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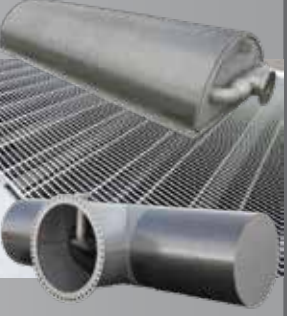


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A cool place to be in right now



Kelvin Hill,
President, Water New Zealand

Well, what another great Water New Zealand Conference we had in September!

Over the three days I talked to a great number of people and the enthusiasm was palpable – the dinner and social events and networking, the expo and the presentations all came together for brilliant time in Hamilton.

Thanks to everyone who came and don't forget to go to our website to check out our keynote presentations and conference video – you may spot yourself!

We also bring you a lot of conference coverage in this issue of our *Water* journal.

For me, the conference reflected the fact that water is a very cool place to be in right now. It's dynamic, it's changing, and this is providing us with so many new opportunities.

On our opening day we had two key government ministers – Hon David Parker and Hon Nanaia Mahuta. The two Ministers brought us up-to-date with the Government's thinking around the reforms – both freshwater and three waters.

It's clear that next year the focus will be on the environment and much-needed regulatory reform. It will certainly be a year of opportunity, and our job will be to make sure that we attract more young people into the water sector.

We know it's a great place to be but we need to ensure we get that message out to young people just starting out – they're our next generation of water sector leaders.

As an organisation, that's certainly what we're going to focus on over the next year. I was very pleased at the conference to see that there were a significant number of young people receiving recognition and awards. Let's continue to build on that.

Our conferences also provide a great source of reflection and help us to gain a better understanding of where the three waters fit into the bigger picture around the environment and how we can help ensure resilience into the future.

In that space, I particularly enjoyed the presentations from our international keynote and thought leadership speakers – Dr Art Umble (page 12), Prof Tony Wong, Mark Gobbie from Australia and many more.

We need to know what's going on in other parts of the world and the lessons we can learn and use in our own situation here in New Zealand/Aotearoa.

You may have noticed our new vision statement – *Ka ora te wai, ka ora te whenua, ka ora nga Tangata*, which translates into *If the water is healthy, the land is healthy, the people are healthy*. This fits much more with where we are heading and how we'll be working with local and central government.

Our special interest groups continue to provide a vital link with the sector. Over the next 12 months, we'll be working on building that relationship with these groups, particularly our Young Water Professionals.

We want to attract more young people into Water New Zealand at an organisational level and to make sure more young people become engaged with us and the sector through our conferences. I was heartened to see a lot of young faces at Claudelands over the three days.

Within literally hours of leaving the conference, I was boarding a plane bound for Chicago – to WEFTEC, the Water Environment Federation's Technical Exhibition and Conference, which is billed as the largest conference of its kind.

As I write this from the other side of the world, I'd like to finish with what I think is some sage advice from our first keynote and motivational speaker, Kevin Biggar.

I know many of us will have been reminded of this as we went back to our offices and places of work – the *Three Bastards* rule.

That is, if you meet three in one day the problem is probably you. In times of change and opportunity, it's important to remember that consideration and tolerance towards our colleagues will go a long way.

This morning, as I finalise this column, the Government announced the establishment of a new, independent, stand-alone drinking water regulator.

It will be a technical body with oversight of some stormwater and wastewater regulatory functions as well.

The Association welcomes this decision, and looks forward to the introduction of the legislation to give effect to these decisions later in the year.

Nga mihi nui
Kelvin



Safer for drinking, safer for manufacturing, safer to put back into our environment

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years in the water treatment industry.

Water New Zealand welcomes new Board member

Priyan Perera was elected as a new member of the Board at the 2019 Annual General Meeting held in Hamilton on September 18 2019.

Priyan is a process engineer and water industry professional and currently Head of Operations Excellence at Watercare Services, having previously worked in several operational roles including a significant period of time as Watercare's Operations Manager, Water Supply.

In fact, he began his water career as a water treatment plant operator. As the Head of Operations Excellence, Priyan is developing and growing Watercare's capability to deliver water and wastewater service delivery across all the business, accelerating capability through investment in people, process and technology advancement.

Priyan has spent the past 14 years of his career focused on the water industry, the delivery of consistently high-quality services to customers, and has enjoyed every minute of it. He is extremely passionate about the water industry and about providing the best service

possible to our customers. He has a proven track record in operational management that reflects this success.

Priyan is enthusiastic about what the future holds for the water industry and the fantastic people who work within it. He values the critical work we do in operations, providing the best we can for our communities across the country.

But he knows and understands the reality of lifting performance under tight budgets and with increasingly more complex requirements. He is firmly of the belief that the change that is coming for the water industry will be positive and will pose significant challenges for us all. These challenges will test us but, as an industry, we are open to this change. We will work to ensure positive outcomes across the country.

He says he would like to help ensure that this happens.

Priyan adds that he is excited by the prospect of representing and working with Water New Zealand members and its



Priyan Perera was elected as a new member of the Board

industry partners to help take us through to the future of water services.

Priyan joins existing members, Kelvin Hill (President), Helen Atkins (President-elect), John Mackie, Lorraine Kendrick, Iain Rabbitts and co-opted members Garth Dibley and Troy Brockbank.

Energy from large wastewater pond

Auckland's electricity and water utility companies are working on a project to build the country's largest solar array in the heart of the city's North Shore, by floating it on top of the Rosedale wastewater treatment pond near the Northern Motorway.

Vector Group chief Simon Mackenzie and Watercare chief Raveen Jaduram says the system, delivered by Vector PowerSmart, will mark a number of firsts for the country.

Watercare chief executive Raveen Jaduram says, "As a large user of energy, it's important that we look at ways of reducing our environmental footprint and becoming more self-sufficient.

"Innovative solutions like this on top of wastewater ponds are a smart way to



reduce operational costs."

The array will be used to supplement electricity from the grid as well as cogeneration from biogas, which is already generated on-site from wastewater treatment. The electricity is used for pumping and aeration for natural bacteria that help break down the waste as part of

the treatment process.

Simon Mackenzie says it's the first time floating solar will be seen here and the first megawatt-scale solar project to be confirmed.

"It can generate enough power over a year to run the equivalent of 200 average homes for a year."



Global brain for local gain

This year, we welcomed four of our international experts to New Zealand to share their knowledge with you at major industry conferences.

ART UMBLE
Global wastewater treatment practice lead
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Sustainable drainage & urban water expert
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Global infrastructure strategy, delivery & operations expert
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MIKE ROGERS
Large dams & waterpower practice lead
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Drinking Water Regulator decided on

At the end of September, Minister of Local Government Nanaia Mahuta released Cabinet material clarifying the independent status of a new national drinking water regulator as part of an overall Three Waters review and reform.

The regional councils will continue to be the storm and wastewater regulators, although there will be some over-lap in responsibility.

The next step is to introduce a 'Drinking Water Regulatory Bill (separate to the Water Services Bill) to Select Committee deliberations early next year and to Parliament around July.

Supported by most interests involved in the country's three waters performance, including Water New Zealand, documents released by the Office of the Minister of Local Government in October indicate the new drinking water regulator will be set up as a stand-alone Crown entity. The Minister's preference was always for a single regulator, and the new proposed one will also have combined interest over stormwater and wastewater.

Cabinet ministers involved in decisions around the new regulator decided it will have the greatest level of independence to effectively oversee the entire drinking water regulatory system. The other choice had been to locate the new regulator within an existing organisation such as the Environmental Protection Authority, which had the advantage of financial efficiencies, but conflicted with the EPA's core responsibilities.

The new regulator is expected to take a sector leadership role and be responsible for setting and reviewing standards; building the capability,

accreditation and occupational regulation of the drinking water industry; providing information, advice and education; be a centre of technical and scientific expertise; and to provide performance reporting.

The regulator is also expected to significantly strengthen compliance, monitoring and enforcement in relation to drinking water regulations, and the regulator will be given powers and resources to take a tougher, more consistent approach to enforcement.

Work to set up this new regulator entity has already started with associated legislation to Parliament expected to be passed by mid next year.

Link with wastewater and stormwater

In addition, the new regulator will provide oversight of the operation of national standards for wastewater discharges and overflows; setting national performance metrics for wastewater and stormwater; and collecting, analysing and publishing performance information of wastewater and stormwater operators. All suppliers will be required (with the exception of domestic self-suppliers) to be part of the regulatory system and provide consistently safe drinking water.

The drinking water regulator will also identify and promote national guidelines and good practices for wastewater and stormwater network design and management, and identify and monitor emerging contaminants in drinking water, wastewater and stormwater.

While regional councils will continue to regulate drinking and stormwater on a day to day basis, the Minister says there are strong synergies with the drinking water functions. This means there will be the ability to co-ordinate and share many of the same systems, approaches, and scientific and technical expertise.

"Co-locating these functions would enable skills and knowledge to be pooled, shared and developed further, helping to create the centre of expertise we are seeking," she says.

A Maori focus

The regulator is to be also 'well-equipped' to work with Maori tribal authorities at a local level.

The Minister says the preference of Maori is to manage water as a holistic integrated system. Putting centralised drinking water, wastewater and stormwater functions together makes sense from this perspective," she says.

"It would also mean a single point of connection with MfE on freshwater policy."

This also means the operating principles of the new entity understands, supports and enables Maori understanding of our world (matauranga), way of doing things (tikanga), and environmental guardianship (kaitiakitanga).

Reference is made to the Waitangi Tribunal's reports on water and the National Freshwater and Geothermal Resources Claim, (released August 2019) that make broad recommendations about water management, allocation and ownership.

Two tribunal recommendations in the report, most relevant to three waters, are being considered, such as the Crown providing urgent assistance, including the funding and expertise, for water infrastructure and the provision of clean, safe drinking water to marae and Maori dwelling clusters (papakainga).

"The design of the drinking water regulator is intended to strengthen and 'hard wire' Maori values and interests in the drinking water system," says the Minister.

There will be further opportunities for Maori interests and authorities to contribute to the design of the regulator through the work of an Establishment Unit and an interim Maori Advisory Group.

Governance and advice

As a Crown entity the new drinking water regulator will feature a board appointed by ministers to monitor the entity.

"In terms of the qualifications of board members, I consider it beneficial that they have an understanding of the regulator's work – both in relation to water regulation and in governing a regulatory body more generally."

The regulator will also need advisory bodies. "In particular, it will need access to technical and scientific advice from appropriately qualified experts, when drinking water standards are being reviewed and amended, for example (similar to the current Drinking Water Advisory Committee)," she says.

The regulator will not be responsible for policy. This, and the provision of policy advice to ministers, will be retained within ministries and departments.

It is also envisaged that the Ministry of Health will continue to provide policy advice relating to drinking water, while the Ministry for the Environment will cover the new wastewater and stormwater components of the new regulator's remit.

It is recognised that the regulator will face a significant challenge in bringing all drinking water supply schemes into the new regulatory system and ensuring suppliers achieve compliance.

The regulator will also require a strong regional presence, especially given that a large number of smaller drinking water suppliers are located in rural and provincial areas.

The 'Establishment Unit' will be set up to design and operationalise the regulator, ensuring it is ready to 'go live' when the legislation is passed. However, this unit would not be, nor become, the regulator.

Three Waters Review – Essential Freshwater

The Essential Freshwater programme is concerned with all aspects of ecosystem health while the Three Waters Review is more narrowly focused as it is a targeted initiative to address immediate concerns about drinking water safety and the performance of wastewater and stormwater systems.

However, improvements to three waters management will feed directly into the water quality improvements sought by Essential Freshwater.

As such, the Minister says she has been mindful that any system architecture developed for the three waters, including the regulator, will need to be able to fit with the system architecture developed through the Essential Freshwater programme and RMA reforms.

To read the full cabinet paper and associated documents, go to www.dia.govt.nz/Three-Waters-Review.

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Water regulation proposal needs sustainable funding

The decision to establish an independent drinking water regulator is very positive and will help bring our water services up to international standards, but the absence of user charges leaves a significant gap in national water policy which needs to be filled," says Infrastructure New Zealand chief Paul Blair.

"That the new regulator will be independent and focus on areas wider than just drinking water quality is particularly pleasing.

"Water is critical to promoting environmental and cultural well-being, as well as sustaining the health and social well-being.

"But it is also critical to promoting economic well-being and there is no clear link in the announcement with the vital role water plays in sustaining the economy.

"There are currently major issues in funding, financing, procuring, maintaining and operating water services to meet

population and economic growth.

"This reflects the ownership structure of water provision, which sees 67 often small local councils carry responsibility for three waters provision, as well as investment arrangements which usually see water funded via rates, rather than volumetrically through user charges.

"Existing challenges are being compounded by a perfect storm of increased regulation, climate change and a backlog of investment starting at \$2 billion and likely much higher.

"Ultimately, user charges are needed to pay for drinking and wastewater infrastructure.

"Structural separation is also required so that publicly-owned expert water delivery companies can manage debt off council balance sheets, prioritise investment over the long term and sustain necessary service expertise.

"Priced water needs an economic

regulator to ensure consumers are not paying too much or too little for an acceptable standard of service.

"Scottish Water, the regulated public water provider for Scotland was able to reduce operating costs by 40 percent and improve levels of service through better specialisation and good economic management.

"We call for the Government to require the new regulator to benchmark key economic and financial metrics, including the costs of service delivery and long term asset management and investment programmes.

"This will provide a stepping stone to future full economic regulation."

Infrastructure New Zealand fully supports the plan to promote social, environmental and cultural outcomes for water, he adds, but a plan without money is not sustainable.

"We call for the Government to expand its approach to fully account for all four well-beings in its water policy," says Blair.

Getting together at Claudelands

The following pages bring you photo, speaker and award highlights from the Water New Zealand Conference & Expo 2019, and many thanks, nga mihi nui, to all those who participated and made it another successful event.



1. Water New Zealand Conference & Expo 2019 was held at the Claudelands Events Centre, Hamilton. 2. Welcoming powhiri. 3. Te Radar, MC. 4. Water New Zealand president, Kelvin Hill. 5. Premier sponsors from left: Tim MacIntosh (Hynds), Tim Gibson (City Care), Raveen Jadurum (Watercare), Keith Martin (Veolia), Wendy Edwards (Broadspectrum), Mark Christison (Fulton Hogan).



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Pathway to a sustainable future

Water New Zealand put on another successful conference this year and **Mary Searle Bell** was there to cover it for the magazine.

A sunny Hamilton was the destination with Claudelands Events Centre providing a great location for delegates to hear some excellent speakers, and for suppliers to show their wares and services on the trade stands.

As in past conferences, speakers were split into various streams, allowing delegates to choose what they wanted to hear, whether it be presentations on thought leadership or something more technical.

Speakers addressed a number of key water issues that we and the world at large are facing. Some of them are pretty scary, with urban migration, resource scarcity, and pollution impacts comprising a particularly troublesome triad of issues.

Keynote speaker, Dr Art Umble of Stantec, USA, says the problem is not too many people, but too many people in concentrated places.

“Large cities (those with a population over five million) use the most resources and create the most greenhouse gasses,” he says.

“By 2030, two-thirds of the global population will be under water stress. The demand for energy and availability will also have a gap of 40 percent.”

Art says economic growth has always been at the expense of the environment, but this needs to change.

“A circular economy is the pathway to a sustainable future,” he says, describing a system where fewer natural resources are used and instead the same products are recycled and reused over and over again.

“Wastewater can be a part of this. We can recover nutrients and energy, as well as carbon [dioxide] for bioplastics and biofuels.”

He also suggests we can learn a lot from nature: “Design, not with nature, but as nature.”

He gave the example of how the noise from wind turbine blades was dramatically



Keynote speaker Dr Art Umble.

reduced when they were designed to mimic the feathering on the wingtips of the barn owl, which flies soundlessly at high speed, and how the Shinkansen high speed train removed the problem of shock waves damaging the train when it entered tunnels by redesigning it to mimic the head of the kingfisher.

When designers copied the cooling effects of tunnels in termite mounds, which maintain a steady 31 degrees in the desert, they were able to minimise heat fluctuations in an apartment building in Zimbabwe and reduce its energy needs by 90 percent.

More specific to the water industry, Art says algae is the solution engine of treatment for tomorrow – it cleans water enabling it to be reusable on or off site (fit for purpose), and the algae itself can be used to make products.

For example, he says it is being used to make the foam soles in running shoes.

“A Water Resources Recovery Facility has the opportunity to return to the economy all sorts of different products – water, energy, nutrients, and products.”

Art’s speech reflected many other interesting and exciting innovations that were presented as part of the conference.

He closed with a heartfelt entreaty to the industry: “Let’s all make a commitment to one another to working on the right things to do, and I think we should avoid, in all possible ways, at making things simply less bad.”



Claudelands Events Centre exhibition hall.



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A community approach to water reform

Nanaia Mahuta, in her role as Minister for Local Government and working on the Three Waters Review, was a guest speaker at the 2019 conference.



"We need an approach that ensures all communities across Aotearoa benefit from safe, reliable, culturally-acceptable three waters services in an affordable way."
Nanaia Mahuta, Minister for Local Government.

The review, with its new system and regulatory framework to improve public safety and reduce pollution went before Cabinet last month (October). Details of the newly decided regulator entity featured on page 8.

"Due to the strong synergies between drinking water, wastewater and stormwater, we're also considering the feasibility of the regulator also undertaking some of the new functions for oversight of waste and stormwater within its role," she says.

"However, regional councils will continue to be the lead regulator of wastewater and stormwater under the Resource Management Act."

The Minister says the Government was hoping to introduce new legislation by the end of the year, to enable the regulator to "go live" later next year.

She addressed the huge conundrum we face around the cost of upgrading treatment plants, saying current estimates suggest it will cost around \$500 million to upgrade drinking water treatment plants to comply with current drinking water standards, along with \$3-4 billion to upgrade wastewater treatment systems and a similar figure for stormwater.

"The problem we face, though, is that some of our smaller councils and communities, and many non-council drinking water suppliers, such as marae, are not well-positioned to meet these costs.

"We will need leadership, collaboration and innovation to navigate our way towards achievable solutions for these communities.

"We need an approach that ensures all communities across Aotearoa benefit from safe, reliable, culturally-acceptable three waters services in an affordable way."

Responding to a question around the links between the Local Government Act and the RMA, and particularly enforcement, the Minister says a problem arises when the penalty for illegal discharge into a pipe carries a paltry \$20,000 fine after conviction.

And getting to that point is a very expensive exercise, she adds.

Compounding that, the council is liable for a \$600,000 fine plus up to two years in jail for discharging that same illegal waste into the environment.

Consequently, she says the Government is considering lifting the penalties to an equal level.

With regards to a question posed around Maori communities, the Minister says it is important for all communities to connect with their waterways and become invested and involved.

"The solution is very much a community approach – not just Maori – with active and not just paper supporters."

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Bottled water - allocation and waste



Bruce Sherman, chair of the NZ Beverage Council, attended the conference to speak on bottled water.

It's a hot topic, with the public questioning the need for bottled water, the allocation of water resources for bottling for export, and the growing concerns around waste and recycling.

Bruce began by delivering a few insightful facts on bottled water and its rivals, such as the fact Kiwis spend \$700 million a year on beverages, including \$67 million on bottled water. Bottled water comprises about 27 percent of all non-alcoholic drinks sold, with coffee close behind at 24 percent.

Water is the most consumed drink in the country, followed by coffee, tea and milk, with soft drinks (the focus of much anti-obesity talk) making up less than four percent of drinks consumed.

"Kiwis don't drink that much soft drinks, and of those, the move is to sugar-free," he says. "We drink more alcohol than soft drinks."

He says there are two key issues for the beverage industry; on one side is obesity and sugar consumption, with the water allocation debate on the other.

Interestingly, he says the anti-obesity drive has been partially responsible for the 25 percent growth per year in bottled water sales.

"Bottled water is a lightning rod for discussion around water, although it makes up only a small percentage of water use," he says, stating that water bottlers comprise 0.005 percent of the 10 trillion litres of freshwater used every year while 50 percent goes on irrigation.

"There are currently 88 consents issued for the purpose of bottling water, but only 26 operating bottling plants around the country.

"And while the sector is very competitive, the money is in it for retailers and not so much manufacturers."

Bruce estimates that of those 26 plants "only about four are making a dollar".

"The gap between manufacturing costs and the retail margin is quite substantial."

On top of the water allocation debate, waste and recycling is the other hot topic.

"With China no longer taking low-value recycling products, it's pushing us to be responsible for our waste and be innovative."

With the single-use plastic bag ban now in place, Bruce says attention is likely to shift to other users of plastic, particularly plastic bottles, which make up around 11 percent of litter.

However, 69 percent of beverage containers bought in New Zealand are recycled, a number comparable to similar countries.

"There's a push for the return to glass, but it's a rose-tinted view. Recycled glass goes into things like roads but not to remake bottles," he says.

"PET (Polyethylene terephthalate) gets a bad rap, but is actually a pretty great product that can be recycled again and again."

One of the questions posed to Bruce following his presentation concerned the introduction of a water export tax on bottled water.

His response was why should just one sector of the market be penalised for water use when many others use as much or more water in the manufacture of their products for export, such as the dairy industry for example?

Bruce then had a question for the industry: "If we had filtered, chemical-free water on tap on every corner, would the bottled water industry exist?"

His answer: "Probably not."

Bottled Water

- Bottled water makes up \$67 million per annum in sales to New Zealand Retailers (not manufacturers)
- There are currently 88 consents issued for the purpose of bottling water
- There are approx. 26 operating bottling plants ranging in size from small family businesses through to large multinational operated plants.
- Sector is highly competitive and profitability is not high.
- The industry is currently operating under the threat of a central government imposed water tax.

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Water New Zealand conference 2019

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1. Outstanding musical entertainment, complete with a watery theme, was provided by Don McGlashen, who opened with 'Anchor Me', followed with 'Harbour Bridge' and finished with 'Dominion Road', which he acknowledges stretches the water theme a bit, but says it does mention rain in the first verse. 2. Xylem – winner Best Multi Expo Stand. 3. Tainui students at the conference. 4. Treadwell – winner Best Single Expo Stand. 5. Dinner table setting. 6. Water New Zealand president, Kelvin Hill with Australian Water Association president, Carmel Krogh. 7. Water New Zealand Board members; Kelvin Hill, Lorraine Kendrick, Iain Rabbitts, Helen Atkins, John Mackie, Kerri McIvor (MC), Troy Brockbank.



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Improving freshwater quality

As there was considerable 'anti-dairying on the Canterbury Plains' talk at the conference, it was interesting to hear Dr John Penno speak, given his background in dairy.

John Penno, chair of the Freshwater Leaders Group, told conference delegates that he had previously worked on how to intensify dairying and his company was responsible for converting some 500 hectares of sheep and beef farmland into dairy farms.

"We looked at the environment," he says. "We knew what we were doing."

The Freshwater Leaders Group was set up by the Ministry for the Environment to support the Essential Freshwater Work Programme, and "brings together expertise and input from leaders across the primary sector and agribusiness, environmental non-government organisations and other voices from the community".

The aim is to improve freshwater management and deliver a noticeable improvement in our water quality.

"There's been a lot done to protect waterways – through fencing and planting – and farmers will tell you this," John told delegates.

"Dairying is possibly ahead of sheep and beef in this regard.

"But there are definitely areas of concern – intensively farmed land, leaky soils, and debates over which rivers and waterbodies are improving and which are not."

John says scientists need to be involved so that they can determine where we will see healthy water bodies and where we will see deterioration.

"From there, we can set up plans so we can move water bodies to where we want to see them."

He says groundwater research has been underfunded historically and in recent years, and this needs to change.

He is also concerned that the requirements only require regional councils to have a robust plan-of-action by 2025.

"That's too late to start for some.

"They need to start now, as the waterbodies will continue to degrade. For many catchments it will take a generation to move them from where they are to where they want to be."

He says the key to stopping the decline lies in understanding 'at risk' catchments, curbing high-risk land use practices – ones that have excessive nitrogen loss, excessive sediment



John Penno, chair of the Freshwater Leaders Group.

loss, and intensification – and to protect waterways.

"The whole system needs to be looked at," he says.

"We've called for some form of water commission to provide national standards and support."

The other key question John and the Freshwater Leaders Group is grappling with is that of allocation.

"Fairness is important, but how do you get to decide who gets what?"

The group is working on a set of principles and are currently debating the hierarchy of need.

"Essential human needs come first ahead of economic needs – industry, commercial, etc – and must protect freshwater quality. But we recognise the importance of certainty for business.

"Many systems are over-allocated and will require transition," he says. "And while FIFS [first in, first served] and grandfathering of historic rights is easy, it is not ideal and not supported.

"There is a need for limited resources to move to best use."

However, as John says, at this stage, there are a lot of questions and no answers.

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Embracing cultural collaboration

A number of sessions at the conference were given over to diversity – particularly the role and involvement of Maori culture in water management.

With his presentation, Water New Zealand Board member Troy Brockbank from WSP Opus helped set the scene, explaining the significance of water in Maori legend.

He retold the ancient story of how the sky father and earth mother were forced apart, and their tears of grief formed the waterways, with rain being the tears of the father and springs the tears of the mother.

“Water is life. We are water,” he says, pointing out that humans are 70 percent water.

“Ko ahau te wai, ko te wai ko ahau.

“I am the water, the water is me.”

Troy says we need to start caring for the land; caring for the people.

“We need to connect people back with water,” he says.

“If the water is healthy, the land is healthy, and the people are healthy.

“This is not motivation; this is just core Maori values. Go back and put it into your work,” he says.

With this background, we then had Frances Curtis speak directly on a recent wastewater treatment project on Maori land, which fully engaged with the local Maori to find the most culturally appropriate yet effective solution for them.

Plans to build a Wastewater Treatment Plant (WWTP) in Rotoma had been thrown out by the Environment Court in 2012 after locals, who say they hadn’t been consulted on the project, objected on cultural grounds.

One of their big issues was that the plant would transfer human waste from one tribal region to the land of another, which would be offensive.

Another consideration was the risk profile in relation to the potential for direct impacts (including both cultural and environmental) from failures in the reticulation network and the resulting accidental discharge of sewage.

Frances says the Rotoiti Rotoma Sewerage Steering Committee (RRSSC) was born out of this. It was mandated to propose a preferred option for the treatment of wastewater in the Eastern Lake Rotoiti and Rotoma communities.

An independent assessment of available short-listed options for a WWTP was undertaken, along with looking into pre-treatment solutions that would reduce the quantity of para (human faeces) transported through a reticulation network, with the assistance of their own engineers and taking into consideration cultural values and aspirations.



Water New Zealand Board member Troy Brockbank from WSP Opus

In August 2017, resource consent was given for a WWTP to be built on Maori land behind the Rotoiti Emery Store, and the plant was commissioned in August this year. In addition, a reticulation network to the plant is being installed to cater for homes in Rotoma and east Rotoiti.

“Rather than having a solution imposed upon us, we are part of the solution,” says Frances.

Her key recommendations going forward are to ensure local Maori representatives are embedded into project teams, and that protocols are included in all aspects of the scheme throughout its full life.

She also says a cultural health and safety induction will ensure contractors and visitors to the site fully understand the mana and cultural values of affected locals.

The third speaker in this Thought Leadership stream was Kaylarnee Meleisea Murray, a graduate engineer with Arup.

Of Maori and Samoan heritage, Kaylarnee fits into a number of minority boxes, and spoke to the benefits of truly embracing diversity and inclusion.

Diversity and inclusion are not just about the workplace, but also expands to community engagement, she told delegates.

“Customers are central to the work of water utilities, so we need to understand their wants and needs. Diversity and inclusion should not be approached with fear and ignorance; it is about collaboration and building long-lasting relationships.”

Students play big role at conference

Seven future young water professionals from Waikato Tainui made the most of the opportunity to gain knowledge and network with current water professionals when they spent three days at the 2019 Water New Zealand conference.

The students, six from schools in the region and one first year university marine biology student were selected because of their overall leadership qualities and interest in water, the environment, science, civil engineering and construction.

This is the second time Waikato Tainui has sponsored students to attend the conference.

North Waikato Transitions Coordinator at Te Wharekura o Rakaumanga, Huntly College and Ngaruawahia High School, Leah Crawford says the students quickly gained the confidence to interact with many other conference exhibitors and attendees.

She says a highlight was when they took part in the *Young Water Professionals* breakout session where they were able to demonstrate their knowledge of their Maori culture and heritage in relation to the water, land and the environment.

The students all spoke of how the conference was valuable in providing networking opportunities, connecting with the environment, and sharing knowledge to help solve water problems.



From left: Jahnece Rewha, Toi Ohomai Institute of Technology/University of Waikato; Manawa Irwin, Nga Taiatea; Ngahuia Eketone, Te Wharekura o Rakaumanga; Stella McLean, Tai Wananga; Te Oranga Herangi, Ngaruawahia High School; and Abagale Burrett, Huntly College, River Mete (Tai Wananga).



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Of cows and water, politics and science

On Wednesday afternoon of the conference the Thought Leadership stream had economist Dr Eric Crampton and Dr Mike Joy discussing issues around freshwater from disparate viewpoints.

Dr Eric Crampton, chief economist with The NZ Initiative, and Dr Mike Joy, from the Institute for Government and Policy Studies at Victoria University, both agreed that better freshwater management is environmentally necessary.

However, their opinions and proposed solutions differed significantly.

For Dr Eric Crampton, money and politics were key to the solution

“Doing the most good for the environment requires cost-effective and politically durable solutions,” he says.

Whereas Dr Mike Joy strongly believes politicians should leave freshwater management to the scientists, arguing that water management has been about politics and spin and not about science.

Eric delivered his presentation first. He spoke about applying an ETS (emissions trading scheme) style scheme to freshwater management, applying a price to freshwater, combined with maps of the underlying hydrology, constraints around water availability and the effects on the environment, and then “letting prices work their magic”.

He believes pricing in environmental effects of activities into an ETS-style scheme will encourage efficient mitigation of these effects to help reduce environmental burdens.

“We need to harness the price system so people can work through the system to find their own solution,” he says.

“Prices can tell who gets the most value out of their water.”

Eric says we could have rural and urban together in the same system, buying water or nutrient credits based on their needs. However, he says a durable scheme will need to address iwi rights and established water consents.

“As water becomes more scarce, being able to trade water becomes more important.”

In contrast, Mike, as a well-known advocate for environment protection, would like to see politicians stay away from freshwater management.

He believes politicians have allowed the intensification of dairying, particularly in Canterbury, even though science shows the resulting increase of nitrates in groundwater have risen to unacceptable levels.

“Politicians have falsified science – they make the problems disappear rather than solve them,” he says.

He explains this by saying nitrate levels have been set at aquatic toxicity levels of 6.9mg/l – the point at which nitrates will kill fish – ignoring the fact that fish will die at much lower levels because lower levels allow algae bloom which also poisons fish.

“The ANZECC guidelines for aquatic species protection sets the level at 1.7mg/l.”

Mike is also concerned about the link between nitrate in drinking water and colorectal cancer risk. He says nitrate nitrogen levels of 0.87mg/l significantly increases the chances of developing colorectal cancer and 72 percent of the 320 ECAN groundwater test sites exceed this level.

With regards to swimmability, Mike says the target to make 90 percent of rivers and lakes swimmable by 2040 sound great, but the details reveal the targets only apply to lakes greater than 1.5 kilometres in diameter (only 25 percent of lakes), and only applies to greater than fourth order waterways – that is around 12 percent of length of waterways of which 70 percent are already swimmable.

He believes the solutions lie in honest environmental reporting; matching the land use to the environment and not the other way around; biological/regenerative farming, maximising soil health and minimising fertiliser use; and trusting the science.

“Don’t let vested interests profit from destroying what belongs to us all,” he says.

“A technological fix won’t work. We should not have cows on the Canterbury Plains; it’s as simple as that.”

Increasing resilience to extreme weather events

Nathan Clarke is a principal wastewater engineer with Beca, working on secondment as the operations manager for the Nelson Regional Sewerage Business Unit (NRSBU).

Servicing a population of around 45,000 along with a significant industrial contribution, NRSBU has a treatment facility on Bell Island in the Waimea estuary and biosolid reuse facilities on Rabbit Island.

“We have some unique features. Because of the estuary, we can only discharge treated wastewater for a maximum of three hours after high tide, which requires us to store waste between tides,” Nathan told conference delegates.

“We also experience variable loads – we can get up to 75,000 cubic metres in a day – but can only discharge a maximum of 25,000 cubic metres per day, which means we have to store excess influent in our facility.”

Over the past few years, the region has experienced some extreme weather, including cyclones and flooding. This has created issues with their assets. Also, saltwater incursion has also killed a lot of trees in the forest on Rabbit Island and created coastal erosion.

“It’s not just the wet either,” he says.

“Rabbit Island burned last summer. This is where our biosolids are disposed – pumped as a three-to-five percent slurry. It’s a fantastic biosolids reuse system but relies on us having a forest.”

Such climatic events have acted as an unwelcome but valuable stimulus for NRSBU to look more closely at the risk and resilience of its facilities, and has assisted to highlight the issues so they can be mitigated.

“While some events of this type can be expected, the frequency and severity of the events leaves us wondering whether this is climate change and whether this is the new normal?”

In the mid-2000s a brief review of the Bell Island facility for climate change was undertaken, and it was estimated that the cost of shifting the facility would be very significant (around \$150-200 million) and would result in additional pumping costs, additional wastewater disposal issues, and additional biosolids management costs, making this solution unfeasible.

“There is still quite a bit of uncertainty around what the real effects of climate change are going to be for our region, and there are no clear trends at this time.

“However, given that NRSBU has experienced a number of significant events over the past eight years and particularly over the past two years, it is important for us to think about what can be done, and what can be learned from our experiences.”

NRSBU is presently looking into ways of mitigating the risk of climate events, and improving the infrastructure to accommodate these types of issues, without investing significantly in new assets.

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Knowledge to share from across the Ditch

Mark Gobbie (pictured), acting chief executive of South Australia Water, provided insights into the challenges his State is tackling.

“We have a dry and variable climate with an increasing number of heatwaves,” he explains. “Adelaide reached a record high of 47 degrees in January this year.” Compounding this problem is the dire state-wide lack of natural water, something that Mark says has always been the case since the State was first settled, coupled with intermittent flooding. Following two years of below-average rainfall, the state is heading into another drought.

“There’s the same amount of water in the world as there’s always been, it’s just not where you always want it or in the state you want it.”

He says South Australia currently recycles 32 percent of the wastewater it produces, however, there is community resistance to direct potable reuse.

“It’s not currently done, but we likely will do so in the next 10 years.

“We’re looking at diversifications of supply – and innovations – to tackle climate variability. This includes recycling stormwater and wastewater, desalination, along with the usual water supply and saving water.

“Water restrictions are not part of our plan going forward,” he says.

“Having a strong relationship between government, industry, and research is very important in water management.”

Another issue his organisation faces is that of energy costs.

“Spikes in energy costs can see the price leap from \$100 an hour to \$2500 an hour,” he says.

“When you’re running pumps, this can chew through your funds quickly. However, tanks are as good as batteries.

“When energy prices are low, we fill the tanks, and empty them when the price is high.”

South Australia Water is also working



to maximise revenue from biogas generation and uses diesel generator backup, because, as Mark says, there comes a point where this is more cost-effective than electricity.

They also have a couple of interesting projects on the go: They’re currently working with the Bureau of Meteorology on cloud cover forecasting to enable them to predict what sort of solar power generation they’ll get from

their 70 solar generation sites across the state.

And they’re working with Adelaide Airport, irrigating certain areas on site, as they have found microorganisms lower the temperature and therefore reduce the air conditioning needs of the terminal.

Mark ended his presentation with an invitation: “We have knowledge that we’re keen to share.”

Smart infrastructure

Improving our management of water was a key theme for the conference, and a topic that Oliver Hawes addressed directly in his presentation on smart water infrastructure.

“**Smart infrastructure enhances the physical world**, with digital insights,” says Oliver Hawes of Mott Macdonald.

“It improves efficiency, helps you make better decisions, and pinpoints errors before they happen. It’s always on and always learning. The more data it receives, the more opportunity it reveals.”

He was talking about establishing a digital twin to optimise outcomes of a system.

We’re already building digital twins that deliver high-value outcomes here, and Oliver gives the example of Auckland

Council’s Safeswim programme.

Unpredictable wastewater overflows are polluting Auckland’s beaches and swimmers don’t know where the sea is clean and safe to swim.

By collaborating with local partners, such as the MetService, Watercare, Surf Live Saving and more, Mott Macdonald pinpointed 10 data streams to measure the performance of Auckland’s wastewater infrastructure – things like flow sensors, local rain radar, tides and swell, water temperature and quality, and more.

Together, these create one billion data

points which are analysed every day, allowing them to predict the water quality at 84 different beaches around the city.

This information is passed on to the public in real time via the council’s website – delivering up-to-date information on water quality and swimming conditions.

“The system continues to learn,” says Oliver.

“It only improves as it collects more data.

“I truly believe this programme is world leading. And it can extend beyond bathing water quality to other issues I’ve heard over this conference.”

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Deserving award winners 2019

One of the highlights of the Water New Zealand Annual Conference and Expo is the awards dinner sponsored by Downer. This is where we acknowledge and celebrate the success and achievements of our members. We congratulate all our winners and will profile their winning entries in future publications of *Water*.



1. **Hynds Paper of the Year Award** for 'Development of a Corrosion Strategy to Protect New Zealand's Largest Wastewater Asset'; from left: Tim MacIntosh, Stephen Grace, Shannon Goff, Kelvin Hill. A precis of this paper is on page p36. The runner-up was Mark Bourne of Watercare with 'A How to Guide for Securing 35-Year Discharge Consents'. 2. **IXOM Operations** prize was won by Marcus Coley from Downer and Leevaai Toremana from Horowhenua District Council; from left John Pfahlert Water NZ CEO, Leevaai Toremana, Marcus Coley, Graham Colquhoun. 3. **SS Prize Winners** Evie Wallace, from Beca, and Kirsten Woods, from Stantec, were the winners this year. The prize, which is funded from personal donations by SS Society members, provides an opportunity for young professionals to broaden their knowledge and advance their careers; from left: Jim Bradley, Caroline Hope, Kirsten Woods, Evie Wallace, John Pfahlert. 4. The **Site Safe Health and Safety Innovation Award** was won by Pattle Delamore Partners for using a drone to collect water samples from up to a kilometre away and thereby negating the need for a person to enter the water; from left: Chris Jobson, Thom Gower, John Pfahlert. 5. **Jacobs Poster of the Year Award** was won by Hugh Blake-Manson of City Care for 'Listening to the Reflections in the Dark'; from left: John Pfahlert, Hugh Blake-Manson, Jessica Hamilton. 6. The **Pipeline & Civil Project Award** went to McConnell Dowell for the multi-award-winning Army Bay Wastewater Outfall (which featured in the September-October 2019 issue of *Water New Zealand* journal). Not only did the project come in on time and under budget, but McConnell Dowell's directional pipeline drive of nearly two kilometres set a world record; from left: John Pfahlert, Brent Whiting, Hugh Goddard. 7. The **Ronald Hicks Memorial Award** was won by Martin Neale and Andrew Schollum of Puhoi Stour, Kris Fordham of Civix, and Nick Brown from the Auckland Council, for Safeswim. The men chose to donate their \$1000 prize to Surf Life Saving Northland, which was involved in the project; from left: John Pfahlert, Martin Neale, Nick Dempsey.





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8. **Hynds Presentation of the Year Award** went to Stuart Anderson of McConnell Dowell for his presentation on the record-breaking innovation on the Army Bay Wastewater Outfall project; from left: Tim MacIntosh, Stuart Anderson, Kelvin Hill. 9. India Eiloart was named as the **Beca Young Professional of the Year** for her exceptional achievement in the early stages of her career. The judges were impressed with her passion, potential and promise. India features on page 32. 10. Jen Rowland, from the Auckland wastewater management team is the **Water New Zealand Trainee of the Year**. Jen is currently pursuing her Utilities Management Level 3 qualification. 11. The **Trility Young Author of the Year** is Caitlin Cairncross, of Tonkin and Taylor, for her paper, 'Designing Pipelines for Low Wastewater Flows'; from left: John Pfahlert, Caitlin Cairncross, Steve Jamieson. 12. **Gold Shovel recipients 2019** Shayne Cunis, Jim Graham, Craig McIlroy, Helen Atkins, Andrew Watson and Jim Bradley.



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Impressive turnout at YWP conference session

By Joan Davidson, YWP Auckland Chair

Engagement of emerging professionals in the water sector is imperative for the success of the industry both now and in the future.

The Young Water Professionals (YWP) group aims to provide opportunities for support and networking throughout the year and at the Water New Zealand conference.

This year we held an interactive session at the conference and there was an impressive turnout of people in the earlier stages of their careers as well as a number of high school students from the region.

The primary focus at the conference has been to encourage attendance by younger generations and to provide a platform for their opinions and thoughts to be heard. Attendance by all generations is encouraged at the YWP sessions!

This year session attendees were divided into six groups. Three keynote speakers then provided their own context on a specific question relating to the water industry.

The groups were then invited to address a question each, with one simple catch: the piece of rope on their table had to be included in their response! The questions addressed were:



1. The water industry in New Zealand is changing. What is the one thing we should not forget as we go through the transition period?
2. Leadership is a great catch phrase, but what does it really mean? How can young people demonstrate leadership in their day to day roles and in the water industry as a whole?
3. Whether they know it or not, everyone has a water story. What is water's water story? As 'New Zealand's water itself', what has been your experience and what are your hopes for the future?

The responses were overwhelming and reflected a general sentiment held by industry professionals, young and old. Key messages that emerged were the need to reflect strongly on the past, focus on people and communities and remember the interconnectedness that is a reality when facing issues concerning water.

Going forward we hope to increase the impact of the conference sessions by facilitating better intergenerational interaction.

In 2020, we also hope to hold a targeted event for Young Water Professionals and work engaging the water professionals of the future.

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A student of water security

India Eiloart was named as the Young Water Professional of the Year at this year's conference. At just 25 years old, she is the youngest to be awarded this prestigious gong and has already packed a lot into her few career years in the industry. **BY MARY SEARLE BELL**

From the time she was very small, India has wanted to work with the environment, "helping it out", as she says.

"It took until I was about 16 years old to find out about engineering. But I soon discovered that engineering was about how things worked and there was an intersection between engineering and how humans interacted with the environment.

"I knew that was where I wanted to be, but I wasn't quite sure how I was going to get there," she says.

"I started down the civil engineering path, but as I discovered other papers that interested me, I would pick them up. Then I discovered natural resources engineering, where instead of beams we were looking at water.

"That was more my cup of tea, so I did that instead.

"It was a great decision and I've really enjoyed it."

India graduated from the University of Canterbury three years ago with a degree in natural resources engineering before returning to her hometown of Wellington to take a graduate role with WSP Opus in its water and wastewater team.

"On my first day my manager said, 'let me know if there's something someone else is doing that you like the look of and we'll help you do that', and I immediately said, 'I want to do what that team's doing', which was the water resources and flood risk management team.

"And within the year I had been transferred across.

"It suits me better – design and construction doesn't really excite me – but I really enjoy being able to analyse the big picture; to look at an entire system and find out all the cogs in the network.

"As a graduate you help out where needed, and one day [principal environmental scientist] Jim Graham was looking for someone to assist with a water safety plan, so I put up my hand.

"Now I do a lot of water safety plans and related projects, and I really enjoy it – it's how my head works.

"You get to look at the whole system, all the way from the source to the tap, and see where things could go wrong."

India says she learnt a lot from Jim and other colleagues, but also gives credit to WSP Opus for letting her chase her passion.

"They're very supportive of me, but I guess that someone who's happy with their job will work harder."

On top of her work with WSP Opus, India is heavily involved in Engineers Without Borders, a not-for-profit organisation with the vision to provide 'access to the engineering leadership and capability required to lead a life of opportunity and be free from poverty in all its forms'.

She joined the student chapter of EWB NZ in her first year at university and began volunteering in 2014.

"When you're studying, some courses can really drain you, but then you have these EWB projects and you're contributing to a global effort to help improve access to engineering.

"As a student, EWB is not going to have you design anything or send you anywhere, but I wanted to support the cause and those who were doing that sort of work, so I started by volunteering with the schools programme."

The EWB schools programme works to educate high school students on issues facing humanity and develop an interest in engineering and sustainable development. They run modules to help youth understand the challenges some communities outside of New Zealand face.

"One of these is 'Water for Life', which educates them on the differences in available materials, literacy, language barriers, and the cost of resources between countries, and then their ability to make the same water filter.

"So, you're learning about how water filters work with activated carbon and some basic materials, and also have the challenge of some people having money and good instructions, while other people have no money and their instructions have been translated into gibberish.

"It's a physical interactive exercise to understand really quickly how many challenges some people face and why there is such inequality with access to engineering, knowledge and resources."

India then became co-ordinator of the EWB NZ schools programme, and also helped with marketing, fundraising and running events, eventually being made the national marketing manager for the organisation in the same month she started her graduate role with WSP Opus.



India Eiloart

At the end of 2018, she moved to the programmes team, where she is currently managing the Tarawa Water Supply Solar Distillation Project in the island nation of Kiribati.

Made up of 33 tiny island atolls scattered over 3.5 million square metres of ocean, an unreliable annual rainfall makes access to fresh water a struggle.

Half the country's population lives in South Tarawa (around 56,000 people) and other than rainfall, a major water supply is brackish water sourced from wells that are simply open holes in the ground.

The project India is running is to test a simple, modular distillation unit – it looks like a solar panel and boils water using solar energy and collects the condensation. It also collects rainwater when the weather complies.

The project wants to see if the plants are suitable as a government-run water source and whether the local communities can operate and use them successfully.

"These communities frequently have technology thrown at them to solve their problems, but then it [the technology] hasn't," she says.

"If this project proves that these plants aren't suitable then it's not a failure; it's confirmed the need for a trial and continues the research into appropriate technologies to support these remote communities."

Her EWB work takes around four hours each week, sometimes more, and WSP Opus is happy to support her need for flexible hours, for which India is very grateful, because she is clearly a woman on a mission.

"There are a few things I want to be doing.

"In my field I want to focus on water security – where is the water you're using coming from? Who is accessing it before it gets to you?

"How will climate change impact that water source? If that source isn't there what are you going to do? I want to understand and pre-empt all those risks.

"I also want to do my master's degree. I've been delaying because I didn't know what I wanted to do it on, but now I want to find a suitable thesis topic in water security.

"And then there are still opportunities with EWB NZ to be going on placements and continue helping people.

"I'm quite passionate about helping communities that don't have what they deserve in terms of access to safe water – and that's not just in the Pacific. New Zealand has a lot of communities that struggle with a secure water supply."

It's an admirable goal, and while she says she's still playing things by ear, you can rest assured that this is not the last you have heard of India Eiloart.

A career in water treatment

Malcolm Loan has dedicated his whole career to one organisation and, after 40 years' service with the Invercargill City Council, has retired. He talks with **MARY SEARLE BELL** about four decades of career.

“When I was growing up, not every town had a wastewater treatment plant,” recalls Malcolm Loan. “In fact, I can remember Invercargill’s first one being built.”

It was back in 1969 that the Clifton Wastewater Treatment Plant opened, and Malcolm was barely a teenager at the time. The idea of working in water and wastewater certainly hadn't occurred to him.

Engineering did appeal however, and, after leaving school, he went to the University of Canterbury to study civil engineering.

“When I chose engineering, I was thinking structural engineering. I wasn't really aware of water engineering until I got to university and saw the public health side of things.”

After completing his degree, Malcolm started work with the Invercargill City Council in a graduate engineer role.

“They moved me around a bit in those first years. I did structural, traffic and roading work. The roading included a bit of pipe design, but it wasn't the main focus.

“This experience did give me a broad base of knowledge though, and that is not a bad thing.”

Over the next five or six years Malcolm moved into more and more drainage work, until, in 1986, he was appointed as the council's drainage manager, which cemented the direction of his career.

“I had done quite a bit of stormwater design in the three or four years prior – we'd had a significant flood in 1984; in fact, several floods over a few years, and this prompted the city to redesign and upgrade its stormwater network, with work programmed over a 20 year period.

“We were kept busy with these improvement works, increasing stormwater drainage capacity, and also some river improvement works in conjunction with the Southland Regional Council. There hasn't been another flood of that size since, but the city is now ready for it.

“I hadn't actively sought this career, but the opportunity presented itself and I was pleased to get into it. I've always had a bit of a passion for the environment so it was good to be working closely with it.”

During Malcolm's tenure, the Clifton Waste Water Treatment Plant has undergone two significant upgrades. In 1992 a secondary treatment facility was installed along with an upgrade of existing primary treatment facility, and in 2004 the plant was further upgraded to tertiary treatment standard.

A second treatment plant was also built in Bluff, opening in 2000.

“From 1991, the Resource Management Act required much more comprehensive consents for major projects. This involved extensive consultation with the community and organisations with specific interest in the project's outcomes to arrive at a solution which had the community's approval.

“Getting into this level of consultation with interested parties was a new thing for us engineers, and created quite an additional workload. Project teams began to include lawyers, planners and scientists to a much greater extent than previously.

“We had to learn a lot of new skills along the way, skills that are now well ingrained in the engineer's role,” he says.

“When I look back, negotiating consents and managing major projects was a large part of my career. It could take two to three years, or longer to gain consent for a major treatment plant upgrading project.

Design and construction would take another two or three years, and then a couple more years to iron out unforeseen issues and have the plant running smoothly if it's a new type of plant.

“A treatment plant upgrade could take 10 years from start to finish”

Another significant change Malcolm has witnessed over the years is the increasing importance of asset management planning.

“When I first started, we put pipes in the ground and gave little consideration to their lifetime operation. Now we plan for replacement and upgrading from the get-go.

“The challenge over the past 20 years has been getting our heads around asset management and planning for the future. Back then we had little concept of what should be included in an asset management plan, and we had national workshops to work through the requirements.

“The plans have become increasingly complex over time, and developing them has become a specialist activity.”

Asset management is just one major challenge for water

engineers, according to Malcolm, the other biggie going forward is quality – with increased awareness of the state of our waterways and the public desire for swimmable lakes and rivers.

“The increase in quality standards for discharges from stormwater and sewage systems will always be a challenge for local authorities, particularly those with large discharge volumes,” says Malcolm.

“This is not ever going to go away and the requirements are only going to get stricter. As science understands the issues more, and new techniques are developed to remove contaminants that might be harmful to the environment and to public health, more will be required of local councils, and will come at considerable expense – something I don't think communities have really grasped yet.”

For Malcolm, however, this is no longer his problem.

Happily retired, he has yet to make any definite plans for the future. There's talk of travel, and he's also involved in a Landcare project to make a piece of land predator free, which will continue to take some of his time.

“When you spend 40 years in a job, there's a lot of things you don't do and opportunities you pass up because you're working.

“I will have plenty to keep busy, but I've deliberately not planned my retirement. Instead my wife and I will see how things develop over the coming months and will pick the activities we most want to do.”



Malcolm Loan

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PAPER OF THE YEAR

Designing a corrosion strategy for our largest wastewater asset

This is a precis of a conference paper focused on wastewater asset corrosion strategy that was awarded the *Paper of the Year* at the 2019 Water New Zealand conference and authored by: Stephen Grace, Watercare Services; Nigel Kay, Jacobs; and Shannon Goff, McMillen Jacobs Associates.

The Central Interceptor is a new deep tunnel sewer that will provide additional capacity to Auckland's water network to meet planned population growth and development by providing a more resilient wastewater/stormwater system, and mitigate a history of wet weather overflows in central Auckland. As a major infrastructure investment, prior to the project build, Watercare Services put a lot of research into the materials used to maximise the durability of the finished project and minimise the maintenance.

The project design

In the older parts of central Auckland, such as north-west Mt Eden, wastewater and stormwater currently flow into a combined network of pipes.

When it rains, the stormwater can (and often does – Ed) overwhelm these pipes and dilute wastewater flows into Auckland's waterways.

The main project component is a 4.5 metre wide, 13-kilometre-long tunnel between Western Springs and the Mangere Wastewater Treatment Plant (MWWTP) for collecting and transferring wastewater for treatment.

Sewer flows will enter the tunnel through drop shafts and traverse the length of the tunnel to the MWWTP where a terminal pump station will lift the flow into the plant headworks. The pump station is designed to transfer up to six cubic metres a second of storm flow to the plant.

The tunnel will also act as a 200,000 cubic metre capacity to temporarily store wastewater thereby controlling the flow into the treatment plant.

The entire project is being built over the next six years, having started in mid-2019 with a project completion by 2025.

The main tunnel, with a constant grade of 1:1000, will be built up to 110 metres below the ground surface and will cross under the Manukau Harbour about 15 metres below the seabed.

This tunnel will be excavated by a tunnel boring machine utilising precast concrete segments installed behind it for ground support (the tunnel lining will be subject to groundwater pressures up to 8.7 bar). The machine will be driven predominantly through weak sandstones and mudstones/siltstones of the Waitemata Group rocks, in particular the East Coast Bays Formation (ECBF), alluvium and marine sediments, and with limited risk of striking harder volcanic basalt.

In addition, two separate link sewer tunnels of 2.4 and 2.1 metres internal diameter and 1.1 and 3.2 kilometres in length respectively will be constructed by pipe jack methods. The pipe jacking drive lengths range from 300 to 960 metres between shafts. There are an additional seven temporary or permanent shafts associated with the link sewer tunnels.

With a spacing of up to four kilometres between shafts, future access for maintenance is a recognised challenge for the project.

Designing for a 100-year asset

The size of the project investment warranted a rigorous examination of the in-service environment and system performance during the design phase and investigations spanned three years of research into the anticipated operational regime, and available materials to ensure that a proposed 100 year asset life was achievable.

Field and laboratory testing has endeavoured to mimic the accelerated corrosion that is anticipated throughout the asset's life in a relatively short time.

Such research requires considerable resource and time and Watercare took the decision in 2016 to undertake the research ahead of market engagement, as there would have been insufficient time during the tender process to obtain the required evidence to select an appropriate system.

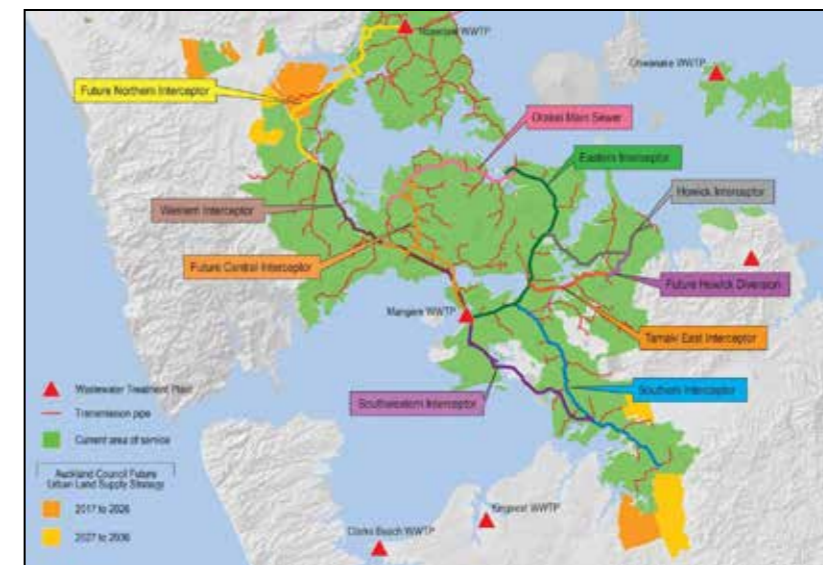
Despite the tunnel being principally used for wastewater, the northern catchments that the tunnel serves include large areas of combined sewer networks, so the wet weather contribution is significant and large storms can dominate capacity requirements.

The catchments to the west and north of Auckland (currently served by the Western Interceptor) carry predominantly sanitary sewage that will be highly corrosive given the long transit times from the network extremities.

It is this sanitary sewage flow that affects the corrosion rates, particularly on Link Sewer C and the Main Tunnel south of the May Road shaft.

To achieve the required design life, a number of strategies were employed, including environmental controls, material selection, and hydraulic design.

Watercare also undertook multiple sampling campaigns to determine the corrosion potential of the wastewater to be conveyed in the system. Over the past two years, this consisted



Watercare's Wastewater Network with Central Interceptor (orange line).

of sewage sampling as well as advanced computer modelling to predict corrosion rates, and extensive laboratory testing of corrosion resistant materials for the highest risk elements.

Concurrently, samples of these corrosion resistant materials were exposed to the existing sewer network to replicate the in-service conditions that the Central Interceptor tunnel and shafts will experience throughout the asset's life.

Additionally, design elements such as concrete cover, embedded polyethylene liners, and the overall hydraulic performance have been considered in determining the optimum strategy.

A risk assessment further assisted in defining what strategy should be applied in specific elements of the scheme.

Construction works have started and Watercare says it proceeded with confidence that the design objectives will be achieved.

The corrosion cause

Microbially induced corrosion (MIC) is a bacterially mediated process of forming hydrogen sulphide (H₂S) gas that biochemically oxidises in the presence of moisture to form sulphuric acid.

The effect of sulphuric acid on concrete surfaces exposed to severe wastewater environments can be devastating.

The extent of dissolved sulphide generation in the sewage, and the sewer gas space H₂S concentration, are in turn dependent on many factors including, sewer slope, sewage velocity, air flow velocity, dissolved sulphide and sulphate concentrations in the sewage, sewer surface roughness, and aggregate sewage detention times in the network.

Overall corrosion results were presented as estimated annual corrosion rate for Ordinary Portland Cement (OPC) concrete, which is the binder in typical concrete used for a segmental tunnel lining and very susceptible to acid attack by the dissolution of the calcium compounds present in the concrete.

There are a total of 17 shafts (including Mangere Pump Station) across the project (for the main tunnel and link sewers) that would typically be constructed of OPC concrete.

Sulphide generation and corrosion models were developed to estimate the rates of corrosion of the Central Interceptor system under both natural ventilation conditions (i.e. with no mechanical air induction into, or extraction from, the system) and forced ventilation conditions, using extraction fans.

Deep tunnels such as those featured in the CI are also difficult to inspect using conventional technologies, so achieving the design life becomes even more critical.

Corrosion protection summary

The corrosion protection strategy for the CI project was determined through a programme of analysis and testing of the real life in-sewer environment, computer modelling, local and overseas laboratory testing, and risk assessment with guidance from international expertise.

After taking ventilation into account, the depth of corrosion in OPC concrete during a 100 year design life is predicted to range from 42mm to 156mm generally, and 50mm to 268mm at hot spots (areas of localised turbulence).

Forced ventilation of the main tunnel and link sewers was proposed to reduce H₂S gas concentration and reduce the rate of corrosion. This involves the exhausting and treatment of air from the sewer air space, which fluctuates as the tunnel fills and drains of sewage, and with a dual benefit of controlling odours by only exhausting at shafts with air treatment facilities.

The selection of materials is critical to the corrosion risk of various project assets. For the main tunnel, which is a considerable length and will be the most difficult to access to complete inspections and repairs, a more traditional corrosion protection strategy was selected that referenced similar international pipe projects. For the shafts, an investigation into alternative materials was undertaken.

Several tunnel lining systems were considered during preliminary design including both one-pass (single lining) and two-pass (primary and secondary lining) options. The two-pass tunnel lining systems were undesirable due to cost and programme considerations, and were not adopted by the tenderers, despite the specifications allowing for this option.

The Main Tunnel lining system decided on is a one-pass, gasketed precast concrete segmental plastic lining system, on the the intrados (inside) surface of the segments, designed to handle the maximum anticipated loading conditions along its length.

The PE membrane is cast into the segments during manufacture and the membrane joints between segments are welded in situ during lining installation.

For the two small shafts (three metre internal diameter), a solution using a GRP pipe liner in a drilled shaft was adopted.

For shafts larger than three metre diameter where drilling a bentonite-filled shaft is impractical, the solution depended on the predicted corrosion rate at the specific shaft.

Where predicted corrosion rates were sufficiently low, the solution of OPC concrete with sacrificial concrete thickness was adopted.

• For more details read the full paper on the Water New Zealand website www.waternz.org.nz

Emerging organic contaminants

A report has found indications that animal and human wastewater are entering our groundwater systems. Article supplied by ESR.



ESR Principal Scientist Murray Close.

A report on groundwater contamination released in October is the latest in a four-yearly nationwide survey of our groundwater resources that have been coordinated by ESR since 1990 on behalf of the regional and unitary councils.

As the eighth consecutive survey, this latest report is based on studies conducted from September to December 2018.

ESR Principal Scientist Murray Close says the latest report testing covered, in addition to pesticides, emerging organic contaminants and glyphosate (the active ingredient in a popular weed killer).

“We found clear evidence in close to two-thirds of wells tested that emerging organic contaminants (EOCs) are making their way into the groundwater,” he says.

“Although they have only been detected at low concentrations, there is growing concern about EOCs in groundwater and their potential impact on the aquatic organisms living there.” Groundwater is an integral part of our freshwater system, he adds.

“With 80 percent of annual river flow coming from groundwater and 40 percent of New Zealanders depending on it for their drinking water, the quality of groundwater is essential to human and animal health and is critical to our environment and economy.

“In addition, in the majority of regions the volume of groundwater used is increasing due to increased demand for agriculture and industry.

“There is growing interest from the community about what contaminants are reaching groundwater – hence the importance of the survey.”

A total of 279 wells were sampled for pesticides, he says, and none of the sampled wells exceeded safe drinking water standards with most pesticides detected at less than 0.5 percent of the maximum acceptable value (MAV).

Glyphosate was found in only one well from the 135 wells tested. The level detected was well below (over 400 times lower) the WHO recommended health-based value.

Murray says that particular well was used for irrigation,

not drinking water and had poor wellhead protection and chemical containers were stored nearby.

“It is most likely that the glyphosate and other pesticides found in the well came from containers stored near the well, rather than through the soil, reinforcing the need for good wellhead protection.

“Glyphosate sorbs to soil strongly and degrades fairly rapidly, so the lack of glyphosate found in groundwater in this survey is not surprising.”

Wells in the survey were selected on the importance of an aquifer to a region and the vulnerability of the aquifer to contamination. Where possible wells were also selected that had been sampled during previous surveys.

The majority of the wells in the current survey showed no change in the amount of pesticides present compared to previous surveys with less than a quarter of the wells having low levels of pesticides detected.

Herbicides were the most frequently detected pesticides group with 98 detections of 17 different herbicides and their metabolites.

Analysis was carried out on 121 wells for a range of EOCs using a highly sensitive analytical technique that measures EOCs at extremely low concentrations (parts per trillion).

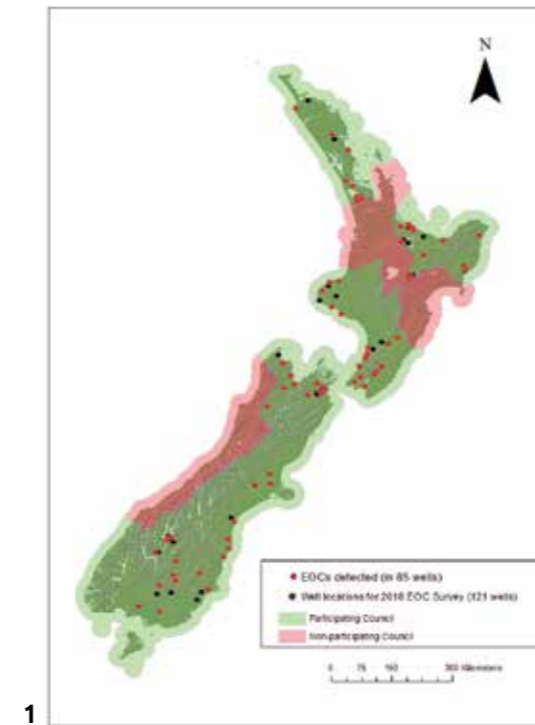
Murray says there is growing concern about EOCs and their potential impact on human and aquatic health. Little is known about their concentrations in groundwater, he says.

EOCs are a class of compounds used for everything from the production and preservation of food to personal care products, as well as human and animal healthcare.

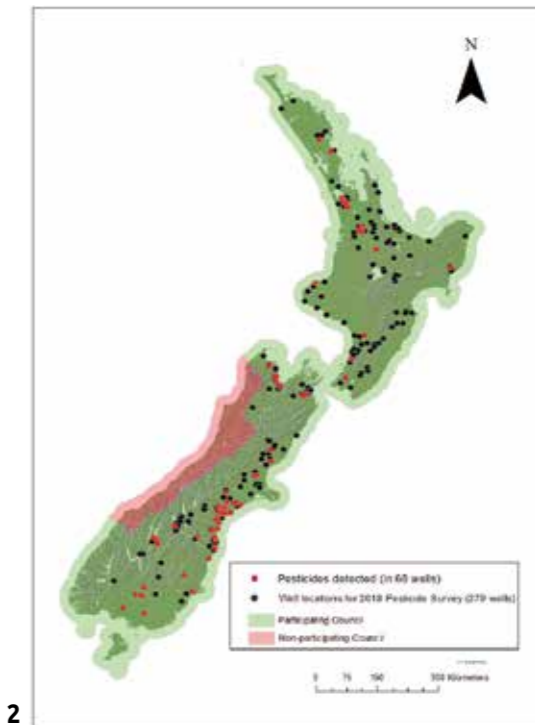
Some of these compounds have been detected in freshwater systems and are more likely to be transported into surface water rather than groundwater, depending on their mobility and persistence.

However, he points out that little is known about the transport characteristics of these compounds and, prior to this survey, almost nothing about their occurrence in our country’s groundwater systems.

“More research is needed so that we have a better



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1. 2018 EOCs Survey Map 30 Sept 2019 at 1pm.
2. 2018 Pesticide Survey Map 29 Sept 2019.

understanding of groundwater systems and how contaminants move with them,” Murray says.

The survey tested for close on 30 EOCs, including a diverse range of products such as caffeine and artificial sweeteners along with pharmaceuticals such as pain relief products, contraceptive pills and sunscreen.

These are all indications that human effluent is getting into the groundwater and Murray says all regions that had wells sampled for EOCs had them detected.

“We found these compounds in 70 per cent of wells, and detected 25 of the 29 compounds we tested for.”

The most commonly found EOCs in the survey was bisphenol-A (BPA), which was detected in 40 wells, along with UV filter compounds.

The report says most of the EOCs detected in the study originated from human body metabolisms such as caffeine, sucralose, ibuprofen, or steroidal hormones, or products applied to protect skin from the sun. Other EOCs, such as BPA, are used widely in packaging and plastic products or, in the case of parabens, as food preservatives.

Overseas research links the discovery of EOCs in groundwater to wastewater sources including municipal treatment plants, septic tanks, farming activities, as well as indirectly from surface water.

The compounds tend to be used by us in milligram and gram quantities, but they are being detected in the groundwater at ng/L or parts per trillion. Those levels are likely to have very low toxicity to humans.

Murray says that, while there are no known health or environmental risks, there are generally no health guidelines associated with EOCs.

“The contaminants are widely used and are making their way into the environment in low concentrations.

“However, some of these compounds have shown some endocrine disrupting effects in surface waters and the main concerns with these EOCs are environmental or ecological impacts.

“There are no or very few guideline values for EOCs regarding ecological impacts as the required studies are sparse.”

Some EOCs, such as sucralose and caffeine, can act as tracers

Organisations involved

Two regional councils provided pesticide results that were sampled outside of this survey. The Waikato Regional Council provided results for an additional 41 wells that had been sampled as part of a regional survey in December 2016.

And Environment Canterbury also provided results for an additional 71 wells sampled in late 2018. Both these datasets were included in this report to give a national perspective.

AsureQuality carried out the pesticide and glyphosate analyses. Samples were analysed for acidic herbicides and a suite of organochlorine, organophosphorus and organonitrogen pesticides, and for glyphosate, glufosinate and their major metabolites.

The EOCs were analysed by Northcott Research Consultants.

ESR coordinated the survey, advised on well selection, collated and interpreted the results and provided the national summary report.

of the presence of human activities or wastewater impacts in the groundwater system.

The latest survey report concludes that there is a lack of knowledge of the fate and effects of many EOCs and whether the concentrations measured in this study are likely to have impacts for ecological systems.

It also recommends that monitoring of the country’s groundwater resources be extended and research be carried out to investigate the likely risks for the EOCs that were detected in the latest study – including any impacts on ecological systems.

“A key unknown area is whether the levels of BPA and some of the other compounds found in groundwater might have impacts on aquatic organisms (protozoa and tiny crustacea) found in groundwater,” says Murray.

The growing 'forever' chemical threat

Variants of PFAS (perfluoroalkyl and polyfluoroalkyl substances) nicknamed the “forever chemical” because it does not break down once released into the environment, have been detected in water sources for 74 Californian communities serving some 7.5 million residents.

According to a report by The Environmental Working Group (EWG – an advocacy group that champions a chemical free environment) findings in the water sources from the California systems exceeded 1 part per trillion (ppt), which is the safe level recommended by the independent studies endorsed by EWG.

More than 40 percent of the systems contained at least one sample with a level of total PFAS over 70 ppt.

Very low doses of PFAS in drinking water have been linked to an increased risk of cancer, reproductive and immune system harm, liver and thyroid disease and other health problems, according to the organisation.

Its report found the utilities with the highest level of PFAS were found in the southern part of Camp Pendleton, the Marine Corps base in San Diego County, where 820 ppt for several different PFAS chemicals was measured in a single well in 2017.

The testing has been done every year since 2013 (at drinking water source, not in household tap water), when the U.S. Environmental Protection Agency ordered nationwide sampling for PFAS.

“Maximum detection levels reported to the California State Water Board and the EPA are a snapshot of what was in the water when it was tested, not necessarily what is coming out of taps now,” the report says.

Tasha Stoiber, a senior scientist at EWG and the lead author of the report, says that, while PFAS has contaminated communities all over the US, the “crisis has been under the radar in California” until now. “PFAS pollution in California is much more widespread than we knew,” she says.

Throughout the US, PFAS has been found in more than 800 communities, military bases, airports and industrial sites, but the EPA has not set a national legal limit for

PFAS in drinking water supplies.

“The only way to tackle this contamination crisis is for Congress to act,” says Stoiber. “Tougher laws and regulations are essential.”

Major sources of PFAS include foams used to fight fires, industrial discharge of PFAS into the air and water, and PFAS in food packaging, non-stick cookware and fabric treatments.

“PFAS are used in hundreds of everyday consumer products and commercial applications,” says Stoiber.

“Decades of heavy use and unregulated production have resulted in contamination of water, soil and the blood of people and animals in the farthest corners of the world.”

New Zealand's track record

This country does not have a good historic record for banning the use of chemicals that were deemed toxic by other countries.

We were one of the last countries to stop the widespread use of DDT. The chemical was widely used in agricultural pest control and was very effective in grass grub control in farm pastures.

DDT is an organochlorine insecticide that is a persistent organic pollutant (POP) with a half life of 2–15 years. Concerns were raised about its use in the 1940s but the

publication of Rachael Carson's book *Silent Spring* in the 1960s was the catalyst leading to DDT being banned: First in Hungary, Norway in 1968, Sweden in 1970, the US in 1972, the United Kingdom in 1984, and in New Zealand in 1989.

Being bio-accumulative, DDT passes up the food chain and organisms at higher trophic levels end up with high concentrations of the pesticide.

In the 1980s 40 percent of the lambs in Canterbury, a region with low rainfall and occasional droughts, had DDT levels that were above the European Union's permitted limit but still acceptable under safe tolerance limits for New Zealand. DDT has even been found in the endangered Hector's dolphin.

Another chemical widely used in New Zealand until banned was 5-Trichlorophenoxyacetic acid (2,4,5-T), a synthetic herbicide used to defoliate broad-leaved plants. It was developed in the late 1940s and was widely used in the agricultural industry until being phased out, starting in the late 1970s due to toxicity concerns.

In 1970, the United States Department of Agriculture halted the use of 2,4,5-T on all food crops except rice, and in 1985, the EPA terminated all remaining uses in the US of this herbicide. New Zealand ceased manufacturing and using 2,4,5-T in 1987.

The global threat

PFAS are a large group of manufactured compounds that have industrial and consumer applications. There are more than 3000 such substances, grouped in various subclasses.

PFAS is an acronym for per- and poly-fluoroalkyl substances.

Some of these substances – such as PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid) – are of concern,

PFAS is very persistent in the environment and human body, with chemical build-up in the blood and organs and present in nearly all Americans who have been tested, says the US Centers for Disease Control and Prevention.

Our own Ministry for the Environment

claims levels of contamination in New Zealand are expected to be low compared to other countries.

The ministry runs an All-of-Government Programme (AoG), that oversees and co-ordinates our official response to PFAS contamination here.

PFAS compounds include both PFOA and PFOS chemicals that have been used in firefighting over the past 50 years for flammable liquid fires at airports and other fire training sites across New Zealand, it says.

“PFOS is a persistent organic pollutant (POP) which was banned for use in New Zealand from 2006 onwards in fire-fighting foams, and from 2011 in all other products.

“PFAS are new contaminants with unique

properties and their interaction with humans and the environment are only partially understood.

“Research to date has found no conclusive evidence to quantify the health and environmental effects of PFAS.

“Consistent with other administrations worldwide, the All of Government programme is adopting a cautious health-first approach to PFAS largely because of its bio-accumulative properties.

“The initial PFAS investigations stemmed from the historic use of firefighting foams on New Zealand Defence Force sites. Firefighting foam was not the only use of PFAS so other industries and sites will be identified and, where required, investigated.”

Michigan makes a stand

The state of Michigan is proceeding with plans that could impose some of the USA's strictest and most far-reaching limits on PFAS chemicals in drinking water.

In October the State Governor, Gretchen Whitmer, directed Michigan's environmental agency to develop drinking water standards for certain toxic industrial chemicals rather than waiting for updated federal guidelines.

The draft regulations, including maximum contaminant levels for seven types of PFAS, are based on recommendations made by a science advisory workgroup back in June. A public comment period is expected to start later this year with final rules adopted by April.

Meantime, the US Environmental Protection Agency, which has established a nonbinding health advisory threshold of 70 parts per trillion, is considering nationwide rules on the toxic chemicals. Whitmer, a Democrat, says she will not wait for the Trump administration to act – a move that has drawn praise from environmental groups.

“This is a serious issue that is impacting more and more

communities,” she says. “I think Michigan can be a leader in combating (PFAS). But it's going to be driven by science and facts.”

Whitmer did not indicate what she thinks the standard should be or when the rule will be finalised, saying “we need to rely on experts and scientists to advise us.”

A Democratic-sponsored bill that would designate a 5 ppt ceiling for perfluorooctanoic acid and perfluorooctanesulfonic acid has not been voted for in the GOP (Republican)-led Legislature, prompting environmentalists to criticise the EPA for not moving fast enough.

More than 60 drinking water systems in the state that were sampled last year had measurable levels of PFAS. Two of them had PFAS levels above 70 parts per trillion. About 75 percent of Michigan's drinking water comes from more than 1100 public systems. The testing by the state's environmental agency did not include private residential wells.

Interesting note: the name of Michigan, a state in the Great Lakes and Midwestern regions of the United States, originates from a native word that means ‘large lake’.

Building connections in Rwanda



Water engineer Jules Scott-Hansen (left) describes her trip to Rwanda on an assignment with Bridges to Prosperity (B2P), a charity organisation constructing a 58 metre suspended bridge across the Sebeya River.

In August 2019 a team of 10 strangers from New Zealand, Australia, The Philippines, Sweden and the UK travelled to Rwanda to take part in a bridge-building project in a remote rural location, in the western area of the country.

The things that had brought us together for this experience included that we all worked for WSP, we were engineers, we all wanted to be involved in a project where we could see the direct benefit to people, and we all had a keen sense of adventure.

After a few months of planning, fundraising, Skype calls with scheduling difficulties due to the 12 time zones, and a near last-minute cancellation due to the Ebola spread in neighbouring Democratic Republic of Congo (DRC), we finally found ourselves together as a group in Kigali, the capital of Rwanda.

After a night of delicious local dining and a few drinks to celebrate our inaugurated group, we left Kigali (and the immediate luxuries of the city) the next day to travel four hours

westward to the Rutsiro district, a rural area near the border of DRC.

The ensuing two weeks we would spend together, living in primitive accommodation with bucket showers and pit latrines, eating the same meal for lunch and dinner every day, laughing, sweating and working together and forming bonds that changed us from strangers and international colleagues to friends.

The task at hand was to help Bridges to Prosperity (B2P), the charity organisation we were partnering with, finalise the construction of a 58-metre suspended bridge across the Sebeya River.

The bridge construction was already well underway by the time we showed up to site, with B2P having worked alongside selected members of the surrounding villages for about two months prior.

The bridge abutments had been built and cast, the six steel

cables had been painstakingly carried across the valley and connected at both ends, and the remaining activities for the last two weeks of construction before the opening ceremony included setting the cable tension, constructing the bridge deck, installing handrail fences and of course painting the bridge towers in yellow, green and blue to match the colours of the Rwandan flag.

How many engineers does it take to build a bridge?

Our team, perhaps not surprisingly, included eight bridge engineers. The two remaining team members included a geotechnical engineer and me as a water engineer.

Given the steep hillsides surrounding our site, one can see how some geotechnical expertise seemed sensible. However, as a water engineer I couldn't help but feel a bit baffled at how I'd managed to get the opportunity to join a project like this.

Having just completed a three-year house renovation back in New Zealand I luckily had some hard-earned practical skills to bring to the table.

A typical day started with a 5.30 am wake-up, breakfast at 6.00, piling into our rental cars by 6.30 and thereafter a bumpy 45-minute drive along dirt roads that tracked ridge lines dotted with mud brick houses, beautiful tea plantations and smiling faces everywhere.

The journey to site also included a 15-minute walk down a very steep hillside, which took twice as long for tired legs to re-climb in the afternoon.

We grouped together with the local workers on the 'soccer pitch' (actually a sandy flood plain at a sharp bend in the river) near site every morning and started off with a toolbox talk, held both in English and Kinyarwanda, and a quick stretch-and-flex session to get our bodies moving before the physical day ahead.

We would usually split into smaller groups depending on the day's activities and for most tasks we would make sure the groups included both our WSP team members as well as local workers.

Language-barriers definitely presented some challenges for both sides, but sign language, some translation from the local B2P staff, and some manual demonstration usually got things progressing smoothly.

By the end of the day, our tired legs slogged back up the hill and after a well-deserved dinner and usually a round of card games we were all ready for bed by 9.00 pm, tucked under our mosquito nets and setting our alarms to get up and do it all again the next day.

Bridge building in a remote part of Rwanda doesn't come without its challenges. But, despite receiving the last of the decking timber on the final day of construction and running out of the right length screws laying the last few planks to connect the bridge deck in the middle (we created some by taking an angle grinder to some longer screws), we managed to meet our deadline of completing the bridge in time for the opening ceremony on the Thursday of the second week.

The opening, in true Rwandan style, was a festive event with the local community and invited guests including local politicians and community leaders.

Once all the speeches were out of the way, we were treated to a display of singing and dancing from what must have been around 1000 local kids and villagers.

Any sulky memories of early mornings, sore muscles and blisters on our hands were quickly erased by the entrancing and vibrant performance we were witnessing.

Safer connections

The bridge will provide the surrounding villagers with safe access across the Sebeya River all year around.

The previous crossing involved rickety timber logs spanning the banks that would get washed away during floods that occur multiple times during the rainy seasons throughout the year.

Despite the danger these floods present, people isolated on one side of the hill from access to health care, work, school and markets would get desperate and eventually attempt crossing, occasionally ending in disaster.

We heard a personal account from the President of the newly formed Bridge Committee, who will be in charge of

maintaining the bridge for the local communities, about losing his cousin and grandparents to the raging torrent of the river.

Stories like these gave the otherwise rather dull-sounding word ‘infrastructure’ new meaning for all of us.

It seemed like just as quickly as we had come together, our group disbanded a few days later as we travelled back to Kigali and thereafter on to our respective home countries.

We reflected on our incredible privilege to get to contribute to a project that has such an immediate and direct impact on people’s lives.

As engineers, I think this is an aspect of our work that is often overlooked, mostly by ourselves as we go about our daily grinds, and it’s important to take opportunities like these to appreciate the improvements we can make through our projects, however big or small.

1. Previous page: The team working on one of the abutments with a line of onlooking kids watching patiently from behind the safety tape. 2. Rewarded with stunning views of the surrounding hills on our afternoon walk back up from the work site. 3. The bridge decorated in balloons ready for the official opening and ensuing celebrations.



Oxfam Flow project to transform Papua health

The project

Oxfam plans to partner with local community-based organisations and closely collaborate with government stakeholders, to provide sustainable safe water supply, and foster improved sanitation and hygiene practices in 12 communities in Eastern Highlands Province.

Reaching an estimated 30,000 people, Oxfam and its local partners will install high-quality sustainable water supply and sanitation systems in 12 schools and eight health centres, and deliver training on improved sanitation and hygiene to surrounding communities.

This new four-year ‘FLOW’ programme maximises the impact of this investment by linking field-based interventions to an evolving water, sanitation and hygiene (WaSH-systems) strengthening approach, designed to motivate government agencies to implement the new GoPNG WaSH policy, and stimulate communities to demand and support the rollout of essential WaSH services.

Led by ATP, Oxfam will install infrastructure (a mixture of gravity-fed systems and rainwater catchment) as well as sanitation facilities (most likely ventilated, improved pit latrines and female showers) to increase the use of safe, appropriate and functioning WaSH facilities.

A people-focused design approach will ensure that this infrastructure is appropriate to the needs of all community members, including women,

“Now that the water is close to my house... my school marks started to improve. It also helps my parents to do other work too,” says Rosalyn Kuman a resident of Kopas Village.

You can help Oxfam New Zealand deliver safe drinking water and sanitation facilities to 12 schools and eight health care centres in the rural highlands of Papua New Guinea that reach an estimated 30,000 people.

With a population of 7.5 million Papua New Guinea is the largest and most populous country in the Pacific.

Unfortunately, some 15 percent of child deaths under five are caused by diarrhoeal diseases; 77 percent of rural people don’t have access to safe water; and PNG ranks 156 out of 187 countries in the UN Human Development Index.

So, there’s a lot we can do as a developed nation to help with water infrastructure.

children, and people living with disability.

To learn more and support this vital project you can donate directly at oxfam-flow.raisely.com

Or get in touch with Oxfam NZ Corporate Relationships manager Charlene Fitisemanu to discuss more.

Art to transform lives

Artist Misery has teamed up with Oxfam for a one-off mural to transform lives in the Pacific region.

World-famous, Kiwi wall and pop artist Misery is renowned for her colourful, whimsical characters, and has joined forces with Oxfam New Zealand to create a stunning mural in the heart of Auckland’s City Rail Link project, to fundraise the delivery of clean drinking water and sanitation to Papua New Guinean communities.

The one-of-a-kind mural was exhibited in downtown Auckland, at 1 Queen Street next to City Rail Link’s tunnel works at Britomart, before seven panels become individually available for purchase by online auction to raise funds for Oxfam’s work.

Misery has also kindly provided a number of limited-edition prints as gifts for generous supporters who donate to this Papua New Guinean project.

Mural panels are on public display at 1 Queen St, Auckland CBD, thanks to City Rail Link, before being auctioned later this year. To register interest please contact: charlene.fitisemanu@oxfam.org.nz



Defining a river bed



By Helen Atkins, Director and Tom Gray, Solicitor, Atkins Holm Majurey.

Further clarification has been provided across regulations, policy and case law impacting on water use, now Central Government has confirmed the independence of the new central regulator as part of its three waters programme.

We explain what this means for the regulator's role and what we can expect the legislative structure to include.

An Action plan for Healthy Waterways has also been launched which seeks to stop further degradation of our waterways.

While the action plan sets out a pathway to achieving goals there may be some difficulties in its application to overcome.

We also see some appeals moving through the superior courts with decisions from the High Court, confirming a hard stance on lapsed water consents, and Court of Appeal, confirming the definition of river "bed".

Three Waters Update

In the Three Waters regulatory space, Ministers have now agreed to establish the new central regulator for drinking water as an independent Crown entity, rather than locating the regulator within an existing organisation such as the Environmental Protection Agency.

The decision hopes to achieve a strengthened and more focused approach to drinking water regulation and safety, while considering longer term strategic benefits of having a standalone organisation as the importance of drinking water continues to increase.

The regulator is the result of concerns regarding the Havelock North incident, with Minister of Health Dr David Clark stating that; "This Government has learned the lessons from the Havelock North tragedy, and we are working to fix the problems exposed by the resulting inquiry."

The Ministers have agreed that the regulator's statutory objectives will relate to:

- protecting and promoting public health outcomes and drinking water safety;
- administering the drinking water regulatory system;
- building capability among drinking water suppliers, and across the wider water industry, including by promoting collaboration, education and training; and
- recognising and providing for Te Mana o te Wai with regard to drinking water.

There has been considerable support for the decision to establish the regulator as an independent agent, including from Water New Zealand, as the focus on drinking water safety will not be impeded as it would with an agency which also must consider other potentially conflicting objectives and pulls on its resources.

The regulator will also contribute to fresh-water outcomes under 'three waters' by providing central oversight and guidance for the sector's wastewater and stormwater regulatory functions.

An Establishment Unit is being created within the Department of Internal Affairs, with support from the Ministry of Health and the Ministry for the Environment, to design and operationalise the new regulator.

While the regulator will be independent, the legislative provisions will also enable government policy statements to be issued to the regulator, and require the regulator to give effect to these statements, where these do not interfere with the regulator's statutory independence in carrying out its compliance, monitoring and enforcement activities.

Associated legislation to arm and direct the regulator can be expected to be introduced to Parliament in the coming months and is expected to be passed in 2020.

Action for Healthy Waterways

Environment Minister David Parker and Agriculture Minister Damien O'Connor launched the 'Action for Healthy Waterways' on 5 September 2019.

The Action plan is intended to halt the degradation of our waterways, make a noticeable improvement in the quality of the waterways within five years, and restore our waterways within a generation.

The Ministers recognised that the health of our waterways is a national issue, and everyone needs to play a part. Minister Parker rejected the notion of a rural/urban divide and acknowledged the importance of a fair approach to Maori rights and interests in waterways.

As part of the Action Plan, the Government has proposed a new Draft National Policy Statement on Freshwater Management (Draft NPSFM) and a proposed National Environmental Standard for Freshwater Management (NESFM).

The Action Plan for Healthy Waterways is a package of documents that aims to achieve the objectives of stopping further degradation of our waterways, reversing past damage and addressing water allocation issues.

To do this, the Government has proposed:

- To speed up the implementation of freshwater regulations through amendments to the RMA;
- Set clarity and policy direction to bring our freshwater to a healthy state within a generation in a new National Policy Statement for Freshwater Management;
- Raise the bar on freshwater ecosystem health by introducing new attributes and requirements in the NPSFM to protect threatened species and habitats;
- Support the delivery of safe drinking water through amending the National Environmental Standard for Sources of Human Drinking Water;
- Better manage stormwater and wastewater to stop things getting worse and improve freshwater health in a generation, through new regulations and potentially new legislation; and
- Improve farming practices where needed to stop things getting worse and improve freshwater health in a generation, through new National Environmental Standards for Freshwater (NES-FW) and regulations.

The proposed Draft NPSFM:

- (a) supports the fundamental concept of Te Mana o te Wai – "the mana of the water";
- (b) is intended to strengthen the requirement to identify and reflect Maori values;
- (c) states the compulsory values – ecosystem health, human contact, threatened species, and mahinga kai for tāngata whenua – that must be considered by councils; and

(d) sets national targets for waterways and a number of limits for different attributes in rivers and streams, including phosphorus, E.coli, and nitrogen.

However, a concern is that the Draft NPSFM does not cohesively or logically apply any of the freshwater management legislation, or standards that are already in place, which may lead to confusion and a lack of action in the future.

The NESFM sits below the NPSFM in the planning hierarchy and outlines the activity status for several activities within the freshwater environment.

The NESFM provides regional councils with the standards and tools needed to implement the limits set out in the NPSFM. The Government will also be proposing National Environment Standards for human drinking water and wastewater discharges as part of the upcoming 'three waters' reforms.

Part of the Action for Healthy Waterways package was an amendment to the RMA that enabled freshwater plans to fast-track through the council processes – in the same way the Auckland Unitary Plan, Christchurch Recovery Plan and freshwater management plans in Canterbury have all been fast tracked.

And the public will only have one right of appeal, which will be against decisions of the council to not adopt the recommendations of the independent hearings panel.

The RMA Amendment Bill has recently concluded its consultation phase, with submissions having closed 7 November 2019.

For more information on these matters look out for the submission from Water New Zealand that was lodged at the end of October.

Kilmarnock Farm Ltd v Canterbury Regional Council [2019] NZHC 2467

The High Court has upheld the decision of the Environment Court declining to make a declaration that two water consents held by Kilmarnock Farm Ltd (Kilmarnock) were given effect to before they lapsed.

Kilmarnock owns a farm in North Canterbury, adjacent to the Hurunui River. For irrigation purposes, Kilmarnock holds two water permits to authorise the take of surface water from the Lower Hurunui River.

In October 2017 the Canterbury Regional Council (Council) advised that the water permits held for irrigation purposes had lapsed on 30 September 2017 because they had not been given effect to.

Kilmarnock then sought declarations from the Environment Court that the water permits had been given effect to, arguing that it had prepared a Farm Environment Plan, installed fish screens and preparatory land development programme had commenced (thus satisfying some of the conditions of the water permits) and that water had been taken from the river.

However, the Environment Court declined to make the declaration sought as the temporary nature of fish screening designs was not sufficient to satisfy the condition requiring ‘final designs’.

Kilmarnock appealed the Environment Court decision, arguing that the Environment Court had erred in law when it found that Kilmarnock had failed to comply with the requirements of the permits’ fish screen conditions and that it failed to give effect to the resource consents.

The High Court assessed the conditions of the water permits and the evidence which was before the high Court and had been before the Environment Court, and found that there was a mistaken factual finding in relation to one of the conditions of the water permit.

But, that this was not determinative of the Court’s overall decision that the establishment conditions relating to fish screening had not been reasonably and substantially satisfied.

Ultimately, the High Court found that Kilmarnock had failed to comply with the conditions of the water permit and that the decision of the Environment Court did not give rise to an error of law.

This reiterates the importance of giving full effect to water permits and issues a warning of the stance taken to enforce the lapsing of unused consents.

The appeal was dismissed.

Canterbury Regional Council v Dewhirst Land Company [2019] NZCA 486

The Court of Appeal has upheld the High Court decision regarding the interpretation of the word river “bed” under the Resource Management Act 1991 (RMA).

Dewhirst Land Company (Dewhirst) succeeded in the High Court on questions of law concerning disputed facts for sentencing purposes regarding prosecutions for works undertaken on the bed of the Selwyn River and water diversion.

Dewhirst owned farming land adjacent to the bank of the braided river and undertook works to develop the land – some of which the Council held to be within the “bed” of the river.

Council now sought a determination from the Court of Appeal of the proper interpretation of “bed” as it related to a river, which is defined in the RMA as “the space of land which the waters of the river cover at its fullest flow without overtopping its banks”.

The definition becomes difficult for braided rivers which may not have a discernible bank and have identified flood plains.

Council sought leave to bring a second appeal on three questions of law:

1. Did the High Court err in its assessment of the correct test for determining the extent of the riverbed in applying the definition of “bed” in s 2 of the RMA?
2. Did the High Court err in adding the phrase “usual or non-flood” into the definition of “bed” in s 2 RMA by implication?

3. Did the High Court err in concluding that the assessment of various flow rates or return periods were an irrelevant consideration in determining the extent of the riverbed?

The Court was satisfied that the issues raised in the appeal were of general and public importance and granted leave to appeal, noting that the correct approach to the RMA definition of “bed” would determine the extent of the area of land considered to be riverbed in rivers across New Zealand, particularly braided rivers, which would have an effect nation wide.

The Court summarised the High Court findings and detailed the present arguments before highlighting the applicable statutory provisions and definitions of the terms “bed” and “river” in the RMA.

However, it was noted that the terms “fullest flow” and “banks” were not defined. The Court also reviewed the statutory and case law history of the terms “bed” in relation to a river, and “banks” in relation to the phrase “fullest flow without overtopping its banks” that it considered assumed the importance and relevance of banks in understanding the space of land which comprised the bed of any river.

The Court agreed that Parliament never intended that floodwaters or flows following only from major storms fell within the RMA definition of “river” when assessing a riverbed.

The Court found that the determination of a river “bed” would depend not only on the position of the banks of the river, but also on the water coverage measure as determined by the river’s fullest flow occurring within those banks.

That qualifying term served to exclude flows higher than normal arising from major storms where the water extended temporarily beyond the banks. As such, the Court upheld the definition of Glendall J in the High Court.

On the second question of law the Court found that there was no need to imply the words “usual or non-flood” into the definition of river “bed”.

Rather, the application of the definition would involve an assessment of what was the usual or non-flood level. The Court also noted that the words “fullest flow” were qualified by the phrase “without overtopping its banks”, which could only be reference to flood conditions when the water breached the banks.

The Court therefore considered that the High Court did err in adding the phrase “usual or non-flood” into the definition of “bed”.

Lastly the Court upheld the judgement of Glendall J in the High Court that any reliance on the methodology using data from 50 and 20 year flood returns was flawed. Therefore, the Court of Appeal upheld the decision of the High Court to disregard such data as irrelevant in applying the definition of river “bed”.

The appeal was dismissed.

A case study in Asset Information Modelling



This article follows an initial introductory piece in the September/October 2019 Water New Zealand Journal, with more detail on the Hamilton City Council Pukete Wastewater Treatment Plant Asset Information Model, and the integrated array of technologies and approaches used in its development.

By Glenn Jowett (pictured), Senior Associate – Beca, BIM Delivery Lead.

Currently home to around 165,000, Hamilton City Council expects to accommodate 187,600 residents by 2028 with increased demand on water resources.

Planning for this growth, the council supports future upgrades of the 45-year-old Pukete Wastewater Treatment Plant, and engaged Beca to undertake the complex problem of collecting, integrating and maintaining existing as-built and newly captured asset information in an accurate way that offers room for future expansion.

The asset management solution needed to be accessible via desktop and mobile devices, and available both online and offline – an important function given Wi-Fi connections are not always readily available onsite.

Essentially, what we needed was a platform that would get the right asset information in the right format, to the right people at the right time.

Breaking down the problem

Working collaboratively with the council, Beca broke the problem down into smaller, palatable chunks, and addressed each component individually with a variety of different technologies.

First, drones scanned the Pukete WTP site to capture key topography and site-wide information, followed by a survey team using high definition laser scanning to capture building and asset geometry.

With this foundation, a modelling team then developed a detailed 3D model of the facility using Building Information Modelling (BIM), and brought together disparate data from various areas and processes into the one accessible and interactive platform.

This data included identifier barcodes for existing assets, with mobile devices used to link physical assets and equipment with their digital counterparts. Asset documentation such as operations and maintenance (O&M) manuals and data sheets were also added, aligned with Council’s asset hierarchy and needs.

“To say that we’ve got these assets, with these attributes, and all the information is linked to the correct asset onsite, will be great – it will remove confusion,” says Parvati Patel, Hamilton City Council’s Asset Engineer implementing the programme.

Addressing the information gap

Before the Pukete WTP Asset Information Model was developed the council’s known asset information was approximately 80 percent accurate for mechanical assets, and less so for civil or electrical assets.

Existing as-built records were typically paper-based, with no simple means of access or keeping them up-to-date. These issues presented challenges for the council both in terms of how the facility was operated and maintained, and how new capital projects were planned and delivered.

The council had tried over the years to close this information gap, however traditional approaches hadn’t delivered to the level required in modern day asset management, and so a new approach was needed.

UAV/drone photogrammetric mapping

Following an extensive site hazards assessment and safety induction, Beca’s Unmanned Aerial Vehicle (UAV) team was deployed to undertake drone-based aerial photogrammetric mapping (see figure 1).

After setting out a network of portable survey control points, the UAV/drone was systematically flown across the entire site, capturing 1500 high resolution aerial photographs with high stereo overlap.

The images in Figure 2 show at top left spray-paint lines that mark out sub-surface utilities recorded during a ground penetrating radar (GPR) survey which was performed by a contractor on the same day as the UAV mapping. This information is now captured within the UAV point-cloud model and maps and provides a long-term record of the buried service locations that will endure long after the spray-paint washes away.

At top right, is shown an existing drainage trench that Council wished to fill, and at bottom left and bottom right, some existing fill that Council wish to dispose of. We were able to calculate the volumes using the UAV model, providing the council with accurate data to support cut and fill works.

High-definition surveying to create a Point Cloud

Building upon the outputs from the UAV mapping, Beca’s survey team used high-definition surveying (HDS), also



Figure 1



Figure 2



Figure 3



Figure 4

known as 3D laser scanning, for a more detailed scan of the plant and facilities.

HDS captures data using LiDAR (light detection and ranging) technology which sweeps across and measures the return laser pulse from objects. The laser scanner collects millions of points from each scan location with X, Y and Z values.

This data is processed and forms a 'point cloud' file, which is essentially a mass model of points, with an accuracy of approximately +/-10mm. (see figure3).

To begin with, we captured geometrical information within three of the primary buildings on site; the Aeration Blower, Recirculating Aquaculture System (RAS) and Motor Control

Figure 1: Pukete Wastewater Treatment Plant UAV Terrain Model. Figure 2: Added benefits of the UAV Mode. Figure 3: High definition survey point cloud. Figure 4: Scanning existing barcodes onsite. Figure 5: (see over page) Example SCADA Integration with the Pukete Asset Information Model.

Centre (MCC) buildings. Two further models were also then developed; the first was a model of the building shell including walls, windows, doors, floors, pits, support steelwork and emergency signage such as fire exit signs.

The other was the plant and process model, which encompasses all mechanical, electrical, plumbing and process equipment.

The HDS point cloud acted as a static record for the design team to refer to and allowed the council to visualise and interrogate these areas prior to any maintenance activities taking place.

Intelligent and editable 3D modelling

When the site and building surveys were complete, the Beca BIM team began developing the three-dimensional (3D) model. We used the UAV and HDS data as a base to build an intelligent object-based Building Information Model of the site and its assets.

A digital terrain model was developed using data from the UAV mapping. This involved exporting a ground contour file from the UAV model and using AutoCAD Civil 3D to create a triangular irregular network (TIN) 3D surface model of the contours.

When the digital terrain model was completed, the UAV data was used to create a series of building shell models. This involved creating individual components (known as families) within Autodesk Revit to represent each of the buildings. The components were attributed with process area data and colour-coded to indicate which process area they are part of.

This resulted in a spatially accurate as-built model to +/- 50mm accuracy on hard surfaces throughout the entire Pukete site.

It enabled measurements to be taken to confirm the distance between or the height of buildings, and to understand access requirements in support of on-going capital works and maintenance projects.

Integrated data from different sources

The process of integrating captured data using different technology (aerial vs terrestrial) into the same spatial dataset was critical to this project's success. We needed to capture data in terms of an official New Zealand geodetic projection and datum, and for repeatability, there needed to be physical control marks left onsite.

We connected to existing survey control benchmarks from previous surveys and confirmed their reliability using RTK GNSS/GPS (Real-Time Kinematic Global Navigation Satellite Systems).

A 'total station' was then used to transfer the control network inside the buildings which allowed coordinated 3D HDS Scanning to occur. The UAV Data capture was post-processed against coordinated ground control points with checks to known features extracted from topographical survey information.



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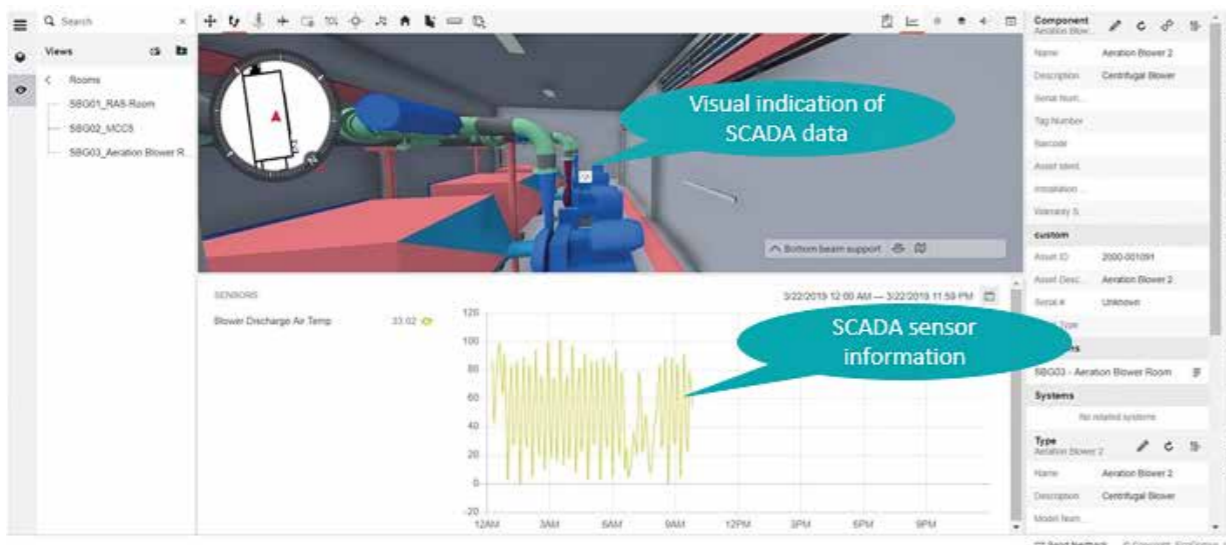


Figure 5

Centralising and integrating disparate datasets

Completion of the as-built 3D Building Information Model paved the way for the integration of disparate datasets and development of the asset information model.

A platform called EcoDomus was selected as the cloud-hosted integrated environment for the asset information model. This environment provided a single source of truth for operations and maintenance information.

“This is the first Water project the EcoDomus technology has been implemented on. Based on our intimate knowledge of the market for this unique type of project, we believe this is the first of its kind in the Water sector in the world,” says Igor Starkov, CEO, EcoDomus Inc.

Asset data was exported to EcoDomus using the EcoDomus BIM connector, which created a unique identifier for every element within the model. These identifiers were used to build up a database of space information (such as room names), object related information (such as length, width and volume) and asset information (such as asset type).

The BIM connector was used to export the model geometry to EcoDomus, to create a spatially and dimensionally accurate 3D model that contained every modelled object. It also linked every modelled object to its associated data in the database, using the unique identifiers created when the database was built.

A spreadsheet of known asset data was imported into the models and in turn into the EcoDomus environment and automatically assigned to each of the objects.

The EcoDomus environment provided us with the ability to identify which assets had missing data (such as serial numbers), allowing Council to collect the missing asset data onsite. This data was reconciled with what was already known and recorded in the database.

Multiple views of the data

Once the asset information model was complete, the functionality was tested by Council’s asset information team. This team needed the ability to start with either a 3D model view before drilling into the asset data, or to start with a data view before drilling into the 3D model.

Plant operators, on the other hand, require the ability to start

with a process and instrumentation diagram, be able to click on an asset such as a pump, and then drill into the asset data – before being able to drill into the 3D model. This functionality was added to provide full flexibility to both groups of users. (see figure 4).

Another benefit of developing a model that aligns with the client asset hierarchy is that it’s possible to provide a visual aspect to specific operations and maintenance activities. For example, rather than a pump being one physical component in the model with several sub-components in its data, it is several components in the model, with relevant data attributed to each individual component.

When maintenance activities take place, a specific component can be selected and all the information relating to that component will be at the fingertips of the maintenance contractor.

A platform that can grow with the city

As a consulting team it was important to us that the final deliverable to Council could be expanded upon in future.

The site-wide UAV mapping, building laser scans and 3D models are set up in such a way that any future survey or modelling work can tie back into this data. This allows gradual development of the dataset as future capital projects or project work requiring retrospective data capture commences.

The models and data can be easily updated in line with any changes at the plant, ensuring Council has the capability and technology to efficiently maintain both graphical and non-graphical asset information.

The technology at the core of the asset information model has the capability to integrate with multiple other platforms including Geographic Information Systems (GIS) and Supervisory Control and Data Acquisition (SCADA) systems, an example of which was ‘mocked up’ in the platform to demonstrate future capability. (see figure 5)

The ability to integrate with systems such as SCADA keeps the door open for Internet of Things (IoT) technology should the council choose to explore this option, and to progressively build on the platform in the future.

More information: ‘Building Information Modelling Pukete’ on YouTube, or contact glenn.jowett@beca.com.

WTP construction case study

The Water Treatment Plant at a steel mill in South Auckland was redesigned and rebuilt last year. Smith & Loveless NZ explains the details.

In 2018 land adjacent to the Bluescope Pacific steel mill in Otahuhu was sold for a commercial development.

This land was also home to the steel mill’s Water Treatment Plant and, in April 2018, Smith & Loveless NZ (S&L) was contracted by Macrennies Construction (main contractor for the commercial project), to design and build the new WTP

The WTP was required to treat the recycle cooling water for the mill, with a design flow of 2250 m³/hr. The water contains mill scale (fine metal particles) as well as oil and grease from the steel-making process. The water also heats up significantly as it goes through the mill, and requires cooling prior to being returned to the mill. Recovered solids

and oil/grease are dewatered prior to off-site disposal.

The project presented a number of challenges for the project team, including considerably less land area for the new WTP, and was complicated by the main mill access road through the middle of this area; and an extremely tight project programme. The mill operates 24hrs/day for 5-6 days/week, and was required to be fully operational throughout the construction of the WTP.

This required the old WTP to be kept fully operational, with the capability to be able to switch between the old and new WTP, until the new plant was fully commissioned.

The project involved a five month design phase, with interactive involvement of Pacific Steel management, and



operations / maintenance personnel, together with the Macrennies/S&L design team. Key process equipment was selected and ordered early in the process, while detailed civil, mechanical and electrical design continued.

Some of the key features and elements of the new WTP included the existing WTP utilised a conventional circular

clarifier for solids and oil separation, with a surface area of 660m². Given the land constraints S&L used a high rate Lamella Clarifier for the new plant that enabled the footprint to be reduced to 160m².

The Lamella design also featured a modular steel tank to facilitate rapid site assembly and installation.

Another key feature of the new WTP was the 'containerised' MCC and PLC building. This design enabled off site assembly and testing of the MCC.

The focused efforts of the project team, and the innovative design features enabled the new WTP to be designed, constructed, tested and commissioned within 15 months of award of contract, with start up in July 2019.

Following a four week monitored operating period the old WTP was demolished enabling construction of the new facility to be completed.

The project team

- Macrennies Construction - main contractor/ civil works
- Smith & Loveless NZ - WTP design and build contractor
- RDT Pacific - project management
- Harrison Grierson - peer review/construction management
- Lutra - peer review/commissioning support



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- Solids Contact Clarifier
- Chain & Flight Scraper

Drinking water pipe rehabilitated trenchless

One of the oldest drinking water pipes still in use in the spa town of Bad Hall in Upper Austria was replaced using trenchless technology.

The old fibre cement pipeline in Bad Hall had been at its capacity limit for some time. In addition, some pipe bursts had to be repaired in the course of time.

AGRU pipes with protective layer in OD 315 mm and SDR 17 that were installed using the burstlining method, are now used as replacements. This soil-protecting rehabilitation method saves the disposal of the old pipeline and ensures the exact positioning of the new pipeline in the original pipeline route.

A 450 metre long pressure line for the elevated tank Voglhub in OD 280 mm and a 1800 metre long transport line branching off from this elevated tank in OD 315 mm was installed.

On its way to the Pfaffenwimm elevated tank, the transport pipeline overcomes a height difference of 17 metres and the pressure in the piping system at the lowest point rises to 5.5 bar.

“Unfortunately, there have been a few pipe bursts in this area in recent years,” says Anton Polbauer, managing director of the Bad Hall Water Association.

As the maintainer of the new PE piping system, quality and service life are very important, he adds. “The last fibre cement pipe was installed in 1979. For more than 20 years we have only been installing PE piping systems from AGRU.

“We have rehabilitated older water pipes with AGRU PE 100-RC pipes using the burstlining and ploughing method and have had very good experience with this.

“We assume that the newly installed lines will have a service life of at least 50 years.”

Lower installation costs thanks to long pipe strings

For an economical installation the ‘burstlining’ method was also used. Since the installation costs decrease with the length of the pipe strings to be drawn in, it was important to install only the maximum possible pipe lengths.

The contractor, WDS Bau GmbH, an Upper Austrian civil engineering specialist known for the careful installation of pipelines, calculated the maximum draw-in lengths between the start and target pits on the basis of the soil conditions and the resulting tensile forces of up to 250 bar pressure. Up to 144 metres long, the pipe strings are welded on site by butt welding from 18 metre long protective layer pipes made by AGRU Kunststofftechnik GmbH.

Sureline III pipes with protective layer offer double safety, as the stress crack-resistant PE 100-RC core pipe is protected from the shards of the burst pipe by a scratch-resistant protective layer made of PP when the pipe is drawn in.

An additional advantage is the fast butt welding due to the factory stripped ends. AGRU Kunststofftechnik provided a CNC-controlled

butt welding machine for the welding process.

Thanks to the new technology, temperature, pressure and time were pre-programmed, ensuring the quality of the welds. The parameters of each individual weld and the name of the welder are also documented.

The finished pipe strings are then drawn into the old pipe using burstlining, which is a cost-effective rehabilitation method for trenchless, underground renewal of pipelines made of brittle materials.

By breaking up the old pipe, a new pipe with a considerably larger diameter can be drawn in. Some preliminary work is necessary for this purpose.

Burstlining – how it works

First, a camera is used to navigate the old pipeline. Fittings made of metal or cast concrete cannot be broken open and must therefore be removed using an open construction method.

Then, the start and finish pits are excavated at precisely specified intervals. In the starting pit there is the bursting head with expansion cone on which the pipe string to be drawn in is mounted. In the target pit there is a hydraulic traction device.

The old pipe runs between the two pits, into which a drawbar consisting of numerous segments is inserted. The travel of the hydraulic cylinder of the towing device corresponds exactly to one segment of the drawbar.

The bursting head is now mounted at one end of the drawbar. The opposite side of the drawbar is attached to the towing equipment.

By pulling the drawbar, the bursting head breaks the cement pipe into pieces. The following expansion cone displaces the resulting shards into the ground and makes room for the larger dimensioned new pipe that follows.

In this way, the old pipe can be destroyed, the pipe channel widened and the new pipe inserted in one go. The construction site team in the target pit removes the new segment of the drawbar that arrives in the pit after each pulling operation.

This process is repeated until the bursting head and the pipe behind it finally reach the target pit. The tensile forces acting on the pipe are electronically recorded and documented throughout the entire time. After successful installation, the complete piping system is disinfected and subjected to a pressure test.

“The welding machine provided by AGRU worked perfectly,” says Gerhard Dieringer, managing director of WDS Bau GmbH.

“We have divided the site into 12 sections for burstlining. Per day we were able to burst 1-2 sections and pipe them again.

“We were very satisfied with the products and services of AGRU Kunststofftechnik GmbH from preparation to delivery and quality.”



The CNC welding machine ST CNC 2. 0 supplied by AGRU ensures perfect welding seams. The bursting head and expansion cone are already mounted on the pipe. The fibre cement pipe is burst in the starting pit and a PE pipe with a larger diameter is drawn in.





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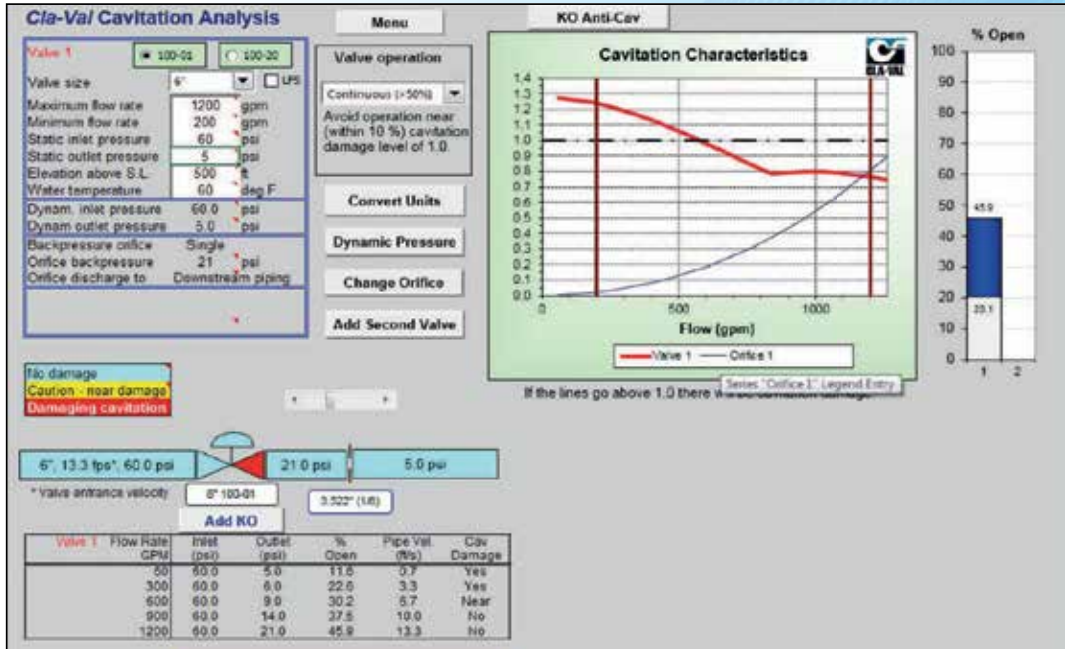
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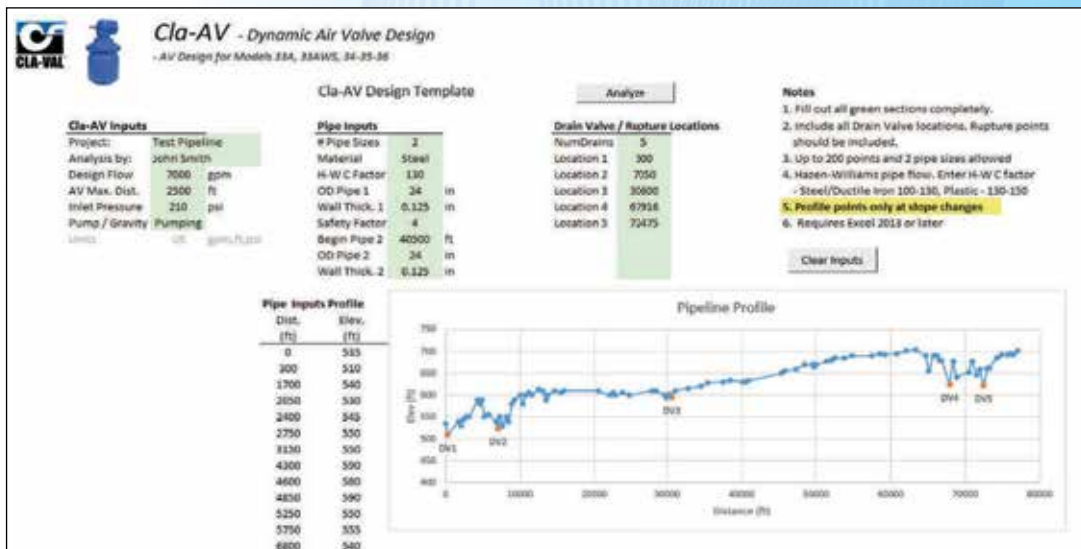


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