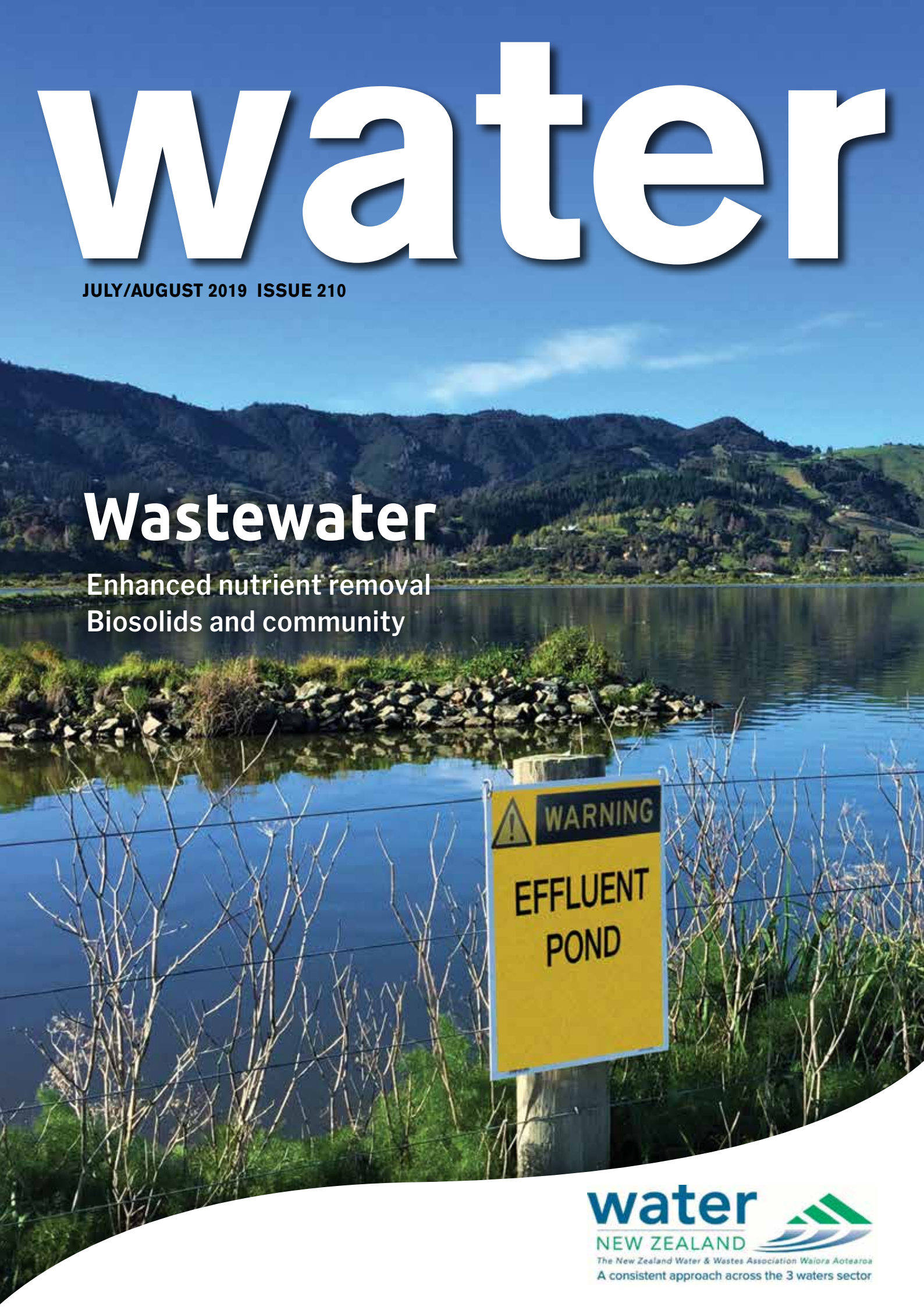
water

JULY/AUGUST 2019 ISSUE 210



Wastewater

Enhanced nutrient removal
Biosolids and community

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

water NEW ZEALAND

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Prinicpal Data Scientist: Lesley Smith
Communications Advisor: Debra Harrington

SPECIAL INTEREST GROUPS
Backflow: Richard Aitken, P: +64 3 366 7252
Modelling: Nadia Nitsche, P: +64 21 576 134
Small Wastewater & Natural Systems: Ulrich Glasner, P: +64 3 450 1721
Stormwater: James Reddish, P: +64 27 705 3139
Water Service Managers' Group: Martyn Cole, P: +64 27 555 4751
Young Water Professionals:
AKL: Joan Davidson, P: +64 21 835 739
WLG: George Beveridge, P: +64 21 718 173
CHC: Jules Scott-Hansen, P: +64 3 363 5400

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

ISSN 1179-2949 (Print)
ISSN 2382-1906 (Online)

Cover: Nelson North Wastewater Treatment Plant on a sunny Nelson day. Submitted for the Water New Zealand Photo Competition by Skye Patterson-Kane, Contract Supervisor Utilities, Nelson City Council.

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water

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INSIDE

FEATURES

REGULARS

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.

The need to collaborate

Kelvin Hill,
President, Water New Zealand

Recently I attended the Australian Water Association's annual water conference at the Melbourne Convention Centre. "Oz Water" as attendees affectionally refer to it is Australia's biggest international water conference with around 3500 people attending from 20 countries around the world.

It was my first time representing Water New Zealand and there was certainly plenty to take in, including participating in a water leaders' workshop and directors' forum.

The conference theme "Transforming the World" did not disappoint with the opening presentation delivered on stage in holographic form by Professor Johan Rockstrom from the US.

Certainly technological capabilities have come a long way – all information from passes to presentations now conveniently available on your cellphone.

There was a big array of keynote speakers ranging from writers, comedians, an award-winning game designer as well as a young inventor and entrepreneurs. But one presentation particularly stood out for me. Mina Guli is the founder and CEO of Thirst, a not-for-profit company, looking to solve the water crisis by changing the way people think about water. To highlight global water crises, Mina completed seven desert runs, six river runs and completed 62 consecutive marathons out of an intended 100 before being sidelined by a serious injury. The challenge to finish the final 38 marathons was picked up by people around the world on her behalf. By the end of the challenge some four billion people had been touched by the events and messages associated with water shortages.

Conference session papers were divided into nine streams giving the attendees significantly hard choices to make. Feedback from fellow kiwi attendees was that the quality of the papers was informative and of a very high standard.

The opening speech by Francois Gouws, AWA president, focused on the United Nations' Sustainable Development Goals and how they have influenced the theme of this conference. His challenge to the audience was that if we are to transform the world we will need to think and do things differently. The clear message was: "We will need to collaborate with each other and other sectors". In the spirit of collaboration, we hope to be able to welcome Francois and incoming president Carmal Krogh to our Annual Conference and Expo later this year.

Down here in our corner of the South Pacific, it's important that we keep an eye on what's happening in the other parts of the world, especially in the area of research and development around new technology and ways of ensuring we're delivering the best outcomes to customers.

It was pleasing that Water New Zealand's principal advisor Water Quality, Jim Graham, was able to get to some key conferences in the northern hemisphere this past month – both in Canada and Scotland.

In Europe, water entities are large enough to fund collaboration between themselves, universities, water suppliers and private companies, and there are many new ideas around creating efficiencies and improving customer outcomes. Digital water, for one, is likely to be a huge driver in these areas.

It's also sobering to be reminded of the global problem of micro-plastics and micro-contaminants in water. Despite the fact that up to 99 percent of micro-plastics can be removed in wastewater treatment systems, the level of plastic contamination in water has become so huge that plastic contamination is a major problem in aquatic environments and has become one of the biggest environmental challenges we're facing. It's worth reading Jim's report on the big issues in Europe on page 20.

Back here, we had a good turnout at the Water Utilities Association (WUA) meeting in Wellington in May where we discussed the ramifications of the three waters review and where the process is at.

The Government's decision is now unlikely to be announced before August – exactly three years since the Havelock North water contamination outbreak.

That it's taken three years and a two-stage inquiry, road-shows and workshops shows just how vexed the issue of water reform is in this country and the likely extent of the much-needed changes to the delivery of three waters.

Over the three years a picture has emerged of a very complex and significant challenge facing us in the way our three waters are delivered. As we know, the subsequent inquiry recommended urgent changes to the way drinking water is delivered in this country including an independent regulator.

While we don't know what the government's final framework for water reform will look like, it's very clear that there will be a new regulator – definitely for drinking water and maybe eventually for two or three waters.

There are some compelling reasons for regulatory oversight of at least drinking and wastewater – given that the two waters are closely inter-related. And of course the three waters review is very much aligned to the broader Essential Freshwater programme led by the Ministry for the Environment.

With water very much a key issue on the Government's agenda this year, both the Minister of Local Government, Hon Nanaia Mahuta and the Minister for the Environment, Hon David Parker, have agreed to speak at our Annual Conference and Expo in Hamilton this September. Once again, the conference looks to be another must-attend event on the three waters calendar. We're also delighted at the calibre of keynote speakers and technical presentations lined up already.

And with that it's timely for me to remind you to make sure you register for the conference soon – earlybird rates are still available.

Nga mihi nui,

Kelvin.

Planning underway for another successful Annual Conference and Expo

plus pre-conference workshop: Regulation – What you need to know.

Hamilton 18-20 September

We're very pleased to be able to offer a big array of eminent speakers and presenters at what looks set to be another successful conference in Hamilton this year.

Regulation of drinking water continues to be a major topic in our sector and we're very pleased that we will be able to welcome two key Government Ministers, Hon David Parker and Hon Nanaia Mahuta to enlighten us on the Government's approach to water reform.

In light of the importance of reform, we'll also be holding a one day pre-conference workshop (September 17) on water sector regulation. So don't miss out on that very informative event.

But as always, there'll be plenty this year beyond regulation. Again, our expo sites sold out within days so we're looking forward to a lively expo area along with a very high calibre of technical presentations which are already in the pipeline.

Our conference is a highlight in the 3-Waters events calendar – bringing together like-minded professionals to share experiences, knowledge and build new relationships.

I look forward to seeing you there.

John Pfahlert
Chief Executive

Keynotes

Dr Art Umble, Stantec, USA
The Circular Economy

With almost 30 years of experience, Art is considered a champion on the global stage of wastewater treatment. He is helping to change the paradigms of the wastewater industry by transitioning from disposal facilities to resource recovery and product factories. According to Art, "the future of municipal utilities requires a great degree of sustainability and resiliency," and that is achievable by embracing new ways of thinking about treatment and adopting new technology.

As the global lead for wastewater practice at Stantec, Art's position involves developing strategies and providing solutions for complex wastewater treatment challenges. His role involves connecting his company's global resources in process design to promote collaboration and deliver comprehensive knowledge and expertise. He is also responsible for pushing scientific research that enables technology adoption in the worldwide marketplace.

Mark Gobbie, Acting Chief Executive
South Australian Water Corporation

Mark has more than 35 years' experience as a professional engineer and general manager in infrastructure delivery, with specialist expertise in water and wastewater.

In his substantive role with the corporation, Mark makes sure its service meet the needs of its more than 1.7 million customers in the most efficient way. His teams look after asset management, bulk water and wastewater operations, capital works, Laboratory Services and River Murray Operations.

Prior to joining SA Water, Mark was employed with Kellogg, Brown and Root (KBR), most recently as its vice president Water in the Companies Infrastructure Business Unit.

Mark has been involved in major projects and operated businesses in the water, transport, minerals, oil and gas, environment and buildings areas throughout Australia, SE Asia, Middle East, UK and USA.

Tony Wong, CRC for Water Sensitive Cities Melbourne

Professor Tony Wong is Chief Executive of the Cooperative Research Centre for Water Sensitive Cities in Australia, with research hubs in Brisbane, Melbourne, Perth and Singapore. He pioneered the water sensitive cities approach for concurrently addressing the social, environmental and economic challenges of urban water management. He has led a large number of award-winning projects based around the adaptation of nature-based solutions for urban water management.

Tony has advanced new understandings of the relationship between the societal and biophysical dimensions of water security and city waterscapes – enabling solutions to be underpinned by creative design through blending bio-mimicry with engineering and architectural knowledge and practices for delivering sustainable urban water outcomes. In 2010 he received the prestigious Sir John Holland Award as Australia's Civil Engineer of the Year.

Water New Zealand Board elections

Calls for nominations for election to the Board of Water New Zealand close on Tuesday, 30 July 2019. The Board comprises six elected members and may include two co-opted members. Members are elected for three-year terms. This year, one position is available.

Members contemplating standing for the Board may wish to discuss the role and responsibilities of directors with sitting members of the Board. The candidate, nominator, and seconder must all be financial members of the Association.

Annual General Meeting

The Water New Zealand 2019 Annual General Meeting will take place at 5.00pm on Wednesday, 18 September at the conference venue, Claudelands Arena, Hamilton.

To meet constitutional deadlines, any notices of motion for this meeting must be supplied to the Chief Executive by 5.00pm on Monday, 12 August 2019.

Notice of meeting, agenda and any notices of motion will be sent to financial members by Monday, 19 August 2019.

Please contact Amy Samuelu, Association Secretary, Water New Zealand, if you have any queries. Phone: +64 4 495 0894, Email: amy.samuelu@waternz.org.nz

Don't forget to pay your subs

It's time again to renew your Water New Zealand membership subscription. By now you should have received your renewal invoice – subs due before 20th August. Prompt payment is always appreciated – thank you.

Survey reveals members want more involvement

Water New Zealand members are looking for more opportunities to take part in regional meetings, networking events and training courses, according to the results of our latest membership survey.

The Association's President, Kelvin Hill says the results of the survey are informative and show that while we're reasonably on track for meeting our members' needs, there is scope to provide more opportunities for further involvement.

"We'll certainly take note of the call for continuing opportunities around events and meetings, and of course training is an area where we've been putting a big emphasis on in the past year, so that's an area where we're optimistic we'll be able to share some bold new initiatives very soon."

He says it's great that members are looking for more opportunities to develop and collaborate in what has become an increasingly dynamic and fast-changing sector.

This year's survey attracted a 22 percent response rate – more than double the number in previous years.

"It may be that we kept the survey short and to the point – in particular we made sure that taking part in the survey would not take any more than five minutes of a respondent's time.

"The view from the membership was that we need to continue to provide balanced evidence-based advocacy on areas of interest. While some members wanted us to be more focused on technical work, there was a bigger group that wanted us to take a stronger role in advocacy for the sector."

He says there will be another opportunity for membership feedback at the annual conference later this year.

"We intend to use the conference app to run another short survey of about three to four questions as another way to ensure that we're listening to our wider membership."

Flushable wipes ruling disappointing

Water New Zealand says the ruling by an Australian federal judge that Kimberly-Clark did not break the law in marketing its wipes as flushable is disappointing.

The Australian consumer watchdog, the ACCC, recently lost its Federal Court battle against the makers of so-called "flushable" wipes after accusing the company of misleading Australians.

The ACCC took Kimberly-Clark Australia to court claiming it broke the law with its marketing of Kleenex Cottonelle Flushable Cleansing Cloths by claiming the wipes were flushable in contrast to other products which warned consumers against flushing them.

However, the Federal Court found the wipes were not the only contributing factor to sewerage blockages.

The ACCC had argued Kimberly-Clark should not be able to take advantage of the fact it was "incredibly difficult" to isolate the impact of their product on the wastewater network.

Ironically, the judge said that there was ample evidence that "wipe" products generally are a significant management problem for municipal sewerage systems, impairing the function of infrastructure and increasing maintenance costs.

Justice Jacqueline Gleeson said it was reasonable to infer that Kimberly Clark wipes contributed to blockages in an unknown number of instances.

But she said other products also contributed to the problems.

Water New Zealand Technical Manager Noel Roberts says inappropriate flushing of wipes is a worldwide problem.

He says it's been estimated in this country that the cost of unblocking clogged pipes caused by non-flushable products such as wipes comes to at least $16 million a year.

Water New Zealand's latest performance comparison report, the National Performance Review, found that since 2013-14 the number of sewage overflows occurring during dry weather blockages has increased five-fold. Dry weather blockages are directly linked to obstructions in pipes.

"Wastewater overflows, caused by wipes, has closed at least two New Zealand beaches after sewage contamination occurred," it says.

Water New Zealand is currently working with its Australian counterparts on a joint set of flushability standards that will provide a clearer determination about what products should and should not be labelled as flushable in order to prevent unnecessary blockages.

Huge infrastructure project gears up

Back in March Watercare, owned by the Auckland City Council, and the Ghella Abergeldie Joint Venture, signed the contract to construct Watercare's Central Interceptor, a $1.2 billion wastewater tunnel with associated infrastructure.

Construction of Watercare's Central Interceptor will start with site works in August and the project is expected to be completed by 2025.

This 13-kilometre tunnel is a vital infrastructure project for Auckland and is part of Watercare's wider wastewater long-term infrastructure strategy.

Watercare's chief executive, Raveen Jaduram, says that in older parts of central Auckland, wastewater and stormwater flow into a combined network of pipes. When it rains, stormwater overwhelms these pipes, which are designed to overflow into waterways, and a mix of wastewater and stormwater can flood urbans streets.

"The Central Interceptor will run underground from Western Springs to the Mangere Wastewater Treatment, collecting wastewater along the way via link sewers and drop shafts."

While the Central Interceptor is being built, Watercare will deliver further projects in the area such as separating the stormwater and wastewater pipes. The largest of these projects is the Grey Lynn wastewater tunnel which is a two-kilometre extension of the Central Interceptor.

"The Grey Lynn wastewater tunnel has been included in our construction contract with Ghella Abergeldie Joint Venture," says Jaduram.

"Together, the Central Interceptor and our western isthmus projects will reduce overflows in the area by at least 80 per cent."

Back in 2005, the company carried out the largest rehabilitation project in our history by removing the oxidation ponds from the Manukau Harbour and upgrading the Mangere Wastewater Treatment Plant to improve the quality of treated wastewater.

More recently, Watercare built a large wastewater tunnel that runs from Parnell to Orakei, referred to as Project Hobson, using the same tunnelling boring technique that will be employed for the Central Interceptor. This allowed the removal of an old sewer that bisected Hobson Bay and reduced overflows.

Jaduram says the Central Interceptor is Watercare's largest project to date: "Because it is a key part of our region-wide wastewater strategy, it was important to find the best company in the world to construct it.

"So after a vigorous tender process we chose Ghella Abergeldie Joint Venture with over 150 years' experience working on major tunnelling and wastewater projects across the globe."

New Zealand's Ghella representative, Francesco Saibene, says: "We have been very impressed with Watercare's process. They kept to the intended timing, were clear with requirements and the evaluation process.

"Plus, the probity measures in place were very robust. One key factor was the extreme dedication and professionalism Watercare has demonstrated on the project. This was an ideal situation for our joint venture, which had an international component that needed those certainties."

Watercare will fully-fund the Central Interceptor using revenue from its water and wastewater service charges on Auckland's residents and businesses, infrastructure growth charges, and borrowings.

The project has been included in the Asset Management Plan since at least 2010 and is built into the price path. The Funding Plan projects price increases over the 10-year period to 2028 of an average of 2.5 percent per year for water supply and an average of 3.3 percent per year for wastewater services.

This represents an overall average annual price increase for combined water and wastewater of three percent per year for a typical household.

As Watercare operates on a self-funded model, it doesn't receive any money from Auckland Council towards this project.

Fast facts

Central Interceptor:

- 13 kilometres long, 4.5 metres in diameter
- Large capacity: the tunnel can store 200,000 cubic metres of wastewater which enables Watercare to control the flow rate to the treatment plant
- Connects to two link sewers, both 2.4 metres in diameter
- Connects to 16 drop shafts, up to 80 metres deep
- Connects to one pump station at the Mangere Wastewater Treatment Plant
- The TBM is expected to progress at a rate of 15–20 metres per day.

Grey Lynn Tunnel:

- This will be a two-kilometre-long extension of the Central Interceptor tunnel (15 kilometres total)
- Included in the construction contract
- Essentially, 15 percent more tunnel for the same total project budget.

- Project build from 2019 to 2025.
- Ghella Abergeldie Joint Venture has over 150 years' experience working on major water and wastewater projects and has successfully completed numerous projects of this scale across the world.

Above: Front row from left: Abergeldie Executive Chairman Mick Boyle, Ghella Vice President Lorenzo Ghella, Watercare Chair Margaret Devlin, Watercare Chief Executive Raveen Jaduram. Back row from left: Ghella Abergeldie Joint Venture Representative Francesco Saibene, Head of Consular Affairs and Trade for the Italian Embassy in New Zealand Nicola Comi, Auckland Mayor Phil Goff, Federico Ghella, Watercare Executive Programme Director for the Central Interceptor Shayne Cunis.

Route map.

High risk of nitrate contamination

Thousands of people could be at risk from drinking water with high levels of nitrates in their private water supplies, says Water New Zealand President, Kelvin Hill.

There are thousands of private drinking water bores throughout the country, particularly on farms and on lifestyle blocks, and many are probably not meeting current Drinking Water Standards, he says.

Water New Zealand's latest National Performance Review reveals that more than 225,000 people do not have a municipal water connection and use either rainwater tanks, or private bores, for their water supply.

"While it is the responsibility of regional councils to monitor water quality in their regions, this doesn't extend to ongoing monitoring of private water bores," says Kelvin.

"If you look at the situation in Christchurch, it is quite clear that our ground water is under pressure from farming and increased agricultural activities."

Water quality is also being affected in other regions around the country, Kelvin adds.

"Contamination from nitrates and fertiliser run-off doesn't just affect our rivers and streams, it also has an impact on groundwater for drinking."

He says regional councils don't actively monitor private bore water quality.

"This means it is up to bore owners to ensure that their bore water is safe to drink through regular testing.

"Ground water quality changes, so just because the water is fine when a bore is first drilled, doesn't mean the quality will be fine further down the track."

Kelvin advises all private owners to ensure that they get their bore water independently tested for bacteria and nitrate contamination at least once a year.

"This is something that needs to be taken seriously, especially given recent research linking nitrate contamination with increased risk of cancer.

"I would hope that when the Government announces the role and responsibilities of the new drinking water regulator, there will be resourcing to enable better advice and support for private suppliers."

Competition to find our best tasting tap water

Our water authorities competed for the title of Best Tasting Tap Water in the Water Industry Operations Group (WIOG) Water Taste Test 2019. Timaru District Council was chosen from three finalists out of a field of 13.

Sponsored by Ixom, the annual competition judged water samples on qualities like colour, clarity, odour and mouthfeel during a series of blind taste tests.

WIOG Chair Nick Hewer-Hewitt says; "The competition is testament to the excellent quality of New Zealand water and to the skill and commitment of the operational employees who deliver it to our communities.

"Many of us turn on taps for a drink, to cook and shower, with little consideration of what it takes to operate and maintain the water infrastructure.

"We want to celebrate our unsung heroes – the water operators and the maintenance crews who work year-round to ensure we have safe water of a consistently high quality."

The other two finalists for the 2019 competition were Wellington Water and Waimate District Council.

The judging panel for the final round was made up of Simon Bretherton, Cassels Brewing, Christchurch; Nathan Swain, Ixom; Martyn Simpson, WIOG; and Adam Panozzo, North East Water, Victoria, Australia.

Congratulations to the Game of Thrones winning team

In a close-run finish, Aqua-Lira, from Beca, beat its closest rival Aqua Vitae to take out the title of winner in the annual Game of Thrones pub quiz in Wellington.

The winning team was Rachael Shaw, Kathryn Jessamine, Lucy Wilson-Guinness, Doug Stirrat, Alex Leo, and Matthew Plummer.

Once again it was another great capital event with compliments on both the venue and food.

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

Backflow Conference

8–9 August 2019

Venue: Quality Hotel Elms, 456 Papanui Road, Christchurch

Subjects and speakers include:

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

The cost of the conference will be $550+GST per member delegate and $650+GST per non member delegate.

Includes a conference dinner on 8 August.

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

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

To register, please visit:

www.waternz.org.nz/backflowconference

Billion dollar consolidation in the water sector

In an almost $1 billion deal Auckland's Watercare has taken over water services for a large chunk of the Waikato region.

Council controlled organisation (CCO) Watercare took over the delivery of Waikato District's drinking water, wastewater and stormwater services from July 1.

Waikato District Council mayor Allan Sanson describes the contract as; "bigger than Ben Hur.

"It's one of the biggest contracts we've ever signed, I'd say it's the biggest one in the Waikato region that's ever been signed as a supplier contract.

"We're the first one in the country to make any moves like this in this respect to try and do things differently."

Sanson adds that the contract will result in nearly $30 million of savings over a 10 year period.

"We've got a lot of expenditure going forward over the next five years in relation to new infrastructure especially for wastewater. By having Watercare do it for us, they will outsource it and bring in contractors to do the work."

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

Sanson says the three waters business is an economy of scale business and small councils are really struggling to maintain it and keep the standards up.

He predicts that eventually only a small number of waters organisations would run water services in New Zealand.

"There could be one in the South Island, and as little as two in the North Island. I would say Watercare certainly would be one of those. So they could end up running all the waters business for the upper North Island from Taupo through to Cape Reinga.

"Others have talked about it, then you get down to local parochialism type thing – that local control and ownership.

"This is the problem that some of the councils have got. They need to do what's right for their ratepayers in terms of providing their best value for money service."

Infrastructure New Zealand chief executive Stephen Selwood also claims Waikato District Council's plan was a step in the right direction for water delivery, and not dissimilar to Wellington Water – an organisation which administers services for several councils in that region: Wellington, Lower Hutt, Upper Hutt and Porirua. South Wairarapa District Council will also soon join the Wellington Water fold (see page 16).

The key advantage for Waikato District Council is that Watercare is a specialist water provider that has experts in maintaining infrastructure and procuring assets, he said.

"What it does mean is that the district council can focus less on managing wastewater treatment plants, pipes under the ground, and water leakages and as a council be much more focused on the people."

Selwood said the current model where most councils deliver water services separately could not continue and he believes more consolidation is needed.

"At a great frequency councils are having to issue boil water notices, because they've discovered *E. Coli* in their drinking water, there are constant water shortages because their water supplies are insufficient to meet demand – particularly with increasing drought and climate change challenges."

Many of the councils have aged water assets that need significant investment but they have an aging and declining population base to charge those costs over, he adds.

"Deferring investments means higher risk for water contamination and health, as occurred in Havelock North, or wastewater treatment plants not meeting satisfactory environmental standards, thereby polluting rivers, lakes and beaches."

At the time of the announcement Local Government Minister Nanaia Mahuta said it was too soon to say whether a small number of organisations would eventually run water services across the country.

"It's too early to predict what the future of water service delivery will look like and we have indicated to the local government sector that this is a longer conversation. Our immediate priority is to develop a regulatory framework and an emphasis on a drinking water regulator.

Meantime, Watercare spokesperson Rachel Hughes says the organisation was not currently negotiating further water services for other councils.

Field trip for BoP Young Water Professionals

About 20 Young Water Professionals from the Tauranga region visited the Te Maunga WWTP, which provides treatment for domestic, commercial and industrial communities from the Mount Maunganui, Papamoa and Tauranga southern catchments via the Southern Pipeline.

The average daily flow to Te Maunga is 9600m cubic metres per day, which is the flow from a population of about 36,500 people. About six percent of the flow to the plant comes from industry. The plant has capacity for 10 MLD, average dry weather flow.

Wastewater is screened then treated with a biological process and secondary clarifiers. A new sludge thickening plant comprising picket fence thickeners, polymer make up and dosing system, screw presses and load out hopper was recently put into operation.

The treated wastewater flows from the clarifier to an eight hectare retention pond before passing through a four hectare man-made wetland before being pumped through the UV plant and then out to sea through a three kilometre pipe line which extends 950 metres off shore at Omanu.

This ocean discharge pipe handles the effluent from both Te Maunga and Chapel St wastewater treatment plants.

Our thanks to Louis Du Preez, Wastewater Treatment manager and Wally Potts, Drainage manager at Tauranga City Council for guiding the group through the plant.

Before the bio-solids are taken off site they enter a hopper that releases the bio-solids into a truck at one tonne per second and the truck is weighed on the weigh bridge. As a fun exercise the team then stepped on to the weigh bridge to demonstrate how accurate the bridge was: it gave a total weight of 1578 kgs.

Public health and community

with a green tinge

Colin Crampton moved into our water industry in early 2014, when he was appointed as chief executive of Wellington Water. Five years on he talks with **Mary Searle Bell** about his role.

A civil engineer by training, Colin Crampton had spent the previous 20 years with the New Zealand Transport Agency, working his way up to the role of group manager, responsible for highways and network operations.

The Wellington Water board recognised that Colin's wealth of infrastructure and general management experience, particularly his people skills, made him an ideal choice for the role. Colin told *Water* magazine, that while he was looking to take the next step up the career ladder into a chief executive role, this particular position appealed to his "green tinge".

"I like working with the environment," he says.

He's been in the role for five years now and considerable change has happened within the organisation in that time.

"Part of the job was to bring all the local councils into one water entity," he explains.

The five councils – Wellington, Hutt, Upper Hutt, and Porirua city councils, along with the Greater Wellington Regional Council – launched their unified water company in March 2015.

"By coming together, we can provide greater value for the region through a critical mass of people and a consistent way of doing things.

"It's been a success," he says.

"We're now an outcome-based company. Where our predecessor, Capacity, focused on operations and maintenance, we are focused on a bigger, long-term picture. We are looking to the future – where will we be in 50 years' time?

"We're concerned about the future – as companies like us should be. Consequently we are focused on sustainability – we're not simply concerned with water and wastewater, but also the water quality of our rivers, streams and harbours.

"We're also prioritising building capacity within the company. We want to get better and better at what we do."

In this regard, Wellington Water is establishing a new model involving three consulting and three contracting panels. This new model, which was scheduled to start on July 1, means that rather than tendering each project as it comes along, the same people will undertake the work going forward.

"By keeping the capital works projects within the sector and planning to a much longer horizon, we are helping build capability within the local sector so contractors can utilise their resource more efficiently," explains Colin. "This will create better long term value for the rate payers of Wellington."

The operation and maintenance of the water network utilises an alliance with Fulton Hogan. The move to an alliance model reflects Colin's history of working with alliances at NZTA and the success that organisation has had with them. He believes the alliance "will deliver way better results".

"Fifty percent of the people in Wellington Water are Fulton Hogan employees. But we're not just a team of 250, we're actually a team of 500, as we work closely with our suppliers.

Colin says it's all about focusing on the customer, rather than the pipes and pumps. The customer is at the heart of everything they do, and using an alliance facilitates this.

"Historically, the dispatch centre for maintenance work was at CityCare, but it is now back within Wellington Water. So how work is treated and dispatched is now in-house, and this ensures better ownership of any issues and a closer relationship with our customers."

The other significant change that has been made under Colin's leadership is that all three wastewater plants in the Wellington region are now looked after by Veolia, a move that Colin says, simply, "makes a lot of sense". He says that where there were once three different operators with three different ways of doing things, there is now one.

"All these changes will help build capability within the sector, which is very important," says Colin. "We've got a lot of good people working for us and with us, but there is concern in the industry around where the water engineers of the future will come from.

"Water New Zealand has a role to play here," he says. "The industry is largely invisible – not only is the infrastructure hidden underground, but it is also a low-profile industry. A lot could be done to attract workers to the water industry.

"We're not actually about pipes and pumps, we're about safe water for people to drink, we're about the responsible disposal of waste. We're about public health. We're about community.

"It's an understated business. We all need to be pushing hard to promote water careers."

Back within Wellington Water, Colin is currently focused on the next long-term plan for 2021-24 with the five councils, ensuring they are investing in the right areas.

Further changes are afoot, as South Wairarapa District Council will soon join the Wellington Water fold.

"With all the service delivery changes we have made it is very easy to deal with a new shareholder. We just scale up the current practice to cope with the services needed over the Rimutaka Hill. For example, we do all our water treatment in house. While we will recruit new operators, they will be backed up by our teams in Wellington. This way when people are sick or on leave the remaining people aren't overloaded.

"Having watched our model develop, and others consider it, I can see it's a maturity curve. You have the likes of Watercare at the fully mature end, with us at Wellington Water not too far behind.

"Other councils should consider it – even if it's just sharing with their neighbour."

Colin is also an advocate of the three waters model over two waters.

"Catchment is often left out, but I believe we should be looking after the entire water cycle. Two waters is not broad enough thinking. By working with three waters, the community stays in harmony with the catchment, the water coming in, and the water going out."

He says this will become even more important in the future, with climate change promising rising sea levels, more intense rainfalls and drier weather.

"This will put more strain on the entire system from source to the tap. Taking more and more water is not the answer because the environment will suffer and the water quality of our streams, rivers and harbours will get worse. We need to educate our customers about the value of water and the benefits of conservation for the betterment of the environment. If we have done all we can with consumption and use, then we can increase storage but hopefully this is years away.

"Fixing all these problems and making water supply and wastewater services affordable is the real challenge we face.

"It will certainly make issues tighter going forward."

Nevertheless, Colin acknowledges that Wellington Water is in a good place currently.

"We're in a good position regarding the possibility of increased regulation around drinking water and environmental regulation.

"And we're well off when it comes to facilities, which have enough capacity for the projected growth for the next 20 years at least." **WNZ**

New ideas and technology explored at international conference

Water New Zealand's Principal Advisor Water Quality, **Jim Graham** reports from the 16th IWA Leading Edge Technology Conference on Water and Wastewater Technologies.

Digital water, microplastics and micro-contaminants in wastewater, along with energy recovery from wastewater, were key themes at a major conference in Edinburgh in June.

The intention of the IWA Leading Edge Technology Conference is to get new ideas and technology into the water industry.

The conference was made up of workshops on the first day, keynote speakers in plenary sessions on the second day, and presentations in water and wastewater on the final two days.

Workshops

The workshops were presented by University professors and their doctorate students. On the first day, I attended mostly the *Frontiers in Engineering Biology* workshop. The first part was about bridging the gap between sequencing the genomes of micro-organisms and understanding those micro-organism communities.

The second part was about biofilms relevant to wastewater treatment and using techniques like *optimal coherence tomography* to understand the structure and behaviour of those biofilms. Presenters outlined computational models used to understand the effects of shear forces on biofilm structures.

I also spent some time in the micro-plastics workshop where a professor from Finland, Riku Vahala, described her work in isolating micro-plastics from wastewater effluent. Ninety-nine percent of micro-plastics can be removed in conventional secondary wastewater treatment systems, but because the quantities of micro-plastics in wastewater are so high, the amount in effluent is still significant.

They remain a concern because they provide sites for the carriage of micro-pollutants (including pharmaceuticals, pesticides, contaminants of emerging concern) and pathogens. They can enter the food chain when they are consumed by organisms in waterways into which effluent is discharged.

Plenary Sessions

The second day plenary sessions were inspiring. One of the speakers was Eric Hoek from the US who was involved in water tech start-up companies. He was a very modest, self-deprecating entrepreneur who described his numerous business failures and what he had learned from them, starting with his failed childhood lemonade stand.

Lesson learned: lemonade stands need to be where there are lots of people, which was not outside his front gate. He has been involved with a number of successful water tech start-up companies and now, based out of UCLA, is working with new start-ups. He provided some interesting insights into what makes start-up businesses succeed or fail.

Jim Graham: The afternoon saw a presentation about the treatment of micro pollutants (pharmaceuticals, detergents, pesticides etc.) in Switzerland. A reported decline in fish health and trout catch led to micro pollutants in wastewater being identified as one of a number of factors affecting waterway health.

This was followed by some presentations and a panel session on digital water. One of the speakers was the Director of Digital, Scottish Water. The fact that Scottish Water employs someone specifically to digitally enable their water business (this is different from IT support) should alert us to the importance that water suppliers in other parts of the world are placing on digital water.

Water New Zealand and our large water suppliers would do well to note this. It's about using the data we collect to produce information, and increasingly using AI to determine which data we should collect. They also referenced a new IWA document, *Digital Water* which highlights the importance of digital water. We need to pay attention to this in New Zealand.

The afternoon saw a presentation about the treatment of micro pollutants (pharmaceuticals, detergents, pesticides etc.) in Switzerland. A reported decline in fish health and trout catch led to micro pollutants in wastewater being identified as one of a number of factors affecting waterway health.

A legislative change required wastewater treatment systems to install treatment processes to remove micro-pollutants. Treatment processes include carbon treatment (PAC or GAC), ozonation followed by sand filtration or a mix of both.

The next presentation was about research from Delph University in the Netherlands into treatment systems for arsenic contamination of ground water. Many people die in Bangladesh due to naturally-occurring high levels of arsenic in ground water. Doris van Halem, Associate Professor in drinking water treatment, working in Bangladesh with her students had developed a simple novel process which uses the iron and manganese in groundwater to remove the arsenic.

The method could be applied at a household level. The challenge made to her students was to use the new process in a household level system, using local materials and expertise and at a cost of no more than one euro.

What's big in Europe and what are they concerned about?

Micro-plastics and micro contaminants in wastewater are big issues and are of considerable concern.

As noted in the plenary sessions, micro plastics are sites for adsorption for a range of compounds, including, research showed, antibiotic-resistant bacterial genes. More than one presenter was concerned that those gene sequences were then available to combine with other bacteria, increasing the risk of further development of antibiotic resistant species.

One researcher showed results which indicated that bacteria with antibiotic resistance genes were more difficult to kill or inactivate using conventional disinfection processes than non-antibiotic-resistant bacteria and the resistance genes themselves were harder to destroy. In fact the role of wastewater treatment systems in microbial antibiotic resistance was an issue that came up regularly.

Many of the technical presentations presented research about techniques for the removal of emerging contaminants from wastewater, including bio-oxidation with white rot fungi, PS-oxidation-assisted membrane distillation processes, adsorption processes which were combined with electrolysis processes, biologically active carbon filtration and advanced oxidation.

The control of micro contaminants in drinking water was another big theme and a number of presentations covered research and technologies to remove these compounds from source waters as a part of water treatment.

These included advanced oxidation and LED UV systems, ceramic membranes treated with substances to oxidise micro-contaminants and ozonation processes.

Similarly, toxins in source waters remain a concern and I attended a very interesting presentation on the successful piloting of a MBBR process used at the head of a conventional water treatment plant to remove MIB and geosmin. Interesting because it was an adaptation of wastewater technology to solve a drinking water supply problem.

PFAS and PFOS are of course a global concern and removal systems were presented, mostly through adsorption but also there was an interesting presentation on methods for continuous monitoring for PFAS/PFOS. The EU has released draft MAVs for PFAS/PFOS in drinking water and Italy is about to adopt MAVs that are even more strict than the EU levels. Our country seems well behind on this.

Technological advances in desalination technology were a hot topic and a morning of the water stream was devoted to it. I didn't attend that stream as it doesn't seem relevant to us.

Nutrient removal is big and the wastewater stream devoted a day to this.

Dissolved organic carbon was a big theme and methods for its removal received a lot of attention. Clearly it is relevant to DBP formation and important to the last day water stream that was devoted to novel disinfection techniques.

The science of engineering biology and its value to our understanding and development of wastewater slime organisms and matrices got a lot of attention and appeared to be the focus of much research, due to the potential that our understanding of these biological processes has to improve wastewater treatment.

Energy efficiency and resource recovery in wastewater was a half day stream that I didn't get to, but apparently Scottish water produces 200 percent of its energy needs and powers its vehicles on waste-generated gas.

Digital water is huge. It is considered that other sectors like telecoms are far ahead of water and wastewater in this area and have benefitted enormously from having an understanding of how to leverage digital systems to improve their customer services. It is seen as an area with similar potential for water and wastewater customers, not without risks, but something we must understand and embrace.

Finally, there was an interesting presentation from a representative of NASA who outlined the water recycling systems used in space and the development of water recycling systems for use in base stations on the Moon and Mars.

So what are the big things we in the water and wastewater industry here need to get our heads around if we are to keep up with the rest of the affluent developed world?

- Digital water. It's going to be huge in the future and it's where water suppliers can find significant efficiencies and improve customer outcomes.
- Micro-plastics and micro-contaminants in wastewater. A growing problem with a growing level of risk.
- Emerging contaminants in drinking water. Our growing knowledge of this and public concern will mean we can no longer ignore it.
- Energy efficiency and energy recovery from wastewater. In an increasingly energy and sustainability conscious world it will make simple sense.

But the one thing that struck me more than anything about this conference was the amount of research that is being done on water and wastewater in Europe. And the way it is being done. The water suppliers are large enough to fund significant collaboration between themselves, universities and private companies.

They fully fund doctorate students. It is producing new ideas, new ways of doing things, new products and improvements to drinking water and wastewater quality.

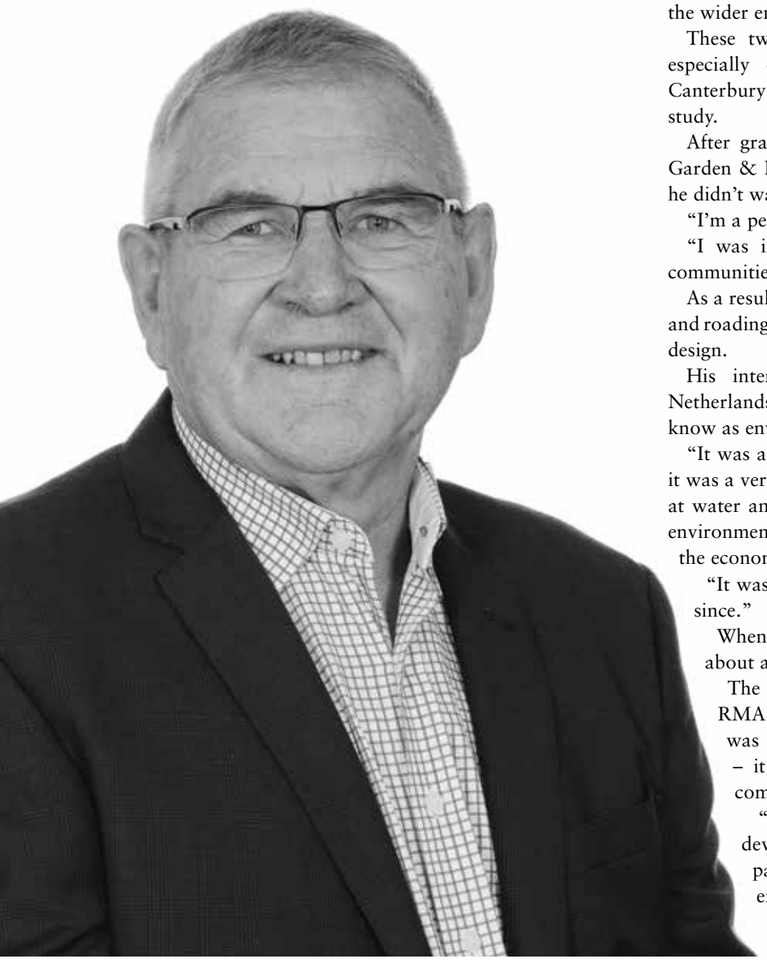
It is just so different to New Zealand where a small number of institutes or organisations are working mostly alone and where universities are undertaking very little research into water/wastewater treatment.

We could keep things the way they are and take the position of being early adopters of others' ideas and research.

Or, do we need to have a rethink of water and wastewater research? Maybe, at a time when our industry is undergoing considerable change and reform, it's also time to involve universities, research agencies and others in reconsidering how we go about water and wastewater research. **WNZ**

A sustainable career

Ahead of his time for many years, Jim Bradley's views on sustainable development, optimising technology and the environment to achieve the best outcome for nature and the community are finally becoming more mainstream. By **Mary Searle Bell.**



As a boy, Jim Bradley was always interested in building things, "I came from a practical family," he says.

In his teens Jim worked as a musterer in the hills of Canterbury, and there he learned about and gained a love of the wider environment.

These two factors together began to steer a course, especially once he started his engineering degree at Canterbury University – influencing the papers he chose to study.

After graduating he started work with consultants ER Garden & Partners in Dunedin and pretty quickly learned he didn't want to be a structural engineer.

"I'm a people person.

"I was interested in the environment, in people and communities."

As a result he soon became involved in water, earthworks and roading projects rather than highly technical engineering design.

His interest in the environment lead him to the Netherlands, where he spent a year studying what we now know as environmental engineering.

"It was an international course in sanitary engineering – it was a very practical course with lots of field trips to look at water and sewage plants and their interaction with the environment. We looked at the science, the planning and the economics.

"It was a damn good basis for a lot of work I've done since."

When he returned home he began writing papers about a new term called 'environmental engineering'.

The world started to catch up, and in 1991, the RMA first included a definition of environment that was much wider than just the natural environment – it included the built environment, people, and communities.

"As a young engineer, I watched with interest the development of sustainability in engineering. I was particularly inspired by the work of [engineer and environmentalist] David Thom and others for their whole new approach to engineering."

Jim is in the rare position of having worked for the same firm his entire career, although the firm he joined has developed over time into what is now Stantec New Zealand. Next year Jim will celebrate his 50th anniversary of joining the team and has nothing but praise for his employers and colleagues over the years.

"The highlight of my career has been being able to develop as I have, working in partnership with the firm. They have allowed me the chance to go the extra mile, to develop new ideas, and develop people, to present papers around the world, and to get involved with the industry both nationally and internationally.

"It's thanks to them I've been able to go for it – they've given me both the opportunity and the support – and it has resulted in a few accolades for me along the way. It's not what I set out to do, but it is nice to have my efforts recognised."

Amongst the various gongs Jim has collected, he's most proud of being the inaugural winner of the William Pickering Award for Engineering Leadership in 2005.

"It came out of the blue, and I was amazed to be selected from some very distinguished engineers. The award also credits the people who've worked with me along my journey."

That 50-year journey has been interesting and varied. We asked Jim to name just a few stand-out projects from among the many he has been involved in.

"In 1994 I was involved in the first environmental audit of New Zealand's Antarctic programme. It was a tall order at the time, as legislation for protecting the Antarctic environment was still being developed. We did an assessment of a number of activities there, particularly waste management and fuel handling, and their impact on the environment. On top of that, sleeping in a snow cave on the slopes of Mt Erebus gave pause for reflection.

"Another was the Life After Waste project for the Waste Management Institute in 2001. I was engaged to go around the country, interviewing various people and organisations across the board about waste and what they thought we could be doing and how we could change. It wasn't engineering, it was basically near psychology.

"It was a national campaign and the results were presented to local and central government. Unfortunately, it was before its time and didn't get over the line.

"However, it was interesting to see that people who lived and worked close to nature had a much better understanding and ethic around waste than some of their urban counterparts."

The Hastings Wastewater Treatment Plant and ocean discharge also makes Jim's top three projects. He describes it as an amazing journey with Maori that resulted in a plant designed to meet their cultural values along with the necessary technical requirements.

"This project was a paradigm shift," says Jim. "It was a partnership between the local iwi, the council, and the project team. And the outcome has stood the test of time.

"The Maori world view is all about holistic approaches that are in harmony with nature and human nature. Likewise, good environmental engineering requires us to balance our human needs and actions with those of the natural and built environment."

Jim's passion for sustainable development and clean technology has inspired many fellow engineers around the world. He has written numerous papers on environmental engineering, and he's still just as passionate as when he first began.

He has also contributed significantly to the industry, giving his time, energy and expertise to advisory groups, technical committees and working groups. Of note is his involvement in the development of New Zealand's first waste strategy, ensuring it was all-encompassing and covered all waste, not just solid waste refuse.

"I also worked with Dr Morgan William, the former Parliamentary Commissioner for the Environment, on a more sustainable approach to urban development for water and waste. We looked at ecosystem services – what our environment can do to naturally treat our waste – and how we should value this instead of destroying it."

He's encouraged by the shift over the years to a more environmental approach, one with effects-driven solutions, but he believes we still can do better, particularly when it comes to integrating natural waters with built waters.

"We all have a duty to be good local stewards of the environments of our planet. I'm committed to working with others and to keep on learning." **WNZ**

Chlorine-free drinking water

how might that be done?

Water New Zealand's Principal Advisor Water Quality, **Jim Graham**, travelled to the Netherlands and Denmark to find out about chlorine-free drinking water supplies.

UV disinfection is sometimes used as an alternative to chlorine disinfection. Photo: Queenstown Lakes District Council.

It must be possible to operate safe drinking water supplies without the use of chlorine because they do this in other countries including the Netherlands and Denmark. But how do they do it and would it be possible in New Zealand?

The Havelock North Inquiry recommended that all water supplies are treated, including with a residual disinfectant, except in exceptional circumstances. The Government is likely to adopt this recommendation, but what might those exceptional circumstances be?

In June I travelled to Europe to speak with Marco Dignam, researcher at Waternet in Amsterdam, Netherlands, Lars Holmegaard, director of Lemvig water supply, Denmark and Henrik Bjorn, associate professor at VIA University College in Arhuss, Denmark.

The Netherlands

First up, the Netherlands doesn't provide a good comparison for our country. The geology, and hence water quality, is different, as are their motivations for not using chlorine. There are 10 water supply organisations in the Netherlands, They are publicly owned and structured on a corporate model. All connections are metered and all consumers pay volumetric charges.

The Netherlands is built on sand, clay and peat and it is small and flat. They stopped using chlorine to disinfect their water supplies due to concern in the 1970s about research which linked chlorine disinfection by-products to increased cancer risk. But while chlorine is not used, drinking water is comprehensively treated, including with disinfection, before being distributed.

Waternet operates the Amsterdam supply. They are a large organisation responsible for drinking water, sewerage, storm water, groundwater and nautical waterway control. Another part of Waternet is responsible for flood protection, water level management, surface water quality control and wastewater treatment.

They have 1.2 million customers and cover 20 municipalities, employ 1770 people and have an annual budget of €383 million ($660 million).

They operate two water treatment plants, providing 90 million m^3/yr via 3100 kilometres of pipes. Every property in their area is connected to their supply and they have a leakage rate of 2-3 percent in their network. All properties are also connected to their wastewater system and they operate 12 wastewater plants with 4200 kilometres of wastewater reticulation. Consumers pay €1.55/cubic metre for drinking water, about $2.70/$m^3$.

The Amsterdam supply highlights the differences to our drinking water supplies. Water is abstracted from two sources, river water from a branch of the Rhine and seepage water from a polder.

QMRA (Quantitative microbial risk assessment) is used to identify the risk of pathogens in source waters and multi-barrier approaches are used to eliminate them. The river water is abstracted and treated with coagulation and sand filtration processes before being conveyed a significant distance to sand dunes on the coast near to Amsterdam.

The water is run into ditches in the sand dunes so that it infiltrates through the sand, a natural filtration process. It is collected from underneath the sand dunes and undergoes further rapid sand filtration, ozonation, softening and carbon filtration before it is passed through slow sand filters. It is then distributed to the consumers of Amsterdam.

A polder is a low point, enclosed by embankments into which water seeps from the surrounding country and nearby lakes. Polder water has a coagulant added to it before it is stored in a lake. It then undergoes sand filtration, ozonation, softening, carbon filtration and slow sand filtration before being distributed.

Similar processes are used in other cities like Rotterdam but in the east, water suppliers use groundwater and treat it with aeration and filtration to remove oxidised iron and manganese. Groundwater is not usually disinfected but surface waters are, generally with ozone, UV, peroxide or chlorine dioxide.

Considerable research is funded by the water suppliers. A research group called KWR undertakes water research on behalf of the water utilities and is funded by them. They collaborate with the universities and water suppliers in this research. Both the Amsterdam water treatment plants divert 1/200th of their flow to pilot plants that are used to test new ideas and equipment, including challenge testing with viable microbes.

Management of distribution systems is more comprehensive than here. Without a chlorine residual, it needs to be. One of the key ideas used in the Netherlands is to maintain biological stability of the water through use of carbon filtration and sand filtration.

That's not to say the water supplied to consumers does not contain bacteria, monitoring by flow cytometry shows typical cell concentrations of 10,000,000/100ml.

The pipe network in Amsterdam consists mainly of cast iron, PE and PVC. Only small amounts of AC have been used (61 kilometres, two percent of total). They have a comprehensive pipe renewal programme. Pressure differentials are monitored across the network, all connections have backflow devices including RPZs at industries.

The water is monitored at 200 routine sites and a number of random sites for *E. coli*, Enterocci, HPC and Aeromonas. A lot of effort is put into ensuring water storage and distribution is secured against contamination. But the key thing that Waternet relies on is the knowledge and hygienic awareness of people working on the system. It is considered a mistake not to report anything considered unusual. The principle of staff taking ownership. Of course chlorine is used to disinfect new pipes and when repairs are undertaken.

Denmark

Denmark provides a much better comparison to New Zealand. The geology, outwash gravels from advancing and retreating glaciers with three significant aquifers under the country, is similar to areas of New Zealand where ground water is used.

Denmark is also small and flat. Every drinking water supply in Denmark uses groundwater and the Danes have 160 years of experience in the sustainable use of ground water for that purpose. They have never used chlorine because they do not consider it necessary.

But that is not to say the water is not treated. Aeration and sand filtration is used to remove iron, manganese and ammonia. UV disinfection is used temporarily in some places if the bacterial quality of water is compromised, but this rarely occurs.

Denmark is also similar to us in having a relatively large number of small water and wastewater utilities. They are owned by the municipalities, but have corporate governance structures and are operated as though they were private companies.

The Lemvig supply for example has a board appointed by the municipality which can include up to two consumer representatives. There are about 100 municipal owned water utilities like Lemvig in Denmark and a further 2400 community supplies, some quite large that are owned and run by the community.

There has been some voluntary aggregation of smaller water supplies in recent years. In 2010 a law was passed that removed direct operation and control of water and wastewater utilities from local authorities.

All water supply costs are recovered from consumers with mandatory water metering and volumetric charging. Domestic consumers pay the equivalent of NZ$ 3.20/m^3.

Some commercial businesses pay less as water suppliers seek to provide incentives to locate in their region. Half of the fee is a tax which the water suppliers collect on behalf of the Government. It is used to fund national initiatives considered necessary to understand and protect the groundwater source.

The universities, research groups and water suppliers work collaboratively to undertake the research they see as necessary to support the way they do things.

There are two key approaches which make chlorine-free water supplies possible in Denmark. The first is source water research and protection.

They have a national database of all groundwater bores with data back to 1818. Three hundred thousand bores are registered into the database and instant access to all information is available, including to the public. Bores are sampled and tested either

annually or biannually for a range of parameters. Additionally the Danes have comprehensively mapped and modelled all of their groundwater and designated groundwater protection areas. They have comprehensive action plans for groundwater protection which allows them to undertake comprehensive groundwater management and informs decisions about where bores can be placed and how much water can be abstracted. These programmes are funded by the national water tax collected by the water suppliers.

The second key approach is careful management of the distribution networks. Every connection has a backflow device, double check valves at domestic premises and RPZs at commercial premises. Testable devices are tested at least annually. Water losses are around 5-6 percent and if losses exceed 10 percent water suppliers are fined by the regulator.

In addition to the usual water quality monitoring, water suppliers undertake considerable flow, pressure and temperature monitoring. In Lemvig, all dead ends have been removed and the network is configured with ring mains, an arrangement called looping.

The network is divided into relatively small zones or district metered areas (DMA), which have a single supply point with flow and pressure monitoring. They constantly monitor usage and leakage by comparing DMA supply point volumes against aggregated household volumes. All data is databased and analysed so that a clear picture of network performance is provided.

But probably the biggest difference in both the Netherlands and Denmark is attitude. The Dutch don't want to use chlorine because they perceive it to be associated with health risks. But they know that means operating their systems in a particular way to minimise microbial contamination.

The Danes have high quality groundwater and don't use chlorine because they don't consider it to be needed. They take the approach of *find it clean, keep it clean, distribute it clean*. It seems to work for them.

And these approaches are supported by the public. The public values chlorine-free water and are prepared to pay for it. They understand that it costs a lot and requires comprehensive national programmes and approaches. It was explained to me that the Dutch and Danes have a high level of trust in their Governments, local and central.

They accept the ideas of metering, charging and paying because they place a high value on their drinking water quality. They see the importance of research because they realise it is necessary to maintain and improve the systems they prefer.

New Zealand

So what might those exceptions to treatment and residual disinfected water supplies look like in a newly drinking water regulated New Zealand? I think Denmark provides us with the best model.

Generally our groundwaters are of high quality, if not without risk and we have a good understanding of our groundwater resources based on the research undertaken by Regional Councils, ESR and NIWA. Maybe we need better funding models for that work and a more nationally coordinated approach.

We would need to do a lot more work on source protection, probably along the lines of what Tonkin & Taylor has done with Hastings District Council for the Heretaunga aquifer, but it would need to be nationally consistent. It seems certain that a new regulator will require comprehensive source water assessments along the lines of GARP (groundwater assessment of risk of pathogens) as done in British Columbia. QMRA would be another option, but I'm not sure that lumping these new requirements onto the many water suppliers is the best way to go about this.

It's probably time for us to be thinking about a national water research unit, along the lines of what is done in the Netherlands and Denmark.

Our approach to distribution networks would need considerable change if we are to have non-chlorinated supplies. There is an AWWA (American Water Works Association) standard for the protection of water quality in distribution systems (G200) which doesn't assume that a chlorine residual is required.

Compliance with that standard would be a good starting point.

Following the Dutch and Danish models would require the installation of backflow devices at every connection and a comprehensive, at least annual testing programme. Considerably more monitoring of pressure and flow and the reconfiguring of networks so that calculations can easily be made of water use and water loss. Networks would need to be modelled and big data would be required to continually monitor network performance.

Network water loss would need to be reduced to five percent or less, requiring considerable, expensive upgrading. These things are just the beginning.

But the major change required would be attitudinal, both amongst water suppliers and consumers. Because the costs of providing water supplies like this is high. Consumers would need to place a very high value on non-chlorinated water supplies and they would probably need to fund the necessary research.

The Dutch and Danes charge $3/m^3 because they have been operating supplies in this way for some time. Retro-fitting is expensive and my guess is that consumers could be expected to pay more than that. It goes without saying that universal metering and volumetric charging would be essential.

Both the Dutch and Danes said that corporatised water entities, large or small, were essential because decision making needs to be independent of other municipal activities. Decision makers need specific water supply knowledge and water funding should not be competing with other projects.

One of the keys to achieving any of the above would be undertaking research to develop a greater understanding of water and wastewater systems, the people who use them and the environments in which they are placed.

Chlorinated supplies or not, future decisions about our water and wastewater need to be informed by coordinated New Zealand-centred research. A uniquely New Zealand water and wastewater research centre would be a great outcome of the current three waters review.

And then there is the question of fluoride. The Dutch and Danes don't fluoridate their water supplies. But that's another story. **WNZ**

• *Water New Zealand would like to thank Koen Overkamp and Sarah Lund for organising meetings in The Netherlands and Denmark.*

A framework for community engagement over biosolid reuse

Supplied by the Centre for Integrated Biowaste Research (CIBR) and Lowe Environmental Impact.

Waste management recognises the importance of 'public acceptance' in the management of contentious wastes such as biosolids, but has focused on public 'education', rather than public involvement in the decision-making.

So how do you involve the community in decision-making without opening the proverbial can of worms?

Figures suggest that over 60 percent of the 70,000 dry tonnes of biosolids produced in our country each year is disposed of in landfills (ANZBP, 2015). While landfilling of biosolids is the chosen option for many local authorities, anecdotal evidence suggests this is due to perceived and real uncertainties around alternative re-use options.

In principle, community preference is often for beneficial re-use of biosolids, and both biophysical and social/cultural science research supports beneficial re-use scenarios.

Yet challenges persist in uncertainty around the fate and effects of some of the contaminants that biosolids contain, as well as specific cultural concerns for some in the Maori community.

While some concerns can be mitigated with guidelines and careful practice, community and cultural concerns remain an uncertain factor for many councils and operators in looking for viable re-use solutions.

Community engagement is the social interaction whereby, in this instance, a waste generator, consults with members of their community about options for waste management.

There are a variety of interactive engagement methods such as one-way communication or the provision of information, through to consultation, collaboration in decision-making, and empowerment (The International Association of Public Participation (IAP2) www.iap2.org.

Communities can, through engagement, assist waste generators and regulators to make better, more sustainable decisions for the re-use of biosolids that benefit the community whilst ensuring social, cultural, environmental and economic values are enhanced.

Community engagement often focuses on public 'education', rather than involvement in decision-making.

This is often based on assumptions that more 'technical' information will change people's values and viewpoints (Goven and Langer, 2009).

However, more education and information are not always effective or necessarily relevant. There is increasing recognition in the sector that the 'technical' expert estimations of 'actual (technical) risk' can marginalise other factors important to how individuals and communities may see risk.

If communities and 'technical' experts can better appreciate each other's understandings of 'risk', there is more likelihood of developing viable options for sustainable re-use.

The topic of biosolids conveys specific risk characteristics, sometimes called 'outrage' factors (Sandman, 1995). These include being involuntary (out of people's control for example); not reversible (eg persistent pollutants are permanent additions to soils); unknowable (such as difficulties of identifying fate/effects of waste components in particular environments); or having delayed effects.

Some effects from the waste may not be evident immediately and may affect future generations. As well, important cultural factors can impact upon people's willingness to consider re-use options.

Both the Resource Management Act (1991) and the Local Government Act (2002) recommend stakeholder and wider community consultation when making decisions on behalf of the community. This is especially so where there is the potential for the rate-paying public to be exposed to any liability for costs relating to those decisions.

In practice, community engagement can be risky as there are often significant existing infrastructural investments and there is a fear of this infrastructure being made redundant.

This means engagement is often heavily driven by technical criteria where there is certainty and a limited range of options are presented that are deemed to be technically feasible.

Managing the use of existing infrastructure and technical constraints often put council staff in the position of 'informing and educating', and often about a select and limited number of outcomes. There is also a fear that the involvement of the community in biosolids management decisions may unrealistically raise community expectations, and may expose such diverse views that a decision is unable to be made.

As a result, the beneficial re-use of biosolids is all too often placed in the 'too-hard basket' and a valuable resource is landfilled.

There are real benefits to involving the community in your decision-making. Community input can improve the quality of policy being developed, making it more practical and relevant.

The team behind *A practical guide to community engagement for the beneficial re-use of biosolids* (from left): Alan Leckie (Scion); Lisa Langer (Scion); Jamie Ataria (Cawthron); Jacqui Horswell (Massey University and Lowe Environmental Impact); and Jinny Baker (ESR).

It can ensure that services are delivered in a more effective and efficient way for that community and can result in cost and time savings by addressing community issues early in the decision-making process. It can also identify new and innovative solutions that may be a break from traditional methods of waste management.

So how do you go about community engagement? What works and what doesn't?

Research shows that involving the community is best when an issue is live, but not at a crisis point or *fait accompli*. It is best to get to know the local community, build relationships and explore options in advance of engaging communities in decision-making.

Identifying and building relationships with key stakeholders (for example all affected people, environmental groups, local businesses) early on, to signal a commitment to include community inputs and provide a transparent process for feedback, has proven to be beneficial.

Merely 'communicating' or 'educating' in a one-way process, does not encourage constructive community engagement and is unlikely to be successful or result in sustainable solutions.

There are many ways to approach community engagement.

Researchers in the Centre for Integrated Biowaste Research (CIBR) (Goven et al., 2012; 2015) together with Lowe Environmental Impact (LEI), have worked with community groups, iwi, regulators and industry stakeholders to derive a

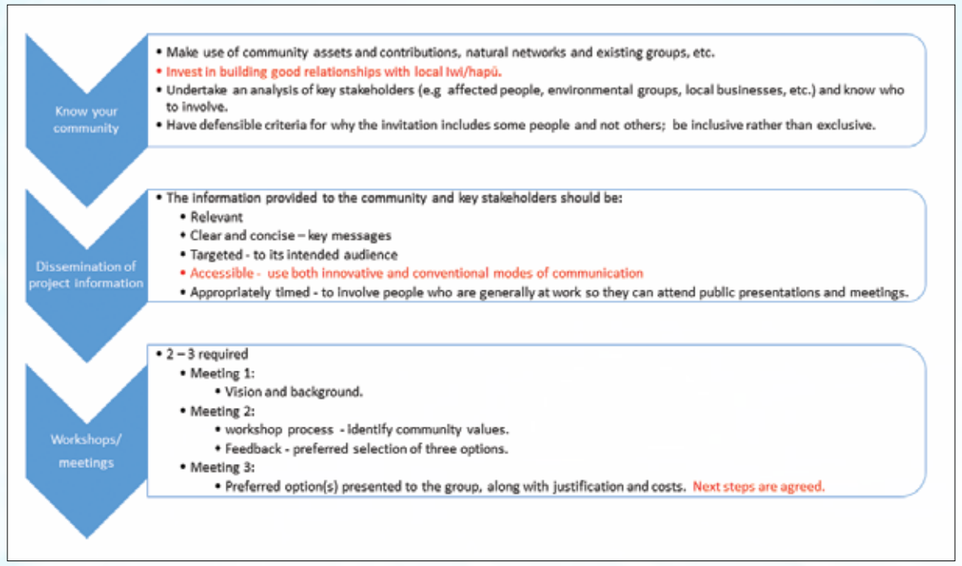


Figure 1: The CIBR/LEI framework – A step-by-step pathway. A step-by-step pathway is used for community engagement that can aid the development of good working relationships with the community.

framework that is fit for purposes and meets the requirements of the Resource Management Act, and Local Government Act.

The framework uses a quadruple bottom line (QBL) approach to decision-making where environmental, social, economic and cultural factors are thoroughly considered in advance of options being developed.

The QBL decision criteria process helps provide a structured way to identify key community concerns and priorities to ensure that any decision is based on technical and community criteria and predetermination of a preferred option is avoided.

The QBL process is ideally facilitated by interactive stakeholder workshops, hui or public meetings. These community meetings provide the mechanism that allows regulators, technicians, engineers, council staff, elected members and community members to identify the key 'community' values that a 'technical' solution will need to align with, as well as to elicit relevant knowledge from the community.

Importantly, the process helps build shared understanding between different stakeholders, strengthens council and community relationships, builds greater trust and confidence in the decision-making process and is showing improved support from communities.

Grounding principles

The CIBR/LEI community engagement framework is underpinned by seven grounding principles. These are:

- Early. Engage the community as soon as possible when there is still the flexibility to make changes to address issues raised by interested and affected people. Early consultation is likely to be more successful than consultation within a crisis. However, if community engagement for decision-making is too far in advance, it is likely that few will be interested. If consultation is left too late, people will think engagement on the issue is being avoided or there is no intention of taking their views into account;
- Transparent. Be open about what the project wants to achieve, what scope there is within the project to change certain aspects of the proposal, and why there might be elements that may not be able to change;
- Open mind. Keep views open to the responses people make and any benefits that might arise from consultation;
- Two-way process. Consultation with the engaged community is intended as an exchange of information and requires both the project team and those consulted to put forward their points of view and to listen to and consider other perspectives;
- Not a means to an end. While community engagement is not an open-ended, never-ending process, it should not be seen merely as an item on a list of things to do that should be crossed off as soon as possible;
- On-going. It may be that consultation, or at least communication, will continue after a decision has been made; and
- Agreement not necessary. Consultation does not mean that all parties have to agree to a proposal, although it is expected that all parties will make a genuine effort. While agreement may not be reached on all issues, points of difference may become clearer or more specific.

In conclusion, community engagement can be difficult and risky; but equally it is difficult and risky not to engage. Management of waste and wastewater can be high cost and high risk and strongly determined by technical criteria and constraints.

There is a need for solutions that recognise complex social and environmental relationships, and for ongoing monitoring that better factors uncertainties and concerns about the latent and cumulative environmental effects that may occur at catchment or regional scale.

The CIBR/LEI community engagement framework was funded by The Ministry for Business Innovation and Employment under ESR Core Funding Programme and is freely available at the following website: www. cibr.org.nz. For more information please contact: Virgina.baker@esr.cri.nz. WNZ

What lies beneath – identifying contamination

Our country has a lasting legacy of soil contamination, stemming from a variety of historical, and not so historical, land use practices. **Tyler Neve,** senior environmental scientist at Beca, explains how sites are recognised.

Legislation was enacted in January 2012 detailing how district and city councils should address the human health risks posed by potentially contaminated soils and this was when the *National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* (NESCS) came into effect.

The objective of the NESCS is to ensure that any land potentially affected by contaminants is appropriately identified and managed, particularly when the land is to be developed. The NESCS sets out an approach to achieve this – the first step being to determine whether or not the land has the potential to be contaminated by identifying historical uses of the site.

Preliminary site investigations

To gain an idea of past and current land uses, a desk-based information review is typically undertaken by a contaminated land specialist.

This Preliminary Site Investigation (or PSI) is a review of information sources such as historical aerial photography, records of previous land ownership, the knowledge of past landowners and information held by Councils.

A good PSI will tell the story of a site's history and along the way identify current or historical land uses that could potentially impact on the contamination status of the soil.

In New Zealand, land uses with the potential to contaminate soil are documented on the *Hazardous Activities and Industries List* (HAIL). The HAIL is a list of 53 activities and industries compiled by the Ministry for the Environment, which are considered likely to result in land contamination.

There are five 'trigger activities' that, if undertaken on land identified as contaminated by activities and industries listed on the HAIL, or with the potential to be contaminated, will result in the NESCS being applied. These triggers are; subdivision, change of land use, soil disturbance, removal of fuel systems, and soil sampling.

Therefore, for the regulations of the NESCS to apply to a piece of land, two checks are required. Specifically: Has a HAIL activity occurred on site and is a trigger activity proposed?

Each of these 'trigger activities' (eg soil disturbance) have a set of criteria that, if complied with, mean the activity can proceed as a 'permitted activity' without a resource consent under the NESCS. However, should the proposed works not be able to comply with the criteria, then a land use consent, under the NESCS, would be required from the territorial authority.

As part of a PSI, an assessment against the permitted activity criteria is usually undertaken to indicate the potential contaminated land consenting requirements.

It is important to note that a PSI cannot be undertaken by just anybody. The NESCS requires that this assessment be undertaken by a suitably qualified environmental practitioner (SQEP). If potentially contaminative activities are identified during the PSI it is likely that further investigation would be recommended to confirm any NESCS requirements.

Detailed site investigations and risk assessment

Further assessment would likely come in the form of a Detailed Site Investigation (DSI). A DSI typically comprises soil sampling and, in some cases, groundwater and/or soil vapour sampling (dependent on the historic land uses identified during the PSI phase).

Additionally, contaminants of concern will change across different sites, as these are determined based on previous land uses.

Aerial photographs of Te Maunga Te Maunga Wastewater Treatment Plant site

1977

2003

2016

PHOTOS COURTESY OF TAURANGA CITY COUNCIL AND LINZ.

2019: Aerial photograph and drone photo (right) of Te Maunga Te Maunga Wastewater Treatment Plant site.

PHOTOS COURTESY OF TAURANGA CITY COUNCIL AND LINZ.

For example, contaminants of concern associated with a wastewater treatment plant may include *Escherichia coli* (*E. coli*) and Ammonium-N in widespread areas. However, sites such as these would also likely contain local hotspot sources of contamination, such as petroleum hydrocarbons in areas used for fuel storage.

The results from a DSI inform a risk assessment, which allows the SQEP to consider any potential implications that the development may have.

This risk assessment will take into account the surrounding environment, any health and safety impacts on those involved with the proposed development, and also potential health impacts associated with the proposed land use.

The DSI will also consider whether or not further investigation or monitoring is required to further inform the risk assessment, and whether or not management and/or remediation of the land is necessary.

Further to the risk assessment and any recommendations regarding site management or remediation, a DSI also informs the level of consent required under the NESCS for any proposed development or activity; controlled, restricted discretionary, and full discretionary.

For example, one of the 53 activities/industries listed on the HAIL is *'waste recycling or waste or wastewater treatment'*. Therefore, any wastewater treatment plant (WWTP) site that exceeds permitted criteria, which commonly involves soil disturbance, would require further assessment under the NESCS.

Requirement to observe and enforce the NESCS

All of our district and city councils are required to observe and enforce the requirements of the NESCS.

Most councils maintain a contaminated sites database for just this reason; to aid in tracking past use of potentially hazardous chemicals in industry, agriculture and horticulture. It perhaps goes without saying that such contamination is a greater problem in environments where food is grown or in close proximity to buildings, people, waterways and significant habitats.

With the NESCS providing a standardised and consistent framework for planning and decision-making, it is important district and city councils are aware of their obligations, and follow best practice to keep our people, communities, workplaces and environments safe and protected.

Case study: Te Maunga WTP

Work undertaken for the Te Maunga Wastewater Treatment Plant, owned and operated by Tauranga City Council (TCC), is an example of the NESCS process in action.

Through discussions between TCC and Beca, a decision was made for the Beca SQEP to undertake a PSI of the wider Te Maunga industrial area, not just of the localised WWTP site. This investigation identified potential areas requiring further assessment under the NESCS, as well as those that did not.

This broader approach was recommended because development of larger areas, such as Te Maunga, often occurs in stages. This can lead to multiple assessments and multiple consents over time, so a single assessment upfront was proposed to save time and ratepayer money later.

Due to the early involvement of the Beca SQEP, when current and future works are proposed in areas where HAIL activities have occurred, Beca will undertake a project-specific DSI. These DSIs characterise potential risks involved with the development, and are used to identify and mitigate any potential future impact on site users.

Laboratory results from the DSIs will also assist in determining specific consenting requirements, both under the NESCS, and under any contaminated land use rules in the Bay of Plenty Regional Natural Resources Plan. These analytical results also inform what level of management may be required for the handling and transport of soils.

Additionally, the testing of the soil assesses its suitability for re-use, rather than being disposed of to a landfill. Reuse is preferable if test results allow, as disposal to landfill takes up valuable space, involves costly haulage and disposal fees, and is overall less environmentally and financially sustainable.

Should material be determined as suitable for reuse, then it is typically transferred to the Te Maunga closed landfill, located within the Te Maunga Industrial area for temporary storage. That soil is then sustainably re-used for earthworks, as part of the final landfill shaping and closure plan.

The early involvement of a SQEP is vital to sites such as the Te Maunga WWTP, to save city and district councils valuable time and money, and to ensure human and environmental health is safeguarded into the future. **WNZ**

The future of stormwater management

Quo Vadis?

The presentation of a paper at this year's Stormwater conference in Auckland included a poll of delegates who were asked to identify the most important drivers for the future of urban and transport stormwater management. By **Dr Richard Wilson**, **Dr Tim Fisher**, and **James Hughes** from Tonkin and Taylor.

The results of both the stormwater conference paper and the poll provides insights for the drivers of our future stormwater management.

How will changing transport preferences and other drivers influence our urban environment, and what will these changes mean for our stormwater infrastructure?

These are profound questions in the context of our fast-changing environment; they're also pertinent given the growing imperative for future-proof infrastructure. And yet, to date these questions have been barely considered.

While a MOT study (i) explored the country's future transport habits, and industry outlook reports investigated future energy supply/demand scenarios (ii) and future clean energy/transport (iii), the impact of these drivers on stormwater management continues to loom large – and be difficult to predict.

Dr Richard Wilson, Dr Tim Fisher and James Hughes started a dialogue amongst the wider stormwater profession by exploring the most important drivers for future stormwater management of New Zealand's transport and urban environments, in their technical paper presented at Stormwater 2019: Next Generation (iv).

The authors used their collective expertise in water engineering, stormwater infrastructure, resilience and climate change, via policy, planning and design, to investigate the underlying drivers for change and to consider the impact on stormwater quality and quantity. They also considered the timing of drivers and aspects of future-proof management.

To predict the effects of future transport environment on stormwater management, they adopted six driver categories – Political, Economic, Social, Technological, Environmental and Legal. Acknowledging a degree of interdependence exists between drivers, they assessed the impact and timing of each driver for stormwater management (see figure 1).

Drivers for change

Political and regulatory drivers reflect increased environmental regulation as a result of new policies, environmental degradation, international agreements and the like. The most important drivers were identified as increased environmental regulation such as the 2017 National Policy Statement for Freshwater Management, Auckland's Unitary Plan and the Zero Carbon Bill. The authors also comment on the regulation of copper in brake pads in other countries and the use of alternative technologies that will likely influence the supply chains for vehicles and brake parts here.

Economic drivers include our projected population growth which is expected to rise to 5.9 million by 2043. This will invariably lead to increased urban densification with more impervious surfaces in urban areas and a heightened need for additional transport infrastructure, i.e. more runoff and contaminant loads.

At the same time, the total economic value (TEV) of the environment will become more important in decision making. In other words, good environmental outcomes and green infrastructure (such as wetlands, raingardens and bioretention swales) will be valued more highly and be more strongly weighted in decision-making.

The rapidly aging population and the trend towards increased use of public transport counts among the social

Dr Richard Wilson (above left), Dr Tim Fisher (above) and James Hughes (below left) started a dialogue amongst the wider stormwater profession by exploring the most important drivers for future stormwater management of New Zealand's transport and urban environments, in their technical paper presented at Stormwater 2019: Next Generation (iv).

drivers. Add the steadily increasing number of cycle trips, the shift towards active transport, personal micro transport solutions and ride sharing, and the stormwater implications become positive. The upshot is a reduction in runoff contaminants and less need to increase impervious areas on arterial routes.

Potential for disruption also comes by way of **technological drivers.**

This includes the number of electric vehicles which are expected to represent 85 percent of the national fleet by 2050 (currently it is three percent – Ed) with a corresponding reduction in hydrocarbon contaminants. Similarly, the use of personal micro-transport devices (electric bicycles, scooters, and the like) is expected to increase. However, this trend would also necessitate micro-transport infrastructure which, in turn, may increase impervious surfaces. The authors also consider the impact of other technologies including vehicle automation, smart systems and the Internet of Things.

Last but not least, the **environmental and climate change drivers** present numerous drivers. From increases in peak rainfall intensities, with accordant negative effects on existing stormwater infrastructure, to increasing severity of droughts with implications for added stress on water-sensitive treatment devices. Keep in mind that a 0.5-metre sea level rise negatively impacts three-waters infrastructure, that has an estimated replacement value of $1.4 billion (v) (a 1 metre scenario has an estimated replacement value of $2.6 billion (see figure 2).

When will these drivers impact?

In their final analysis, the authors collate the key drivers which stormwater management specialists should consider. In the immediate future they see a focus on compliance functions with stricter environmental regulation; it will improve water quality/quantity management but may be

Figure 1.

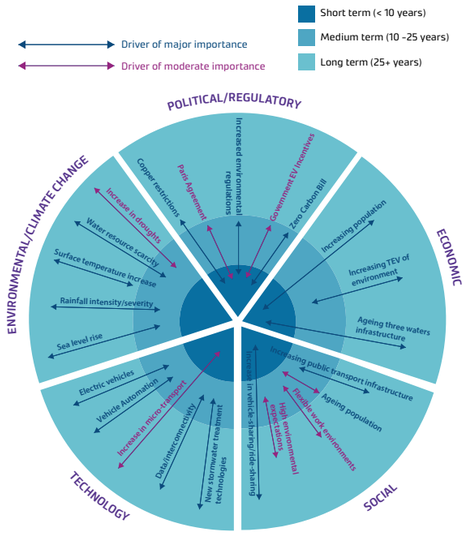


Figure 1:
Drivers for change organised by categories and with relative impact and timing.

Figure 2:
The drivers stormwater management specialists should consider now and next.

Figure 3: Conference poll results – What are the top drivers for stormwater management of transport and urban infrastructure in NZ?

Figure 2.

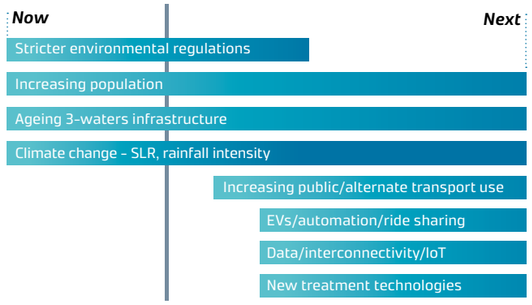
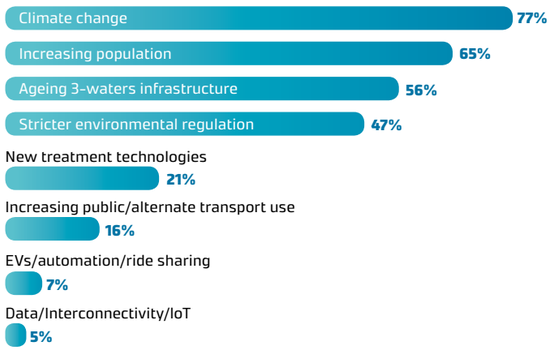


Figure 3.



difficult to achieve in practice.

Climate change has implications over all timeframes with planning starting now and impacts felt in the future. Next they envisage effects from technologies, densification and population growth with tremendous changes to transportation.

Other drivers, such as changing transport use, EVs, technologies or climate change will need to be considered for stormwater management issues with longer term ramification, while stormwater design itself will need to be better integrated within the urban design (see figure 3).

This brings us back to the conference poll.

What were the views of delegates who were asked to list their top three drivers?

Interestingly, the results confirmed that stormwater professionals were largely aligned with the authors' assessment of drivers.

Climate change headed the list (77%), followed by increasing population (65%) and ageing three-waters infrastructure (56%).

Needless to add, all these changes and their drivers are complex by nature, which makes their timing and impact difficult to predict. Despite (or perhaps because of) this, there's a growing need for enhanced co-ordination of water outcomes across all parts of the industry and disciplines.

Ultimately, the authors see it as a call to action for all participants – be it industry, local or central government. The task at hand, they suggest, is to evolve best practice and test both policy and stormwater design for different future scenarios so our investments in stormwater management are future proof or at least future-aware.

(i) Ministry of Transport (2017b) Transport Outlook: Future State. Wellington.
(ii) Transpower New Zealand Ltd (2018) Te Mauri Hiko - Energy Futures.
(iii) Engineering New Zealand (2018) Cleaner Energy.
(iv) Wilson, R., Fisher, T. and Hughes, J. (2019) *What is the future of stormwater management for transport and urban environments in New Zealand?*. Paper presented at Stormwater 2019: Mo Apopo – Stormwater: The Next Generation. Auckland, New Zealand.
(v) Simonson, T. and Hall, G. (2019) Vulnerable: the quantum of local government infrastructure exposed to sea level rise. Local Government New Zealand. **WNZ**

Recent policy developments

Water New Zealand has been involved in a number of policy areas including the Resource Management Act (RMA), the review of vocational education and with local government funding as well as the government's building system legislative reform programme.

The following provides an overview of those issues, and more, as well as our response to them.

National Planning Standards

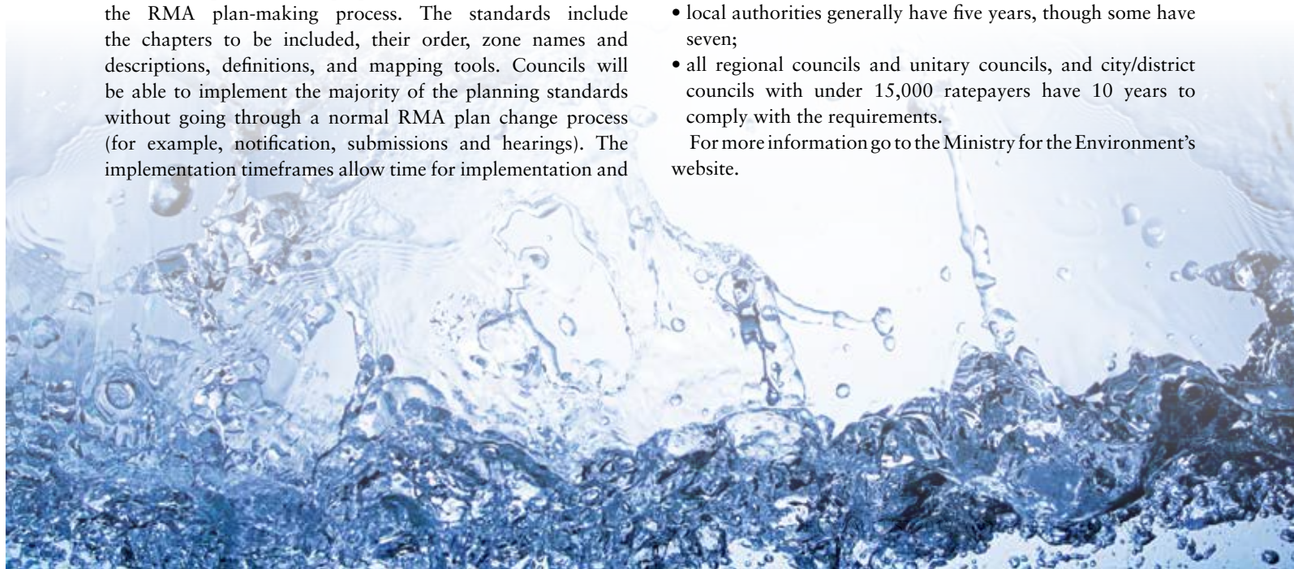
In April the Minister for the Environment released the first set of national planning standards which came into force on May 3. The planning standards are a set of national rules aimed at improving the efficiency and effectiveness of the planning system.

They are designed to make regional policy statements, regional plans, district plans and combined plans under the Resource Management Act 1991 (**RMA**) more consistent with each other, easier to use and faster to make. The first set of planning standards address the structure and form of plans, set national definitions and require plans to be accessible through an online ePlan.

The planning standards address matters that must be standardised across all plans, while enabling the detailed content of plans to be prepared and confirmed through the RMA plan-making process. The standards include the chapters to be included, their order, zone names and descriptions, definitions, and mapping tools. Councils will be able to implement the majority of the planning standards without going through a normal RMA plan change process (for example, notification, submissions and hearings). The implementation timeframes allow time for implementation and for a more nuanced approach for different councils, planning documents and standards. These include:

- all councils must meet basic electronic accessibility and functionality requirements before 3 May 2020;
- regional councils have three years to adopt the standards for their regional policy statements, 10 years for their regional plans;
- unitary councils have 10 years to adopt the planning standards; and
- city/district councils have five years to adopt the planning standards, with seven years for the definitions standard. Councils who have recently completed a plan change have seven years, and nine years for definitions;
- Different timeframes also apply for online interactive plans. These include:
- local authorities generally have five years, though some have seven;
- all regional councils and unitary councils, and city/district councils with under 15,000 ratepayers have 10 years to comply with the requirements.

For more information go to the Ministry for the Environment's website.



National Disaster Resilience Strategy

This new strategy came into effect on April 10. The Strategy, together with associated tools and resources, can be found at www.civildefence.govt.nz/national-disaster-resilience-strategy.

The Strategy has been a long time in the making – nearly four years. The strategy builds on the Government's response to the Technical Advisory Group report *Better Responses to Natural Disasters and Other Emergencies*.

Productivity Commission Investigation into Local Government Funding

Water New Zealand lodged its submission to the Commission on this review on February 11. The submission is on our website. We met with the commission to discuss our submission. The Commission received 135 submissions on their discussion paper.

The Commission released its draft report on July 4 for review and feedback by August 29. Water New Zealand will submit to that document. Their final report will go to Government by November 30. The Commission chair Murray Sherwin has agreed to attend the Water New Zealand conference in September and speak to the investigation.

Auckland Council – Our Water Our Future

Auckland Council has been undertaking consultation on the above strategy document. Water New Zealand appeared before the Committee and broadly said that while identifying a new water source for the city was important, it was likely to be seen by ratepayers as business as usual. We indicated to council that ensuring that human effluent did not discharge into the harbour was far more likely to exercise the views of ratepayers. We said the council needs a plan to fix the issue, acknowledging the excellent progress and financial commitment to date to the task at hand. See the consultation paper on the Auckland Council website.

Review of Vocational Education

The Government released a discussion paper in late February which Water New Zealand submitted on.

In relation to the water industry, the current review of vocational education reform has implications for other work that Government agencies are currently undertaking. Specifically the Three Waters Review currently led by the Department of Internal Affairs and as part of that, measures to establish a new national drinking water regulator.

Water industry education and training was identified as a significant issue in the Report of the Havelock North Drinking Water Inquiry, and has been raised as a significant issue in the Three Waters Review. There is an urgent need to resolve water industry education and training issues if some of the wider industry problems are to be addressed.

Recently the Water New Zealand Board directed the organisation to take a greater leadership role and put in place a number of initiatives to ensure the needs of water industry employers and employees are met. A key pillar of the work that Water New Zealand proposes to undertake is capability development through education and training.

Water New Zealand's submission provided comment on each of the three proposals put forward by Government, and the questions asked by the Ministry of Education in the consultation document. We were supportive of the proposed vocational education changes, as the current system has not, in our view, served the industry well.

Building System Legislative Reform Programme Discussion Document

We submitted on the above discussion document and welcomed proposed reforms to the regulation of the building system and support the removal of exemptions for plumbers and drainlayers. However, we believe that certification or licensing of safety-critical engineering work is likely to be complex to introduce and may not resolve the issues or prevent the failure that can lead to a potentially fatal accident.

The Havelock North Inquiry demonstrated that ongoing life-safety risk remains high in the ongoing operation and maintenance of systems, not just at the design, construction and installation stage. Water New Zealand's view is that all water-related work should be licensed or certified as any failure in the system can result in a significant public heath incident. **WNZ**

Drinking water issues reflected in Canadian discussion

Water New Zealand Principal Advisor Water Quality, **Jim Graham**, attended a conference in Victoria, British Columbia (BC), where he discovered that the Canadian province faces similar issues to us over the supply and safety of drinking water.

Titled *The Rise of Water*, the British Columbia Water and Wastes Association conference was largely technical with seven streams including programmes in education, climate change, wastewater treatment, municipal utility management, water distribution, water quality, source control, operations, demand management, stormwater, groundwater, small water systems, and risk management.

The conference's only keynote speaker was storm chaser and adventurer George Kourounis who described his adventures in the midst of Hurricane Katrina, the Aral Sea and in the lava crater of a volcano in Vanuatu.

I attended presentations in the groundwater stream, including the use of the BC Groundwater Assessment for risk of Pathogens (GARP) guidance document (an approach which I have been promoting here) in the City of Langely, groundwater management for the city of Chilliwack and the future of groundwater for the town of Gibsons.

They all highlighted the need for comprehensive assessment of groundwater quality and quantity and the importance of protecting groundwater sources. Mostly they highlighted what each supply had done about those things.

The water quality stream included a presentation on the Water Safety Plan (WSP) that had been prepared for the Victoria supply. WSPs are not compulsory in BC and not surprisingly the plan and process described for Victoria was about where our country was 10 years ago. They have a long way to go if they want WSPs to be useful in BC.

As with most places in the world, BC is looking to future-proof water as much as possible against the effects of climate change and the conference looked at plans to adjust source water protection plans to take account of climate change.

I presented in the first session of the third day of the conference. Prior to my presentation, Laith Furatian, who Water New Zealand brought to our conference last year, made an excellent presentation about the history of regionalisation of water supplies in North America and showed how, though state governments had wanted regionalisation, various non-mandatory attempts at making regionalisation happen had been unsuccessful.

My presentation included a recap of the Havelock North contamination event and details of what happened in Martinborough as a case study of the water utility problems in New Zealand, including poor governance, lack of funding and problems with operator competency.

I spoke about the findings of our literature review into water supply reform, particularly that it is difficult to untangle whether benefits come from regulatory reform, corporatisation or regionalisation.

I also spoke about the difficult regionalisation debate occurring in New Zealand at the moment and outlined that while Water New Zealand does not have a view as to whether regionalisation should occur here, that change is needed if another Havelock North event is to be avoided.

I also noted the need for decisions to be made, first and foremost, in the interests of drinking water consumers. The presentation was well received and a number of people spoke to me about it throughout the day.

In the afternoon I attended a two hour session about lead in drinking water supplies. BC has recently halved its MAV for lead, so that it is now 50 percent of the World Health Organisation (WHO) MAV and the NZ MAV.

They have done this because the WHO has advised that there is no safe level for lead in drinking water. Historically lead MAVs had been based on the levels that analyses could detect.

With technological advances these levels are becoming lower. In some parts of North America, lead service pipes and use of lead solder are common and lead leaching into drinking water is a problem.

There was considerable discussion on the merits of sampling from flushed or unflushed taps. I remember having this discussion at length here in 2007. While we do not have lead service lines, we do have risks of lead contamination of drinking water and it may be useful for us to revisit the lead question and the lead MAV.

I took time while the final sessions were on to meet with some representatives from the BC Ministry of Health, the drinking water regulators.

They were very interested to hear about our regulatory reform, but also we discussed drinking water regulation in BC where they operate in a very similar way to that which has failed in New Zealand. **WNZ**

Seismic quality pipe project

Wellington Water has installed the country's first seismic resistant ductile iron pipe technology designed to keep the network working when the ground moves. BY **MARY SEARLE BELL.**

A bulk supply water pipe project being carried out for Greater Wellington Regional Council in Porirua has provided the opportunity to trial a new type of pipe – a seismic resilient ductile iron pipe. As the name suggests, this pipe is designed specifically to weather the effects of earthquakes.

The manufacturer, Kurimoto of Japan, says the pipes are able to sustain severe ground movement during seismic events or in the case of weak ground subsidence, thanks to its flexible joints, which allow compression and expansion of the pipe without the joint separating.

The Porirua Branch Pipeline Extension project, designed and managed by James Craig of the Wellington Water design team, involved the installation of a 400mm diameter pipe from Cleat Street to Conclusion Street, a distance of about 830 metres. It is being installed to significantly reduce water pressure losses at times of high demand so that the high-level reservoirs in Porirua are able to be filled at all times without additional pumping, including when demand is high. It will also provide increased resilience for the network in case of an emergency and for maintenance work.

Gary Cullen, design manager at Wellington Water, says he and his team have been talking to Kurimoto for about a year now, with support from their consultancy panel through GHD. In that time, they have done a technical assessment of the new seismic resilient pipe, assessing not only its strength and flexibility, but ensuring it meets with New Zealand standards and that it is compatible with our network.

"We needed to assess how it would fit in with our other pipes, what spare parts we would need to store, and to ascertain that the pipe does what Kurimoto says it does," he told *Water*.

"The next phase was to test the constructability of the pipe – to test actually laying the pipe, to see what it's like to work with and fully understand the practical aspects of working with this pipe. This is the first time the pipe system has been used in New Zealand, and installation at the Porirua site will be complete by July."

The test section of pipe comprises a 140 metre stretch of the new pipeline, while the remainder is regular ductile iron pipe. Contractor GP Friel began laying the pipe in mid-June, with support from Wellington Water's in-house pipeline team.

"We've now got a draft report from our experts that suggests the new pipe will meet our needs as well as New Zealand standards, and the indications from the team on site are also good," says Gary. "The guys are finding it easy to work with; it doesn't need as much protection while being handled as it is well protected as part of its design and fabrication."

The Kurimoto SRDIP pipe has a triple layer of external corrosion protection coating, which eliminates the need for PE sleeving. Layer one is a zinc-based alloy spray, layer two is a sealing treatment, and layer three is a synthetic resin coating. There is also an internal layer of epoxy powder coating, oven baked onto the pipe.

"The external coating provides 100-year durability, and the lining inside has a surface friction co-efficient similar to

plastic pipes, allowing more water down the pipe," explains Todd Randell, business development manager at local distributor Hynds Pipe Systems.

Earthquake resilient pipe technology is used throughout Japan as well as in California and other places with active fault line crossings. Todd says it's also good for ground prone to liquefaction, subsidence, soft weak, pipelines crossing bridges and their abutments, and tsunami-prone areas.

"The pipe socket allows for both extension and compression as well as angular deflection of the pipe. It also prevents joint separation," he says. "This means the pipeline can move in a seismic wave, staying intact during severe ground movement."

Or, as Gary explains, the pipe can move longitudinally in a concertina-like fashion – like a shock absorber at each joint, and the flexible joints allow eight degrees of deflection at each joint.

"This flexibility doesn't compromise the pipe's strength," he says.

"The current Type-NS pipe system has been used in Japan since 1995 with no failure (the previous seismic model called Type-S had been used since 1975). We can see how well they coped during the devastating 2011 earthquakes, where they performed beyond expectation: The pipes moved significantly but stayed intact."

"Seismic resilient ductile iron pipes are designed specifically to weather the effects of earthquakes and are able to sustain severe ground movement during seismic events."

It's this kind of performance that is seeing them used in transmission and water pipelines connected to critical services – reservoirs, hospitals, civil defence headquarters, and government buildings, etc – throughout Japan.

"Our next step is to look at the need in our network and see where it could benefit from these pipes," says Gary.

"We will then work on a strategy for where it can be employed to get the most value from it."

Gary says the Kurimoto pipes are more expensive than ductile iron pipe most commonly used for this type of work, however, he says an assessment shows that this additional cost is less than 10 percent of the overall project costs.

"We are open to bringing in proven technology from around the world and this was an opportunity to work with a well-respected Japanese manufacturer of earthquake resilient ductile iron pipe.

"It's a good-quality system and we expect it to last its design life of 100 years." **WNZ**

Developing a proof-of-concept for a national pipe data portal

By **Angus Bargh** from Openplan and **John Pfahlert**, CEO Water New Zealand.

Over the past couple of years Water New Zealand and the IPWEA NZ branch have been working with the Quake Centre at the University of Canterbury on a number of projects.

One of these has been the Quake Centre's Building Innovation Partnership (BIP) which has developed a proof-of-concept for a National Pipe Data Portal. The project sought to demonstrate the concept and benefits of federating infrastructure asset data using an agreed national data standard.

The development of a national data standard for three-waters infrastructure provides for a standards-based approach to assessing water infrastructure at a national level. Asset data currently held by the asset owners exists in unique data structures.

These datasets have varied attributes which define and describe the assets and reside in many different types of data storage systems. Each council and water authority have developed their own unique approach to defining their asset base. This makes federation of data difficult across and between industry sectors.

A national data standard provides a framework for asset owners to standardise their data. There are two pragmatic reasons why standardisation at a national level is difficult to achieve. The first reason is that each asset owner has developed legacy systems, processes and protocols which are highly dependent on the uniqueness of the asset data which they support. If the base asset data is changed to meet a national standard then there will be a cost to replicate legacy processes which depend on the base data.

The second reason is simply one of time. Pragmatically, an asset owner is unlikely to dedicate time to reformatting its asset data and rebuilding associated legacy processes until there is a clear reason or change-moment for their organisation to invest in-demand resources to this task.

There has been strong support amongst asset owners for a national 3-waters standard. But while the case for standardisation remains compelling the decision to commit to a new standard and invest the effort to reformat data is often competing with other high priority tasks which the infrastructure sector is increasingly facing. Standardisation at a national level is possible but would take considerable time.

An alternative approach to standardising asset data 'at-source' is provided by this proof-of concept project. This project proposed a federation approach to data whereby asset data, provided by an asset owner, is not re-formatted to align with a standard but remains in its native format and is simply 'mapped' to a standard.

The mapping process is an approach where the mapping is defined at three levels; firstly between the asset class of the source data and the asset class of the standard; secondly between the attributes for a particular asset class from the source data and the corresponding attribute data in the national standard and; thirdly between the permitted values for each attribute which exist in the source data and those which exist in the national standard.

By defining and storing the data-mapping between the asset owner's data and the national standard the asset owner isn't required to re-format its source data in order to realise the benefits which arise from federating its data with that from other asset owners.

This approach achieves federation of data through a web application where data is either loaded using a web service or is stored within a cloud hosting environment. The overarching concept is that by mapping separate asset data-sets to a national standard all data can be considered to form a single data-set which can be visualised and analysed together even though the individual data-sets remain in their native hierarchy and format.

A key consideration with this alternative approach is ensuring there is completeness in the data-mapping between the source-data and the national data standard. Completeness, in this context, means that all the asset classes, data attributes and data value types required by the data standard are contained within the source-data from each council and asset owner.

It is therefore very important for this proof-of-concept trial to also include a data quality checking process which reviews the completeness of each dataset with respect to the data standard. It is recognised that the resultant data quality report will provide an important source of feedback from which each asset-owner can assess the effort required to improve its data and create a comprehensive dataset.

It is also important that any asset classes, data attributes or data value types which are contained within the data from each asset owner, but omitted from the national data standard, are also recorded as a means of determining the fitness of the data standard itself.

Example of stormwater asset data federated into a single visualisation and data structure.

This approach has the benefit of supporting dynamic standards. This means that should the national standard change then only the mapping needs to be updated for each data-set for the federation to be preserved.

An alternative approach, where each asset owner is required to maintain consistency with a national standard in order for federation to be achieved, would require the re-formatting of source asset data every time a standard is updated. This would be prohibitively complex and time-consuming.

It is worth noting that in defining a data national standard for three-water infrastructure there is an expectation that stakeholders will align their asset data over time with this standard – increased alignment will create better data interoperability and simpler mapping processes.

However, this proof-of-concept project demonstrates that benefits can be captured now with limited requirements placed on asset owners to invest significant time or effort.

Development of National Data Standards for three waters

This project also feeds into the development of a National Metadata Standard for Three-Waters. A previous project sponsored by Land Information New Zealand (LINZ), developed a draft Metadata Standard for Three-Waters. This standard was published in 2017 and it was passed to Water New Zealand as custodians.

However, for a number of reasons, the standard in its current form has not been adopted. On behalf of Water New Zealand, the Quake Centre is leading the development of an amended 3 Waters Metadata Standard, to a point where it can be republished and implemented nationally.

As an interim step the Centre has adopted a beta version of a national standard for reticulation. This beta-version standard is limited to reticulation assets that are underground, i.e., pipes, chambers, etc. It has been evolved from the LINZ published standard taking into account feedback from industry.

This standard has been largely evolved by Graham Clark, formerly of Christchurch City Council and now at Fulton Hogan. The beta standard was used as the reference standard for this project.

Further development of this standard is underway with the aim of publishing 3-Waters Metadata Standard V1.0 (Reticulation) by the end of July 2019.

In this project, students from the Masters of Applied Science (MADS) worked with three local authorities, namely: Christchurch City Council, Tauranga District Council and Auckland Council. The students undertook a quality assessment of the storm water asset data of the three councils and compared the as-built storm water data with a beta version of a national data standard.

They then mapped the councils' data to the beta-standard and federated the three councils' data allowing it to be visualised as a single entity, then they ran simple queries across the federated data.

In addition this project:

- Informed and provided a testing ground to assist the development of Nextspace's Bruce tool for managing data;
- Informed the development of the 3 Waters Metadata Standard;
- Initiated the development of data dictionary for three-waters data;
- Developed some preliminary tools for assessing three-waters data quality.

This successful project developed, tested and confirmed a viable path towards developing a full National Pipe Data Portal and the development of a full National Digital Infrastructure Model.

Lessons learnt include:

- Mapping infrastructure data to a national standard is technically viable and scalable;
- Federating infrastructure data from disparate sources can be carried out in a way that makes visualisation and analysis open and transparent;
- There are few technical barriers to implementing the sharing of infrastructure data based upon open data standards;
- There is value in undertaking the federation of national infrastructure data using an enterprise solution provided this is based on open standards.

This proof-of-concept study was undertaken by Quake Centre which is part of the University of Canterbury.

This forms part of Quake Centre's Building Innovation Partnership programme (BIP) and the authors would like to acknowledge Quake Centre's support of this article. Please direct any queries to Angus Bargh – angus@openplan.co.nz or Greg Preston at the Quake Centre. **WNZ**

Freshwater
still the issue of the moment

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

Since writing over a year ago it would be fair to say that while there have been a number of developments in the freshwater space no sweeping changes have yet been announced. In this article the government review of freshwater and the likely changes in the water supply space are traversed.

Government review of Freshwater

There is no question that 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, concerningly, from a health perspective, aquifer contamination from nitrogen and *E. coli* can create health risks.[1]

This wide array of effects touches on things many New Zealanders are passionate about – swimming, the health of the environment, and their own personal health and that of their families. As such, the public demand for reform has led the Government to produce Essential Freshwater – Healthy Water, Fairly Allocated".[2] While this was announced in October 2018, due to the length of time many of the work streams are taking to get underway it is still very current and topical.

The Essential Freshwater work programme has three main objectives:

1. Stopping further degradation and loss – taking a series of actions now to stop further degradation and to start making immediate improvements so that water quality is materially increased within five years;
2. Reversing past damage – promoting restoration activities 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; and
3. Addressing water allocation issues – working to achieve efficient and fair allocation of freshwater and nutrient discharges, having regard to all interests including Maori, 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; and
- 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, and indeed a number of the stated timeframes have already slipped. There is no doubt 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.

Government response to the Havelock North Water Inquiry

In our last article we noted the details of the Havelock North Water Inquiry. In a nutshell the Inquiry found that there was "*a widespread systemic failure among water suppliers to meet the high standards required for the supply of safe drinking water to the public*", and that "*the administration of the present system of regulation does not ensure that water suppliers comply with the law and the [Drinking Water Standards New Zealand]*".

Officials have been hard at work and have confirmed that the Inquiry was not wrong and that there are the following systematic problems with our drinking water system:

- Fragmented regulatory system;
- Poor co-ordination between central and local government;
- Unclear roles and responsibilities;
- Weak/no accountability for outcomes;
- Variable capability across water providers;
- Insufficient system oversight by Government;
- Lack of compliance and enforcement;
- Lack of government advice and support to meet compliance; and
- Poor information to citizens/communities.

Some preliminary work has been done mostly at the local level, including a number of previously untreated water supplies now being subject to some form of permanent or temporary treatment, including chlorination.

In July or August the Government is set to announce changes to the regulatory regime for drinking water which is likely to see the following – the announcement of an independent centralised water regulator. The details are likely to include:

- new duties and obligations imposed on water suppliers;
- an enhanced and centralised compliance, monitoring and enforcement function;
- clarification of local government's obligation to ensure the supply of safe drinking water to households/communities in their district; and
- substantial strengthening and expansion of central government regulatory functions in relation to drinking water.

The Government has signalled that while drinking water is the first of the three waters off the rank, wastewater and stormwater are also in their regulatory sights.

First working paper in Phase 2 of EDS Resource Management Reform project

The EDS RMA reform project continues to take a first-principles look at how New Zealand's resource management system could be improved. Phase 1 of the project outlined three potential models for what a future system could look like, while the second and final Phase is now starting to look at designing a single preferred model.

Phase 2 is arranged in three stages across two Working Papers. This first Working Paper largely focuses on Stage 1 and looks at criteria for reform before offering three alternative sets of criteria that could be applied: a "progressive" set, a "transformational" set, and a "market-led" set. The Paper is careful not to select or indicate a preferred set at this stage.

The Paper covers six substantive chapters, beginning with a more in-depth description of the overall structure of the project and how Phases 1 and 2 fit together. Chapters 3 and 4 summarise the key messages from the Phase 1 report, as well as the many options and presents three overall models. Chapter 5 introduces the concept and categorisation of criteria for reform, while Chapters 6 and 7 set out some possible criteria and considers some of the key relationships between them.

The second stage of Phase 2 (to be the main focus of Working Paper 2) is about applying a preferred set of criteria to construct a preferred model for a future system in detail, with the final stage (also in Working Paper 2) being about charting a pathway to reform.

Working Paper 2 will be released by the EDS at the end of the year and will introduce significant real-world elements including the drafting of key legislative provisions. The content of the working papers will evolve over the course of the project and be synthesised into a final report. As such, this working paper is intended to elicit feedback, which will be fed into the project – responses can be directed to RMProject@eds.org.nz.

The Working Paper can be found in full at: www.eds.org.nz/assets/Publications/RMLR%20Pathway%20to%20Reform_Phase%202%20WP1.pdf.

Lapsing water consents

The Environment Court has declined to make a declaration that two water consents held by Kilmarnock Farm were given effect to before they lapsed.[3]

In October 2017 Council advised Kilmarnock that the water consents

1 Information from Government Paper "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 see page 9.
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 Kilmarnock Farm Ltd v Canterbury Regional Council [2019] NZEnvC 84.

held for irrigation purposes had lapsed, stating that conditions for both consents involving the requirement for water metering, a Farm Environment Plan (FEP) and installation and certification of a fish screen had not been complied with. Kilmarnock then sought a declaration disputing this.

The Court held that the breaches relating to the water metering were technical breaches only and any breach of the FEP conditions would be irrelevant. In fact, the main concern was over the fish screen installation. The conditions required that a report showing the final design plans be sent to Council. The Court found that the term 'final designs' implied an element of permanence to the screening. The clearly temporary design sent to Council was therefore not compliant and no permanent design was ever received. Rather Kilmarnock used one mobile pump across the two takes, meaning that for at least one take the arrangement could not have been permanent.

Due to receiving prior notice and subsequent extension of the consents, the Court held the view that Kilmarnock was on notice to do things right or at least reasonably correctly.

The Court considered that Kilmarnock's compliance with the imperfect fish screening requirements were perfunctory and temporary, finding that neither of the two consents had been adequately or sufficiently completely given effect to and as a consequence they lapsed on 30 September 2017.

National planning standards

A new rule-book has been released by David Parker, the Minister for the Environment, to improve the consistency of council plans and policy statements.

The planning standards were introduced as part of the 2017 amendments to the Resource Management Act 1991 (RMA) under the National-led government and have been developed further over the past two years under the current coalition government.

The Ministry for the Environment held nationwide meetings and received 201 submissions on the draft Standards from the public, councils, resource management professionals and iwi last year. Changes were then made to increase clarity and make the Standards more adaptable to local contexts before coming into force on 3 May 2019.

The standards align the format and function of plans. The Minister notes that they do not determine local policy matters or the substantive content of plans as these "remain the responsibility of local councils and communities".

While acknowledging that there will be some upfront costs, the Minister stated that the standards will make plans easier to prepare, use and understand reducing overall costs to both councils and users over the long-run.

The new standards will address some of the undue complexity of RMA plans and will also help transition planning documents to electronic interactive plans, helping to make them more user friendly for the public and resource management practitioners.

The standards contain mandatory and discretionary directions from the Minister determining whether provisions have immediate effect or must follow the standard process involving the public.

Many of the provisions will be automatically adopted across the country with little or no public process. Some discretionary directions require local authorities to choose provisions from a range of options appropriate to their area and the public will be involved in choosing provisions relating to a zone framework component. In those instances, the changes will happen within five to seven years.

Looking forward, the Minister states that "while this is an excellent start, there is more that could be done, like more standardised definitions. We hope that future iterations of the national rule book will continue at the same pace."

The Resource Management Law Association (RMLA) supports the standards and hopes that future iterations continue at the same pace and standardise more definitions. The RMLA maintains that within a year anyone looking for plans will be able to see the same structure of planning information online, regardless of where they live.

Farm investor fines

The Environment Court has given a warning of liability to those investing in dairy farms by imposing $204,000 worth of fines. The fines were levelled at the owner of the farm, Blue Rata Investments Ltd; the manager, Farm Ventures Ltd; and the sharemilker's company, Khloby Dairy Ltd, for the discharge of dairy effluent and silage leachate into a tributary of the Mangatete Stream at Okato.

According to the Council's director-Resource Management, Fred McLay, the discharges arose from substantial carelessness in the way the effluent treatment system and the silage pit were managed and operated. McLay stated that "the case highlights the fact that all parties involved in a dairy farm – including any passive investors not normally involved in day-to-day operations – have a duty of care to ensure environmental and legal obligations are met".

The discharges resulted in green discoloration of the stream for up to 100 metres and other downstream effects including the growth of sewage fungus up to 140m from the discharge.

While the target of enforcement action for previous non-compliances at the farm on a number of occasions since 2008, Blue Rata received the first dairy effluent warrant of fitness in Taranaki for Okato farm in 2014. Tim Barrett, co-owner of Blue Rata and CEO of Farm Venture, said that the audit leading to the award ensured the system was up to scratch, stating that "confidence the farm is fully compliant and is being operated using good industry practice is extremely valuable to owners".

While all parties plead guilty, these are the highest fines ever imposed for dairy effluent discharges in Taranaki by the Environment Court. The message Fred McLay is sending is that "you can't just say it's up to the manager or operator or staff. You need to know when things are going wrong, and you need to be proactive and check compliance and ensure any faults are addressed with fit-for-purpose equipment".

Remember it is a local government election year

Finally, least we forgot it is a local government election cycle this October. Water and all issues related to it such as:

- Chlorination;
- Water bottling;
- Farming sector impacts;
- Combined stormwater and wastewater systems;
- Overflows of wastewater into our harbours;
- Climate change;
- Flooding effects;
- Insurance for natural disasters; and
- The cost of clean and safe drinking water,

will all be topics being debated around the country and each candidate puts their own stake in the ground depending on the particular issue of concern at the local community level.

One thing is certain. We can expect more freshwater regulation at the national level trough the myriad of legislative tools available that are concerned with freshwater management. **WNZ**

Enhancing nutrient removal

A new pilot-study's results demonstrate how membrane aerated biofilm reactor (MABR) technology can be used to enhance sustainable nutrient removal in the global water and wastes industry. By **Sandeep Sathyamoorthy**, **Yueyun Tse**, **Kelly Gordon** and **Tom Scott**, from Black & Veatch.

In years to come, wastewater treatment plants across the globe will be transformed into fully integrated resource recovery facilities.

These facilities will incorporate a suite of solutions to convert incoming raw material resources, such as wastewater and other waste streams, into valuable products as part of an integrated circular economy.

Upcycling at resource recovery facilities will need to be balanced by core, long-held environmental stewardship values espoused by the water industry. This will include removal of nutrients using biological processes and reuse of water.

Central to finding this balance between biological nutrient removal (BNR) and resource recovery is the effective use of influent biodegradable organic carbon and low-energy BNR strategies.

New technology delivers results

MABR is a promising new BNR intensification technology being developed to support future resource recovery efforts.

In MABR technology, oxygen is delivered to a biofilm growing on the outside of a membrane surface by diffusion through the membrane wall from inside the membrane lumen (see Figure 1). The substrate is delivered from the opposite direction from the bulk liquid (or mixed liquor) into the biofilm.

The oxygen and substrate is then introduced from opposite directions into the biofilm, resulting in a counter-diffusional biofilm. Oxygen is consumed within the biofilm with minimal transfer to the bulk liquid, resulting in "bubble-less aeration".

Effective control of the air-flow rate into the lumen and therefore the supply of oxygen supply into the biofilm theoretically results in a biofilm with an aerobic biofilm layer adjacent to the lumen and an unaerated biofilm layer adjacent to the bulk liquid (as illustrated in Figure 1).

When an MABR is placed in an anoxic (depleted of oxygen) zone of a suspended growth bioreactor, both ammonia and organic carbon (BOD) diffuse into the aerobic biofilm. The ammonia molecule, being smaller in size, preferentially diffuses into the biofilm, promoting nitrification rather than BOD oxidation within the film closer to the membrane surface where oxygen is abundant.

The nitrate (and any nitrite) produced within the biofilm diffuses toward the bulk liquid, and denitrification occurs in the unaerated (here anoxic) biofilm layer and in the bulk liquid using the available BOD in the influent.

As a result, the use of an MABR enables efficient simultaneous nitrification denitrification (SND) within the biofilm when the bulk liquid surrounding the MABR is anoxic.

In this way, a hybrid MABR-suspended growth system can be used as an intensified BNR process.

A brief history of MABR technology

As early as the 1960s, research groups were experimenting with the idea of "bubble-less" aeration using a silicone membrane to provide oxygen to biological processes.

These early efforts were thwarted by the observation of an unwanted biofilm growth on the diffuser surface.

Studies in the late 1970s and early 1980s saw applications for early patents related to the use of membranes for aeration of biofilms. The research and development remained largely confined to the academic community for the next decade or two, with excellent scholarships on the application of membranes for aeration coming from a range of reseach groups in North America, Europe and Japan.

The mid 2000s finally saw the commercialisation and emergence of developed MABR technologies.

So, while the concept and principles of the process have been extensively evaluated in laboratories for over three decades, commercially-available MABR technologies are relatively recent. There are currently only three MABR technology providers with full-scale installations in service, treating domestic wastewater, landfill leachate, industrial waste, and lagoon waste.

Although major strides have been made in the commercial development of MABR in recent years, full-scale implementations are relatively rare, and significant gaps in our knowledge need to be filled before implementation of this potentially game-changing technology will be widespread.

Using applied research to fill key knowledge gaps

Our MABR research collaborative, consisting of Black & Veatch, Suez, and the City of Hayward (CA, USA) aims to evaluate a hybrid MABR-suspended growth (MABR-SG) process in a real-world application treating primary

effluent at the Hayward Water Pollution Control Facility.

Intensification of the BNR process with an MABR results in nitrification occurring in the anoxic zone, in addition to the bulk aerobic zone as with traditional fine-bubble diffusers. Our preliminary modeling results suggested that the solids retention time (SRT) required for nitrification in the hybrid MABR-SG system should be lower than that for a conventional activated sludge (CAS) system (Figure 2). These modeling results were tested using the pilot-scale MABR-SG reactor (Figure 3).

Figure 1.

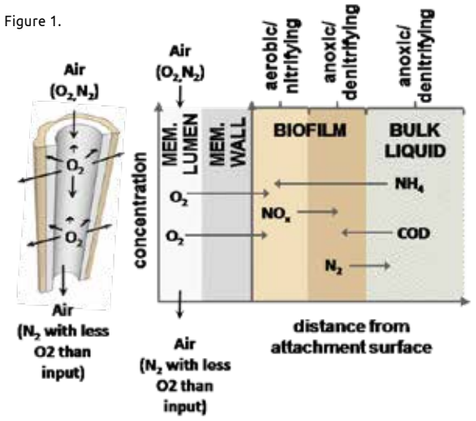


Figure 2.

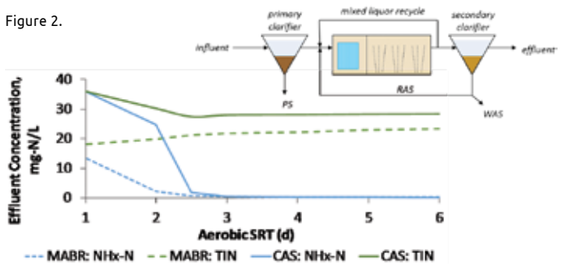
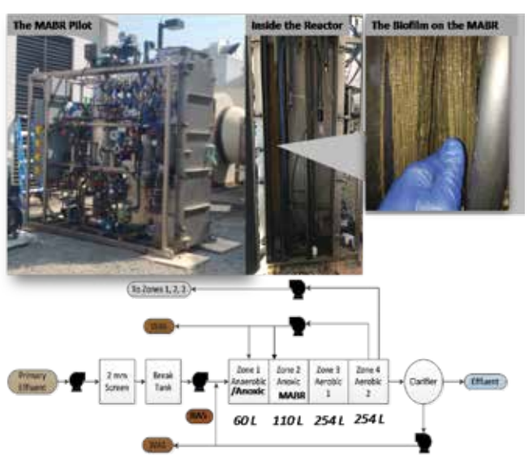


Figure 3.



Knowledge gained

When the pilot-scale MABR-SG process was operated at a suspended SRT of four days, the effluent ammonia-nitrogen concentration was typically around 1 mgN/L and the total inorganic nitrogen (TIN) was below 15 mgN/L (Figure 4, top panel). TIN is the sum of the ammonia-N, nitrite-N and nitrate-N concentration.

These results are comparable to the model with a marginally lower TIN than a CAS process operated under similar conditions, suggesting more effective use of the organic carbon for denitrification.

Operation of the MABR-SG process at a suspended SRT of 1.5 days, comparable to a high-rate activated sludge process for BOD removal, resulted in removal of approximately 40 percent of the incoming ammonia nitrogen (Figure 4, bottom panel).

Figure 4.

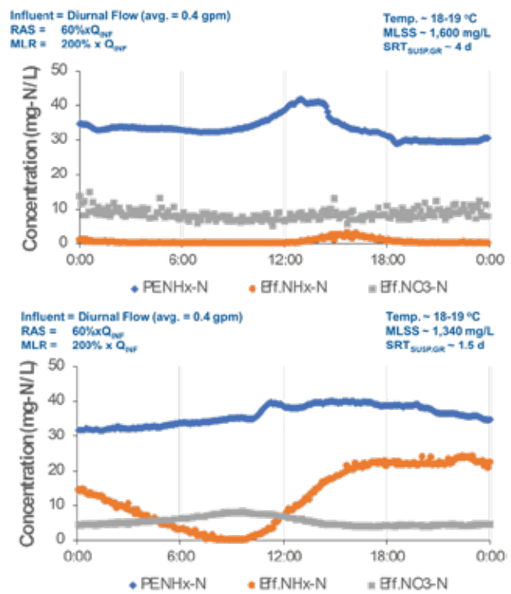
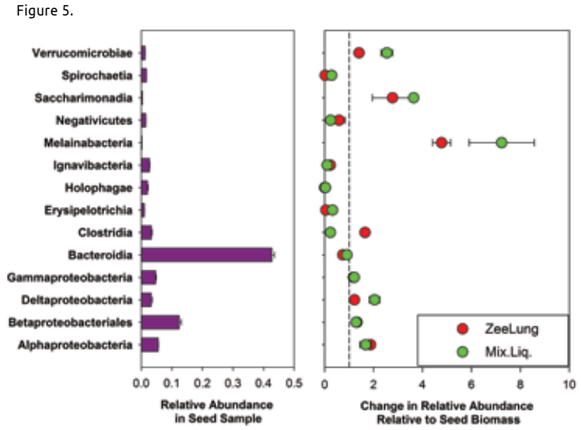


Figure 5.



Operation at this aggressive SRT yields two observations. First, the effluent ammonia-N is below 10 mg-N/L for almost half the day. Second, a large fraction of the ammonia-N that is oxidised is denitrified.

Indeed, the next generation sequencing data suggests that proliferation of heterotrophs capable of metabolising complex carbon substrates in the biofilm is greater than in the suspended biomass (Figure 5). This observation may support the opportunity for enhanced denitrification (as part of SND) within the biofilm. The MABR study is ongoing, and additional data, including additional comparisons between the biofilm microbial community and suspended growth community, using quantitative, real-time polymerase chain reaction, are being evaluated.

Looking ahead

Results from this collaborative study filled key knowledge gaps related to the applicability of the MABR technology to achieve nutrient removal and SRTs lower than conventional BNR processes.

The data suggests that a hybrid MABRSG system may be valuable for utilities considering intensification of BNR systems. Existing biological reactors could be retrofitted to achieve a 50 percent to 100 percent increase in treatment process capacity without construction of new concrete tanks.

The relatively low nitrogen concentration, coupled with effective sludge settling (i.e., low sludge volume indices) achieved with short SRTs makes this technology highly suitable for retrofit applications. Additional site-specific investigations would be necessary to confirm performance and integration within specific process flowsheets.

This technology reduces capital costs associated with such upgrades while leaving valuable space to incorporate resource recovery facilities in the future.

Availability of biodegradable organic carbon drives a range of processes from denitrification to phosphorus removal to a carbon-based upcycling economy. Therefore, influent BOD as well as that which may be produced through fermentation within the utility are valuable commodities.

As utilities focus on the need for energy and carbon-efficient nutrient removal as part of a broader resource recovery and optimisation portfolio, the MABR-SG hybrid process evaluated in this research provides an important process tool to effectively achieve these goals.

Based on our research of its value proposition, we believe the MABR technology is ready to be used in more applications. **WNZ**

Sustainable hydrogen production

Chemists at the Technical University of Munich (TUM) have developed an efficient water splitting catalyst as part of a collaborative international research effort. The catalyst is made up of a double-helix semiconductor structure encased in carbon nitride, perfect for producing hydrogen economically and sustainably.

An international team led by TUM chemist Tom Nilges and engineer Karthik Shankar from the University of Alberta, have now found a stable yet flexible semiconductor structure that splits water much more efficiently than was previously possible.

An inorganic double-helix compound comprising the elements tin, iodine and phosphorus (SnIP) forms the core of the structure. It is synthesised in a simple process at temperatures around 400 degrees Celsius. The SnIP fibres are flexible and, at the same time, as robust as steel.

"The material combines the mechanical properties of a polymer with the potential of a semiconductor," says Tom Nilges, professor of synthesis and characterisation of innovative materials at the Technical University of Munich.

"From this, we can manufacture flexible semiconductor components in a further technical step."

Soft shell with a hard core

The use as a water splitting catalyst is the first application for the unusual material. The chemists prepared nanoparticles from each of the starting substances and mixed the suspensions of these two nanoparticles with each other.

The result was a structure with a hard but flexible SnIP-core and a soft carbon nitride shell.

Measurements show that the resulting heterogeneous structure is significantly more stable than either of the initial materials.

It also splits water four times more efficiently than was previously possible, making it interesting as a material for producing cheap hydrogen or to chemically store surplus electricity from wind farms.

One-dimensional fibres

Knowing that the catalyst's great efficiency stems primarily from its large surface, the chemists increased the surface area by splitting the SnIP fibres into thinner strands. A mixture of 30 percent SnIP and 70 percent carbon nitride turned out to be the most effective.

The thinnest fibres comprise several double-helix strands and are merely a few nanometers thick. The material is in principle one-dimensional.

Wrapping it in carbon nitride allows the material to retain its high reactivity while becoming more durable – thereby making it more suitable as a catalyst.

Flexible semiconductors may trigger new hype

But the one-dimensional SnIP double-helices also open the door to very different kinds of applications. The researchers would be particularly keen on obtaining single strands of SnIP. These would then be right- or left-handed – with their own respective very special optical properties. This makes SnIP a highly attractive material for optoelectronics.

"We were able to show theoretically that many other compounds of this kind are possible. Currently we are working on the synthesis of these materials," says Nilges.

"Flexible, inorganic, nanometer-sized, 1D semiconductors might create as much hype as 2D layered materials like graphene, phosphors, or molybdenum disulfide do today."

IMAGE: BMW CAR HYDROGEN PROTOTYPE 2014.

Dihydrogen monoxide's part in the energy Holy Grail

As every Water New Zealand journal reader will already know – dihydrogen monoxide is made up of two molecules of hydrogen and one of oxygen.

Hydrogen is the most common chemical element in our universe, making up 75 percent of all baryonic mass.

At standard temperature and pressure, hydrogen has no colour, smell, taste, is not toxic, is a non-metal and burns (or explodes) easily if touched by a flame to make water.

It is also the fuel of choice in terms of the sustainable energy source of our future. For a long time the only economical way of producing hydrogen for mass commercial use was to pry it out of fossil fuels to turn it into gas.

Researchers around the globe have been on a Holy Grail towards a hydrogen economy based on renewable generation.

For instance researchers at the University of Colorado Boulder are harnessing sunlight through a network of mirrors to split water into its two components of oxygen and hydrogen molecules and collect hydrogen gas. Mirrors concentrate sunlight onto a single point on top of a tower that heats up to around 1350C that is then delivered into a reactor containing metal oxides (a combination of iron, cobalt, aluminium and oxygen) that releases oxygen atoms. Steam is added, produced by boiling water in the reactor with the concentrated sunlight, which causes oxygen to adhere to the surface of the metal oxide, which then frees up the hydrogen molecules for collection.

On a larger scale China is reportedly close to launching its "artificial sun" through a doughnut-shaped Experimental Advanced Superconducting Tokamak (EAST) reactor (no, we didn't make this up).

This reactor juts out on a spit of land into a lake in eastern Anhui province and uses nuclear fusion to heat hydrogen from sea water and readily available lithium.

In November last year this reactor became the first facility in the world to generate 100 million degrees Celsius (212 million Fahrenheit), which is six times as hot as the sun's core, and the sort of temperatures needed to achieve future nuclear fusion reactions with an inexhaustible energy source.

China's 'artificial sun' aims to release nuclear fusion in the same way as the sun by using deuterium and tritium (radioactive hydrogen-3), to generate electricity that will not generate waste.

A complete fusion reaction will extract enough deuterium (heavy hydrogen) from just one litre of seawater to generate the equivalent energy of burning 300 litres of petrol.

Floating mixers and mixer/aerators

JIPL says it is bringing in the latest and most cutting-edge technology with four hyperboloid INVENT mixers about to be installed for a major council organisation.

JIPL develops and implements pioneering technologies and products for the treatment of wastewater.

The most important processes in any wastewater treatment plant are the mixing and aeration processes and INVENT's hyperboloid mixing technology effectively and efficiently answers these needs.

INVENT (available through JIPL) introduced the hyperboloid mixing technology to the market for water and wastewater treatment over 25 years ago. Since then, the hyperboloid mixing technology has been continuously developed and improved. Thousands of successful installations in municipal and industrial wastewater treatment plants worldwide impressively demonstrate that the hyperboloid mixing technology has fast become the industry standard in this field.

The mixing technology has been further developed to provide an integral mixing and aeration system. The HYPERCLASSIC-Mixing and Aeration System was developed and optimised especially for tough applications in industrial and municipal wastewater treatment plants. It caters for efficient oxygen input and optimal mixing during the biological stage. Due to the mechanical aeration method the oxygen transfer performance is nearly as high in wastewater as it is in pure water.

The Hyperclassic mixer/aerator is a unique system in the field of aeration with well-defined applications. Basically, it can be used for all aeration and mixing tasks, specifically in all variations of the activated sludge process – especially for SBRs (Sequential Batch Aerators).

Now a floating version of both the mixer and the mixer/aerator is available for aerated lagoons, ponds etc. There are a large number of wastewater treatment ponds in New Zealand and INVENT's floating mixers and floating mixer/aerators are an ideal solution for efficient wastewater treatment plant operations. INVENT's floating mixer and mixer/aerator technology also allows modifications of existing ponds – enabling existing ponds to be easily converted to a far more energy efficient operation.

In a Swedish wastewater lagoon where INVENT mixer/aerators have recently been installed, it has been proven that the INVENT mixer/aerators are able to mix and aerate 19 times the volume for the same power consumption – compared to the original surface aerators.

The new floating mixer/aerators utilise advanced mixing and aeration technology for a system that is uniquely flexible and efficient, minimises maintenance and produces a consistently high-quality effluent. With this technology, no cage or concrete bottom is required, making this an efficient solution that provides effective, superior mixing.

The advantages of these mixer/aerators is that they are very easy to install and everything is serviced from the top. The operating costs are also extremely low and little maintenance is required making these a great, low-cost, effective solution.

JIPL is a design and project engineering company specialising in providing quality, turnkey wastewater technologies installations – specifically mixing and aeration (incl. turbo blowers), SBR technology, and thickening/dewatering systems.

More information contact: info@jipl.co.nz.

Organic food chain reactors

Supplied by Hydroflux Epco, the representative for Organica Water's Food Chain Reactor process.

Integrated Fixed Film Activated Sludge Plants (IFAS) rely on the use of a media on which a biofilm is grown, which results in a compact footprint as a majority of the biomass is fixed to a high surface area as opposed to being suspended.

A recent development of this process by Organica Water combines naturally-occurring plants with engineered media. To put it simply, a botanical garden is placed on top of the IFAS reactors, with the plant roots penetrating into the reactors.

The interaction of enzymes and various organic acids from the plant roots to the bio-media creates a diverse biology, leading to increased process stability, less sludge production and lower energy demand when compared to conventional activated sludge plants. And the sewage treatment plant looks like a botanical garden.

Large scale installations in Europe have been in operation for over a decade. Organica's Food Chain Reactor (FCR) combines the use of naturally occuring plants, such as bulrushes, marsh reeds, together with an IFAS based process. A greenhouse is typically used to house the process, resulting in an aesthically-pleasing treatment system. For warmer climates, a shaded structure is used.

The use of bio-film technology provides a number of advantages with regard to footprint and biomass inventory. The combination of natural plants and IFAS results in a process that has been scaled up to full size treatment faciltities, that provides a number of capital and operational cost savings.

The natural plants do not actually treat the wastewater, but provide nutrients, organic acids and enzymes that create a highly diverse biology within the plant roots and IFAS modules. A much more dense bio-film is created, when compared to other IFAS systems or MBBR processes.

With an obversed total biomass concentration that is three times conventional systems, a reduced footprint of up to 65 percent can be achieved. Savings in energy demand and sludge disposal are two other key benefits of the process, particular over MBR based systems that exhibit similar space saving features.

The aesthically-pleasing look of the Organica FCR has also changed local community attitude towards wastewater treatment, and has provided a place for communities to interact with process in a very positive way.

Contact Hydroflux Epco NZ on 09 352 2052, www.hydrofluxepco.nz

Figure 1.

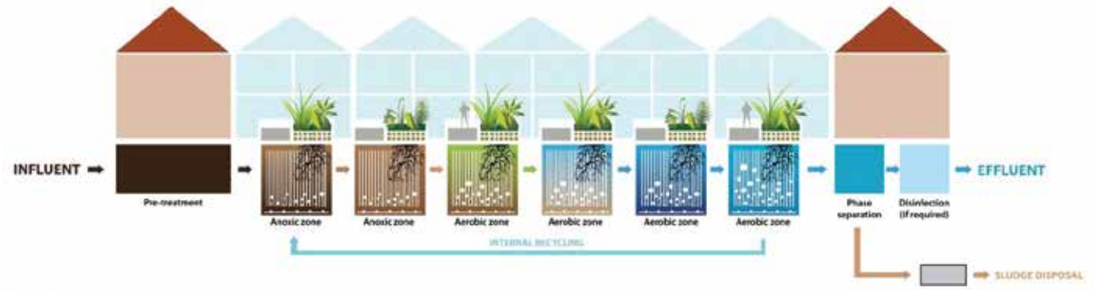


Figure 2.

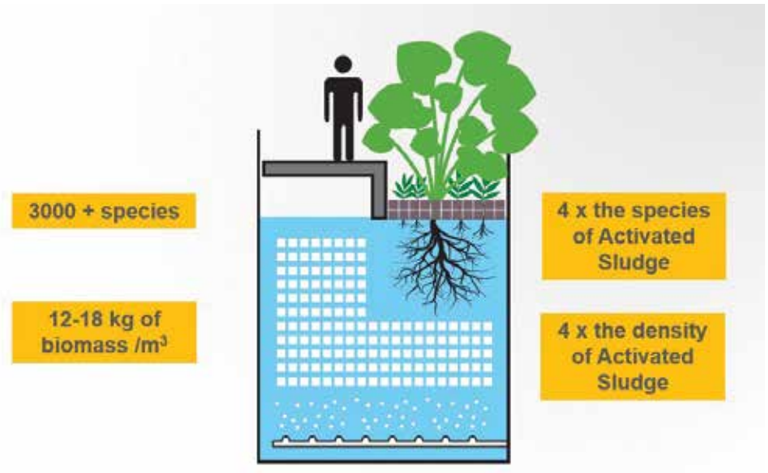


Figure 1: The multi-stage Food Chain Reactor (FCR) process

Figure 2: Food Chain Reactor (FCR) – Cross section of the reactor process

Realising the benefits of BIM

Glyn Shawcross, engineering and design director at engineering solutions provider Boulting, explains why BIM is redefining the water industry and how digital technologies are driving opportunities throughout the asset management cycle.

The UK Government Construction 2025 strategy recognises Building Information Modelling (BIM) as a contributor to delivering 33 percent cost reductions in construction and operations, and 50 percent faster delivery from conception to completion with BIM expected to drastically improve efficiency of construction projects, says Glyn,

BIM is already radically changing how capital projects are delivered and is often spoken of in relation to government guidelines, which have been mandating its use on projects since 2016.

Following the government directive for BIM Level Two on centrally-procured construction projects, the method has gained considerable recognition from other industries.

As with any other technological advancement, software licences and computer power can prove costly, as can the required training. But with the industry knowledge and expertise of a solutions provider that incorporates BIM into the design and build of its projects, such as Boulting, it is also possible for the water industry.

Typically, BIM is a process of creating and managing a project's information, to produce a model that contains a digital description of every asset. Building on 3D modelling, BIM includes the data behind the model. In addition to the benefits of a 3D model, such as physical coordination, BIM brings together data at the required level of detail, making it accessible to all involved parties.

BIM Waste Water plant.

Deeper than 3D

In addition to perceptions that BIM is best suited to new-build projects, it is all too often perceived as being principally about impressive 3D graphics. While this isn't untrue, the crucial fact that these models are embedded with valuable data is often overlooked.

In the water industry, things go a little deeper. BIM is also about better information management across the asset lifecycle as well as the recognition that we are moving into a data driven digital world.

When applied in operations and project delivery, BIM is able to produce many benefits for end users. For example, using digital technology allows utility managers to better engage with customers, letting them know of any future water works or maintenance that may affect them.

BIM also means that asset maintenance becomes less reactive, improving the level of service that utility managers can provide to customers by reducing the risk of water issues such as sewer flooding.

Doing more with data

BIM also holds the potential to help operators deliver big-scale projects more competently, reasonably and more speedily. According to BIM4Water – a dedicated volunteer group that works to devise a strategy for the sector – BIM makes data more user-friendly and gives operators a better understanding as to why it's important.

By providing operators and maintenance teams with a semi-automated data capture validation tool, rather than requiring them to manipulate data from traditional paper-based maintenance manuals, the quality of information is increased. Traditionally, projects often operate in a silo environment. The consequence of this is that where there is a repeatable solution involving the same data being used, the same information is delivered by different projects.

This replication of data is both wasteful in terms of time and cost, and harms capital efficiency as it unnecessarily adds to the amount of data that operators are expected to manage and maintain. In a BIM process, data handlers share responsibility to ensure that data is open, accurate and accessible across the asset's lifecycle, so every operator and maintenance team member is on the same page of a project.

As the water industry heads into a more digitalised future, it must consider how its projects are managed. Regardless of whether a current project mandates the use of BIM, ensuring your business is BIM-enabled and that your operators understand its benefits will ensure the best service is provided to each customer, operator and maintenance team member involved in any project.

- For more information about how best to use BIM, or about the range of Boulting's services, visit www.boulting.co.uk.

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