



# Sustainable water solutions for communities



## | Mark Christison National Water Manager

The map of New Zealand on the following pages paints a picture of Fulton Hogan's immersion in the world of water in New Zealand. Those many projects – with all their differences – share two important elements. Each is led by local teams who know the territory, the people and the lay of the land.

Each, too, is supported by our national Engineering Solutions team.

For our clients and the communities we serve, this means our highly committed local teams are supported by sector specialists, innovative technologies, plant and equipment, construction practices and supply chain management.

Being deeply involved in the full range of infrastructure development in New Zealand allows us to connect our clients' thinking, planning, building and management. This is leading to new levels of collaboration between client, design and construction partners to ensure the best use of resources to accelerate developments where the need is most pressing and the benefit greatest.

Never before has this been more critically important to successful water infrastructure design, build and maintenance. This is because, quite simply, getting water right has never been more important for New Zealand. This requires bringing the best of contemporary practice to addressing a legacy problem for the benefit of future generations.

The Watercare Enterprise Model is a high profile example, and we anticipate seeing this introduced more widely as the industry develops.

The national conversation about what we're doing with water, and increasingly, what water is doing to us, reflects that we're at the confluence of three powerful forces – aging underground pipes, a changing climate and new regulatory environment.

The need for reform – for change – is now accepted across the political spectrum, even if there are differences in what that change might look like, and how it is achieved.

No matter what decisions are made, we are deeply committed to building resilience into the planning, design and construction of all our projects.

For 90 years our family-owned business has designed, developed and maintained water systems, railways, ports, airports, roads and bridges in New Zealand and, increasingly, Australia.

We provide end-to-end solutions for our clients that span operations and maintenance, asset management, product testing and design. Across these services and industries we support our clients 24/7 365 days a year through good times and bad. We live and breathe providing quality essential services to customers.



“...getting water right has never been more important for New Zealand. This requires bringing the best of contemporary practice to addressing a legacy problem for the benefit of future generations.”



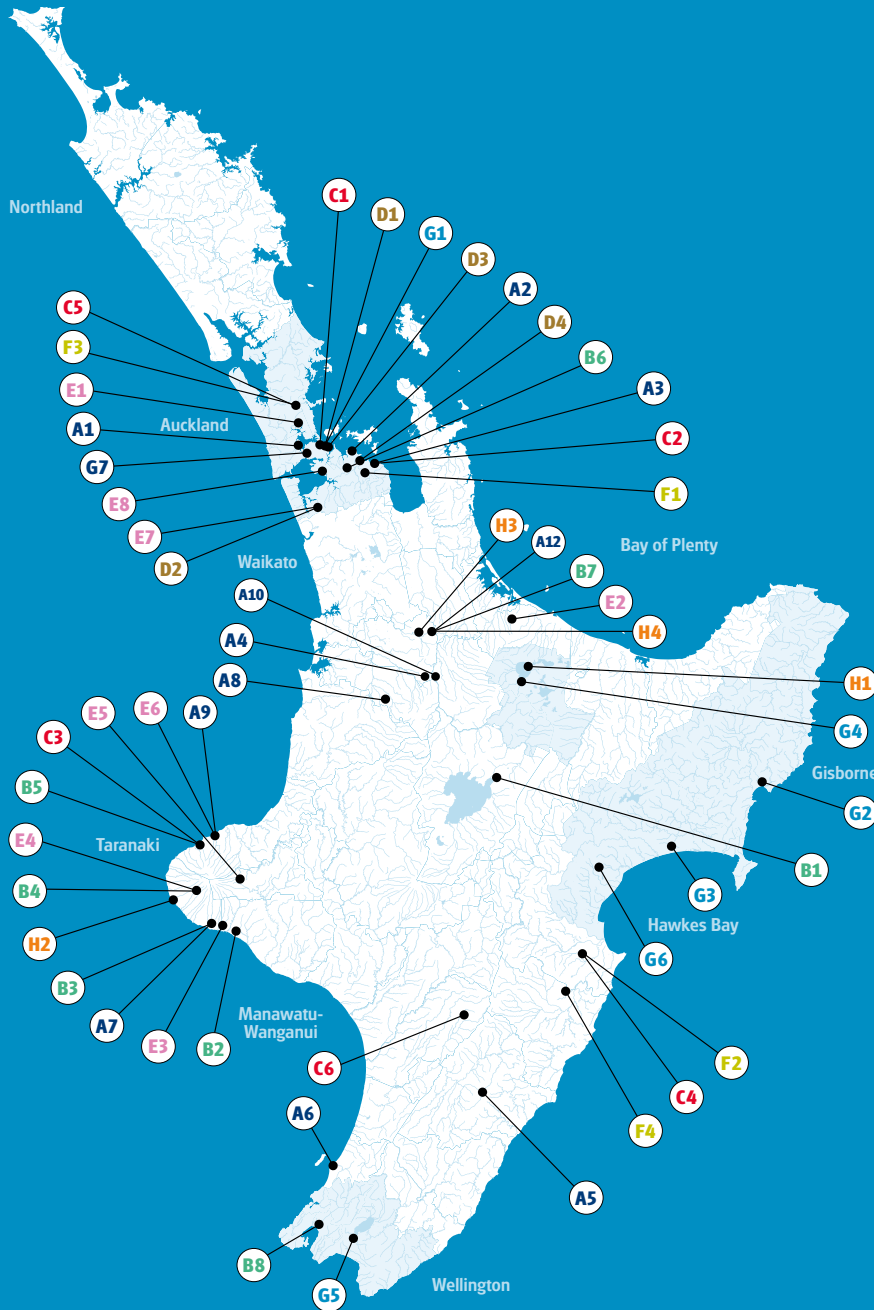




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# North Island Water Contracts



## North Island Key

### WASTEWATER TREATMENT PLANT

- A1** Rosedale WWTP Upgrade
- A2** Beachlands Maraetai WWTP
- A3** Kawakawa Bay WWTP and Wastewater System
- A4** Project Florence WWTP
- A5** Project Leonardo WWTP
- A6** Paraparaumu WWTP
- A7** Open Country WWTP
- A8** Te Awamutu WWTP
- A9** New Plymouth WWTP Upgrades: Aeration, Sludge Thickening, Inlet Works
- A10** Project Pisces Hautapu (Fonterra) WWTP
- A11** Tirau WWTP (Fonterra)
- A12** Rotorua WWTP Upgrade

### WATER TREATMENT PLANT

- B1** Taupo WTP
- B2** Whareroa WTP
- B3** Kapuni WTP
- B4** Stratford WTP
- B5** Manaaki Wai WTP
- B6** Ardmore WTP Resilience Upgrade
- B7** Waiari WTP
- B8** Te Marua WTP Upgrade

### PUMP STATIONS & SCHEMES

- C1** Wynyard Quarter Pump Station
- C2** Kawakawa Bay Pump Station
- C3** Oakura Wastewater Pumping Scheme
- C4** Havelock North Water Booster Pump Station
- C5** Milldale, Auckland Pump Station
- C6** Taihape WWPS

### SEWERS

- D1** Kohimarama Storage Tank and Branch Sewer Upgrade
- D2** Pukekohe Trunk Sewer Upgrade
- D3** Glendowie Trunk Sewer
- D4** Dunkirk Pipeline and Wastewater Pump Station (Watercare)

### RESERVOIRS

- E1** Albany Reservoir
- E2** Oropi Reservoir
- E3** Whareroa Reservoir
- E4** South Taranaki Reservoirs
- E5** Stratford Reservoir
- E6** New Plymouth Reservoirs
- E7** Pukekohe East Reservoir
- E8** Redoubt Road Reservoir (Watercare)

### WATER PIPES & MAINS

- F1** Hunua 4 Watermain
- F2** Omaha Rd Bulk Water Services Pipeline
- F3** Milldale Pipeline
- F4** Central Hawkes Bay District Council Otane pipeline

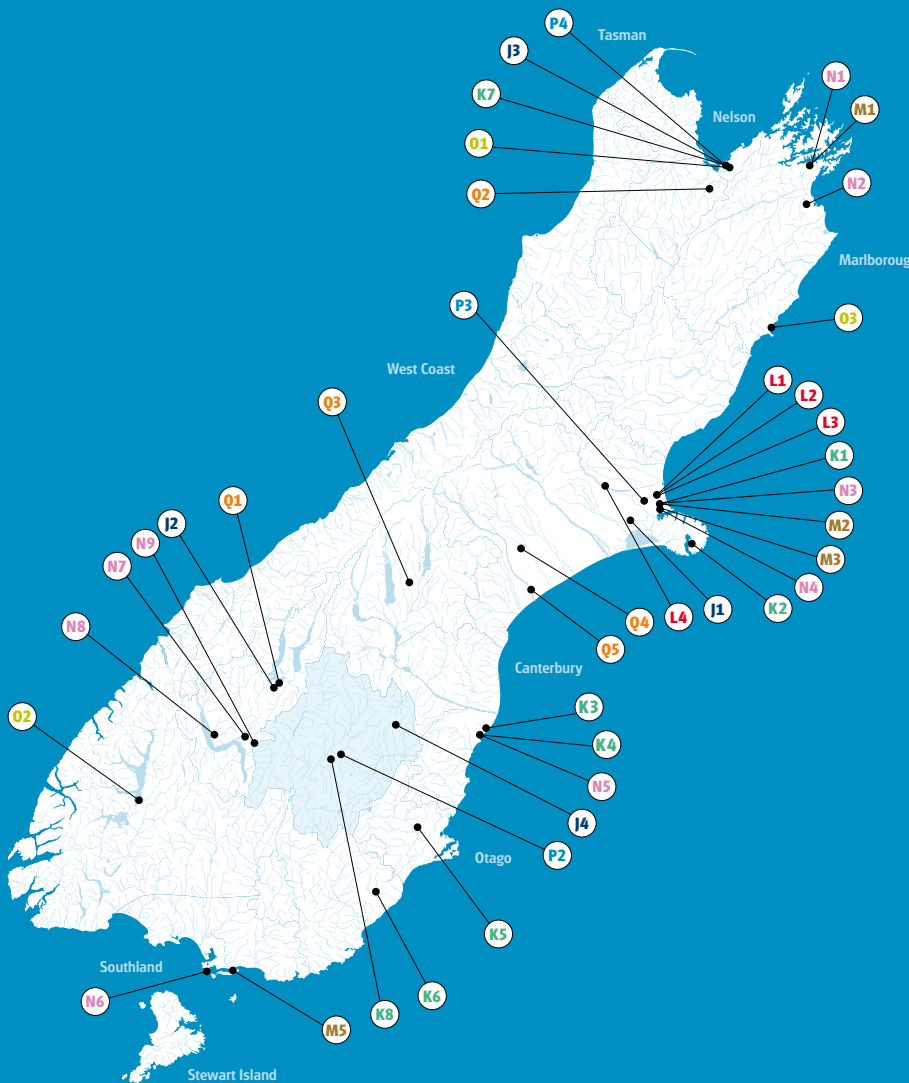
### OPERATIONS & MANAGEMENT

- G1** Watercare Services Water Meter Installations
- G2** Gisborne DC Three Waters O&M
- G3** Wairoa DC Three Waters O&M
- G4** Rotorua DC Lakes Wastewater Contract (Trilogy and Fulton Hogan)
- G5** Wellington Water O&M Alliance
- G6** Hawkes Bay DC Three Waters O&M
- G7** ACC Healthy Waters Central Auckland SW O&M

### OTHER

- H1** Rotoiti/Rotoma Wastewater Reticulation Scheme
- H2** Opunake Water Supply
- H3** Cambridge Pipe Bridge

# South Island Water Contracts



## South Island Key

### WASTEWATER TREATMENT PLANT

- J1** Pines WWTP
- J2** Project Pure WWTP - Extension
- J3** Bells Island WWTP Upgrade
- J4** Naseby Oxidation Pond Upgrade

### WATER TREATMENT PLANT

- K1** Colombo Street UV WTP
- K2** Akaroa WTP
- K3** Alliance UV Plant
- K4** Oamaru WTP
- K5** Southern WTP
- K6** Milton WTP
- K7** Nelson WTP
- K8** Lake Dunstan WTP

### PUMP STATIONS & SCHEMES

- L1** Gardiners Road Pump Station
- L2** SCIRT Pump Stations and Pipelines
- L3** Preston Road Pump Station
- L4** Central Plains Irrigation Headrace, Stage 1

### SEWERS

- M1** Picton Sewerage Upgrade, Stages 2 & 3
- M2** South East Halswell Wastewater Scheme
- M3** Lyttelton Wastewater Scheme, Pump Stations and Pipelines
- M4** Lyell Creek Wastewater Upgrade
- M5** Braxeholme Pipeline

### RESERVOIRS

- N1** Taylor Pass Reservoir
- N2** Blenheim Reservoir
- N3** Huntsbury Reservoir
- N4** Cashmere Reservoir
- N5** Oamaru Reservoir
- N6** Bluff Reservoir
- N7** Queenstown Reservoirs
- N8** Glenorchy Reservoirs
- N9** Beacon Pt Reservoir

### WATER PIPES & MAINS

- O1** Maitai Pipeline Duplication, Stages 1 & 2
- O2** Te Anau Pipeline
- O3** Heathcote Water Main

### OPERATIONS & MANAGEMENT

- P1** Chatham Islands DC Water, Wastewater O&M
- P2** Central Otago DC Water Meter Reading, Three Waters O&M, Treatment Plants O&M
- P3** CIAL Three Waters O&M
- P4** Nelson City Council Water Treatment Plant and Catchment O&M

### OTHER

- Q1** Wanaka Water Supply
- Q2** Waimea Community Dam
- Q3** Tekapo Canal Remediation Project
- Q4** Mayfield/Hynds Irrigation System
- Q5** Rangitata Division Race Outlet for Irrigation Scheme

 Operations and Maintenance Areas on Map

# Our REA

## Respect

- We understand, listen and learn
- We respect our differences
- We take care of ourselves and others
- We treat others the way they expect to be treated

## Energy & Effort

- We bring out the best in everything we do
- We do it once, we do it right
- We never give up
- We keep things simple
- We have fun

# Core Values

## Attitude

- We are one Fulton Hogan
- We take pride in everything we do
- We do what we say
- We challenge and improve
- We work together, win together and celebrate together

## Leadership

- We value and grow our people
- We do the right thing
- We are fair and trustworthy
- We are accountable
- The standard we walk past is the standard we set
- We are humbly smart



**\$724M**

New water assets  
between 2019 - 2023



**1.320M**

Customers served



**363**

Skilled Fulton Hogan  
staff working in the  
water division

What we've been  
working on...



# | Watercare Services Ltd

## Bringing enterprise to project design

The Watercare Enterprise Model is a collaborative delivery partnership between Watercare, Fulton Hogan and Fletcher Construction (construction partners); Aurecon and Stantec (strategy and planning partners) and Beca and WSP (design delivery partners).

It sets out the standards, practices and outcomes that are too often part of the traditional end-to-end processes in our sector. It does this by taking an overall ten-year programme view and, in addition, having all parties working in unison on each project from beginning to end. Then, at the start of the next project, benefiting from the collective increases in understanding and teamwork, delivering a better result, next time.

Early contractor involvement (ECI) is key to this, especially for sharing ideas, for saving dollars and reducing carbon emissions. It also means project managers can be 100% forward looking and focused on achieving project objectives, safe in the knowledge they have the approach, the systems, the people and the necessary teamwork for success.

An important catalyst for this is our 40:20:20 goal. Short-hand for 40% less embodied carbon, a 20% improvement in cost efficiency (value) and a 20% year-on-year improvement in health, safety and wellbeing, it has already led to considerable gains in all three through, amongst other things, extensive digital engineering and increased off-site manufacture.

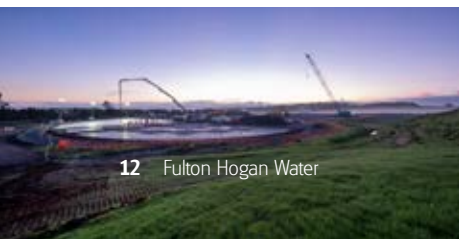
“ Our experience is such that we’d like to encourage – or perhaps even inspire – the entire infrastructure sector to also ask this question: Are your practices, behaviours and outcomes what you would like them to be, or is status quo thinking getting in the way of a step change in results? ”

Employing a model designed for genuine collaboration takes readjustment and some willingness to ‘let go’. After three years – and with those adjustments largely entrenched – motivated and focused teams are well on the way to achieving our goals. I can report this is not just among our partners – we know that adjustment is equally Watercare’s responsibility, and we want to be challenged to innovate and grow.

Our experience is such that we’d like to encourage – or perhaps even inspire – the entire infrastructure sector to also ask this question: Are your practices, behaviours and outcomes what you would like them to be, or is status quo thinking getting in the way of a step change in results?

Having done this ourselves, I can say the results make it a worthwhile exercise.

*Former Fulton Hogan NZ Chief Executive Graeme Johnston (now Chief Executive Fulton Hogan Australia) at the ceremony to officially announce the Watercare Enterprise Model in late 2019.*



### Location

Auckland

### Client

Watercare Services Ltd

### Partners

Watercare, Fulton Hogan, Fletcher Construction, Aurecon, Stantec, Beca, WSP

### Objective

More efficient and effective future proofing of Auckland’s water services

### Contract type

Partnership agreement

### Number of projects concurrently

10 in construction  
50 in pre-contract stage

# Sydney Water

## Partnering for success

Sydney Water is Australia's largest water utility, providing the majority of Greater Sydney's water, wastewater, recycled water and trunk stormwater services for around five million people. As the construction and programme management partner for the West Region Delivery team joint venture, Fulton Hogan's remit is to increase the value for Sydney Water's customers through greater certainty and efficiency of delivery brought about from collaboration and consistency across the construction supply chain.

In the face of organic growth and ageing assets, up to AUD\$3B per annum is projected to be invested in capital works. To meet this step-change in asset delivery, Sydney Water looked internationally for a more progressive framework for procuring and delivering projects with its industry partners.

As a result, it has adopted the principles of Project 13 (similar to the Watercare Enterprise Model outlined on the facing page) and adopted an NEC4 framework contract to promote collaboration and collective risk sharing with supply chain partners.

Under the NEC framework, each job is issued as works orders, expediting procurement of individual services. Shared purchasing has also been introduced across the regional delivery teams, including supplier panels for greater value-for-volume procurement.

The team is trialling different practices and testing various hypotheses, including establishing a subcontractor panel engaged through an open book target cost model, thereby extending the partnership approach and ethos right through the supply chain. The objective is subcontractors and trades having more certainty to invest, to achieve greater repeatability and continuity of work.

The structure is designed to cascade a continuous improvement culture throughout the enterprise, and includes introducing LEAN principles into design and construction schedule management. With the sheer scale of the capital work ahead, careful scope management, risk mitigation and project management controls – particularly in the design phase – are all at a premium.

As a relatively new partnering model there is also a major focus, culturally and operationally, on moving from a status quo mindset to a deeply collaborative framework for earlier identification of risk and sharing of mitigation actions to curtail adversarial behaviours. The transition is not being underestimated, and neither is the potential rewards for the people of Sydney in having a world-class collaborative delivery model for their water assets.

### Location

Sydney

### Client

Sydney Water

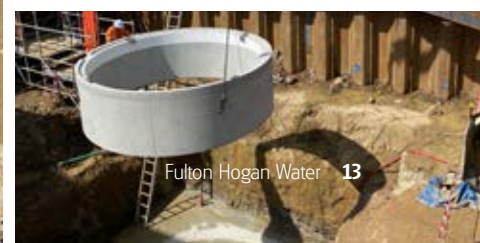
### Objective

Capital construction services with more integrated supply chain for operational efficiencies and cost savings

### Contract type

Project 13 and NEC4

“The structure is designed to cascade a continuous improvement culture throughout the enterprise, and includes introducing LEAN principles into design and construction schedule management.”





SLUDGE TANK 2

SLUDGE TANK 1

Loadout / Chemical  
Delivery Bay

Slud  
Loc



# Wastewater Community

# The Fonterra Wastewater Community

## The common good of fresh water

*COMMUNITY – a body of individuals unified by desire for a common good.*

The Fonterra Wastewater Community is a team of leading local and international designers, engineers, constructors and project managers unified in protecting the taonga of the water, water courses and surrounding land across 14 Fonterra manufacturing sites.

Working with Fonterra and fellow community members, Fulton Hogan has recently built the water treatment plant at the giant Whareroa plant in Taranaki. Among other projects are a water treatment upgrade at Tīrau (also known as Project Oraka) with New Zealand-based Vertex and Tetrapac; a phased wastewater upgrade with Tetrapac in Te Awamutu and a new process wastewater system at Hautapu in the Waikato, also with Tetrapac.

Guiding the community across every project is the principle of Te mana o te wai – the knowledge that the health of freshwater protects the wider environment by ensuring the balance between water, the wider environment and the community.

“.....a move away from site-by-site decision-making on capital investment towards geographically wider, designed-based, decisions that are common to multiple sites.”

Between 2021 and 2029, Fonterra plans to invest approximately NZ\$600M on water projects, primarily in wastewater treatment. In addition to the intrinsic desire to protect the environment and enhance the brand's reputation locally and internally, is the goal of a 15% reduction in the cost of ownership based on better solutions, smarter delivery and portfolio efficiencies.

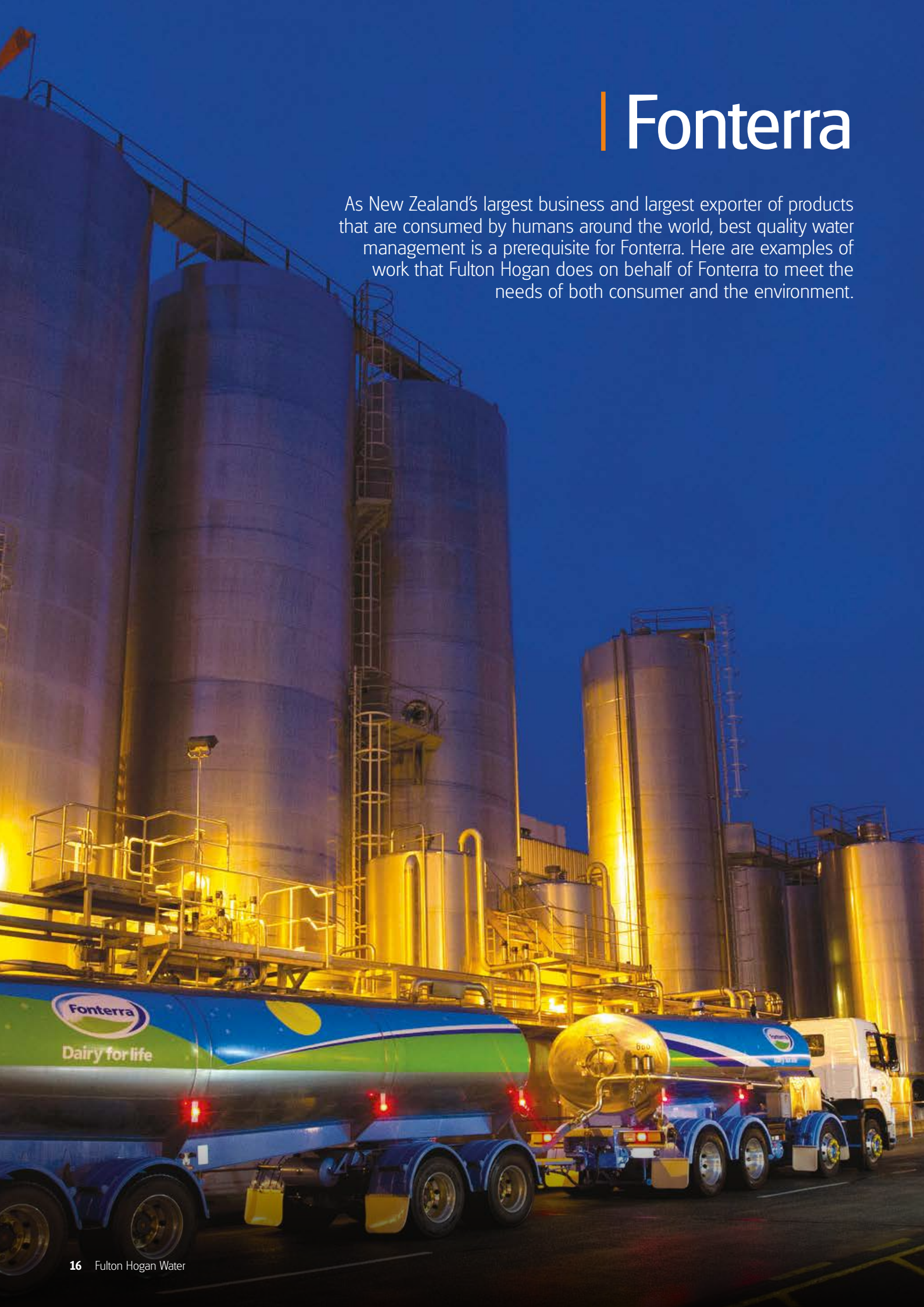
Aiding this is the move away from site-by-site decision-making on capital investment towards geographically wider, designed-based decisions that are common to multiple sites. This is more possible when partners work together, foster continual innovation and development, and bring economies of scale, standardised systems and early engagement-based innovation.

Key to addressing the sheer business and technical complexity of the programmes is the community's formal board, portfolio and project level structure. This helps ensure knowledge and expertise is shared to achieve the full potential of the collective design, project management, construction and technical expertise of the community members.



# | Fonterra

As New Zealand's largest business and largest exporter of products that are consumed by humans around the world, best quality water management is a prerequisite for Fonterra. Here are examples of work that Fulton Hogan does on behalf of Fonterra to meet the needs of both consumer and the environment.



# Whareroa Water Treatment Plant

## High turbidity to crystal clear in 12 months

As New Zealand's largest exporter of products consumed by humans world-wide, the best quality water management is a non-negotiable for Fonterra.

Fonterra's Whareroa Plant in Hawera produces around 15% of New Zealand dairy products, with the 1,000-strong team at the site producing 400,000 tonne of milk powder, cheese, cream protein and lactic casein annually.

With a key raw water source – the Tangahoe River – having high levels of natural turbidity, Fulton Hogan has built Fonterra a greenfields treatment plant to deal with raw water with a continuous turbidity as high as 1,000 nephelometric turbidity units (NTUs).

Working with design partner Beca, the team opted for a lamella clarifier and gravity sand filter process with gas chlorination and UV treatment, capable of producing 28.5 million litres of water per day, and a 4.5 million litre treated water reservoir.

To accelerate the project to just 12 months – six months less than would normally be required – pricing was finalised during the design process and, during the project, the scope increased with no additional time allowance. The addition was a new water intake from the Tangahoe River, including building a new 12m deep x 3m diameter wetwell in the bank of the Tangahoe River, complete with raw water supply pumps.

The environmental sensitivity of the river-side area, and the safety imperative, necessitated using 3m diameter concrete manhole sections to form the wetwell structure, with the team manually excavating from within the structure to sink the shaft, removing 80m<sup>3</sup> of mudstone. The design included provisions to ensure the pumps could be removed for servicing in the future, with minimum disruption.

At the raw water intake, two Lakos hydrocyclones were installed removing up to 40% of solids. A lamella plate clarifier was installed at the plant, after which the water enters the gravity filters, followed by UV treatment and chlorination.

Fulton Hogan self-performed the construction of all concrete structures on the project (including pre-casting componentry onsite) all above ground pipework, pumps and valves, installing the MCC board rooms and hardware, automation and controls.

“ The environmental sensitivity of the river-side area, and the safety imperative, necessitated using 3m diameter concrete manhole sections to form the wetwell structure, with the team manually excavating from within the structure to sink the shaft, removing 80m<sup>3</sup> of mudstone. ”

### Location

Whareroa, Taranaki

### Client

Fonterra NZ

### Designer

Beca

### Objective

Production of high quality water for dairy product manufacture

### Contract type

ECI

### Investment

\$20M

### Capacity

25 million litres/day



# Lyttelton Wastewater Project

## Helping create a pristine harbour

Fulton Hogan Canterbury has helped create a more pristine marine environment in Lyttelton Harbour, permanently halting treated wastewater discharge into the harbour from Diamond Harbour, Governors Bay and Lyttelton.

The project is part of the Council's wider Waka-Ora plan to restore the cultural and ecological health of Lyttelton Harbour. Working with Te Hapu o Ngati Wheke, Te Rūnanga o Ngāi Tahu, Lyttelton Port Company and harbour communities, the goal is to improve water quality in the harbour, address erosion, sedimentation and pollution of waterways, and to increase biodiversity.

“ There are certainly some interesting challenges in taking wastewater under a harbour, through a mountain and then for a long distance under railway tracks and a river to its destination. ”

The Lyttelton Wastewater Project pumps all the wastewater from Diamond Harbour and Governors Bay under the harbour to Lyttelton, and then on through the Lyttelton tunnel to Christchurch's Bromley treatment plant, 4.5km north of the tunnel.

The team built waterwells in Diamond Harbour and Governors Bay, a buffer tank in Lyttelton, a new waste water pumping station at Church Bay and three, seven metre-deep progressive cavity pumps in Lyttelton to pump the wastewater through the tunnel, as well as laying 8km of PE pipe to the Bromley Treatment Plant. McConnell Dowell did the submarine pipe work between Governors Bay, Church Bay and Lyttelton.

Project Director Laurence da Silva says the highlight for the team is knowing the difference the project will make to the harbour for decades to come.

“There are certainly some interesting challenges in taking wastewater under a harbour, through a mountain and then for a long distance under railway tracks and a river to its destination,” says Laurence. “But with these challenges comes the satisfaction of the benefits this project will bring Lyttelton Harbour for generations to come.”

Among the most challenging engineering was laying 535 metres of pipe 10 metres beneath the Heathcote River on the north side of the Lyttelton Tunnel, including a challenging double Kiwi railway line cross. The trains were kept running by digging an entry pit at one side of the railway and an exit at the other, and thrusting a 24 metre long, 600mm steel pipe underneath.

### Location

Lyttelton Harbour

### Client

Christchurch City Council

### Designer

Jacobs

### Objective

To fundamentally improve water quality in the harbour, address erosion, sedimentation and pollution of waterways, and to increase biodiversity

### Contract type

NZS 3910

### Investment

\$54M

### Completion

2023



# Project Pure

## QLDC's newly enlarged wastewater plant

The expansion of Wānaka's wastewater treatment plant beside Wānaka Airport is a showcase of a new wastewater management facility seamlessly integrated with an existing plant, to meet rapidly growing community needs.

'Project Pure' involved heavy civil, mechanical, electrical and process works within live operations on one of Queenstown Lakes District Council (QLDC)'s critical water assets, to meet 30 years of projected population growth.

Fulton Hogan Civil helped build the original plant a decade ago to treat all domestic and commercial wastewater from Wānaka, Albert Town and Luggate. With this already near capacity, QLDC engaged Beca to complete the design of a new sequencing batch reactor (SBR) tank alongside it. Fulton Hogan was successful in a competitive tender to complete the construction and integration works.

“ A showcase of a new wastewater management facility being seamlessly integrated with an existing plant, to meet rapidly growing community needs. ”

At least 12 tie-ins between the new plant and the existing facility required meticulous upfront planning with QLDC and QLDC's O&M Contractor, Veolia.

In addition to the multiple tie-ins, the project included:

- Diverting the existing high voltage power onsite.
- Building a third SBR tank and second decant tank – 60m long x 16m wide x 5m deep with 1,050m<sup>3</sup> of in-situ 50MPa concrete.
- Modifying the existing ancillary plant to integrate with the additional SBR.
- Relocating the existing UV units and installing a third UV unit.
- Supplying, installing and commissioning all process mechanical and electrical equipment.
- Expanding the existing disposal field with 2,000m of feeder and irrigation distribution pipework.
- Designing and building a separate building for amenities and the laboratory.
- Upgrades for additional sludge processing capacity.

The project is also being used by QLDC as a pilot for carbon spend and waste management benchmarking, with carbon emissions measured across the project, including from subcontractors and suppliers. The data gathering is being assessed against the original design's desktop assumptions, enabling QLDC to use the numbers to benchmark future projects.

### Location

Wānaka

### Client

Queenstown Lakes District Council

### Designer

Beca

### Objective

Meet the future needs of a rapidly growing region

### Contract type

NZS 3910

### Investment

\$18.3 million

### Capacity - previously

3,795m<sup>3</sup> / day average flow, 7,701m<sup>3</sup> / day peak wet weather flow

### Capacity - now

7,873m<sup>3</sup> / day average flow, 16,130m<sup>3</sup> / day peak wet weather flow



# Waimea Community Dam

## A more bountiful and resilient future

Built by Fulton Hogan and Taylors Contracting, the Waimea Community Dam will be a landmark project for the Tasman region.

The project is designed to deliver water to irrigate the fruit, vegetables, hops and grapes of the Waimea Plains, its benefits include:

- Securing the region's water supply for the next 100+ years and alleviating the effect of crippling droughts.
- Improving water quality and the environment for people, plants, fish and animals.
- Strengthening the economy through the growth of primary industries and food processing.

As the first major dam project in New Zealand in 25 years – and the largest built here in 40 years – the project featured building techniques and technologies that hadn't previously been used in New Zealand.

Encasing the almost 500,000m<sup>3</sup> of rock that forms the core of the dam is a 300mm concrete facing, built using a 15m wide slip-form working platform, with four 40-tonne marine grade winches. The same approach was used on the spillway, for a mirror-like finish.

Dams require higher specifications for concrete than almost any other structure, due to the forces of water. The spillway, in particular, is hydraulically critical – any imperfection can create the potential for it to self-destruct under cavitation.

Recent developments, including the catastrophic failure of the Oroville Dam spillway in California in 2017, have accelerated techniques to ensure maximum performance of concrete.

Accordingly, there was careful thermal modelling of the concrete, using 'finite analysis' models and in-situ concrete trials to flatten the temperature/time curve and minimise potential for micro cracking. Another challenge was ensuring water tightness on underlying rock that was naturally highly foliated (fissured), leading to a series of grout mixes being injected up to 35m into the ground along the upstream perimeter of the dam.

### Dimensions:

Height: 55m | Base width: 180m | Crest width: 6m | Reservoir volume: ~13 billion litres  
Operational flow: 2.2m<sup>3</sup>/sec | Environmental (min) flow and flushing flow: 0.5m<sup>3</sup>/sec and 5m<sup>3</sup>/sec, respectively | Maximum: 17m<sup>3</sup>/sec (1.5 million m<sup>3</sup>/day = 10% of reservoir / day)

“ As the first major dam project in New Zealand in 25 years – and the largest built here in 40 years – the project featured building techniques and technologies that hadn't previously been used in New Zealand. ”

### Location

Waimea, Nelson

### Client

Tasman District Council  
and Waimea Irrigators Ltd

### Designer

Damwatch Engineering

### Objective

Reliable and resilient  
water supply for the  
Waimea Plains

### Contract type

NZS 3910

### Investment

\$120M



# Rotoiti onsite Wastewater Treatment

## A natural response for a place of natural beauty

As a place of considerable natural beauty, Lake Rotoiti is also benefitting from a natural way of protecting the health of the lake and local residents.

Since 2021, Fulton Hogan has been supplying, installing and maintaining onsite wastewater management systems for the 424 residential properties and for marae, sports clubs, hospitality venues and businesses. Central to this system are worms which help break down matter at each site, leaving only liquid to be pumped to the Rotoiti Wastewater Treatment Plant.

Following extensive client and iwi consultation, Rotorua Lakes Council accepted Fulton Hogan's proposal to fit each residence with a Biolytix EcoPod BF2, and to decommission the existing septic tank systems. The proposed solution enables the disposal of wastewater in a way that is both environmentally and culturally appropriate to mana whenua, and technically robust.

“ As a lakefront environment, many of the installs are in areas with high groundwater – an issue that's growing in intensity as climate change-induced rainfall increases lake levels. ”

The Biolytix EcoPod system mimics nature by having tiger worms and micro-organisms convert the solid material to liquid, naturally aerating it, in the process. The low energy EcoPod system removes the majority of wastewater contaminants, leaving a liquid to be pumped to the wastewater plant.

The contract also includes keeping worm levels topped up, with some sourced from a worm farm at Fulton Hogan's Rotorua depot.

As a lakefront environment, many of the installs are in areas with high groundwater – an issue that's growing in significance as climate change-induced rainfall increases lake levels.

Fulton Hogan's solution of pumping pre-treated effluent to a central wastewater treatment plant ensures the system will continue to service the community for decades to come, and minimise the problem of traditional soakage being unusable during climate-induced weather events.

These levels would inundate and drown traditional soakage fields, making a pump-based system all-the-more appropriate.

Given the invasiveness involved in digging and siting the EcoPods in a sensitive ecological area, Fulton Hogan has developed a system for minimising disturbance and the degree of reinstatement required. Approximately 80 ground protection mats have been used during the works to ensure the area of disturbance is constrained to the smallest possible area. This was a major factor in the almost uniformly positive feedback from locals to the changes on their properties, and in their community.

The Rotoiti onsite Wastewater Treatment system contract is part of a wider contract Fulton Hogan has with Rotorua Lakes Council for reactive maintenance and renewals on the 450km-long reticulation system.

### Location

Lake Rotoiti

### Client

Rotorua Lakes Council

### Objective

To introduce innovative, nature-based, wastewater management to the pristine and environmentally sensitive Rotoiti lakeside

### Contract type

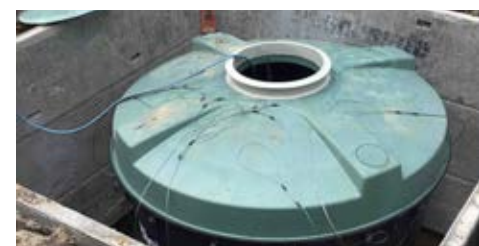
Supply/install/maintain – 15 years operation and maintenance

### Investment

\$16.8M (installation)

### Duration

2021 – 2036



# Dunkirk Road Wastewater Capacity Upgrade

## The Watercare Enterprise Model in action

Few projects epitomise the Watercare Enterprise Model's ability to deliver on its 40:20:20 goal (40% less embodied carbon, 20% improvement in cost efficiency and 20% improvement in health, safety and wellbeing) than the Dunkirk Road Wastewater Upgrade.

As a shovel-ready project, the team must deliver to tight timescales to secure critical funding for Watercare. A major civil project sandwiched between the Tamaki River and housing, the challenges became the catalyst for a range of innovations in building materials, building techniques and in carbon reduction.

The wastewater upgrade helps underpin planned rapid population growth in Panmure. Led by Kāinga Ora and Tamaki Regeneration, 10,500 new homes are envisaged for area in the next 15 years, and an additional 4,000 houses by the private sector.

Central to the solution were four 24m long, 3m diameter, 53 tonne, 166,000 litre storage tanks. In a joint ECI session, the team chose to build the tanks from glass reinforced plastic (GRP). Prefabricated locally, they were bolted together in two days, rather than several weeks using traditional concrete construction techniques.

Six metres underground, they are linked to a single wet well and an 870m gravity main, also made from GRP.

The GRP pipe choice has reduced carbon use by 13%, contributing to the 40% carbon reduction envisaged in the Watercare Enterprise model's 40:20:20 goal.

In addition, there were numerous other innovations in health and safety, and efficiency, including:

- Replacing the overhead power lines with a hydrogen fuel cell 100kVA generator, giving stakeholders 24/7 power supply, addressing the threat from the overhead power lines and reducing the project's carbon footprint at the same time.
- Developing a bespoke manhole concrete hopper to reduce manual handling when pouring manhole corbels.
- Developing a new handrail system on truck beds for additional protection from the risk of falls from heights.

The significant disruption caused, in particular, by the 870m long, 5m deep pipe, required exemplary stakeholder management, through community open days and engagement evenings.

The second phase of the project will link the wastewater plant with Watercare's Eastern Interceptor.

### Location

Tāmaki, Auckland

### Client

Watercare Services

### Designer

Beca

### Objective

To address increasingly regular overflows of wastewater into the Tamaki River, and the needs of a growing community

### Contract type

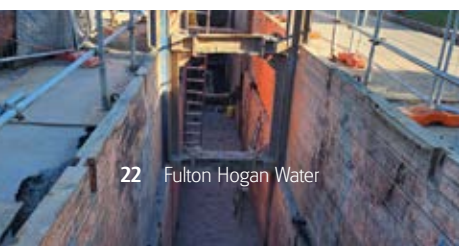
NZS 3910 Lump Sum

### Investment

\$52M

### Completion

2023



Creating,  
connecting and  
caring for communities



**Wellington  
Water**

Our water, our future.

477290

# Willowbank Quarry

## Bringing the water back for the benefit of all

In mid-2023, Willowbank Quarry won the New Zealand quarrying sector's premiere environmental award, the 2023 MIMICO Environmental Award.

The award was for a fish passage that allows native and introduced fish and invertebrates to reach the upper catchments of the hills behind Wellington.

Quarry Manager, Shane Hagai, managed final construction of the fish ramps, addressing almost 300m of stream that had disappeared below ground through fractured rock. The fish ramps are designed for fish to migrate under any conditions, from low water to storm-generated high-water flows, and have 17 fish resting pools and 54 baffles.

The quarry is on the 650ha Willowbank Farm near the top of the Pauatahanui and Hutt River catchments. The Willowbank Farm Trust holds the consent for the quarry, and Farm Manager, Paul Nation, calls the award "the icing on the cake" of a number of environmental initiatives in recent years, including planting 60ha in native trees.

"The quarry is an opportunity to diversify with the same environmental principles and attitude that drives the rest of our operation. It's pretty exciting, and we're delighted for everyone involved with this recognition."

Willowbank was first operated as a quarry by the previous owners of Willowbank Farm in 1993. After being closed for a number of years from 1999, consents were gained to reopen the quarry in 2018 by the CPB / HEB alliance to source aggregate for their nearby Transmission Gully project.

Following the completion of Transmission Gully, Willowbank Trustee Ltd partnered with Fulton Hogan to obtain a long-term (35-year) consent to operate the quarry, which was granted in January 2023. Willowbank Quarry will provide affordable and high quality aggregate to a region that has relatively limited quarry resources and strong demand.

The resource consent application included an ecology impact study (by Cardno NZ), erosion and sediment control plan (by Ridley Dunphy Environmental), a full traffic study including micro-modelling of traffic on State Highway 58, a stormwater management plan, a comprehensive blasting report, geotech report and air quality assessment (all by Beca), and a complete study on the effects of noise.

“ The fish ramps are designed for fish to pass under any conditions, from low water to storm-generated high-water flows, and have 17 fish resting pools and 54 baffles. ”

### Location

Willowbank Quarry,  
Wellington

### Client

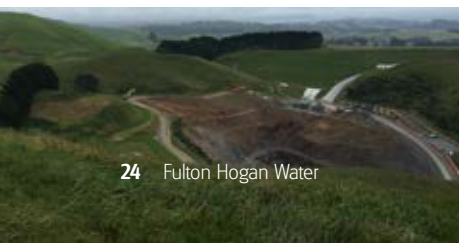
Fulton Hogan /  
Willowbank Farm Trust

### Designer

Fulton Hogan

### Objective

To make a quarrying operation a better environment for native fish and invertebrates to pass



# Challies Island Quarry, Tasman

## Protecting and creating a new body of water

Fulton Hogan has developed a means of extracting aggregate from the 22ha Challies Island site to the west of the Waimea River and transporting it to the Appleby plant on the other bank, without adversely affecting the river. As the aggregate is removed from the site, the area will progressively become a fully planted wetland over the next decade.

“It’s been a long consultation and planning process, with some lateral thinking from all concerned. The end result will be a much better environmental and social asset for the people of Nelson to enjoy.”

For their efforts, Fulton Hogan won the 2023 National IPWEA (Institute of Public Works Engineering Australasia) Excellence in Asset Management Awards for environmental management.

Working with subcontractor, Taylor’s Contracting, the team has constructed a relocatable 30m bridge across the Waimea River that allows 80 tonne (laden) rigid dump trucks to cross to the Appleby processing plant. It can be removed in 48 hours if a major flood is predicted. Most importantly, the bridge means no vehicle comes into contact with river water.

The Challies site is on council reserve land, and the wetland will be one of the first physical stages of the development of the Waimea River Park. It will be excavated in five stages, with each area remediated on completion.

“It’s been a long consultation and planning process, with some lateral thinking from all concerned. The end result will be a much better environmental and social asset for the people of Nelson to enjoy,” Bruno says.

The two-hectare LINZ gravel extraction site on the banks of the Motueka River 50km to the west has been a useful pilot for the Challies wetland.

Partnering with FuturEcology Ltd, five species of rush have been planted in the water – the large rush *eleocharis sphacelata* (kuta), *machaerina articulata* (baumea) and *schoenoplectus tabernaemontani* (kāpungawhā), *cyperus ustulatus* (upoko tangata), and *juncus pallidus* (tall swamp rush).

FuturEcology’s Managing Director Robert Fryer says the LINZ site has been an exciting opportunity to create a functioning wetland in an area lacking biodiversity through a combination of engineering, construction and ecological development.

The key has been creating a true wetland with shallow littoral margins for rushes, as these are the most productive zones in any wetland or riparian planting.

### Location

Waimea River

### Client

Fulton Hogan

### Designer

Fulton Hogan and Taylors Contracting

### Objective

To protect a river source and create a future wetland

### Duration

2023 - 2035



# Waipuku Stream, Taranaki

## Taranaki project a blueprint for fish passage

At Fulton Hogan, we are fortunate to be able to help protect some of New Zealand's most beautiful and sensitive areas. Working in Taranaki with KiwiRail, Taranaki Regional Council, Department of Conservation and Tonkin and Taylor, we have helped open up 27km of previously inaccessible river to native freshwater fish – for the first time in more than 100 years.

When an historic weir and rail bridge were built across Taranaki's Waipuku Stream in 1987, its builders didn't anticipate it would bar some migratory fish from the upper reaches of the waterway under Mt Taranaki.

To address this, Fulton Hogan has built a full width rock ramp weir to overcome the 1.5m vertical height barrier to fish. This nature-like rock ramp consists of a continuous ramp of rocks, placed below the barrier and connected by continuous water flow. The fishway ramp is designed to provide a range of flows to support a wider variety of fish to move upstream.

“ When an historic weir and rail bridge were built across Taranaki's Waipuku Stream in 1987, its builders didn't anticipate it would bar some migratory fish from the upper reaches of the waterway under Mt Taranaki. ”

Fulton Hogan's National Environmental Manager - Construction, Omar Seychell, says the works open up a large area of habitat upstream of the weir and should have a significant positive effect on the health and wellbeing of the waterway.

In addition, it can be a blueprint for addressing other human-made impediments to fish migration elsewhere in the country.

A key to this project is undertaking monitoring to determine the effectiveness of the remediation, which included pre and post 'eDNA' (environmental DNA) monitoring to measure the presence/absence of fish over time. As part of this monitoring, and in a relatively short timeframe from when works were completed, the upstream stretches of Waipuku Stream indicated the presence of shortjaw kokopu (not previously sighted pre-works) in addition to longfin eel, shortfin eel, various bully species, galaxiids, salmon and trout.

The works were done in accordance with the New Zealand Fish Passage Guidelines, to best practice standards, starting physical works in mid-April 2022. Appropriately, they were completed in time for World Fish Migration Day two months later.

### Location

Waipuku Stream, Taranaki

### Client

KiwiRail

### Designer

Tonkin and Taylor

### Objective

To reinvigorate the ecology of the upper Waipuku River water system

### Contract type

Construct

### Investment

\$1M

### Completion

2022



# Clyde and Alexandra Water Treatment Plant

## Paying water the highest possible compliment

Central Otago District Council (CODC) Mayor Tim Cadogan claims the water at the new Alexandra and Clyde water treatment plant tastes “better than champagne.”

He made this comment in mid-2023 at a gathering of CODC executives and Fulton Hogan to mark the opening of the water supply upgrade that fundamentally improves Alexandra and Clyde’s drinking water.

The development signals a welcome goodbye to limescale build-up that locals had become used to in their water.

Project Manager, Peter Hogan, says it is rewarding being part of a project where, as a result, the community can literally taste the difference, bringing a measurable benefit to their daily lives.

“For an area with a relatively small ratepayer base, this was a major project and one that was watched particularly closely and warmly welcomed,” says Peter.

The project began at the Clyde bore fields that pull water from Lake Dunstan, where an existing bore was refurbished with upgraded headworks, and two new bore pumps and headworks installed to increase resilience. A new electrical switch room, variable speed drives, back-up generator and a new larger transformer were also installed on the bore fields site.

A new, 14 megalitres per day, water membrane filtration system treatment plant was constructed 780m from the Clyde Dam, above the bore field. Fulton Hogan managed the design and build of the 450m<sup>2</sup> building and installation of the electrical and control system. A 225m<sup>3</sup> raw water tank was also built, in addition to surrounding infrastructure – roads, wastewater pipelines and stormwater control structures.

The third site, 200m from the water treatment plant site, involved building a 750m<sup>3</sup> treated water balance reservoir. The fourth major element was all the pipework feeding this tank from the bore fields and water treatment plant, and the connections to existing pipework for Alexandra and Clyde reservoirs. Fulton Hogan managed the integration of the new system into the existing water supply.

Despite COVID-19 delays and price increases the project was commissioned on time, as per the revised programmed date in May 2023, and close to budget.

“ For an area with a relatively small ratepayer base, this was a major project and one that was watched particularly closely and warmly welcomed. ”

### Location

Clyde, Alexandra

### Client

Central Otago District Council

### Designer

Stantec

### Objective

To future proof and improve the quality of the water for the people of Clyde and Alexandra

### Contract type

NZS 3910:2013

### Investment

\$12.7M

### Completion

2023



# Te Anau Subsurface Dripper Irrigation

## Turning waste into bounty

With many wastewater treatment consents in New Zealand nearing expiry, and increasing minimum treatment standards, the Southland District Council's (SDC) subsurface dripper irrigation (SDI) system near Te Anau may be a pointer to the future.

Developed by Fulton Hogan in Stages Two and Three of the Te Anau wastewater treatment plant upgrade programme, it involved laying a DN315 and DN280 diameter pipe running 19km from Te Anau to the 40ha field owned by SDC (Stage 2), and installing a network of dripper fields and service lines (Stage 3).

Manufactured and shipped from Israel and buried at an average depth of 210mm, the 100micron drippers are at 600mm intervals. The DN20 drip irrigation tube has special anti-microbial protection, fluoro-ethylene slip agent, anolyte, bacterial inhibition and root intrusion prevention technologies.

The drip irrigation applies the wastewater directly to the crop root zone, providing valuable nutrients to the soil, making the dry-in-summer, freezing-in-winter land a bountiful source of baleage.

SDC regularly tests the uplift of nitrogen by the grass to ensure it meets resource consents for nitrogen loss.

Prior to the development, the treated wastewater went into the Upukerora River and then to Lake Te Anau.

“ The drip irrigation applies the wastewater directly to the crop root zone, providing valuable nutrients to the soil, making the dry-in-summer, freezing-in-winter land a bountiful source of baleage. ”

The benefits include:

- A practical and safe use for treated wastewater.
- The nitrogen primarily taken up into the plants, rather than leaching.
- Subterranean release means little soil evaporation and no surface runoff.
- Enhancing plant growth, crop yield and quality.

The project involved installing:

- 3,600m of PE pipe.
- 11,300m of cable ducting for more than 80 instrumentation and automated valves.

- 3,200m of DN50 and DN100 uPVC pipe.
- 146 concrete chambers fitted up off-site and transported to house more than 180 air valves.
- A mixture of PVC and polythene jointing – 3,540 tee joints (50mm), 4,000 drip line connections, 12,000+ cuts and glue joints and 250 flanged joints.
- 462,000m of 20mm dripper line, including 770,000 emitters.
- A 110m<sup>3</sup> and two, 30,000 litre tanks for treated effluent storage.

### Location

Te Anau,  
Western Southland

### Client

Southland District Council

### Designer

Stantec

### Objective

To redirect treated wastewater from Lake Te Anau to a subterranean irrigation scheme

### Contract Type

NZS 3910

### Investment - 19km transfer pipeline (Project Phase 2)

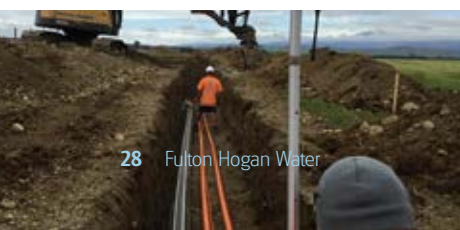
\$6.3M

### Investment SDI - (Project Phase 3)

\$4.96M

### Completion

2021



# The Auckland New Connections team

## The measure of a quality water service

Most of the 400 million litres of water that Watercare provides Auckland daily pass through a water meter.

The meters are a valuable tool for better water management by households, businesses and by Watercare itself. It follows that management of relationships with customers is critically important.

Fulton Hogan's 50-strong Auckland New Connections team installs up to 12,000 new water meters annually, from Pukekohe to Warkworth. Around 75% are residential, the remainder are commercial.

“ This is definitely the people end of potable water – a people programme as much as a logistics and engineering exercise. ”

Fulton Hogan's Auckland Divisional Manager, Andrew Long, says there is almost as much variety in the work as there are customers. A typical week has around 200 installations, on up to 100 different sites across the Auckland region.

“This is definitely the people end of potable water – a people programme as much as a logistics and engineering exercise,” says Andrew.

A premium is placed on people skills and improvisational ability; the sort of attributes shown day in and day out by people like Darryn Little, Fulton Hogan's nominee for Water NZ's Trainee of the Year Award for 2023.

Darryn's pride in creative solutions, minimising impact for customers and an appetite for 'new and better' is leading to innovations that include a redesigned low flow water meter set up that allows a crew of three to almost double their installation rate.

Andrew says adaptability and resourcefulness are at a premium.

“Every day and every job is different – there might be a power pole that isn't shown on the plans, working within the dripline of some trees may require an arborist stand-over, and there can be any number of things (known and unknown) under the ground.”

The team is also involved in the roll-out of smart meters, increasing Watercare's real-time data across customers and a more exact and actionable overview of water use.

### Location

Greater Auckland

### Client

Watercare Services Ltd

### Contract started

2016

### Objective

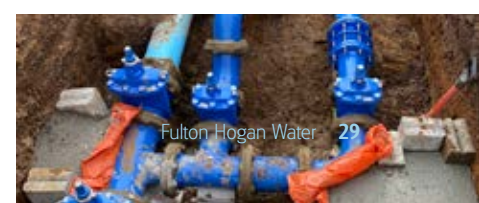
Ensuring the efficient and safe installation of water metering and backflow prevention across the Auckland Region – low flow, domestic (smart), and commercial metering, ranging between 15mm and 150mm.

### Percentage of connections - residential

95%

### Percentage of connections - commercial

5%



# The Waiāri Water Treatment Plant

## A master class in collaborative outcomes

A finalist in CCNZ's 2023 National Awards, the Waiāri Water Treatment Plant is an infrastructural cornerstone for one of New Zealand's fastest-growing regions.

But even more than this, the microfiltration membrane-based plant is also testament to the power of collaboration for achieving environmental, social and community goals.

A primary collaboration was with people for whom the water of the Waiāri Stream is a taonga tuku iho (treasure). Flowing in a deep ravine outside Te Puke, it is an awatapu (sacred river) to tangata whenua as it flows from the Otanewainuku ranges to the Kaituna River.

The Waiāri plant sources water from the Waiāri Stream, reducing pressure on the existing streams that provide water to Tauranga - the Tautau and Waiorohi - as a growing population demands more water.

Recognising tangata whenua's relationship with the stream, the project team's partnership with the Waiāri Kaitiaki Advisory Committee honoured iwi relationships with the river and involved them closely in monitoring and measuring its health.

Another primary collaboration was between Tauranga City Council, Fulton Hogan and designers Beca. This was built on a nine-step integrated commissioning plan, and involving careful integration of the project's 47 contractors to minimise the risk of double-ups, efficiencies or reworks. This made the collaboration between Fulton Hogan's Digital Engineering and project management teams a key to the success of the project.

Synchro 4D Pro was used as a collaboration tool, allowing efficient programming of the job across multiple subtrades and subbies, while 3D models helped minimise clashes to ensure works were done efficiently and risks managed well.

This helped Fulton Hogan identify and address potential design sequencing issues at both a macro and micro level, helping increase integration with the multiple subcontractors and reducing hazard risks. It also ensured the construction could proceed seamlessly even with severe space limitations caused by, for example, the need to prop temporary works and their concrete supports.

One of the key clashes identified ahead of time, with the benefit of digital engineering, was the sequencing of the construction of the roof for the process hall and the filtered water pipeline.

Detailed planning also ensured a carefully staged approach to the construction of the process building and pre-treatment structure, allowing crane access for precast and steel lifts. There was also detailed temporary works modelling for structural stability while building the reservoir.

The team also implemented multiple ways of reducing waste onsite and, where possible, using different or re-usable materials. This included permanent formwork (speedform) for in-ground foundations to minimise the use and waste of timber framework.

'Lessons learnt' were also a key part of the process, whereby any shortcomings were clearly identified and communicated to teams. These led to several improvements, including eliminating the need to work at heights and reducing manual handling. Subcontractors were closely involved in these processes.

The final major collaboration was with the public, through educational programmes, open days and the opportunity to plant many of the project's 30,000 native plants. This spirit of community involvement was central to the project, allowing local people to contribute to, and be intimately involved in, an important community asset. And of all the views the public enjoyed, none exceeded that of the children who, during an open day, viewed the Waiāri treatment plant from 60m in the air, on the 170-tonne crane of subcontractor Pollock Cranes.

### Location

Te Puke, Bay of Plenty

### Client

Tauranga District Council

### Designer

Beca

### Objective

To meet Tauranga and the wider Western Bay of Plenty's future water needs, and ease pressure on existing water sources

### Contract type

NZS 3910 lump sum

### Investment

\$49.6M

### Design capacity

60 million litres / day

### Duration

August 2020 -  
December 2022



# Puketutu Island

## The creative use of biosolids

Has any island seen more change than Puketutu in Auckland's Manukau Harbour? Home to a 12-year project by Watercare and Fulton Hogan to create a site for storing and remediating biosolids, the first chapter in Puketutu's story predates both Watercare and Fulton Hogan by around 30,000 years.

That was when a volcanic eruption formed the island in the first place.

Then, 700 or so years ago, it became the home to the crew of the Tainui waka on arrival in Aotearoa. Known as Te Motu a Hiaroa to mana whenua, the island remains sacred to the people of Te Kawerau ā Maki, Te Waiohū and Waikato-Tainui.

Then, 70 years ago, the island's four volcanic cones were quarried for their scoria and basalt rock to build nearby Auckland Airport's runways.

“ Sometimes it's easy to think this is normal – to forget that this is an extraordinary project, unique in its creativity and practicality and one which I'm extremely proud to have been involved with. ”

Chapter four of Puketutu's story is now almost complete. In 2024, Watercare and Fulton Hogan complete the project that will ultimately enable the island to return to its original appearance – cones and all. At that point, it will be returned to the people of Auckland as a regional park.

The volcanic cones are being rebuilt with biosolids from Watercare's Mangere Wastewater Treatment Plant. The plant treats more than 300 tonnes of biosolids daily, which is transported to the cells Fulton Hogan is building on the island. The first biosolids arrived in 2015, and the storage cells have been developed in parallel.

These include a sealed liner and pump system that captures and returns biosolid leachate to the Mangere plant, protecting the island's aquifer.

A giant 450,000m<sup>3</sup> bund has been built around the perimeter of the volcanic cones, and nearly 60,000m<sup>2</sup> of liner (equivalent to 12 rugby fields) laid. With the last of the liner now laid, all that remains is for the pre-load to settle the section of liner that has been built over the old quarry pits.

Puketutu Project Manager, Russell Green, knows Puketutu like no-one else – having been on the project almost since day one.

“Sometimes it's easy to think this is normal – to forget that this is an extraordinary project, unique in its creativity and practicality and one which I'm extremely proud to have been involved with.”

### Location

Puketutu Island, Manukau Harbour, Auckland

### Client

Watercare Services

### Designer

Beca

### Objective

To create a safe and sustainable environment for storing biosolids from the treatment plant, creating a public amenity in the process

### Contract Type

Part of the Watercare Enterprise Model, effectively an ECI project with cost independently verified

### Completion

2024. Returned to the public as a regional park by 2049



# The Redoubt Road Reservoir

## A project complex in its simplicity

Redoubt Road Reservoir Project Manager, Nathan Summerscales, describes the new Redoubt reservoir project as “a project complex in its simplicity.”

At face value it could be another square box, like the two boxes adjacent to it, through which 80% of Auckland’s potable water flows.

But closer inspection shows it is a five-sided square – a sign of the lengths taken to address the limitations of a confined site to achieve a 45 million litre volume. The maximum area was also achieved by stabilising a technically challenging slope with engineered fill and a counterfort drain network.

Because of the restrictions, Fulton Hogan built the reservoir from the inside out, with the 280T crawler crane situated inside the reservoir for the majority of the works.

Less visible to the naked eye was a series of carbon reduction measures. These included using supplementary cementitious material – primarily 25% fly ash in the cement – low carbon cement and the re-use of 35,000m<sup>3</sup> of fill from Redoubt Road at another Watercare site, Puketutu Island. The use of tapered wall units also reduced the concrete used, and post-tensioning reduced the amount of reinforcing steel required.

Key to constructability was minimising in-situ work in favour of prefabrication. Fulton Hogan Precast began manufacturing in July 2022 and finished 10 months later, with a strong emphasis on clash detection through computer modelling. Key achievements included the post-tensioned, tapered wall panels and complex pilaster panels – the largest of which weighed 47-tonne. The moulds were manufactured from steel profiles which, in addition to a particularly high-quality finish, allowed for steel side shutters to align reinforcing and post tensioning.

“ Key to constructability was minimising in-situ work in favour of prefabrication. Fulton Hogan Precast began manufacturing in July 2022 and finished 10 months later. ”

The reservoir has an 8,300m<sup>2</sup> post-tensioned floor slab on top of a 1m thick raft foundation, 650-tonne of steel reinforcing, 600m of 1,965mm diameter CLS watermain, eight in-situ valve chambers (each more than 4m deep) and 750 pre-cast elements (wall panels, double tees, columns, column heads, beams and baffle panels).

With the third reservoir completed, Watercare plans to build as many as three more reservoirs on the site, based on future demand.

They are expected to be delivered through the Watercare Enterprise Model, giving further opportunities for additional efficiency gains through, for example, re-use of formwork and refinements to the constructability of design.

**Location**  
Redoubt Road, Manakau,  
Auckland

**Client**  
Watercare Services

**Designer**  
Beca

**Objective**  
To increase Auckland’s  
potable water storage  
resilience

**Contract type**  
NZS 3910

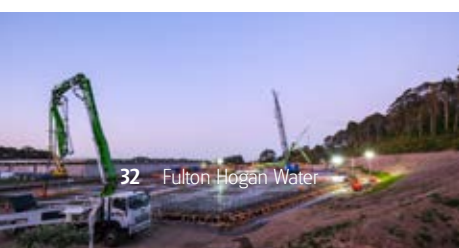
**Investment**  
\$65M

**Completion**  
2024

**Dimensions**  
106m long, 77m wide,  
8m high

**Capacity (new)**  
45 million litres

**Capacity (existing two  
reservoirs)**  
120 million (total)



# Kurimoto Pipe Installs

## Ready for a magnitude 9 seismic event

A legacy of recent earthquakes – Christchurch and Kaikoura in particular – is the rapid uptake of seismic tolerant infrastructure.

Two Fulton Hogan projects have pioneered the use of Kurimoto seismic resilient ductile iron pipe (SRDIP) in New Zealand – a Wellington Water project in Porirua and a 680m, DN150 water supply line integrated with Fulton Hogan’s construction of the Heathcote cycleway in Christchurch.

“ SRDIP’s flexible joints allow angular deflection, compression and expansion without joint separation – the pipeline moving in a seismic wave and staying intact even under severe ground movement. ”

Kurimoto’s pipeline specialist, Akira Yabuta, spent three weeks in Christchurch ensuring the team was familiar with the new technology and its application. Given its seismic issues, Japan has become a leader in earthquake and liquefaction resilient pipe technology. Kurimoto’s SRDIP’s flexible joints allow angular deflection, compression and expansion without joint separation – the flexible joints allow the pipeline to move in a seismic wave and stay intact even under severe ground movement and displacement.

Fulton Hogan Project Engineer, Kennedy Evans, says the drainage team adjusted quickly to the new pipe.

Among the benefits of the system is that thrust blocks are no longer required because these are accounted for in the joint system. The joints also have nearly 270mm flex on each 5m length, allowing it to be routed around services. This all adds to the productivity and cost effectiveness of using the product.

“The consensus from the crews is that they would be happy to work with the pipe again. In fact, they enjoyed it and said it’s a quality product,” says Kennedy.

The Kurimoto SRDIP pipe has a triple layer of external corrosion protection coating, which eliminates the need for PE sleeving. The first layer has a zinc-based alloy spray, the second is a sealing treatment, and layer three is a synthetic resin coating. An internal layer of epoxy powder coating, oven-baked onto the pipe, gives the lining inside a surface friction coefficient similar to plastic pipes, while the external coating is claimed to give 100-year durability.

The pipe is rated to PN35 – high pressure pipe – and designed to stand a magnitude 9 earthquake. There’s nearly 270mm flex on each 5m length of pipe, allowing it to be routed around services where necessary.

### Location

Heathcote, Christchurch

### Client

Christchurch City Council

### Designer

Velos (CCC Major Cycle Route Design Team)

### Objective

To introduce earthquake resilient pipe to the city, and test its constructability

### Contract type

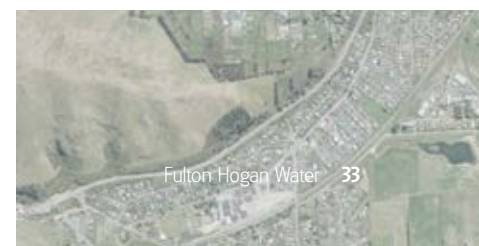
NZS 3910

### Investment

Tendered value \$7.3M

### Undertaken

Mid-2023



# Christchurch International Airport

## Understanding tomorrow, today

Fulton Hogan's Christchurch Airport GIS Analyst, Isaac Shaw, refers to the airport as 'virtually a mini city.' Almost everything you find in a town with a population of approximately 8,000 people.

"Virtual" also applies to another aspect of the airport's asset management. It's city-like nature makes it a premium site to apply GIS (geospatial information services) to its fullest for managing assets, including the many underground.

**“ By better understanding rate of change – the trends in degradation – we will be in a better position to understand cause and effect, and hence better predict future needs. The information will be the basis of accurate trade-offs relating to the timing and nature of response. ”**

In early 2023, Fulton Hogan's long-running maintenance contract with CIAL was expanded to include 1,700 stormwater assets, primarily sumps and soak pits. In late 2023, the contract was expanded further still to cover sewer and potable water.

This, in turn, is part of a wider relationship with CIAL that spans water and treatment facilities management, airside runway, taxiway and apron maintenance and capital projects, which all come under the GIS technology umbrella.

The technology is helping Fulton Hogan give CIAL better understanding of likely future investment needs, using richer information about past and current performance of assets to refine the modelling of likely future needs. The technology is helping us understand not only what's there, but what's happening over time to what's there, by way of more accurate, more regular points of comparison.

This includes mapping assets for CIAL's remote water lines to understand their rate of degradation over the next 10 years.

"By better understanding rate of change – the trends in degradation – we will be in a better position to understand cause and effect, and hence better predict future needs," Isaac says.

"The information will be the basis of accurate trade-offs relating to the timing and nature of response."

### The information recorded on each asset:

- CIAL or tenant maintained
- Client IP
- Client asset ID
- Location map
- What it is - sump, soak pit, interceptor, shut off valve
- Accessible Y/N
- Condition to check for (sediment structural holding water, surrounding area requires attention)
- Condition rating general comments
- Photos
- Sign-off

### Location

Christchurch International Airport

### Client

Christchurch International Airport Ltd

### Design partner

Fulton Hogan Engineering Solutions in-house delivery

### Objective

Ensuring the quality maintenance and development of the airport's assets

### Contract type

Short form agreement

### Duration

24-month initial term with renewal option



# Nelson Stormwater Replacement

## Passing the elements' greatest test

Whether you say it was irony or fate that the new stormwater system on Rutherford Street should be constructed during a 100+ year rain event in August 2022, it nevertheless had a profound effect on the project.

Putting additional pressure on an already challenging 40-week programme that included 950m of water mains and 400m of wastewater lines, in addition to the 400m of new 1,800mm pipe laid at up to 6m deep, a series of innovations were required to keep the project on track.

The result was, despite the weather and the discovery of extensive coal tar that needed to be addressed, the project was completed nine weeks ahead of programme, \$315k under the \$7.85M tender price, excluding additional works.

“Despite the weather and the discovery of extensive coal tar that needed to be addressed, the project was completed nine weeks ahead of programme, \$315k under the \$7.85M tender price, excluding additional works.”

The various elements that made it possible included:

- Through the early phase of the project developing alternative design options for the sewer and watermain alignments. This enabled works to be completed in parallel, saving time and money and minimising disruption to stakeholders.
- As a result of the above, up to seven crews worked on the project simultaneously – two on the stormwater line and one each on the water main renewals, the stormwater chamber, water main, sewer line and footpath construction.
- Given the high traffic location, extensive signage and maps were produced for stakeholders, including adding extra crossing points and designated pick up and drop off areas for school children. This enabled more teams to work, without limited public inconvenience.
- Opting for a single 6m x 6m x 5m chamber to build in additional redundancy, rather than the twin chambers originally envisaged.
- Temporary works for the chamber install, in the form of a sacrificial steel frame in the base of the chamber excavation, avoided the need for additional deep sheet piling to support the excavation walls, minimising time, cost and disruption.
- Minimising the extent of coal tar that needed to be removed from site, by utilising the material as trench backfill.

It is telling that the first comment Project Engineer, Josh Turner, made on the project's completion was: “the team enjoyed it so much, we'd like to do it again.”

Fortunate it is, then, that this was stage two of a three stage project. The final stage takes the storm water main to the sea.

**Location**  
Rutherford Street, Nelson

**Client**  
Nelson City Council

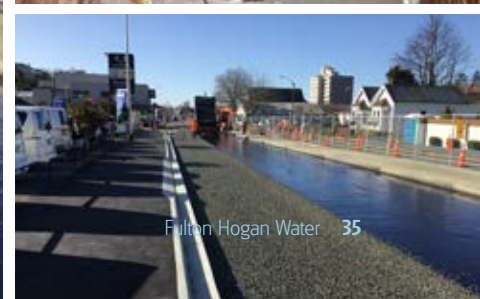
**Designer**  
CGW

**Objective**  
To address under-sized stormwater pipes, and add new watermain and wastewater lines simultaneously

**Contract type**  
NZS 3910

**Investment**  
\$7.535M

**Completion**  
2023



# SH6 Remediation

## Water and its increasing effect on roads

Like many highways, SH6 through the Whangamoia Ranges between Marlborough and Nelson was built with a horse and a stage coach in mind. Like other highways, more than a century of realignment, widening and resurfacing has concealed problems in dispersing water.

Four culverts on SH6 were key points of weakness when an 'atmospheric river' – more than one metre of rain – hit Nelson over three days in August 2022. Poorly positioned due to previous road realignments and too small, the culverts were destined to fail under the sheer pressure of water.

Their failure led directly to the failure of four stretches of the road. The culverts were overwhelmed, the road embankment acted like a dam, and something had to give.

**“ Out of sight has often been out of mind, but with climate change leading to record levels of rainfall, this needs to change. ”**

In 2023, Fulton Hogan won three of the leading awards in civil contracting in New Zealand – the Engineering New Zealand (ENZI) Award, a national CCNZ Award and an Āpōpō award for demonstrating how this road, conceived in the 19th century and running through steep, forest-strewn landscape, could be re-engineered for 21st century climatic needs.

With careful planning and the support of Waka Kotahi, WSP and subcontractors, Fulton Hogan replaced 30 culverts and installed 2km of new concrete lined channel, as part of a wider programme of retaining walls and road reinstatement on SH6. The culverts varied between 600mm and 1,350mm, compared with the 300mm and 450mm culverts they replaced.

Key to this was thinking from the 'bottom up', addressing the underlying need to disperse large volumes of water under – and along - the road.

“This project shows that to have more resilient roads we need more holistic approaches to the root causes of potential water damage, the necessary hydrological analysis, drainage, structures and overland flow,” says SH6 Reinstatement Project Manager, Matt Loach.

Matt says shortcomings of legacy drainage infrastructure has tended to be under-acknowledged in the past. “Out of sight has often been out-of-mind, but with climate change leading to record levels of rainfall, this needs to change.”

Matt says prevention – in the form of proactive replacement of culverts – is becoming an increasingly important consideration. Key to this is benefitting from the hundreds of years of experience people working on NOC roading contracts have gained.

“Through practical observation and experience, they know how water behaves on their roads under different conditions at least as well as anyone.”

Matt says addressing storm water around roads can create 'Catch 22s'. “In channelling the water, it needs to be managed throughout its journey or it can create problems greater than if it was not channelled in the first place.”

He says a more methodical, scientific approach to understanding hydrological capacities will pay dividends in minimising avoidable road failure in the future.

“As an industry, we understand pavements and their loading capability to minute levels of detail, but there hasn't been the same level of scrutiny of the capacity of culverts.

“Events like the August 2022 floods are a reason to change this, and their legacy will be more appreciation of the importance of water dispersal in preventing catastrophic damage to roads.”

Since the SH6 rebuild, Matt has witnessed an even more profound outcome of culvert inundation. He's been helping with the SH25 repairs in the Coromandel, where a 300,000m<sup>3</sup> slip resulted largely from a failed culvert.

“The level of damage has been horrifying, and the remedial action immense. There's a lesson in that for all of us.”



“ In channelling the water, it needs to be managed throughout its journey or it can create problems greater than if it was not channelled in the first place. ”



# Valve Conditioning

## Fulton Hogan innovation could have benefits across New Zealand

As New Zealand looks to significantly enhance its Three Waters infrastructure, one of the key areas to dial up – or in some cases turn off – are valves.

We estimate 200,000 valves are installed across New Zealand, many of which are decades old and in poor condition. A cornerstone of the entire water network, it is imperative that they operate when most needed and that money isn't wasted replacing valves that can be re-conditioned.

A Fulton Hogan Water innovation is dramatically improving the functioning of water valves, providing more accurate information for decision-making for valve renewals and reducing the potential capital cost of unnecessarily replacing valves.

The system combines new valve exercising machinery with Fulton Hogan-developed data mapping (GIS) and asset management systems. This enables identification and monitoring of the condition of valves, and when a valve needs to be closed, achieving this more quickly, accurately and safely. The 'careful logic' – the brains of the system – ensures pressures are never too great to break a valve and that the valve is 'exercised' to the point where there is consistent pressure across the full travel of the valve.

**“It's one thing to know where valves are – it's another altogether to be confident that the valves are fully functional – able to do their job – when we need them to.”**

The live data reporting provides real-time visualisation of a valve's condition and position metrics, and access to a purpose-developed, geospatial reviewer gives network owners accurate information to plan for shut-downs, and budget for renewals.

Fulton Hogan Water Engineer, Patrick Gledhill, says the combination of the software and the hardware is the key.

“It's one thing to know where valves are – it's another altogether to be confident that the valves are fully functional – able to do their job – when we need them to,” says Patrick.

Previously, there was a considerable 'human factor' – including attempting to ascertain a valve's position and condition, applying the right pressure on the valve and the physical demands on operators.

In Three Water networks, valves are primarily used for maintenance to enable isolation of network sections without requiring wider shut-downs. Faulty or stuck valves traditionally require shutting off water to a wider community, with the significant physical, economic and financial costs associated with this.

Conditioning faulty or stuck valves with this new process minimises this need.

“There is no operator fatigue, as we undertake the same operation on every valve, every time. We can count the number of turns and measure the amount of torque used to turn it, giving us full control and an accurate assessment of operating condition,” says Patrick.

Historically, large aging valves can take multiple operators hours to open or close – the new service takes one operator only a few minutes.

Valve deterioration is typically caused by tuberculation on stems and valve seats – the automated exercising sequence runs multiple passes from open to closed to clear away the built-up growth.

Turn counting allows operators to record the as-found and as-left position of valves, which is particularly important given that 100mm valves can have anywhere between nine and 22 turns.

“We are optimising and extending the health of the network by more accurately identifying problem valves, together with confirmation of valve position and operability. Through our visual maps, we can now paint a clear picture of network function and redundancy for our clients,” says Patrick.

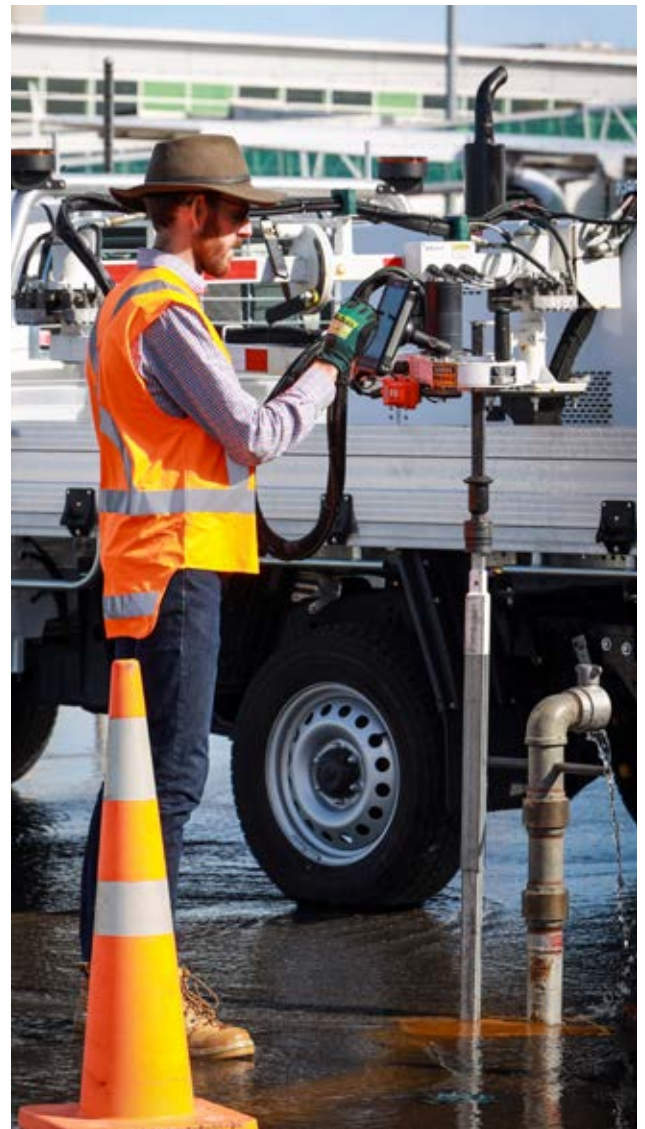
Ultimately, this new service gives local government utilities greater confidence in how, and when, to spend ratepayer money on water infrastructure, while minimising disruption to users.

“This is the most important outcome for communities – minimising disruption and ensuring an accurate renewal programme, so budget allocations are aligned with the actual needs of the network,” says Patrick.



**The new valve conditioning system:**

- Improves the operation of old valves, through consistent valve exercising.
- Gives a visual record of the condition of individual valves right across networks.
- Improves knowledge of optimum times for maintenance, through understanding changes in valve condition over time.
- Keeps operators safe from strains and sprains, by removing the manual opening and closing of valves.
- Gives early identification of problem valves to allow planned renewals.
- Minimises disruption to the community during unplanned shut-downs.





# | Nelson Water Treatment Plant

## Handling the August 2022 storm event

Is there a better example of meeting a city's critical water needs under potentially catastrophic circumstances?

Fulton Hogan has operated and maintained Nelson's water treatment plant since the facility opened in 2004, responsible for ensuring uninterrupted supply of quality water for 53,000 residents, businesses and industry.

The plant's operational and maintenance team of seven staff includes two full-time caretakers, each living at one of the two catchment sites, and on-call, year-round for faults or to control water intakes. Their partners also work for Fulton Hogan, in communication and administration roles to oversee the catchments' surrounding recreation areas for Nelson City Council.

When a metre of rain fell on Nelson in just four days in mid-August, the 900mm concrete Maitai raw water pipeline was one of the first casualties. After automated flow alarms sounded, the full team gathered at the plant, isolating the damaged section of pipe and engaging the smaller duplicate pipeline. They set up two 12-hour shifts throughout the flood.

With the Maitai and Roding rivers both in flood, the team changed the water source from the two rivers to the Maitai Dam.

Then the power to the plant failed due a fallen tree, followed by the generator failing three hours later. An on-call diesel engineer negotiated a major slip on the road to access the plant, while the team organised a back-up generator from a Fulton Hogan quarry. Keeping the electrics alive was key to ongoing supply.

The power was restored within five hours. However, with the fibre optic cable also gone, automatic comms to the auxiliary pump stations were inactivated. This meant water was not getting to the reservoir in Stoke, so the team drove to the site to manually manage the pumping operation.

With the Nelson City Council putting water restrictions in place, the team took all the volume they could from the dam via the duplicate line. They continued to test water as the event unfolded, and while the input turbidity was 1,000 times that of typical river flow, they managed to

keep the plant producing the city's water compliant with drinking water standards. Normal rain-event flow measured at the Maitai Dam is 10,000 litres per second. During the flood event, there were 300,000 litres per second.

**“ When a metre of rain fell on Nelson in just four days in mid-August, the 900mm concrete Maitai raw water pipeline was one of the first casualties. ”**

The level of the Maitai Dam was just below the water fuses, which would allow water through the slipway in a controlled release if required. Trevor, the caretaker for the Maitai River regularly checked the level of the auxiliary spillway dam in case he and his wife, Jude, needed to evacuate.

The deluge caused a series of slips on the road to and from the plant. While the team were working on maintaining the city's water supply, subcontractors repaired the road to the Maitai Dam and to the plant, to give the team ongoing access.

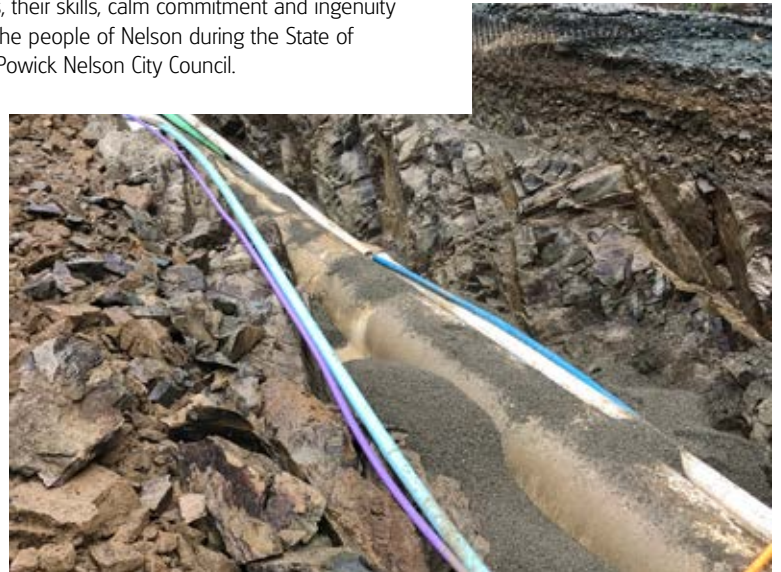
While the team was running the plant manually, they saw potential for losing filtered, chlorinated, safe and clean drinking water due to water-borne diseases and started to think of how to overcome this “worst-case” scenario. Following the event, in conjunction with Nelson City Council they saw the need for a mobile water treatment plant that could be mobilised at short notice should there be a need in future.

Tonkin and Taylor were engaged to produce sketches of a basic design for an emergency filtration and chlorination system with a chlorine pump and a 10,000 litre storage bladder. The Fulton Hogan plant team built a prototype that would be easy to run with basic training, which the team have now produced ready for testing.



### ***From the client...***

"During and following the August 2022 flood event in Nelson, the team at the Nelson Water Treatment Plant managed and achieved the massive task of maintaining Nelson's clean water supply. Under extremely difficult conditions, with the main supply pipeline broken and power outages, their skills, calm commitment and ingenuity provided surety to the people of Nelson during the State of Emergency." Eddie Powick Nelson City Council.



# Water Safety Management

## A unique perspective - a unique contribution

In our water management contracts throughout New Zealand, ensuring consistent potable water quality is as important as ensuring consistent supply. That quality is the responsibility of a team of local plant managers, centrally supported from our Engineering Solutions division, alongside our clients.

The multiple safety considerations, from water source to water meter and use, require a diverse range of skills. Few people in New Zealand epitomise this diversity better – geographically, scientifically, socially and culturally – than Engineering Solutions Water Safety Advisor, Leila Dadian.

Leila's experience began in a country where water is particularly scarce, and where its management has strong social, economic and cultural implications. The native Iranian prepared and implemented environmental management plans, social impact assessments, relocation studies, water quality monitoring plans, environmental/catchment risk assessments and erosion modelling for several multi-purpose dam projects.

Moving to New Zealand in 2011, Leila expanded her experience into the research environment at the Bio Protection Research Centre at Lincoln University, and undertook a postgraduate diploma in water resource management.

Then, as a water quality engineer for Selwyn District Council, Leila worked in a local government organisation upgrading facilities across its 26 water schemes. As part of the water operational team she was responsible for monitoring water quality within the district and preparing annual potable water quality plans as well as analysing water treatment plant/network function using remote monitoring system SCADA (real time data). Leila collaborated in preparing water safety plans for the council and led the implementation of WSPs audits.

With this came a deep appreciation of drinking water quality management, drinking water standards and guidelines, safety planning, auditing, water supply risks assessment (catchment to tap), compliance reports and requirements, supervisory control and data acquisition (SCADA) analysis, critical control points (CCPs) and standard operating procedures (SOP) for drinking water and emergency management plans.

"After working in environmental and social management on major new water facilities, biological research and provision of water services by a council, I feel I am now bringing all these skills and experiences together on behalf of local bodies across New Zealand, and the people they serve," says Leila.

"I can think of few jobs with more purpose and ability to make a difference."







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