and water availability. Understanding how vegetation changes due to these stresses are the key science question being addressed by NASA.

The Ecostress instrument was launched into orbit on 29 June 2018 and installed on the International Space Station on July 5, where it will remain for at least 12 months.

Collectively, our own network of ground sites spans a diversity of land uses and climate, including wetland peat bog, irrigated and non-irrigated agricultural sites, and dairy pasture.

This variety of well-characterised mini-environments makes our country uniquely positioned to contribute to global science missions by providing calibration and validation of space-based measurements across ecological zones.

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The versatile excavator

A 24-tonne excavator was floated up the Kawarau river on a barge to extract the submerged trees that were turned into mulch for the Zoological Gardens at Frankton.

Some 150 tonnes of wood was removed from the Kawarau River near Queenstown in a project funded by Land Information New Zealand (LINZ) and the Otago Regional Council, and with contractors Boffa Miskell carrying out the work.

"This was a pretty unique project that took an innovative approach to resolve a significant problem," says Marcus Girvan from Boffa who oversaw the work.

"The wood under the water was like a dense jungle making it very difficult for divers to carry out work to tackle lake-weed, and reduce the risk of it spreading."

The wood was removed to allow hessian matting to be laid on the river bed to prevent the spread of the invasive pest plant lagarosiphon.



Preventing lagarosiphon from growing in the Kawarau River is part of the wider work being done in Lake Wakatipu.

"Wakatipu is just one of Otago's pristine lakes and it's paramount it is protected from the invasion and establishment of lagarosiphon," says Richard Lord, Team Leader Biosecurity Compliance at Otago Regional Council.

"This joint agency approach and effort in controlling lagarosiphon is a great example of how we can work together in our region."



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Country's largest water project due to start

Watercare has selected the Ghella-Abergeldie Harker Joint Venture as its preferred bidder for the construction of the Auckland Central Interceptor wastewater tunnel.

Ghella-Abergeldie Harker Joint Venture is one of four contractors that tendered for the project. The other three are: CPB Contractors; Pacific Networks (comprising McConnell Dowell, Fletcher Construction and Obayashi); and VINCI Joint Venture (comprising VINCI Construction Grands Projets, HEB Construction and Soletanche Bachy).

The Central Interceptor will run for 13-kilometres from Western Springs to a new pump station at the Mangere Wastewater Treatment Plant. At 4.5 metres diameter, it will be Auckland's largest wastewater tunnel and the biggest wastewater project ever undertaken here.

Watercare chief executive Raveen Jaduram says the Central Interceptor is a big step forward for the Queen city.

"This project will improve the health of our city's waterways by reducing wet-weather overflows and provide for population growth. Not only that, its construction will create employment and opportunities for the city." The contractors submitted their tenders in mid-September and Watercare has been continuing its due diligence, working with the joint venture on a range of conditions and issues relating to the bid.

"If the conditions and issues can be successfully worked through, the Central Interceptor team will take a recommendation to our Board of Directors in the first quarter of 2019.

"If the conditions and issues cannot be successfully worked

through, then we will start liaising with the second bidder – who cannot be named at this stage."

Watercare has run a thorough procurement process that involved prequalifying the contractors through the expression of interest stage and interacting with them during the request for proposal stage.

"Often when a company undertakes a project of this size, they tender for design and build. By contrast, we have already completed the detailed design.

"This means all four contractors have a very clear understanding of our project and as a result, there is better pricing and less risk for both Watercare and the contractors."

The joint venture of Ghella and Abergeldie Harker combines more than 30 years of tunnelling expertise in here with over 150 years of Italian and international tunnelling experience. Projects include the Legacy Way tunnel project in Brisbane which achieved world records in tunnel boring machine excavations.

Currently, Ghella is working on some of the biggest tunnelling projects around the world, including the Follo Line in Oslo, the Sydney Metro and the Riachuelo sewage system in Buenos Aires.

Meanwhile, Watercare has already spent over \$10 billion in infrastructure and, between 2007 and 2010, carried out the \$118-million Project Hobson which saw it replace a 90-year-old sewer pipe that crossed Hobson Bay with a three-kilometre-long wastewater tunnel that connects to a large pump station at Orakei (see photo).

"With Project Hobson, we successfully used a tunnel boring machine to construct a 3.7 metre wide tunnel that connects to



Far left: This photo shows the 3.7-meter-wide, 3-kilometre-long tunnel that was constructed during Project Hobson.

Left: Taken during Project Hobson when the tunnel boring machine reached its destination, breaking through into a shaft at the bottom of Logan Terrace, Parnell. It features former chairman of the Auckland Regional Council Mike Lee, former Auckland City Council Mayor John Banks, former Minister of Local Government Rodney Hide and late Watercare chief executive Mark Ford.

two shafts and a large pump station. The Central Interceptor project is similar in many ways, only on a larger scale."

While Project Hobson has reduced overflows in Hobson and Okahu bays, the Central Interceptor will reduce overflows into central Auckland waterways that flow into Waitemata Harbour.

"Parts of the old Auckland City Council area have no stormwater system, so when it rains the stormwater goes into the wastewater pipes and then overflows into streams and beaches," explains Jaduram. "It was designed to do that in the early 1900s because it was acceptable back then – and with fewer houses, there was more land for the rain to soak into. But Aucklanders' expectations have

changed – we want a clean and swimmable water environment." The Central Interceptor will address wet-weather overflows by collecting the wastewater and stormwater from these overflow points and transporting it to Mangere for treatment. "It's expected to reduce the volume of overflows by at least 80 percent. It also provides time for Auckland Council to install stormwater pipes in areas where there are none." The project has been on Watercare's agenda for many years, and its funding is already catered for in the company's pricing plan. "The Central Interceptor is part of the \$5.8 billion we will be spending on upgrading and expanding our infrastructure over the next decade."

Construction will begin this year and continue until 2025. **WNZ**

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Pitching for a **global conference**

As part of her position as the New Zealand chair of International Water Association (IWA), Marion Savill travels the world, learning about the latest innovations and issues in all aspects of the water industry.

BY MARY SEARLE BELL.

It's a role Marion Savill loves – it plays right into her strength as a networker and exposes her to new ideas, thoughts, and problems.

"In my role, I mix with people from all aspects of the water sector from all over the world," she says.

"I get to hear their solutions to various problems and think, 'Oh, that would be good for us'."

She, along with Water New Zealand CEO John Pfahlert, are heading up the bid for New Zealand to host the IWA conference in Auckland in 2023.

In hosting the conference, Marion says we will bring international experts to the country, and they will be about to see what's going on here, and, ideally, provide some insights and solutions we haven't considered to the issues we face with our water.

The conference will also give us an opportunity to share what we're good at.

"We're better than most international countries at working with our indigenous people. Crown and Maori are working together to solve water issues and is 'work in progress' but head and shoulders above other countries.



“The Maori traditional system sees water as water – they appreciate that it flows in a cycle, whereas European regulation separates it into different parts – drinking, waste, etc. – and, in doing so, we have lost focus on the cycle,” she says.

“This relationship was very much a part of our bid to host the conference and is a key theme.”

One of the main topics covered at the conference will be wastewater, and recapturing nutrients out of water.

“We need to start looking at our waste as a resource,” Marion says. “I’m currently working with a group in Japan who have a device which can remove nutrients from any sort of waste. Put plastic, food scraps, animal waste, whatever, into the machine for just 15 minutes, and the nutrients are removed. This is potentially very exciting for small rural towns.”

Climate change will, naturally, be a feature of the conference.

“What does climate change mean for the water industry?” Marion asks. “Extreme weather events – more floods and droughts – are something water engineers need to tackle. Here, we also have issues with stormwater storage, ageing infrastructure, and increasingly intensified farming bringing more chemical and microbial pollutants into our water.

“Runoff into rivers from farming is already an issue,” she says. “Many pathogens transfer to humans from animals, and this is where many of our new pathogens originate from; for example, SARS. In the future, we will probably have to treat animal waste before it is discharged particularly waste from CAFO’s (concentrated animal feeding operations) prevalent in the EU and the US.

“New Zealand has some opportunities where treatment could be applied. It’s going to be a big thing for Kiwis to get their heads around.

Water allocation is another hot topic: What will we choose to use our water for?

There’s already much debate around water for irrigation, especially in Canterbury, and some aquifers are already fully allocated. Water trading is in our future, says Marion.

“New Zealand has always had a lot of water but, in the future, we will look at water being reused. Not all recycled water will have to be treated to a drinking water standard, but instead treated to an appropriate standard for reuse.”

So how has Marion come to be our representative to the international water sector?

A biochemist originally, she began her career as a forensic scientist with DSIR.

“DNA profiling was just coming in when I started working. It then morphed into PCR. [Polymerase chain reaction, a method used to make many copies of a specific DNA segment for biomedical research and forensic

purposes.] After 12 years, DSIR became ESR and I was asked to set up DNA profiling in the natural world – microorganisms and the like. This got me into pathogens, which took me into water – both drinking and in the environment.

“As I was good at networking, I was sent to a lot of international conferences, where I made a lot of contacts and brought back new ideas which we could learn from.”

Eight years ago, Marion set up her own company, Affordable Water, with some business people and started doing consulting work. She works with national and international scientists on projects targeting future issues of the microbiological component of water. In doing so, she looks at where the world was going – the issues that we could learn from and new technologies that potentially could be commercialised.

She has worked for the Ministry of Health within the drinking water sector here, and with Korea, for what was then the Ministry of Science, on water, renewable energy, and climate change.

“This was a wonderful opportunity to really get to know the Korean scientific community,” she says. “I would take scientists up there, and we’d discuss the various issues with them – they have some fantastic research going on in their universities and scientific corporations. They also have a lot of money to spend on research, and we can capitalise on this.

On the governance front, she was invited to join Singapore’s international programme committee from 2009 on; in 2011, made a fellow of IWA, attending the association’s main congress, serving on programme groups; and, in 2013, elected chair of the health-related water microbiology special interest group within the IWA, serving two years in this role and the following two as past chair.

A star networker herself, Marion believes the willingness and ability to talk with others is a skill inherent in the New Zealand engineers and scientists in our water sector but one that is less necessary for many of our international counterparts.

“I think one of the key strengths the scientists and engineers in our water industry have is the ability to talk to each other,” she says. “Because we’re so small, we must network – and one type of water engineer or scientist will happily chat to one with a different speciality. Also, we’re not confined to one area – it is not uncommon for someone to work in potable water, wastewater and environmental water throughout their career.

“The whole world is facing very similar issues, and by talking we can learn from each other. We need to keep awake and watch what’s going on. There are things happening all the time.

“Also,” she says with a laugh, “it’s good to make international friends; they have more money for the water sector than us.” **WNZ**

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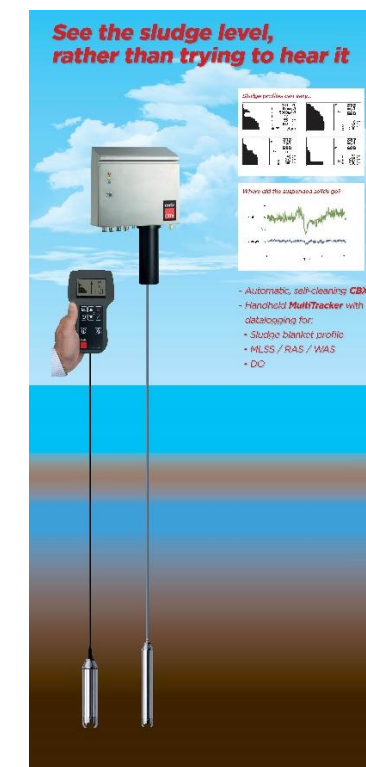
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Wastewater treatment and migratory bird conservation

Christopher Garton, a senior environmental scientist at Watercare Services, made a fascinating presentation at the 2018 conference based on a paper called *60 years of migratory bird management on the Manukau*, co-written by himself, David Lawrie from Birds NZ, Bronwen Turner of the Manukau Harbour Restoration Society, and Liam Templeton from Watercare Services.

Edited by **Alan Titchall**.

Chris Garton and Liam Templeton are charged with managing the ecologically important bird roosts at the Mangere Wastewater Treatment Plant for the many wading bird species that depend on them. His popular presentation at Water New Zealand Conference & Expo last year explained the history of the project and the close relationship that thousands of domestic and global birds have with one of the world's largest treatment plants.

The harbour

Manukau Harbour, located to the west of the Auckland Isthmus, is our second largest harbour. It has a surface area of 365 square kilometres and a shore length of about 460 kilometres. This vast harbour supports over 20 percent of our wader bird population at any given time, and an estimated 60 percent of all New Zealand waders will transit through the harbour at some stage in their lives.



Page 35: Manukau Harbour, located to the west of the Auckland Isthmus, supports over 20 percent of our wader bird population at any given time, and an estimated 60 percent of all New Zealand waders will transit through the harbour at some stage in their lives.

1. When Watercare built the chick shelters, Christopher Garton approached a local primary school to ask students to camouflage them. "I thought the kids would have fun, become educated about the project and I was pretty sure they would do a much better job of it than me," he says. "So, I gave them some bags of shells and some gravel and lots of glue, and they just went to town, and it was awesome. It turned out to be a really cool project."
2. Involving members of the public to help look after the wadding bird roosts has been an important community linkage that ensures the conservation work is valued and ultimately successful. Projects continue to involve local groups, churches and schools, who have become involved in conservation and restoration work on and around the roosts. These projects have proved not only great for conservation, but also great fun.

The harbour is also very important for international migration because we lie at the southern end of the East Asian-Australasian flyway for wader species, such as the Eastern bar-tailed godwits, which make the flight from Alaskan breeding sites to New Zealand in one go without stopping. This is the single longest non-stop migratory journey of any bird species in the world. It takes them about four or five days of non-stop flying (they arrive in September each year).

Up to two hundred thousand migrant waders arrive here each summer, with many making the Manukau Harbour their final destination. Others stop in the harbour to recover and 'refuel' before heading further south.

Manu (bird) kau (to wade or swim) means 'wading bird' in Maori – such was the proliferation of species when the first wave of humans arrived here. Their arrival also set off the first human induced extinctions in NZ.

The second wave of humans over the past 250 years has accelerated that trend of extinctions, and the early pioneers around the harbour environs did a lot to change the landscape, with introduced mammalian predators, land use change from native forest to scrub then to modern farming, and massive raw sewage discharge into the harbour from urban land use intensified.

The treatment plant

Up until the 1960s, a lot of birds roosted along the Esplanade Mangere Bridge area, and generally just along the shoreline, but were competing with urbanisation in the area.

From 1960 the city of Auckland took a small part of the harbour to treat its wastewater through 515 hectares of oxidation ponds, the largest of its kind in the world at that time. This was made up of land-based treatment followed by four large ponds separated by pond walls (serving as access roads).

"After the ponds were constructed it was discovered that thousands of migratory wading birds found these walls to be excellent places to roost," says Chris Garton.

These roads were dry at high tides and largely separated from the mainland so it was hard for predators such as mustelids, cats and rats to successfully predate the bird colonies roosting on them. Data from OSNZ surveys showed that about 20 percent of the wading bird population that feed in the Manukau Harbour were roosting adjacent to the Mangere WWTP.

"The plant staff inadvertently found themselves to be caretakers of some of the best roosting sites in New Zealand."



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The upgrade

When the treatment plant was upgraded (1998) through 'Project Manukau', the oxidation ponds were replaced by a high-quality tertiary treatment based system. This represented the largest coastal rehabilitation project in NZ's history and involved removing the oxidation ponds and allowing the harbour to reclaim the mudflats.

Construction work started in 1998, and the ponds were fully removed by 2003. During this upgrade, 13 kilometres of coastline was restored, seven artificial beaches were created and over 300,000 trees planted.

The Mangere Wastewater Treatment Plant (MWWTP) is now one of the largest wastewater treatment plants in the world. It treats the majority of the residential and commercial wastewater from the Auckland region and releases the treated water into the Manukau Harbour with the outgoing tide.

During the upgrade the wading birds lost their roosting walls, so Watercare decided to replace them with some artificial bird roosts built on natural lava flows in this harbour area. To provide viable roosts, gravel and shell material were used to increase their height, then they were armoured with rock riprap to protect them from erosion.

"When these ponds were decommissioned, and the area returned to the harbour in 2003, a considerable amount of care was taken to ensure that the birds had viable places to roost," says Chris.

This involved the construction of the largest 'artificial' island roosts in the country.

"The roosts are actively managed to control weeds and predators, and reconstruction activities are periodically undertaken to remedy the effects of wind and wave erosion.

The management of these roosts reflects Watercare's vision and commitment to operate in a sustainable manner."

Every day now, more than 30,000 wading birds feed on the mudflats of the Manukau Harbour with about 20 percent roosting on the artificial bird roosts adjacent to the MWWTP. Between tides, the birds cannot feed and will roost in a safe place. This time is precious to the birds because they use it to sleep and rest. If this rest is disturbed then this can be seriously detrimental to their health and the viability of the population.

Long-term, the Bird Roost Management Plan involves a panel of ornithological experts called the Bird Roost Advisory Group (BRAG), which has met every six months since 2007.

Meanwhile, the Mangere wastewater treatment plant remains an incredibly important roosting site, especially during the winter months when we host a quarter of the world's total population of wrybills, which are endemic to New Zealand.

Involving the community

"Involving members of the public to help look after these roosts has been an important community linkage which helps to ensure the conservation work is valued and ultimately successful", Chris says.

"Projects continue to involve local groups, schools, and churches who have become involved in conservation and restoration work on and around the roosts. These projects were not only great for conservation, but also great fun!

"Predator control is achieved through trap and bait lines,

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While there are many ways to measure success of the project, some 20,000 Eastern Bar-tailed Godwits arrive in the area each year, and there are only about 2000 New Zealand dotterels alive today, and they are classified as 'conservation dependent', which means that their continued existence as a species is dependent on such conservation work.

carried out by a team of volunteers that are organised by the park rangers from the neighbouring Ambury Regional Park.

"They go out every week to change the traps and pull out the dead rats and all that kind of lovely stuff, and we pay for all the traps and all the bait, and we also pay for a professional to shoot the rabbits, which makes the area less attractive for cats and stoats.

"We also have to do a lot of work in terms of weeds and erosion, so roosting birds have a good line of sight for avoiding predators.

"Erosion is a big issue, and in 2016 we did a massive reconstruction project on one of the roosts, with about 20 truckloads of gravel and shells to build up the height of the roost.

"We also brought in large rocks to re-armour the seaward side of that roost. On advice from John Dowding, we incorporated little bird ramps every 20 metres through these large rocks so that the dotterel chicks could safely reach the mudflats to feed. These chicks have to find food themselves when they pop out of their eggs. Little A-frame cups also provide protection for the dotterel chicks.

"When we built these chick shelters, I approached the

local primary school to ask if the students would like to camouflage them. I thought the kids would have fun, become educated about the project and I was pretty sure they would do a much better job of it than me.

"So I gave them some bags of shells and some gravel and lots of glue, and they just went to town, and it was awesome. It turned out to be a really cool project."

Watercare also arranged a poster competition with the local primary school, where every kid drew a picture, and the students from each class voted for the one they liked best from their class.

"We ended up with 18 posters, one from each class. We put them along the foreshore next to the roosts, and gave every child whose poster was chosen, a book with all the pictures in it. We gave a couple to their library and a couple to the local library as well.

"The whole point about all of this is to build a connection between the people living in the area and a precious asset that's right on their doorstep, and making a special acknowledgement to the hundreds of Birds NZ volunteers who, rain or shine, undertake the winter and summer census counts of wading birds."

Measuring success

There are many ways to measure success of the project, says Chris.

"You could measure it by the 20,000 Eastern Bar-tailed Godwits that come each year, but I like to measure success in breeding terms of our endangered New Zealand dotterels.

"While they are pretty robust once they're adults, and good at flying away from predators, when they are young they are very vulnerable.

"There are only about 2000 New Zealand dotterels alive today, and they are classified as 'conservation dependent', which means that their continued existence as a species is dependent on the conservation work of humans.

"In the summer of 2017-18, from only eight breeding pairs of New Zealand dotterels, there were six confirmed fledgelings with another two as being highly probable, but unconfirmed.

"The national average is 0.5 per pair per season, making this an excellent result.

"So, to have six chicks last year get away is above the natural average and that's a pretty good measure of our success." **WNZ**

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By **Amber Murphy**, Engineer at Beca, and written in collaboration with the Bells Creek project team led by: Paul Carran, WSP Opus in partnership with Beca; Karissa Hyde, Project manager with Octa Associates, currently working for the Christchurch City Council; Dr Antony Shadbolt, Parks Biodiversity Team Leader, CCC; and Peter Christensen, Technical Lead Land Drainage Recovery Programme, CCC.

Traditional flood mitigation schemes require significant tracts of land in order to soak up and minimise the impacts of flood waters.

When considering flood mitigation within the bounds of existing developed areas, city and regional councils across the country need to find creative ways to provide land for flood management that offer multiple benefits to the community. Christchurch City Council has a six values approach to stormwater management, aiming to address not only drainage, but also culture, heritage, environment, landscape and recreation.

Following the major Christchurch earthquakes of 2010 and 2011, Christchurch City Council staff identified opportunities to continue this approach by developing flood mitigation infrastructure in ways that would be highly functional, and yet also enhance social, ecological and cultural connections and values for local communities.

One particular example of this is the Council's Bells Creek project, which saw WSP Opus, Beca, and Christchurch City Council come together to design and project manage a solution with both form and function.

Bells Creek catchment

The Bells Creek catchment is in Christchurch's eastern suburbs of Linwood and Woolston. Part of the Council's Land Drainage Recovery Programme, the catchment has been subject to increased flood risk due to subsidence from the earthquakes.

This subsidence caused the upper part of the catchment to sink and the lower part to rise, reducing the ability of the catchment to drain, and increasing the number of houses and properties at risk of flooding. Ultimately, the effects of this were seen in a widespread flood event in March 2014.

One component of the Bells Creek project is the development of a stormwater detention wetland, Te Oranga Waikura Urban Forest, to retain water in the Lower Linwood Fields site.

Based on land previously owned by the Ministry of Education and used as sports fields, the site was purchased by Council for this project after the fields became unusable due to earthquake damage.



PHOTO COURTESY OF WSP OPUS.

Te Oranga Waikura Urban Forest

Officially opened on October 16, 2017 in a special community ceremony, Te Oranga Waikura Urban Forest serves as an essential stormwater detention wetland, habitat for native flora and fauna, and park for local residents and visitors.

The name for the 2.75-hectare forest was gifted to the Community Board by mana whenua, with Te Oranga meaning rejuvenation, 'Wai' denoting the flow of water, and 'kura' reflecting leadership.

More than 16,000 native trees and plants have been planted, including kahikatea, totara and matai. The forest will eventually grow into mature full height trees and become a habitat for native birds, and it's hoped the bush will attract bellbird, kereru, fantail, grey warbler and in the future, even tui, kakariki and kaka, back to the area.

Stands of kahikatea-predominant forest blocks are positioned on the basin's lower benches, with totara and matai predominant stands on the higher areas. The varieties of forest plants reflect natural species combinations, and also the intermediate growth phases that will be experienced before the forest giants mature after some decades.

With plant species chosen for their low maintenance

requirements and robustness, the forest includes wetland plant species that will be low growing and suitable for submergence in water. An urban forest has the advantage over wetland planting or grassed basins, in that the requirements for plant maintenance are actually far less. The forest canopy (once mature) effectively suppresses weed growth and controls soil moisture.

Open to the public, with a gravel walkway and boardwalk bridges installed to provide for a recreational loop walkway, the forest park is an integrated and well used resource for the community. Signage and interpretive information along the pathway describe the roots of the urban forest and its importance to the flood mitigation scheme.

To ensure the safety of the park, Council offered neighbouring properties the option of replacing their boundary fences with new 'see-through' secure fencing, to increase visibility into the forest and reduce possible risks of antisocial behaviours.

Function as well as form

During larger storm events, the lower Linwood Fields Basin will receive stormwater flow from the Bells Creek catchment, attenuate these peak flows, and then discharge the flow slowly back into Bells Creek through Arran Drain.

Primarily, the basin needed to meet the aims of flood mitigation, with design parameters defined through

hydraulic modelling by WSP Opus including the excavated detention volume of 6500 cubic metres, inlet and outlet parameters, and a 24 to 48-hour draw down time to protect vegetation and accommodate successive storm events.

Base flow in the urban forest is important in order to reduce stagnation, thermal gain, and risks of algal blooms and midge infestation. The base flow in Bells Creek itself was maintained to protect fish in adjacent reaches. A base flow channel from Arran Drain was constructed to meander through the basin transferring base flow and provide a drainage route for the main base of the excavated land.

The buffer around the boundary of the site includes a minimum five metre wide grassed strip. This strip has multiple purposes; it provides an access route for operational vehicles, a buffer between properties and the forest planting, improves visibility, and mitigates any shading impacts or fire risk.

Christchurch and Banks Peninsula Tree and Urban Forest Plan

Te Oranga Waikura Urban Forest complements the city's proposed 'Christchurch and Banks Peninsula Tree and Urban Forest Plan' (TUFPP) that is currently being prepared by the Council's Biodiversity Team.

Amongst the broad range of ecosystem-related services that trees and forests provide, the TUFPP seeks to restore

viable indigenous forest ecosystems across the city. It is envisioned that these forests will one day provide viable habitat for a range of bush birds and other indigenous fauna, many of which have been locally extinct in the Christchurch area since not long after European colonisation in the 1840s.

Community engagement

Building relationships and actively engaging with the local community was key to the projects' success, to ensure the community felt informed at every stage, and had input as users and owners of their public space.

To promote this community engagement, the project team held several events through the course of the project: Te Oranga Waikura Urban Forest opening ceremony; community and School planting days at the Urban Forest and Bells Creek Realignment sites; and an ecological site visit with local schools, to view the electro-fishing of the eels and other fish in Arran Drain for relocation.

Community engagement and enthusiasm for Te Oranga Waikura Urban Forest remains high, with a range of great feedback received on the amenity, ecological and property value benefits the forest will bring to the area.


The forest walkway is listed on Council's walkways website and is being utilised well, with local schools requesting to undertake projects in the new forest. [WNZ](http://www.wnz.org.nz)

Page 42: The constructed Te Oranga Waikura Urban Forest, with juvenile planting.
Below: Drone photo of Te Oranga Waikura Urban Forest after construction




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A standout veteran

At six foot five or so, Roly Hayes is literally a standout figure in the water industry. And while he may credit his career success to his great height, unusual name, and the fact he's from Dunedin, there's no doubt he's good at what he does. BY **MARY SEARLE BELL**.

Roly Hayes' critical thinking skills were pronounced early on. He studied applied maths in sixth form and was fascinated by it and was considering a future as either a maths teacher or an engineer. To help him choose, he asked his teacher how much money he earned, then phoned the city engineer to find out his salary.

"My maths teacher was on £1750 a year and the City Engineer was earning £2500 – the decision was easy: I would be an engineer. What I didn't appreciate at the time that the teacher had a staff of maybe one, while the engineer was responsible for around 50 people.

"The school career advisor said I could either get a Post Office bursary or join the Navy. I thought the Post Office was all about mail, I didn't realise they looked after the phones too, so I opted for the Navy. But there was nothing to do – there was no war on – so I talked my way out after a year.

The turning point came in 1966 when a "real" guidance counsellor in Hamilton explained to Roly the difference between the various engineering disciplines – civil, mechanical, chemical, etc.

"He then sent me across the road to the Hamilton Council and I spent an hour or so in each division. At the end of it they told me I could start there tomorrow.

"I said, "No, I want to work in Rotorua", as I had family there."

So, he went to the council in Rotorua and started the following week as a civil engineering cadet.

"I then met a girl and moved to Wellington. In 1970 we moved to Dunedin to be near her mother who was unwell; and she was, she died nearly 20 years later," he jokes.

Roly spent 22 years at the Dunedin City Council, until, at age 43, he decided to leave the bureaucratic council world to become a consultant.

"It was a total breath of fresh air," he says. "My job focused on finding the best solution to a problem and working the right number of chargeable hours, rather than office politics.

"I've enjoyed it ever since."

As a consultant, Roly has been paid for work by every council in the country. He has also spent a considerable amount of time tackling water engineering projects overseas. Something that comes with additional challenges.

"The Pacific is a very different place to work," he says. "It is frustrating at times because change is resisted. You have the key executives who are pushing for change, but further down the ranks they are quite conservative and reluctant to do things differently. Also, as there is poverty everywhere, the price of temptation is low. To counter this, there is a lot of bureaucracy.

"I spent a lot of time in Fiji, and while there is a strong sense of community, unemployment is high. Consequently,

“ One project I did for a chlorination plant would reduce the staff requirements from 60 to just 6. It was a good business case and would save money, but it never went anywhere – no one spoke out against the project, it just got delayed and delayed again. ”

the Fijians don't like reducing jobs, they prefer to create them.

"One project I did for a chlorination plant would reduce the staff requirements from 60 to just 6. It was a good business case and would save money, but it never went anywhere – no one spoke out against the project, it just got delayed and delayed again."

To further illustrate his point, Roly explains that the whole of Fiji's main island has 25 water treatment plants and 20 sewage treatment plants. The geographical area is similar to Southland District, which also has about the same number of plants, however, in New Zealand there are about six guys, each with a phone and a truck, looking after them, while in Fiji the work is undertaken by a staff of 600.

Roly believes there are savings to be made here, "once we get Water and Wastewater away from councils and take them into business structures. Councils have a lot of extra people in middle and upper management.

"The beauty of water engineering is that if you find a better solution, you can cut 30-40-50 percent off the costs. The same is not true of roading or structural engineering, where a good solution may cut 10-15 percent off costs. Water engineering is not constrained by human sized things.

"If you have a good idea, you can halve the cost and get a better outcome."

What Roly really enjoys is bringing his technical analysis skills to problems.

In a recent example, a contractor had laid two-metre-diameter pipes under seven metres of sand. An inspection after backfill showed the pipes to be oval (a deflection of six percent instead of under the allowable five percent). The concern was they would go flat and it was suggested they should be taken out. A wall had been cast across the pipeline, which showed the shape before the sand was placed.

"I sat down and calculated the strength of the pipes, the

load, and the deflection, and concluded they would perform as desired. Not one of the other engineers could or would do the maths.

"Fortunately for the contractor, photographs had been taken of the pipes before they were laid that showed the pipes had deflected while sitting in the sun while waiting to be buried. And later, the German software of the pipe manufacturers showed the same results that I had calculated."

This spot of maths saved a lot of time and money.

Roly gives an even more dramatic example from his work in the Philippines, where privately funded projects are guaranteed a 19 percent return. This reward encourages inflated costs. This meant that on a \$500 million rockfill dam and tunnel project, they were digging out 80MPa rock to put in a 30MPa concrete lining.

"I asked why? By not lining the tunnel we saved \$110 million and about three months of work. A few other changes saved another \$20-30 million.

"We also were able to generate power from the water, which would mean the project started making money. However, because of this, the whole thing stalled, as the profits weren't there for the investors – we made it too cheap," he laughs.

But this is exactly what he enjoys about engineering: "I love finding a way through complications to find an elegant solution."

Roly himself is currently facing a complication that's a little more personal. He's been sidelined by an aneurysm and was headed for surgery when we spoke to him in January.

"As a water engineer, I understand exactly what's wrong; the doctors need to go in and replace a bit of pipe!"

He's pretty upbeat about it, saying, while the aneurysm has him physically stalled, he doesn't feel the slightest bit slowed down mentally. So, while he is scheduled to have a few months off work to recuperate, it won't be long until he's back doing what he loves. **WNZ**



Like a fish in (clean) water



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

Welcome back into 2019 – the Chinese year of the Pig. As we are in the midst of a true scorcher of a summer, we feel this is an entirely appropriate time to reflect upon the role that water plays for many New Zealanders.

As such, this article is a run-through of the issues that we foresee (as we gaze into our crystal ball), which will bubble to the surface of water discussions in 2019. As a full disclaimer, this article contains no guarantee of the accuracy of our crystal ball gazing.

Freshwater

There is no question in our eyes (barring hugely unforeseen scandal in other water areas) that freshwater will be the topic de rigueur of 2019.

The notion of ‘freshwater’ as a topic extends to healthy and swimmable rivers, treatment options and safety of drinking water, bottling and exporting drinking water, ownership of freshwater, nitrogen leaching and grandparenting provisions, water conservation orders, the Government overhaul and review of the Three Waters frameworks.

The list goes on. In this article we focus on the Government’s review of freshwater, nitrogen leaching and grandparenting provisions, and the Ngaruroro and Clive Rivers Water Conservation Order.

Government review of freshwater

Public calls for swimmable waterways and cleaner freshwater has been a key driver in the Government announcement of a review.

New Zealand has 4200 catchments. Of the aquatic indigenous species reported on, three-quarters of fish, one-third of invertebrates, and one-third of plants are threatened with, or at risk of, extinction. New Zealand has lost 90 per cent of wetlands to agricultural and urban development and they are now some of the rarest ecosystems.

Estuaries from Northland to Southland are being seriously damaged by sediment smothering the seabed and shellfish. Between 2002 and 2017 the area of irrigated land increased by about 70 per cent nationally. And concerning from a health perspective, aquifer contamination from nitrogen and E. coli can create significant health risks¹.

This wide array of effects touches on things many of us are passionate about – swimming, the health of the environment, and their own personal health and that of our families. As such, the public

demand for reform has led the Government to produce “Essential Freshwater – Healthy Water, Fairly Allocated”².

The Essential Freshwater work programme has three main objectives:

1. Stopping further degradation and loss – taking a series of actions now to stop degradation and to start making immediate improvements so that water quality is materially increased within five years.
2. Reversing past damage – promoting restoration activity to bring our freshwater resources, waterways and ecosystems to a healthy state within a generation, including through a new National Policy Statement for Freshwater Management and other legal instruments.
3. Addressing water allocation issues – working to achieve efficient and fair allocation of freshwater and nutrient discharges, having regard to all interests, including Māori, and existing and potential new users.

The Government considers that the work programme will deliver on these objectives through:

- targeted action and investment in at-risk catchments;
- amendments to the Resource Management Act – to be introduced later this year;
- a new National Policy Statement for Freshwater Management – to be in force by 2020;
- a new National Environmental Standard for Freshwater Management – to be in force by 2020;
- wide engagement in developing options for allocating water resources, starting with allocation of discharges to water in 2019;
- ongoing future policy framework development.

The Government has stated its commitment to looking at how to improve water quality in urban and rural communities, and measurement and monitoring of impacts to support the Essential Freshwater Programme. In 2023 the Government expects this environmental reporting to show evidence of improved water quality.

There are highly complex issues at play here, and a number of parties with an interest in these issues. There may be difficulties in meeting what are fairly tight timeframes. However, this optimism and focused action plan appears a good starting point. It is also quite likely that the populace will hold the Government to account to deliver here as we cannot see the importance of freshwater diminishing in the public’s eyes and hearts.

There has been some slippage in the timeframes for this work and we will continue to monitor this situation in future articles.

Nitrogen leaching and grandparenting

One very visible aim of central and local government is to attempt to put in place restrictions on the amount of nitrogen leaching emanating from farming activities. Nitrogen has been the focus to date due to the fact that there is already some ability to measure, model or monitor nitrogen discharges at the property level.

An example of this lies in the Waikato Region with Proposed Plan Change 1 slated to go before a Hearings Panel this year. The notified Plan Change limits nutrient discharges from non-point source discharges (ie largely agricultural discharges) through ‘grandparenting’ nitrogen discharge limits.

This means that those farms currently producing higher discharge limits (such as some dairy farms) will be locked into being able to discharge to these high limits, and farms which currently are at the lower discharge end of the scale (such as non-irrigated sheep and beef farming) will be locked into only being able to discharge to these current low levels.

The numerous submissions on the Plan Change directly challenge the approach taken. In addition, the Minister for the Environment has been seeking input into regimes that provide an alternative to grandparenting. Waikato’s Plan Change 1 will no doubt be the start of the test cases as to whether grandparenting is still a viable, desirable, or optimal tool for controlling nitrogen discharges from non-point source discharges.

Water Conservation Order – Ngaruroro and Clive Rivers

The Water Conservation Order (WCO) concerns the entire length of the Ngaruroro River, the tributaries, hydraulically connected groundwater, and the seven kilometre long Clive River. In December 2015 a grouping of environmental and recreation interests³ applied for a WCO to protect the entirety of the Ngaruroro River, tributaries and hydraulically connected groundwater and the Clive River.

As we noted in our article of November 2017, an application for a WCO is heard by a Special Tribunal appointed by the Environmental Protection Agency and there is a right of appeal of the Tribunal’s decision to the Environment Court.

The Application states that the rivers have certain outstanding values, including:

- significance in accordance with Maori custom;
- cultural and spiritual purposes;
- habitat for rainbow trout and fishery, angling, amenity and recreation;
- habitat for avifauna and native fish;
- whitewater kayaking, rafting, and jetboating amenity and recreation;
- wild, scenic and natural characteristics;
- scientific and ecological values.

A hearing in relation to the upper reaches of the Ngaruroro River was held towards the end of 2017. In 2018 scientific evidence developed as part of the Hawke’s Bay Regional Council’s ‘TANK’(see below) confirmed that wider hydraulic connections exist through the Ngaruroro and Clive Rivers catchment than was properly understood when the Application was first notified. Accordingly the Special

Tribunal directed that further public notification was required.

The hearing for the lower portion of the Ngaruroro and Clive Rivers will be held mid-2019.

At the same time as this hearing is progressing, a related process guided by Hawkes Bay Regional Council is also underway – TANK (an acronym of the names of the waterways this process looks to manage – Tutaekuri, Ahuriri, Ngaruroro and Karamu catchments). TANK was comprised of a stakeholder group to represent the wider community.

Representatives included iwi, producers (Heinz-Watties), growing representatives (Federated Farmers, Dairy Sector, Irrigators, Forestry, Vegetable Growers, Pipfruit), local government, government agencies (Department of Conservation), waters users groups, viticulture (Gimblett Gravel Grape Growers’ Association, Hawke’s Bay Winegrowers), environmental interest groups (Fish and Game, Forest and Bird). The aim of TANK was to look at the best way to manage the waterways of the four catchments through assisting in the development of objectives, policies and rules for the Plan Change. Science indicated that the waterways and aquifer below the Heretaunga Plains are highly inter-connected, giving rise to a significant consideration for the TANK group.

The TANK group produced a TANK Draft Plan which was presented to the Regional Planning Committee in August 2018. Not surprisingly there are a few matters the TANK group was unable to reach consensus on which were highlighted as requiring further review and consideration by the Regional Planning Committee.

In December the Hawkes Bay Regional Council agreed to adopt the TANK Plan Change for targeted consultation in early 2019 with formal notification envisaged mid-2019.

From all accounts, water users and interest groups appear to agree that the TANK Plan Change has been appropriately formulated by an informed group of representatives, contains views which are inclusive of multiple regional interests and representative groupings, and has been properly and widely consulted on, with further consultation processes in the pipeline.

There are views that WCO process could compromise the TANK Plan Change process and conflict or run roughshod over the work that has already gone into the TANK Plan Change. There are also questions as to the desirability of a WCO instrument in this circumstance where so much work has gone into the TANK Plan Change to date, and whether the WCO is an irrelevant and unnecessary protection instrument in regards to the Ngaruroro and Clive Rivers.

We predict that many questions will arise throughout the WCO hearing and decision of the Special Tribunal, and throughout the simultaneous TANK Plan Change notification and public submission phase, about the appropriate tool for protection in this instance.

Questions may well arise as to whether the WCO is an outdated tool created under the previous Water and Soil Conservation Act regime and rolled-over largely unchanged into the Resource Management Act in 1991.

It is likely that, with an overhaul of the RMA, consideration would be given as to whether there is a more appropriate regulatory tool to protect outstanding values in water bodies under the auspices of the National Policy Statement Freshwater Management. **WNZ**

1. 2018, Ministry for the Environment and Ministry for Primary Industries as authors <http://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/essential-freshwater.pdf>

2. “Essential Freshwater, Healthy Waters, Fairly Allocated” 2018, Ministry for the Environment and Ministry for Primary Industries as authors <http://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/essential-freshwater.pdf>

3. New Zealand Fish and Game Council, Hawke’s Bay Fish and Game Council, Operation Patiki Ngati Hori ki Kohupatiki, Whitewater NZ Incorporated, Jet Boating New Zealand, and Royal Forest and Bird Protection Society of New Zealand

Removing copper and zinc with mussel shell

Nestled within the picturesque Queen Charlotte Sound, Waikawa Marina is the largest of Marlborough's three marinas with 600 berths, a floating fuel jetty and a range of boating related facilities, including boat maintenance. **Mary Searle Bell** looks at a unique approach to water treatment in this vicinity.

Located just one bay to the east of Picton and the interisland ferry terminals, Waikawa Marina also offers boaties a boat maintenance hardstand. Here, boats are cleaned, sanded and repainted, all a necessary part of boat ownership.

However, the anti-fouling paint used on boat hulls to prevent the accumulation of marine microorganisms (such as barnacles and algae), has high levels of copper.

Water blasting, wet sanding, dry sanding, and scraping can introduce this copper into the environment in the form of copper-rich paint chips and dust. Zinc can also be released during the preparation process from sacrificial zinc anodes located on hulls undergoing maintenance.

Consequently, the runoff from the hardstand has high levels of copper and zinc that need to be removed before it is discharged into the marina.

To do this, a treatment system was installed in 2012. The runoff is collected via sumps and directed to a treatment system comprising a Hynds Environmental Downstream Defender for sedimentation, followed by a filter chamber that initially contained a 50/50 mix of sand and peat as the treatment media.

A disadvantage of that system was that the sand/peat media was clogging with fines and the system was

working suboptimally. Additionally, as per the operational requirements, the media required replacement every 12 months. Peat is a non-renewable resource, which is relatively expensive and scarce, and it degrades over time.

The sand for the media was also expensive to source as it had to be graded and washed prior to being mixed with the peat.

Port Marlborough initiated a review of alternative filter media to see if the operation of the treatment system could be improved. They engaged The Urban Engineers to help assess the options and optimise the treatment system performance.

David Wilson, director and principal engineer at The Urban Engineers, says an effective and economic solution was sitting on their doorstep, in the form of waste mussel shells from the region's mussel farming industry.

"A 2010 report by Auckland Regional Council found that the crushed shell of the New Zealand green-lipped mussel is very effective at capturing zinc and copper. Mussel shells are high in calcium carbonate, and the calcium undergoes an ion exchange mechanism with these metals."

An ensuing field study also found that the initial flow rate of the mussel shell media was approximately double that of the sand media used in the study.

This meant the mussel shell media received approximately

double the volume of runoff compared with the sand media. Despite this, the field study found that the crushed mussel shell media removal rates for copper and zinc were superior to a straight sand media.

"A Canterbury University Study in 2013 also showed that mussel shells were effective in removing copper and zinc and that there was no statistical difference between using crushed and graded mussel shells, and uncrushed shells," David adds.

Thanks to the thriving green-lipped mussel industry in the Marlborough Sounds, Marlborough has an abundance of discarded mussel shells – hundreds of thousands of them. Whole mountains of mussel shells in fact.

With around 60,000 tonnes of green-lipped mussels harvested in Marlborough annually, millions of empty shells are stockpiled on farmland near Havelock.

In Marlborough, mussel shells are considered a waste product of the aquaculture industry and could be sourced for five percent of the cost of the sand/peat media.

"With faster filter rates than a sand/peat filter and good copper and zinc removal rates, mussel shells seemed like a good fit. The fact that we might be able to use a waste product just added to the appeal."

So, in late 2017 Port Marlborough approved the change of filter media to aged ungraded mussel shells sourced from the Havelock stockpile. The change was made during the treatment system's annual servicing that September.

A more focused monitoring programme was initiated after installation of the mussel shell media. It sampled dissolved and total copper and zinc from the inlet to the treatment system, the outlet of the Downstream Defender, and finally the outlet of the filter chamber at the end of the treatment system.

"The results to date show that the mussel shell media achieves similar levels of treatment to the original sand/peat filter (up from 68 to 70 percent for copper and 76 percent for zinc) but with higher flow rates, we are treating more runoff

with fewer bypass events," says David.

He adds that with a measured flow rate of 7.5-10 times the sand/peat media, they are currently investigating the potential to increase the depth of the media to achieve even greater levels of treatment.

It hasn't been completely plain sailing, however.

"In August last year, almost 12 months after installation, we observed that the flow through the system was being restricted," he says.

"An inspection of the filter chamber showed that the mussel shell media was covered with a layer of fine material and had become compacted. Consequently, the mussel shells were promptly replaced – a much cheaper operation than the previous mixed media."

Testing of the used mussel shell media from the filter chamber showed that the mussel shells had the potential to remove significantly more copper and zinc but had been inhibited by the fines.

David says that while the mussel shell filter media has the potential to last a lot longer than a year, the fines need to be removed earlier in the treatment train.

They are now looking at source control and other means of preventing fines from entering the filter chamber. Hopefully, this will increase the life of the mussel shell media and further reduce costs.

"However, what is particularly satisfying with this project is that we are able to use a waste product to treat stormwater.

"It is an environmentally-friendly and sustainable solution, and cheap and effective as well.

"Not only could mussel shell media be considered from the outset of a project, but it would also be an ideal retrofit solution where there may not be the capital funds to replace or upgrade an underperforming treatment system." **WNZ**

• For more information on this project, email David Wilson, david@theurbanengineers.co.nz.

This paper was presented at the 2018 Water New Zealand Conference in Hamilton.

PREVENTING THE 'PONG': WHANGANUI'S FIVE-YEAR JOURNEY

Arno Benadie (Whanganui District Council) & Brett Eaton (Cardno)

ABSTRACT

Whanganui has undertaken a long and interesting journey with wastewater treatment. From 1984, screened wastewater was discharged to a long ocean outfall. Subsequently, in 2007, the first Wastewater Treatment Plant (WWTP) was commissioned.

This design was based on a deep aerated lagoon, which combined liquid stream treatment with in-pond storage and digestion of sludge, followed by the use of a smaller settling pond for additional solids removal and, finally, ultraviolet (UV) disinfection.

Significant odour events in 2013, along with ongoing resource consent compliance issues, initiated an investigation process culminating in the design and construction of a new treatment plant.

Cardno was engaged to provide an upgrade solution that would meet the outfall consent requirements, make best use of the existing invested capital assets and mitigate the risk of future odour events.

Through a collaborative investigation and design period followed by a rigorous peer review process, it was determined that a new treatment process would be required to consistently meet effluent compliance requirements and minimise the risk of odour as much as possible.

A significant factor in the Whanganui design is the presence of large wet industries. These comprise a substantial proportion of the wastewater load. At various points in the design and pre-construction phases, the necessity of continuing to treat separable trade waste was raised. This was based on the precedent set by other wet industries that discharge directly to the ocean elsewhere in the country.

It was determined that a combined treatment plant for both industrial and

domestic waste was the only option as this effectively manages risk related to resource consent compliance, solids disposal and odour mitigation.

The liquid stream treatment is a covered primary pond, followed by a contact stabilisation process, clarification and UV disinfection. The solids stream treatment is co-settlement and stabilisation of sludge in the primary pond, followed by thickening, dewatering and drying.

Odour is collected from the covered primary pond and treated via a gas flare. Bark biofilters treat foul air collected from the inlet works, contact stabilisation and sludge handling processes.

The full paper (see link below) outlines in further detail the treatment plant options that were considered, selection and development of the final design, design and construction issues encountered, and commissioning experiences.

GOVERNMENT

This project attracted a lot of attention from central government. There were constant enquiries and communications from the Department of Health, the Department of Internal Affairs, and the Office of the Auditor-General. There were also many requests for information via the Local Government Official Information and Meetings Act and even a complaint to the Office of the Ombudsman.

CONTRACTUAL

The construction contract was tendered as a standard NZS 3910 contract but, for potentially the first time in local government, it was put to the market as a Guaranteed Maximum Price (GMP) contract with a substantial Early Contractor Involvement (ECI) phase. This aimed to protect WDC against a price blow-out in a contract where there were many unknown conditions that could severely influence the final cost.

Hawkins Infrastructure (now Downer), the contractor that won the tender, had substantial experience in ECI processes and GMP contracts but, for WDC, the process

was a very steep but valuable learning curve.

The ECI phase of the project was to allow the contractor to have input into the construction best practice to create savings for WDC and simplify the construction. In this project, it created savings of well over \$1 million.

The way in which the contract was set up and tendered delivered a construction contract that produced unrivalled value for money. Despite the fact that this was a complex construction, the contract was completed on time and well under the original contract value.

CONCLUSIONS

Two independent peer reviews, and the process commissioning, show the final 'for construction' design is a proven, robust and cost-effective design, based on the project's governing scope: to minimise odour; utilise existing assets; and meet discharge consent compliance.

The design of the new WWTP was more than just an engineering process, it involved key stakeholders from local government, central government, ratepayers and the wet industries. It was also a test of local government processes and procedures to get to a position where councillors could make a decision while at the same time minimising the risks that come with a decision as complex as this one.

The contractual setup enabled the delivery of the complex construction contract to be completed on time and well under the original contract value. The liquid stream was commissioned in March/April 2018 and the sludge stream in July/August 2018.

There were many learnings during commissioning, the most notable being that there can never be enough redundancy and safety built into plant operations. A prime example of this is the over-performance of the primary pond sludge extraction and dewatering system causing conveyance issues to the sludge drying process.

• To read the full paper go to: bit.ly/Preventing_The_Pong

Leachate – lessons from Australia

Australian Government data suggests that there are around 500 officially registered landfill sites in Australia and although the number is declining, the average size of the landfill site is increasing. Approximately 75 percent of garbage in Australia goes to just 38 sites.

Our neighbour is reducing its reliance on landfills, partly by recycling and focusing more on the use of anaerobic digestion plants that are converting waste to energy. The country is also reducing the amount of non-biodegradable products, such as disposable plastic bags.

Released in 2016, the second edition of The Environmental Protection Authority's Environmental Guidelines for Solid Waste Landfills, requires that (among many other regulations), all landfills are to have a leachate barrier to contain leachate and prevent the contamination of surface water and groundwater over the life of the landfill. However, even if all landfills met these requirements, leachate from old landfills still needs addressing as the problem lingers for many years.

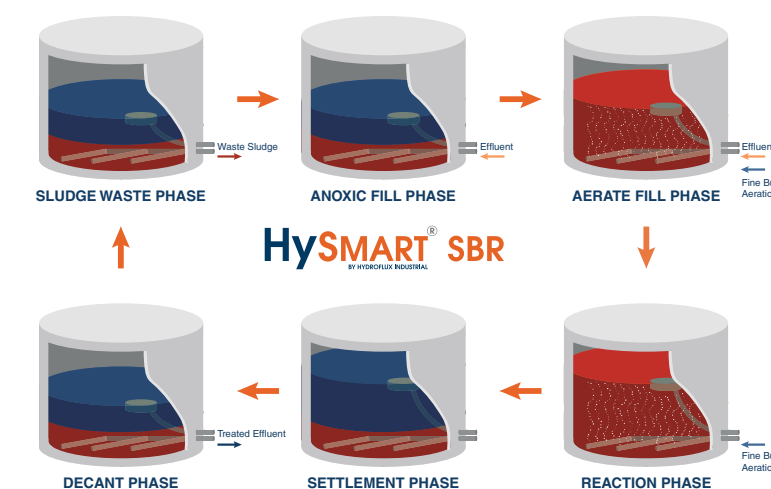
Moreover, it is not only landfills that generate leachate. There are many other problems associated with contaminated land in general. There are numerous sites throughout Australia where developers need to overcome leachate problems caused by historical industrial activity.

Options for handling leachate from landfill sites

The options available include offsite disposal, discharge to sewers with or, possibly, without pre-treatment or treatment onsite for environmental disposal or reuse. Offsite disposal is very uncommon due to prohibitive costs unless the landfill is very small.

Discharge to sewers may be possible depending on the site location, and infrastructure availability and capacity. The degree to what leachate has to be treated depends on local trade waste legislation.

Leachate from landfill sites contains a variety of different substances, although by far



the most significant contaminant is ammonia. Ammonia and other forms of nitrogen occur naturally in the environment, but concentration levels in leachate are alarming. Decomposition of plant, animal and human waste produces ammonia and many household and industrial cleaning products, including disinfectants, also contain ammonia.

Ammonia levels for discharge to sewers vary across Australia. For example, Sydney Water requires an ammonia concentration of less than 100 mg/L for sewer discharge whilst Urban Utilities in Queensland set 200 mg/L as a more lenient upper limit. However, with ammonia often present in concentrations in excess of 1000 mg/L in landfill leachate, discharging leachate to sewers will almost certainly require some form of pre-treatment anywhere in Australia.

Naturally, discharging into the environment has far more stringent requirements. Due to ammonia's environmental effects, discharge concentrations are very low. In fact, 0.3 mg/L for freshwater and 0.5 mg/L for marine waters are the trigger levels established by the Australian and New Zealand Environment and Conservation Council (ANZECC).

Leachate treatment methods

Ammonia concentrations in leachate can be reduced by air stripping, chemical treatment or biological processes.

The Hydroflux HySMART SBR can easily be configured for ammonia removal.

Air stripping is not a common practice as stripping towers are expensive with high operating costs due to high alkalinity, strong buffering and the need for large volumes of alkali to enable the process to work. Air stripping also releases large quantities of ammonia into the air resulting in air pollution, which is a major concern also.

Work and research have also been conducted on chemical precipitation with some success, and although sewer discharge limits may be achievable with this method, operational costs are also high.

Biological processes are the preferred means of treatment of leachate, and there are several types of aerobic biological processes that can be adapted for ammonia removal. Mixed Bed Biological Reactors (MBBR), Membrane Bioreactors (MBR), activated sludge, various fixed film media processes and Sequential Biological Reactors (SBR). The preferred option generally comes down to cost, space requirements or simply personal choice.

Hydroflux has extensive experience in treating wastewater sources containing high ammonia loads and are experts in the fields of design, construction and operation of many different types of wastewater treatment plants. **WNZ**

Phosphorus reduction in wastewater treatment

Andrew Miley, director, Global Market Development – Hydroflux Group.

Phosphorus, usually in the form of phosphates, originates from sources such as human and animal waste, detergents and food residues. Food and beverage processing plants will very often have phosphate inputs from all of these sources.

Wastewater treatment systems that are commonly used in the food and beverage industry typically manage to reduce biological oxygen demand (BOD) and nitrogen effectively but very often are not as effective at reducing phosphorus to acceptable levels.

In order to protect the environment, industrial wastewater treatment plants are tasked with reducing the levels of contaminants, including phosphorus, so that the treated effluent meets environmental standards before it is discharged into a local water body.

Environmental impacts of phosphorus

Phosphorus is a naturally occurring nutrient found in soil and rocks that is required by all living organisms. Phosphorus (phosphates), together with nitrogen (nitrates), is an essential plant nutrient that is readily taken up by plants for growth. However, when these nutrients are available in unwanted excessive amounts, they can fuel rapid plant growth, which is why they are used extensively in fertilizers.

High levels of phosphates in aquatic environments can fuel algal growth, resulting in algal blooms that can potentially lead to eutrophication as the thick algal mats block out sunlight causing the algal cells to die off.

Oxygen is stripped from the water column as the dead algae cells decompose, leading to anoxic conditions that can result in mass die-offs of fish and other aquatic life. As the algae and other dead organisms decompose, the organic form of phosphorus bound in the dead organic matter can be converted to orthophosphate, making phosphate available to aquatic plants and algae once again.

So, in effect, internally recycled phosphorus can fuel another algal bloom, and this cycle can be continually perpetuated.

Phosphorus removal

The effectiveness of phosphorus removal during wastewater treatment can vary, depending on the available equipment and the treatment methods used. Only wastewater treatment plants that employ specialised phosphorus removal techniques will normally be able to remove phosphorus to the desired levels.

Many food processing plants ultimately treat their wastewater by discharging it to aerated settling ponds where the organic waste is broken down by aerobic bacteria. Upstream of this aerobic biological process, there may be some primary treatment process such as a DAF or perhaps an anaerobic pond; however, neither of these stages of treatment provide a satisfactory reduction in phosphorus loads if any at all.

There are two methods of removing phosphorus from wastewater: biological removal and chemical removal. Biological phosphorus removal can be achieved by cycling the activated sludge in anaerobic and aerobic conditions, which can build up a population of microorganisms that are capable of storing phosphorus intracellularly as polyphosphate. If these specific microorganisms exist in sufficient numbers, then the phosphorus will be removed along with the waste activated sludge.

Unfortunately, to establish and maintain biological conditions for effective and continuous phosphorus removal has proven to be quite challenging for the food and beverage sector.

A much simpler method of removing phosphorus can be affected by dosing a metal-based coagulant into the wastewater. The metal targets phosphates via two routes: 1) When a metal is added to wastewater, it reacts directly with phosphates present in the wastewater, forming the metal phosphate, which is insoluble. 2) The metal ions hydrolyse in water, forming a dense, gel-like precipitate (metal hydroxide),

which binds with phosphorus to form the metal phosphate.

Once the metal combines with phosphorus to form the metal phosphate as discrete flocs, the flocs can be removed from the water phase.

Separation of the metal phosphate is a fairly simple process and can be achieved by filtration or clarification, the latter using settling or flotation methods. Filtration is rarely used as a sole method of treatment as the suspended solids level after the chemical treatment stage is usually too high, although filtration is commonly used downstream of a clarification stage as a means of protection and polishing.

When it comes to flotation (more especially a dissolved air flotation system or DAF) versus clarifier, either process will work. A small dose of polymer upstream of the separation device will enable a clear virtually solids-free stream to be discharged. The choice of which process to select can depend on available space, cost, ongoing costs or can simply be put down to personal preference.

Conclusion

Phosphorus is an important plant nutrient that drives algal blooms in both freshwater and marine ecosystems and is a key factor for triggering extensive blue-green algae (cyanobacteria) blooms that can be toxic to humans and wildlife.

High concentrations of phosphates from human inputs, such as industrial wastewater discharges, can cause eutrophication, resulting in the death of fish, shellfish and other species.

As a result, environmental agencies are focusing more attention on phosphorus in wastewater discharges and imposing limits on how much phosphorus can be discharged with industrial wastewater. To ensure certainty in the continuous and efficient removal of phosphorus to comply with given discharge limits, a physical-chemical system wins hands down. **WNZ**

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When it comes to the rehabilitation of steel or concrete pipes, water tanks or concrete basins, plastic products made of polyethylene play an essential role. Engineering plastics are a better solution in many renovation cases. Thanks to the simple processing, the high chemical resistance and last but not least because of the attractive prices.

Leaking steel or concrete pipes can be remediated with different methods. The relining with plastic pipes and concrete protection liners prevents the corrosion of sewers and concrete pipes, preserves the old pipe as a protective pipe and is also chemically resistant to aggressive media. It is important to distinguish whether the restoration can take place with or without an annulus.

When refurbishing without annulus, the advantage is that the old inner diameter remains almost unchanged and thus also the media flow and the transport capacity are maintained. The company AGRU Kunststofftechnik has been offering well-proven solutions for decades.

On the one hand, a folded and therefore reduced PE pipe section, the so-called AGRU SureFIT liner, can be pulled into the old pipe. After the AGRU SureFIT Liner has been inserted into the existing old pipe, both ends are sealed and the pipe is pressurised with water vapour. Heat and pressure activate the memory effect.



When relining without an annular space, a folded and therefore reduced PE pipe string, the so-called AGRU SureFIT liner, will be pulled into the old pipe. Pipes and entire tunnels with cross sections of more than 1 metre in diameter are thermo-plastically lined with AGRUSAFE concrete protection liners.

The AGRU SureFIT Liner regains its original round shape and nestles like a second skin inside the old pipe. Particularly large pipe cross-sections are provided with a thermoplastic lining consisting of AGRUSAFE concrete protection liners. The result is a permanently sealed composite pipe, which is resistant to corrosion, abrasion and chemical media.

When renovating with the annulus, the pipe cross-section is reduced because the new PE pipes must fit into the old pipe and therefore have a smaller diameter. This results in an

unavoidable annular gap between the new and old pipe. Partially, the reduced transport capacity is compensated due to the smooth surface of the new PE pipe.

The rehabilitation takes place with coiled AGRULINE pipes in standard length of 100m and OD of up to 90mm. For larger diameters, individual AGRULINE pipes can be welded step by step in the excavation and pushed into the old pipe.

The entire dimension range of available AGRULINE PE pipes (from OD 20mm to OD 3500mm) is available for relining. **WNZ**

Anaerobic digestion technology

A new wastewater-to-energy plant shows Australasia how quiet achiever technology can turn an environmental problem into a profit.

A clean green wastewater technology that can turn an environmental problem into a source of profit is being introduced to New Zealand and Australia by CST Wastewater Solutions.

The Global Water & Energy (GWE) anaerobic digestion technology has been proven worldwide in more than 400 installations, including food and beverage, and agribusiness operations in Australasia and, most recently, another brewery in a chain of global successes.

The GWE technologies involved use anaerobic digestion to consume organic contaminants in industrial and municipal wastewater streams, removing typically more than 95 percent of the previously troublesome content by transforming it into biogas (primarily methane). This resource can then be used to fuel industrial processes such as boilers, or to generate electricity, replacing expensive fossil fuels in both cases.

"The quality of wastewater effluent produced by GWE processes from food, beverage and agribusiness processes is often so high that the effluent coming out from plants is often substantially better than the water drawn in from the surrounding environment," says CST Wastewater Solutions managing director Michael Bambridge.

The technology is applicable to the food and beverage businesses important to both Australia and New Zealand, as well as meat, livestock and crop agribusinesses that must conform with increasingly strict environmental and groundwater statutory obligations.

"A huge bonus also – in addition to the environmental benefits – is that the biogas produced by the anaerobic process can then be captured, stored and used to substitute for expensive and polluting fossil fuels, such as bunker oil. So users get both clean water and green energy," says Bambridge, who is an Australasian distributor for the GWE technology, which will be shown at the Ozwater exhibition in Melbourne from May 7-9.

The technology is also available throughout New Zealand from CST Wastewater Solutions' Representative Pieter Groenewegen. **WNZ**

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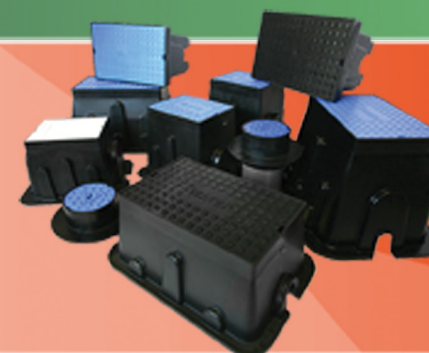
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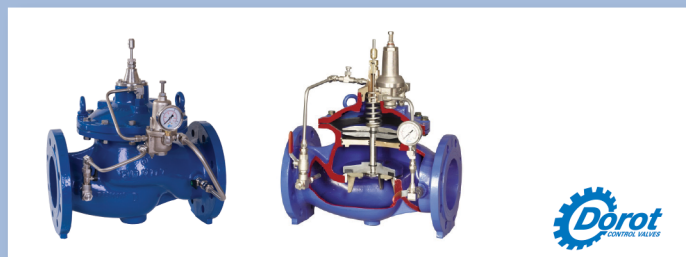
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