

# **Christchurch Water Supplies Water Safety Plan Volume A: Components Common to All Water Supplies**

Christchurch City Council

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Revision 2





May 2022

Water safety plan requirements are provided in two parts. This volume (Volume A) covers components that are common to all of the Council's water supplies. Information that is specific to individual water supplies is noted in the relevant sections with links to the supply specific water safety plans provided in section 2.

### Version Control

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Revision 1	2020	Developed to address components of the water safety plans that apply to all supplies	Daniela Muruges (CCC) Sarah Hemmingsen (CCC)
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### Internal Document Review and Approval

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Revision 1	2020	Veronica Zefferino (CCC Team Leader Quality & Compliance)	Helen Beaumont (CCC Head of Three Waters & Waste)		20/12/2020
		Bridget O'Brien (CCC Team Leader Asset Planning Water Supply & Wastewater)	David Adamson (CCC General Manager City Services)		21/12/2020
			Dawn Baxendale (CCC Chief Executive)		22/12/2020
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# 1 Commitment to Drinking Water Quality Management

## 1.1 Relationship of the Water Safety Plan to organisational policy and strategy

The protection of our drinking water and public safety is a key priority for the Christchurch City Council (the Council). *High quality drinking water* is one of the 18 community outcomes listed in the Council’s Strategic Framework adopted in December 2019, and *ensuring a high quality drinking water supply that is safe and sustainable* is one of the Council’s five strategic priorities. Figure 1.1 illustrates the hierarchy from Council’s vision for the city through to the strategic documents for water supply and corporate documents for service delivery, showing how they fit together.



**Figure 1.1: Hierarchy of Council’s strategic documents for water supply**

### 1.1.1 Te Wai Ora o Tāne Integrated Water Strategy 2019

The Council has a responsibility to ensure that its water services, network infrastructure and water resources are managed in a manner that supports the environmental, social, cultural and economic wellbeing of current and future generations. Te Wai Ora o Tāne – Integrated Water Strategy (the Strategy) was approved by the Council on 26 September 2019. The vision of that strategy is:

**Te wai ora o Tāne - Water for Life**  
Water is a valued taonga, in all that we do

The Strategy was developed to establish the strategic direction for the Council's sustainable long-term management of water resources, water services delivery and related infrastructure. It focuses on water supply, wastewater and surface water including stormwater and flood management. The Strategy also recognises and incorporates the Urban Water Principles – Ngā Wai Manga recommended by the Urban Water Working Group.

The Strategy has four overarching goals:

Goal 1: The multiple uses of water are valued by all for the benefit of all



Goal 2: Water quality and ecosystems are protected and enhanced

Goal 3: The effects of flooding, climate change and sea level rise are understood, and the community is assisted to adapt to them

Goal 4: Water is managed in a sustainable and integrated way in line with the principle of kaitiakitanga

The Strategy identifies eleven objectives to guide actions to meet the goals and vision. Five of the eleven objectives relate specifically to drinking water supplies:

Objective 1 – Awareness and engagement: Increase awareness and engage with the community and mana whenua regarding the multiple uses and values of water.

Objective 2 – Efficient and resilient infrastructure: Ensure efficient use of three waters infrastructure through a completely integrated management structure and ensure the resilience of entire networks (including natural waterbodies) to future environmental, social and/or cultural changes and natural hazard risks over the long term through timely asset renewal and/or better alternative solutions.

Objective 9 – Groundwater protection: Advance source protection of groundwater recharge areas and surface water supply sources for all drinking water supplies.

Objective 10 – Improvement in understanding of aquifer system: Understand the vulnerability, transit times and extent of confining layers of the Christchurch aquifers as well as the link to surface water quantity and quality.

Objective 11 - Safe and sustainable water supply: Manage the water sources for drinking water supplies to meet the forecast reasonable demands over the long term and ensure efficiency of water use; and ensure demonstrably safe drinking water without the need for residual disinfection (e.g. chlorination).

Goal 2, objectives 9, 10 and 11, and strategic issue 11 are all focussed on delivering the Council's commitment to provide drinking water that is safe and community health remains our top priority. This focus also underlines the Council's approach to manage and mitigate risk of contamination of Christchurch's urban public water supplies, to protect public health and avoid the need for residual disinfection (e.g. chlorination).

The Strategy will be implemented through a suite of action plans. For potable water supply, the relevant document is the Water Supply Implementation Plan.

### **1.1.2 Water Supply Implementation Plan**

The Water Supply Implementation Plan (approved by the Executive Leadership Team on 28 October 2020) is the implementation plan for Te Wai Ora o Tāne – Integrated Water Strategy. It contains the Council's responsibilities as a community water supplier and the Council's requirement to protect water supply sources for public health.

The Water Supply Implementation Plan also outlines the Council's statutory responsibilities relating to drinking water. This includes requirements under the Local Government Act 2002 to ensure prudent stewardship and the efficient and effective use of its resources in the interests of its district or region, including by planning effectively for the future management of its assets. Providing a sustainable water supply that is safe to drink is a fundamental requirement for healthy communities. It is also required to comply with Environment Canterbury's Land and Water Regional Plan and was prepared in accordance with Schedule 25 of that plan.

The Water Supply Implementation Plan endorses the six fundamental principles in the Guidelines for Drinking-water Quality Management for New Zealand, and as recommended in the *Report of the Havelock North Drinking Water Inquiry: Stage 2*<sup>1</sup>.

Principle 1: A high standard of care must be embraced

Principle 2: Protection of source water is of paramount importance

Principle 3: Maintain multiple barriers against contamination

Principle 4: Change precedes contamination

Principle 5: Suppliers must own the safety of drinking water

Principle 6: Apply a preventive risk management approach

### 1.1.3 Legislative Requirements

The responsibility of providing drinking water is also undertaken in accordance with:

- Drinking-water Standards for New Zealand
- Health Act 1956
- Resource Management Act 1991
- Health and Safety at Work Act 2015
- National Policy Statement on Urban Development 2020
- Water Supply, Wastewater and Stormwater Bylaw 2014.

The Council must deliver the water supply service to comply with:

**Water Services Act 2021:** This legislation outlines the duties of a water supplier including: Registering their supply; complying with drinking water standards (including aesthetic standards), providing sufficient quantities of water, having a drinking water safety plan, notifying the new authority (Taumata Arowai) and local authorities of any risk or hazard to the water, maintaining records of supply, compliance and monitoring, providing specified information and a complaints process for those consuming the water and paying fees and levies as Taumata Arowai requires.

**Safe drinking water standards:** The Health Act 1956, supported by the Drinking-Water Standards for New Zealand (DWSNZ), specifies standards for drinking water quality and securing a safe supply.

**Water safety plan:** Under the Health Act, a water safety plan must be prepared for each of the Council's water supplies. The Council must manage and operate each water supply in accordance with the relevant water safety plan.

**Abstraction of raw water:** The Council is consented in terms of the Resource Management Act 1991 on the volume of water which it may take from a given water resource.

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<sup>1</sup> Department of Internal Affairs, 2017: *Report of the Havelock North Drinking Water Inquiry: Stage 2*: <https://www.dia.govt.nz/Report-of-the-Havelock-North-Drinking-Water-Inquiry---Stage-2>

**Water services assessments:** The Local Government Act 2002 requires a territorial authority to assess, from a public health perspective, the adequacy of its water supply in light of health risks, quality of service, current and future demand and regulatory compliance with drinking water standards.

**Fire flow:** Although the New Zealand Fire Service Firefighting Water Supplies Code of Practice is not mandatory, the Council provides fire hydrants as part of its urban water reticulation system. The Council endeavours to provide water for fire-fighting but does not guarantee a constant flow of water or any maximum or minimum pressure. The Christchurch District Plan requires all new developments to meet the Code of Practice.

**Development capacity to meet demand:** The National Policy Statement on Urban Development 2020 directs local authorities to enable greater supply and ensure that planning is responsive to changes in demand, while seeking to ensure that new development capacity enabled by councils is of a form and in locations that meet the diverse needs of communities and encourages well-functioning, liveable urban environments.

**Emergency preparedness and response:** Under the Civil Defence and Emergency Management Act 2002, the Council as a local authority is required to plan and provide for civil defence emergency management in its district. It must be part of a Civil Defence Emergency Management Group and must provide suitably trained and competent personnel for effective civil defence emergency management in its area. As a lifeline utility, the Council as a water supplier must ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency. It must also participate in the development of the national civil defence emergency management strategy and civil defence emergency management plans.

#### 1.1.4 Climate Smart Strategy 2010

The Council has a responsibility to provide certainty around future water supply by understanding potential impact of climate change on infrastructure and supply.

The key strategic goal influencing water supply is Goal 1: understanding the local impacts of climate change – monitoring, investigations and modelling seeking to understand the potential impacts of climate change on coastal and low lying areas, stormwater management and water supplies.

The Council's Climate Smart Strategy is being reviewed to ensure it continues to be fit for purpose.

#### 1.1.5 Long Term Plan and Annual Plan

Budgets for the water supply programme are determined through the Council's Long Term Plan (LTP) process. The Long Term Plan provides a 10 year plan for the Council. It includes the 30 year Infrastructure Strategy, Activity Plans, Asset Management Plans and a Financial Strategy. The purpose of the Long Term Plan is to:

- Describe outcomes the Council aims to achieve
- Specify the services, projects and budgets that will enable those outcomes
- Provide integrated decision-making and coordination of resources
- Provide a long-term focus
- Demonstrate transparency and accountability
- Provide an opportunity for participation by the public in Council decision-making processes.

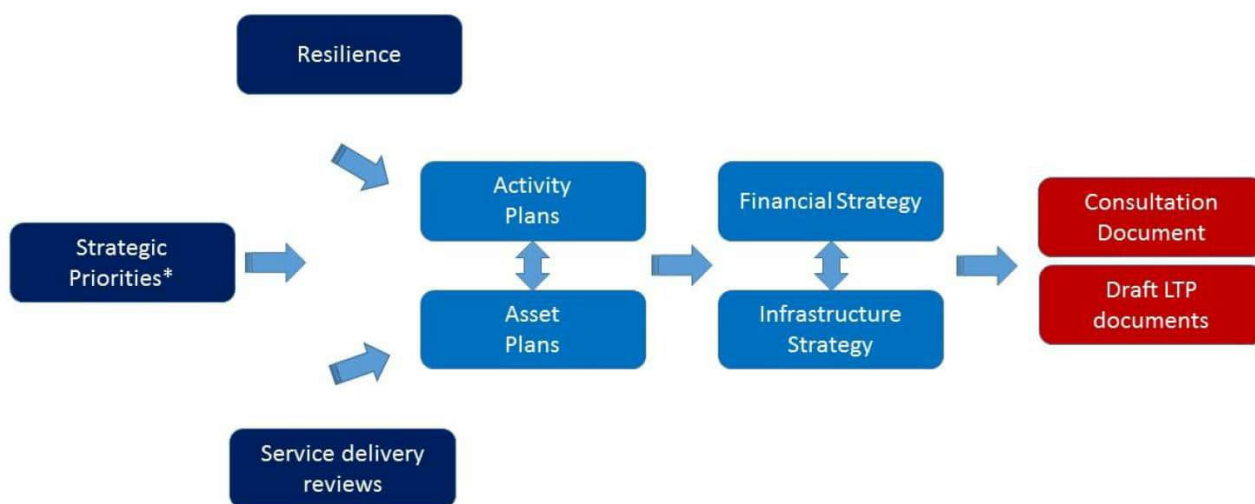
The development of the Long Term Plan is supported by the preparation of Asset Management Plans, including one for water supply, and Activity Plans setting out the levels of service that the Council intends to

deliver. The Financial Strategy describes the revenue sources, and capital and operational expenditure for the next 10 years. The Infrastructure Strategy identifies the significant issues for the Council over the next 30 years, the options and planned approach for dealing with those issues, and forecast capital and operational expenditure for the next 30 years.

The draft Long Term Plan is released for public consultation, providing the Council’s stakeholders (including the public) an opportunity to provide direct feedback on the Council’s proposed priorities and associated budgeting. The Council takes the feedback into account and then finalises the Long Term Plan before the start of the financial year on 1 July. This process is outlined in Figure 1.2.

The LTP is reviewed every three years to ensure it continues to reflect the Council’s strategic priorities, reflects legislative requirements and incorporates any changes in budgeting requirements that may have occurred.

In the intervening two years, the Council undertakes an Annual Plan process. The plan for the coming year as set out in the Long Term Plan is reviewed, released for public consultation as a draft Annual Plan, and then finalised before the start of the financial year on 1 July.



**Figure 1.2: Long Term Plan development framework**

For issues that may arise and require urgent action within a financial year, there is an internal change request process to reallocate funding within existing budgets to prioritise work programmes. Projects for water supply are prioritised by risk and public health outcomes. Water supply budget information is provided in section 2.4.3.

### 1.1.6 Documentation

A summary of water supply documents is provided in Table 1.1. Documents that are specific to a particular water supply are recorded in the relevant supply-specific water safety plan (see Table 2.1).

**Table 1.1: Policy documents and resources related to water supply**

Name	Description	Document Location
<b>Plans, Strategies and Bylaw</b>		
Te Wai Ora o Tāne – Integrated Water Strategy (2019)	The strategy establishes the strategic direction for Council's sustainable long-term management of water resources and related infrastructure. It focuses on water supply, wastewater and surface water including stormwater and flood management.	<a href="https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/strategies/te-wai-ora-o-tane-integrated-water-strategy/">https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/strategies/te-wai-ora-o-tane-integrated-water-strategy/</a>
Water Supply Implementation Plan 2020	Serves as the implementation plan for the Integrated Water Strategy and the 'Water Supply Strategy' in accordance with the requirements of the Land and Water Regional Plan and its Schedule 25.	<a href="TRIM://20/1133601">TRIM://20/1133601</a>
Council's Long Term Plan and Annual Plans	These documents outline the Council's priorities, activities, services, capital programme and operational expenditure and how the Council proposes to pay for it.	<a href="https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/plans/long-term-plan-and-annual-plans/">https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/plans/long-term-plan-and-annual-plans/</a>
Infrastructure Strategy 2018 - 2048	Describes how the Council plans to manage its infrastructure (including water supply) over the next 30 years, taking into account the significant issues facing Christchurch. Capital and operating expenditure forecasts are included.	<a href="https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/strategies/infrastructure-strategy/">https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/strategies/infrastructure-strategy/</a>
Water Supply Service Plan 2018-28	Describes the levels of service for water supply for the Long Term Plan	<a href="https://www.ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Plans/LTP-2018-2028-Service-plans/Long-Term-Plan-2018-28-Service-Plan-Water-Supply.pdf">https://www.ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Plans/LTP-2018-2028-Service-plans/Long-Term-Plan-2018-28-Service-Plan-Water-Supply.pdf</a>
Water Supply Asset Management Plan 2018	Describes management requirements for the Council's water supply assets to meet agreed levels of service and optimise whole of life costs, such that Council can meet the requirements of present and future customers and ratepayers.	<a href="TRIM://18/803609">TRIM://18/803609</a>
Water Supply Asset Management Plan LTP 2021-2031	Describes management requirements for the Council's water supply assets to meet agreed levels of service and optimise whole of life costs, such that Council can meet the requirements of present and future customers and ratepayers to align with 2021-2031 Long Term Plan.	<a href="TRIM21/974350">TRIM21/974350</a>
Water Supply, Wastewater and Stormwater Bylaw 2014	The bylaw's purpose is to manage, regulate and protect from misuse or damage the Council's water supply, wastewater and stormwater systems and to protect the public from nuisance and maintain public health and safety. It also contains Council requirements with respect to backflow prevention. This bylaw is being reviewed.	<a href="https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/bylaws/water-supply-wastewater-and-stormwater-bylaw-2014">https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/bylaws/water-supply-wastewater-and-stormwater-bylaw-2014</a>
<b>Standards and Specifications</b>		
Infrastructure Design Standard (IDS)	The IDS sets out Council's design guidelines for the construction of infrastructure assets, including those for water supply.	<a href="https://www.ccc.govt.nz/consents-and-licences/construction-requirements/infrastructure-design-standards">https://www.ccc.govt.nz/consents-and-licences/construction-requirements/infrastructure-design-standards</a>

Name	Description	Document Location
Christchurch City Council Construction Standard Specifications (CSS)	The CSS set out Council's technical requirements for the construction of land and asset developments, including those for water supply.	<a href="https://www.ccc.govt.nz/consents-and-licences/construction-requirements/construction-standard-specifications">https://www.ccc.govt.nz/consents-and-licences/construction-requirements/construction-standard-specifications</a>
Water Supply, Treatment, Pumping Station and Reservoir Design Specification	Design standard requirements for Water Supply, Treatment, Pumping Stations and Reservoirs	<a href="https://ccc.govt.nz/consents-and-licences/construction-requirements/infrastructure-design-standards/pumping-station-design-specification/">https://ccc.govt.nz/consents-and-licences/construction-requirements/infrastructure-design-standards/pumping-station-design-specification/</a>
<b>Emergency Response</b>		
Canterbury Civil Defence Emergency Management (CDEM) Group Plan	The Canterbury CDEM Group Plan provides information for organisations involved in emergency management and for the general public on how the Canterbury CDEM Group will plan for and coordinate an emergency.	<a href="http://cdemcanterbury.govt.nz/document-library/cdem-plans">http://cdemcanterbury.govt.nz/document-library/cdem-plans</a>
Council's Capital Programme Management System (CPMS)	CPMS directly supports both the Council's Long Term Plan and annual planning processes. This is achieved by having a single place for managing capital works projects.	<a href="https://cpms.sentientppm.co.nz">https://cpms.sentientppm.co.nz</a>
Emergency Management and Business Continuity Plan	The Business Continuity Plan covers the roles and responsibilities and procedures developed to enable the restoration of essential three waters and waste services after a disaster or major incident.	TRIM://FOLDER15/2268 – Business Continuity Plans – Operations Group
<b>Operations and Maintenance</b>		
Water Supply Processes and Procedures	Council has mapped out all important water supply related processes and procedures.	ProMapp: <a href="https://go.promapp.com/ccc">https://go.promapp.com/ccc</a>
Network Operations Manual (draft 2020)	Documents the system for operating the Christchurch City Council's 3 Waters infrastructure, including Potable Water, Wastewater, Storm Water, Landfill Gas, and Tsunami Warning Systems.	TRIM://19/1048910
Potable Water Zone Manual (draft 2019)	General information for the operation of all potable water zones	TRIM://19/1054164 - Potable Water Zone Manual
Water Supply Maintenance Contract	Existing contract is with Citycare Water for 'Maintenance of City Water & Wastewater Network'	TRIM://CN460000778
Authorised Water Supply Installer Scheme	The scheme ensures that work on the water supply reticulation is carried out in a hygienic manner and in compliance with Council standards and procedures.	<a href="https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-water-supply-installers">https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-water-supply-installers</a>



### Drinking Water Quality Statement

Christchurch City Council will manage its responsibilities as a community water supplier to provide safe, high-quality drinking-water that meets the expectations of consumers. As a supplier, the Council will meet the requirements of the Water Services Act (2021) and Drinking-water Standards for New Zealand, and other regulatory requirements.

To achieve this, in partnerships with stakeholders and relevant agencies, Christchurch City Council will act to ensure the six principles of drinking water safety in New Zealand are incorporated in the Council's drinking water quality management throughout the organisation:

***Principle 1: A high standard of care must be embraced***

- embrace a high standard of care to manage water quality at all points along the delivery chain from source water to the consumer, to provide a continuous supply of safe drinking-water
- undertake regular monitoring of the quality of drinking-water and effective reporting mechanisms to provide relevant and timely information, and promote confidence in the water supply and its management
- regularly review water safety plans and amends these plans as required to incorporate new regulatory frameworks or requirements

***Principle 2: Protection of source water is of paramount importance***

- acknowledge that protection of source water is of paramount importance in protecting consumers against drinking-water contamination and illness
- advocate for the protection of source water as required

***Principle 3: Maintain multiple barriers against contamination***

- maintain robust multiple barriers against contamination appropriate to the level of potential contamination and harm

***Principle 4: Change precedes contamination***

- recognise that contamination is almost always preceded by some kind of change (including changes to processes and hazardous events),
- monitor and respond to change
- have appropriate contingency planning and incident response capability

***Principle 5: Suppliers must own the safety of drinking water***

- maintain a personal sense of responsibility and dedication to providing consumers with safe drinking-water
- ensure all managers and employees involved in the supply of drinking-water are aware of their responsibilities for understanding, implementing, maintaining and continually improving the drinking-water quality management system
- integrate the needs and expectations of our consumers, stakeholders, regulators and employees into our planning

***Principle 6: Apply a preventive risk management approach***

- use a preventive risk-based approach to identify and manage potential threats to water quality and quantity
- identify and undertake appropriate investigative activities to ensure continued understanding of drinking-water quality issues and performance
- continually improve our practices by assessing performance against corporate commitments, stakeholder expectations and regulatory requirements

Signed: \_\_\_\_\_

*D. F. Baxendale*

Date: 28 January 2022

Dawn Baxendale Chief Executive Officer

## 1.2 Engaging stakeholders

### 1.2.1 External stakeholders

The Council works with other agencies in the management of its drinking water supply. Key stakeholders with responsibilities for managing activities in the catchment that may impact on source water quality, or be affected by decisions or activities of the drinking-water supply are listed in Table 1.2. Supply-specific external stakeholders will be provided in the supply-specific water safety plans.

**Table 1.2: Key external stakeholders**

Stakeholder	Position	Name
Taumata Arowai	Regulatory Team Leader (ChCh) Principal Advisor Drinking Water	[REDACTED]
Canterbury District Health Board	Medical Officer of Health	Medical Officer of Health on duty
	Health Protection Officer	Health Protection Officer on duty
	Public Health – renal dialysis	[REDACTED] provides contact information for home renal dialysis patients to Council
Citycare	Maintenance Manager	[REDACTED]
	Branch Manager	[REDACTED]
	General Manager, Central Region	[REDACTED]
Environment Canterbury	Director Operations	[REDACTED]
	Consent Planning Manager	[REDACTED]
	Resource Management Officer – Incident Response	[REDACTED]
	Resource Management Officer – Monitoring and Compliance	[REDACTED]
	Groundwater Science Manager	[REDACTED]
Fire and Emergency New Zealand	Local Commander (Banks Peninsula)	[REDACTED]
	Christchurch metro area commander	[REDACTED]

These lists are maintained and updated through the Council’s Three Waters and Waste Business Continuity Plan. The Business Continuity Plan is used as part of Civil Defence exercises and a training programme in place to regularly test elements of the units Business Continuity Plan with all key stakeholders. A record of all exercises is taken with lessons learned and areas for improvement (see section 8).

The Council has a comprehensive programme of engagement with Environment Canterbury on water issues. At a governance level, there is the **Water Forum** attended by all Councillors from both Environment Canterbury and Christchurch City Council, with a standing invitation to the Chairs of Ngāi Tahu Rūnanga. The Water Forum is held at least twice a year. The purpose of the Forum is to develop a common understanding of issues and actions relating to the water resources of Christchurch and Banks Peninsula. A standing item on the agenda is an update on the joint Christchurch City and Environment Canterbury work programme. Minutes of the meetings held in 2019 can be found in TRIM:[FOLDER19/31](#) The 2020 minutes are in [FOLDER19/1039](#) and 2021 minutes in [FOLDER20/1964](#)

The Council and Environment Canterbury work with the community and Ngāi Tahu through the **Canterbury Water Management Zone Committees** established under the Canterbury Water Management Strategy



(endorsed by Environment Canterbury and all the district/city councils in Canterbury in 2008/2009). The Banks Peninsula, Christchurch West Melton and Selwyn Waihora water management zone committees are joint committees of the City Council and Environment Canterbury. Each zone committee comprises one Environment Canterbury councillor, one City Councillor (and in the case of the Christchurch West Melton and Selwyn Waihora zone committees also one Selwyn District councillor), one representative for each rūnanga within the respective zones, and four to six community members. The zone committees each prepare zone implementation programmes which include recommendations for water management within their zones<sup>2</sup>.

There are four Rūnanga whose takiwā or territories lie within the Christchurch City Council's area of jurisdiction. Two, Te Taumutu Rūnanga and Te Ngāi Tūāhuriri Rūnanga, have boundaries that include Christchurch City but also extend beyond the City Council's jurisdiction. The Christchurch City Council established Te Hononga Council - Papatipu Rūnanga Committee, which includes representatives from the Council and the six Rūnanga, to further enhance the relationship between the Council and Ngāi Tahu. **Te Hononga Council - Papatipu Rūnanga Committee** meets quarterly and is responsible for:

- Leading the development of an enduring collaborative relationship between the Council and Ngā Papatipu Rūnanga
- Building shared understanding and strong coordinated leadership on matters of mutual interest within the respective areas of jurisdiction
- Having oversight of, and providing advice and assistance to the Council on, matters of significance or priority to Māori, and to inform Council decision making
- Receiving regular updates from staff on Council programmes and projects of significance or priority to Māori
- Operating in accordance with the Relationship Agreement between Christchurch City Council and Ngā Papatipu Rūnanga signed on 15 December 2016.

Water supply is a matter of significance and priority for Ngāi Tahu and Te Hononga Council.

At a governance level there are also meetings between City Councillors and the Canterbury District Health Board. The purpose of these meetings is to consider opportunities to work in partnership on the determinants of health, including mental health, housing and community wellbeing. Water is an agenda item at these meetings and meeting minutes can be found in TRIM: [FOLDER18/987](#) and [FOLDER19/1038](#)

The Council is also a member of the **Canterbury Drinking Water Reference Group**. The Canterbury Drinking Water Reference Group was proactively formed by the Canterbury Chief Executives Forum in 2016 following the contamination of drinking water and outbreak of disease in Havelock North. It involves representatives from Environment Canterbury, all ten Canterbury territorial authorities and the Canterbury District Health Board. The group meets regularly to discuss Canterbury's public drinking water supplies, share information, identify high-risk supplies, and review contingency planning in the region. Agendas, minutes and presentations at these meetings are saved in TRIM [FOLDER20/635](#).

In addition to the strategic engagement opportunities, there is also engagement across the technical work programmes. The **Water Issues Management** group is a bimonthly meeting of senior managers from Environment Canterbury and the Council to identify and resolve any issues that arise with respect to the

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<sup>2</sup> Banks Peninsula water management zone: <https://ecan.govt.nz/your-region/your-environment/water/whats-happening-in-my-water-zone/banks-peninsula-water-zone/>

Christchurch West Melton water management zone: <https://ecan.govt.nz/your-region/your-environment/water/whats-happening-in-my-water-zone/christchurch-west-melton-water-zone/>

management of three waters services and their impact on the environment. For water supply this group has identified the following issues to consider as part of the joint work programme:

- potential for increasing nitrate levels in the aquifers
- global water take consent and compliance with conditions for individual wells
- change of use applications for water takes.

There is a quarterly meeting with Environment Canterbury compliance monitoring staff and the Council's Three Waters & Waste unit to discuss issues related to the Council's resource consent compliance.

### **1.2.2 Operations and maintenance contractor**

Citycare Ltd, a Council-controlled trading organisation, is the dedicated maintenance contractor for water supply reticulation on Banks Peninsula and for Christchurch/Lyttelton Harbour Basin water supplies. The Council's contracts with Citycare outline the expectations around maintenance of the water supply network.

Council is responsible for undertaking the daily, weekly and monthly maintenance inspections and instrument calibration at water treatment plants.

If any issues or faults are identified within the Christchurch/Lyttelton Harbour basin, Citycare's Water Maintenance Manager or Pump and Storage Manager immediately informs Council's Work Maintenance Supervisor/Auditor for Christchurch/Lyttelton. For the Banks Peninsula Water Treatment Plants, Council's Team Leader Water and Wastewater Treatment immediately informs the Council's Reticulation & Maintenance Operational Delivery Leader for Banks Peninsula supplies so appropriate remedial action can be determined, depending on the scale of the issue.

Citycare provides scheduled maintenance activities (as agreed with Council) as part of the monthly lump sum for a station. Any renewal or refurbishment of assets where a replacement components cost in excess of \$500 is anticipated requires a Works Order and approval from Council before proceeding. Council may also tender or engage third parties to complete any refurbishment and renewals as there is no obligation for this work to be provided to Citycare.

### **1.2.3 Laboratory**

The Council uses its own IANZ accredited laboratory to undertake water sampling and analysis. The current IANZ accreditation certificates are found in TRIM21/1729598. Staff in the Three Waters & Waste unit are immediately notified if there is any contamination (in accordance with process *Raise Alert re: Test Showing Water Contamination*) and a joint decision between Council and Citycare is made on how to proceed (in accordance with *Respond to Drinking Water Contamination*), including a review of the incident afterwards. The sampling programme and procedures have been developed in collaboration with Citycare and the Council to ensure it meets or exceeds the DWSNZ requirements.

Any testing required that is out of the ordinary, may be undertaken by an external IANZ accredited laboratory. When the Council engages these labs to undertake testing on its behalf, a project is raised with an approved Council vendor who would instruct the Council accredited laboratory to take the necessary samples and send them to a specialist accredited laboratory for analyses and reporting. Our laboratory has a working agreement with a number of specialist IANZ Accredited Laboratories who can be relied upon to carry out specialist testing.

### **1.2.4 Water Safety Plan engagement**

Water safety plans have been prepared by Council staff, drawing on information provided in previous versions and other sources. Each plan has been developed in accordance with the *New Zealand Drinking-water Safety*

*Plan Framework*<sup>3</sup> (Ministry of Health, 2018), taking into account the guidance provided in the *Handbook for Preparing a Water Safety Plan*<sup>4</sup> (Ministry of Health, 2019). Plans takes into account feedback received from the Drinking Water Assessor on the draft water safety plans that had been previously submitted for approval.

Where additional information has been required, staff have sought information from the relevant operational area of Council or contacted the appropriate staff at Citycare for area specific information. Citycare contract managers have provided commentary for the risk register, attended the risk assessment workshops and, along with their staff, have contributed information on relevant operational processes and procedures. Citycare have provided information on the drinking water supply system and their staff qualifications and training. There have been twice weekly meetings between the Citycare Operations Manager and Council staff developing the water safety plan to clarify queries, request and provide additional information and review commentary. Follow up actions were recorded and a single point of contact was established to keep track of the information requested and responses between both organisations.

The implementation of the water safety plan will include a joint Council and Citycare workshop training session to ensure staff from both organisations are aware of the risks, compliance requirements and quality assurance provisions. The intent of the workshop is to ensure staff are aware of the water supply requirements as they are contained within the Water Safety Plan, including the six fundamental principles in the guidelines for Drinking-water Quality Management in New Zealand. Developing an induction process and ongoing training programme for water supply staff on the importance of water supply and the risks that can arise is an improvement item in the relevant supply-specific water safety plans.

The Council considers the Water Safety Plan to be a living document. As such internal auditing of performance and contract reviews are undertaken to ensure the water safety plans are fit for purpose and being implemented appropriately, as described in sections 7.5 and 11.2. Water safety plan actions and associated issues and non-conformance are discussed at the fortnightly Water Supply Network Operations, Planning and Improvement Coordination meetings which are attended by staff from Three Waters & Waste Network Operations, Asset Planning, Asset Management, Quality & Compliance and Water & Wastewater Operations teams. The Three Waters Improvement and Compliance Programme Control group has a role across water supply, wastewater and stormwater with a purpose to assess, track and monitor the improvement and compliance actions and works for the water, wastewater and stormwater systems. The group meets monthly and minutes are found in [FOLDER21/1043](#).

The Council and Citycare staff with responsibilities in the development and implementation of the water safety plan are listed in

Table 1.3 and Table 1.4. The RASCI role assigned to a person reflects the highest responsibility a person has as some people are involved in more than one aspect. For example if someone was consulted in the development of the water safety plan and is responsible for implementing it, they have been identified as responsible (R).

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<sup>3</sup> Ministry of Health, 2018: *New Zealand Drinking-water Safety Plan Framework*:  
<https://www.health.govt.nz/publication/new-zealand-drinking-water-safety-plan-framework>

<sup>4</sup> Ministry of Health, 2019: *Handbook for Preparing a Water Safety Plan*:  
<https://www.health.govt.nz/publication/handbook-preparing-water-safety-plan>

**Table 1.3: Council staff with responsibilities in the development and implementation of the water safety plan**

Position	Name	RASCI*
Chief Executive Officer	Dawn Baxendale	A
General Manager Infrastructure, Planning and Regulatory Services	Jane Davis	A
Head of Three Waters & Waste	Helen Beaumont	A
Manager Service Excellence	Tim Drennan	R
Manager Operations	Adam Twose	R
Manager Planning and Delivery Three Waters	Gavin Hutchison	R
Team Leader Instrumentation & Electrical Control	Ben Beaumont	R
Team Leader Water Services	Will Rowson	R
Manager Laboratory	Belinda Wilson	R
Team Leader Microbiology Laboratory	Nicholas Ohs	R
Team Leader Asset Planning (Water and Wastewater)	Michele McDonald	S
Team Leader Water and Wastewater Treatment	Colin Hefferman	R
Team Leader Network Operations (Network Controllers)	Gijs Hovens	R
Team Leader /PM Water Supply	Grant Deeney	R
Commercial Specialist (Contract Management)	Jason Lemmon	I
Operational Delivery Leader Reticulation & Maintenance	Steve Pink	R
Senior Advisor Reticulation & Maintenance	Chris Mance	S
Senior Planning Engineer - Growth	Daniela Muruges	C
Senior Project Manager	Patrick Cantillon	R
Programme Manager Water Reform	Teresa Wooding	I
Resource Consent Compliance Coordinator	Currently vacant	C
Process Engineer	Ian Baker	R
Process Engineer Water and Wastewater Treatment	Fredy Moreno	R
Process Engineer Water and Wastewater Treatment	Matt McLellan	R
Team Leader Quality & Compliance	Veronica Zefferino	R
Team Leader Water & Wastewater Operations	Jeanette Gower	R
Water Security Specialist	Judy Williamson	R
Other staff in Three Waters & Waste Unit		I

\* R = Responsible (works on)

A = Approver

S = Support

C = Consulted

I = Informed

**Table 1.4: Citycare and external staff with responsibilities in the development and implementation of the water safety plan**

Position	Name	RASCI
Branch Manager		I
Water Maintenance Manager		R
Water Reticulation Manager		R
Water Supervisor		R
Pump and Storage Manager		R
Pump and Storage Engineer		R
Pump and Storage Supervisor (Unplanned)		R
Pump and Storage supervisor (Planned)		R
Technical and Operational Support (External Provider BP)		S
Technical and Operational Support (External Provider BP)		S

## 1.3 Engaging community

### 1.3.1 Public consultation

As described in section 1.1.5, the public is consulted every three years on the draft Long Term Plan and every year on the Annual Plan. They can provide feedback on how we plan to deliver water supply, including levels of service, and the proposed expenditure.

*Ensuring a high quality water supply that is safe and sustainable* is one of the Council's Strategic Priorities. These strategic priorities were developed by elected members and were publicly consulted on as part of the 2020/21 Annual Plan process.

Community consultation and stakeholder engagement was part of the development process for Te Wai Ora o Tāne Integrated Water Strategy. A series of workshops included Councillors and Community Board members, Ngāi Tahu Rūnanga representatives, members of the Banks Peninsula, Christchurch-West Melton and Selwyn Waihora Zone Committees, Environment Canterbury councillors and staff, and community stakeholders from a range of environmental Non-Governmental Organisations. There was public consultation on the draft strategy and feedback from this was taken into account in the final strategy. The Water Supply Implementation Plan has been developed with input from Environment Canterbury staff, Mahaanui Kurataiao and Ngāi Tahu Rūnanga representatives.

### 1.3.2 Incidents and emergencies

Communication plans and contact lists for incidents and emergencies are included in each procedure document. These processes are outlined in section 8. Three Waters & Waste Business Continuity Procedures related to water supply schemes also contain contact lists for Council staff and external stakeholders. There is a specific procedure for informing the public about water contamination should it be required.

Through the Promapp incident and emergencies procedure documents, operational alerts are in place to remind staff when to contact the Communications team and the information that should be considered when notifying them. This includes information on:

- What the event is
- Who's affected by the event
- How long it's likely to last including a possible time/date on when it will be resolved
- What actions the public may need to take
- Social media notifications
- CCC website notifications
- Civil Defence and Emergency Management text alerts.

The Council is continually reviewing the incident and emergency procedure documents to ensure they are up to date and, where appropriate, are consistent in their approach to communication plans and procedures. The review period for each process is set by the process owner, for example, *Respond to Significant (Unplanned) Event (City Services)* is reviewed annually. Review dates are included in the procedural information.

Figure 1.3 shows the linkages between the Promapp water supply procedure documents and other processes. Staff positions identified in Figure 1.3 are process owners not staff contacts. Information relating to key staff to contact in event of an incident or emergency are contained in each Promapp process and include alternative contacts to address issues such as staff absence/availability. Further information about the processes is contained in the individual procedure documents.

### 1.3.3 Customer complaints

There is a specific Promapp process for responding to consumer complaints; this is linked to the Council's customer service requests *Action Three Waters Customer Service Requests*. Where customer complaints are received, consumer engagement is described through that process. This process is outlined in section 7.3. When there is a cluster of complaints in one area relating to a specific issue, such as water taste, these complaints are dealt with collectively.



# Water Supply Process Relationships

## Water Safety

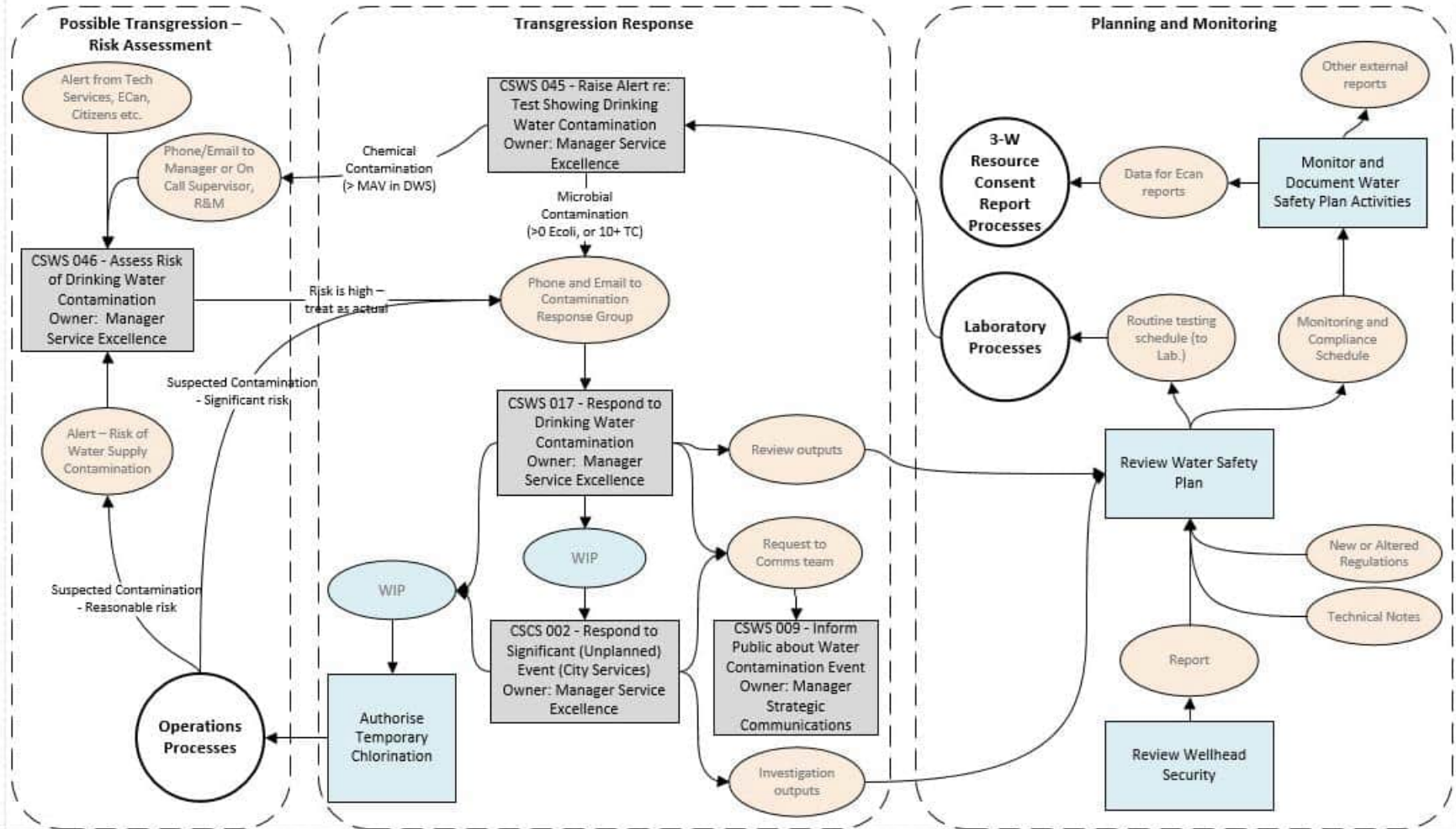
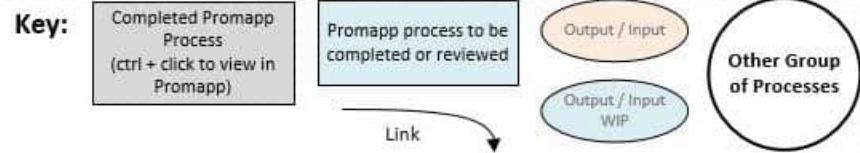


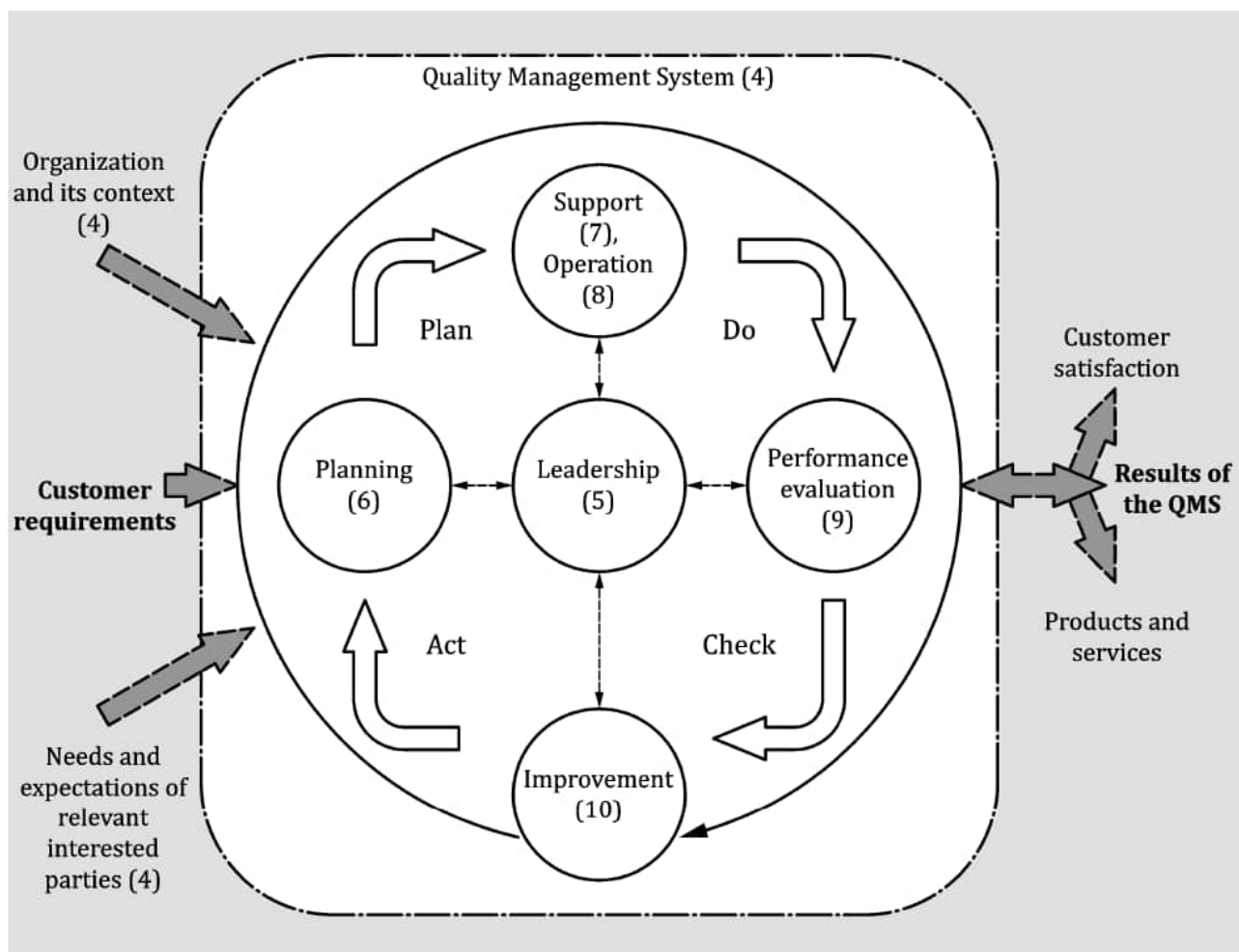
Figure 1.3: Water Safety Process Relationship

## 1.4 Quality management system

Council's Three Waters & Waste Unit intends to develop and implement a quality management system for its water supply activities. The adoption of a quality management system will help improve overall performance and achieve benefits such as:

- The ability to consistently provide services that meet customer and applicable statutory and regulatory requirements including key elements of the water safety plan framework.
- Facilitating opportunities to enhance customer satisfaction.
- Addressing risks and improvements.

Using the recognised standard AS/NZS 9001:2016 (TRIM [19/775880](#)) as a guideline, a process approach will be used which incorporates the Plan-Do-Check-Act (PDCA) cycle and risk-based thinking, as shown in Figure 1.4.



**Figure 1.4: Quality Management System Plan-Do-Check-Act Cycle<sup>5</sup>**

The work will be led by the Three Waters & Waste Quality & Compliance Team in close cooperation with the other Three Waters & Waste teams. Documentation is currently being developed to initiate discussions and relevant information is stored in TRIM [FOLDER18/745](#) (AMCV – 3W – Quality Management System Development). The development of the Quality Management System is included as a Procedural Improvement in the supply-specific water safety plans.

<sup>5</sup> Source: <https://www.risk-technologies.com/PagePreview.aspx?pag=3067>



## 2 Description of the Drinking Water Supply

### 2.1 Overview

Description of individual drinking water supplies is provided in the supply-specific water safety plans. Information includes, where relevant:

- Catchment characteristics and source water risk management
- Resource consents within close proximity
- Well characteristics and secure bore status
- Water treatment
- Distribution system – asset characteristics
- Water quality characteristics.

The supply-specific water safety plans and TRIM references are provided in Table 2.1.

**Table 2.1: Water supply specific water safety plans and TRIM references**

Water Safety Plan	Revision No.	Date	Status	TRIM reference
Akaroa/Takamātua	5.3	November 2020	Approved	<a href="#">22/438313</a>
Birdlings Flat	3.0	N/A	Draft, not yet submitted	<a href="#">19/608839</a>
	2.0	September 2017	Approved, old requirements	<a href="#">17/1178739</a>
Christchurch/Lyttelton	Revision 1 - 2020	Volume A	Submitted to DWA – Not approved	<a href="#">22/438283</a>
		Volume B		<a href="#">22/438287</a>
		December 2020	Draft	<a href="#">22/438290</a>
		Volume C (source RMP)		
Duvauchelle	5.1	May 2019	Revised 2019, not approved	<a href="#">20/891820</a>
Little River	4.1	February 2021	Submitted, not assessed	<a href="#">22/438473</a>
Pigeon Bay	5.1	August 2019	Revised 2019, not approved	<a href="#">20/891831</a>
Wainui	5.1	November 2020	Submitted to DWA, not approved	<a href="#">22/438501</a>

### 2.2 SCADA control measures and alarms

#### General SCADA Information

Supervisory control and data acquisition (SCADA) is a system of software and hardware to control processes, gather information, and record events. Our SCADA system is used to monitor and operate the pump stations and storage reservoirs as well as monitor unauthorized site entry and vandalism. A team of network controllers manages the SCADA system 24 hours a day, 7 days a week and is responsible for ensuring that any problems are escalated. The network controllers access the network SCADA for potable water, wastewater and stormwater operations via two computers in the Control Room. The network SCADA and the treatment plant SCADA are run on dedicated servers in the Network Operations building. These can be accessed remotely from computers within or outside of the Christchurch City Council’s computer network. There is one network controller on duty for each shift.

For potable water, the network controllers are responsible for monitoring over 150 pump stations and reservoirs. The monitoring includes which pumps are operating or not, what the flow rates are from each pump, the pressure at the outlet of each pump station, and the water level in the reservoirs. From this information, they determine whether pumps need to be turned on or off to meet demand, and whether more water is needed to top up the reservoirs. The pump stations are able to be operated remotely. Screenshots from the SCADA system to illustrate the data that the network controllers see in the control room are provided in Appendix B.

There are 5769 SCADA alarm tags for the water supply (see TRIM [19/984689](#)). Alarm types include process (pressure, flow, pump, sand filter), communications (communications failures), backup systems (fuel levels, fire protection), power monitoring (ripple active) and security (hatch/door triggers). The system has a 'Current Alarms' screen. This screen is continuously monitored by the network controller and displays a table of the fault or event conditions that are currently live on the SCADA.

When alarms are raised, they are acknowledged by the network controller who assesses the alarm and the response required. For critical alarms, the network controller immediately contacts the Citycare electrician, fitter or treatment plant operator who the network controller identifies is required to resolve the fault. For non-critical alarms, there is a meeting at 7am each morning, Monday to Friday, where the network controller provides the Citycare contractors with a list of faults that have occurred since the previous meeting that need to be addressed.

A non-critical fault does not have the potential to affect the provision of water to the network. A critical fault has the potential to affect the provision of water to the water supply network. For example, at a pump station with two pumps, a fault with one pump may not be critical, as there is still the ability to meet the water demand. If a fault occurred at the second pump as well, the situation could be reclassified as critical and result in an immediate call to the appropriate duty contractor, as the situation now has the potential to impact on network capacity.

Currently the response relies on the expertise and experience of the network controller. There are no documented standards for the alarm types and there are no standardised documented triggers or response plans for the alarm tags. This is an improvement item in the supply-specific water safety plans and draft documents are being prepared.

Where there are variations from the described process, supply specific SCADA information is provided in the supply-specific water safety plans.

## **2.3 Distribution system**

### **2.3.1 Infrastructure design standards**

The Council's design standard for reservoirs and pumps is the 'Water Supply, Treatment, Pumping Station and Reservoir Design Specification' and is found in TRIM [15/1248260](#).

The document outlines the Council's design philosophy for water storage, which includes objectives relevant to water safety including minimising the chance of contamination, promoting mixing and minimising thermal stratification of contents. The design standard gives specific requirements, criteria and features for storage sizing and partitioning and the design of appurtenances to provide the above functions and a number of water safety features. Seismic risks are carefully considered in the design process, including liquefaction, ground settlement, water surface wave effects and loosening of construction and pipe joints. Wall to floor joints, water stops, seals and sealant design details have specific requirements.

Where pipes, valves and vents are open to atmosphere, these are fitted with a corrosion proof fine mesh barrier to prevent ingress of particles and entry of vermin. Overflow and drainage discharge points to outfalls and drains have a defined air gap to prevent backflow. The roof is required to be watertight and adequately sloped for rainfall run-off and, where practical, designed to be windswept for self-cleaning of deposited dry material. Roof access is designed with security features to prevent unauthorised access to the roof. Design for security of the whole site may be required to prevent unsafe public activities.

### 2.3.2 System water loss and leakage

Council has been carrying out water loss and leakage reduction work since the late 1990's.

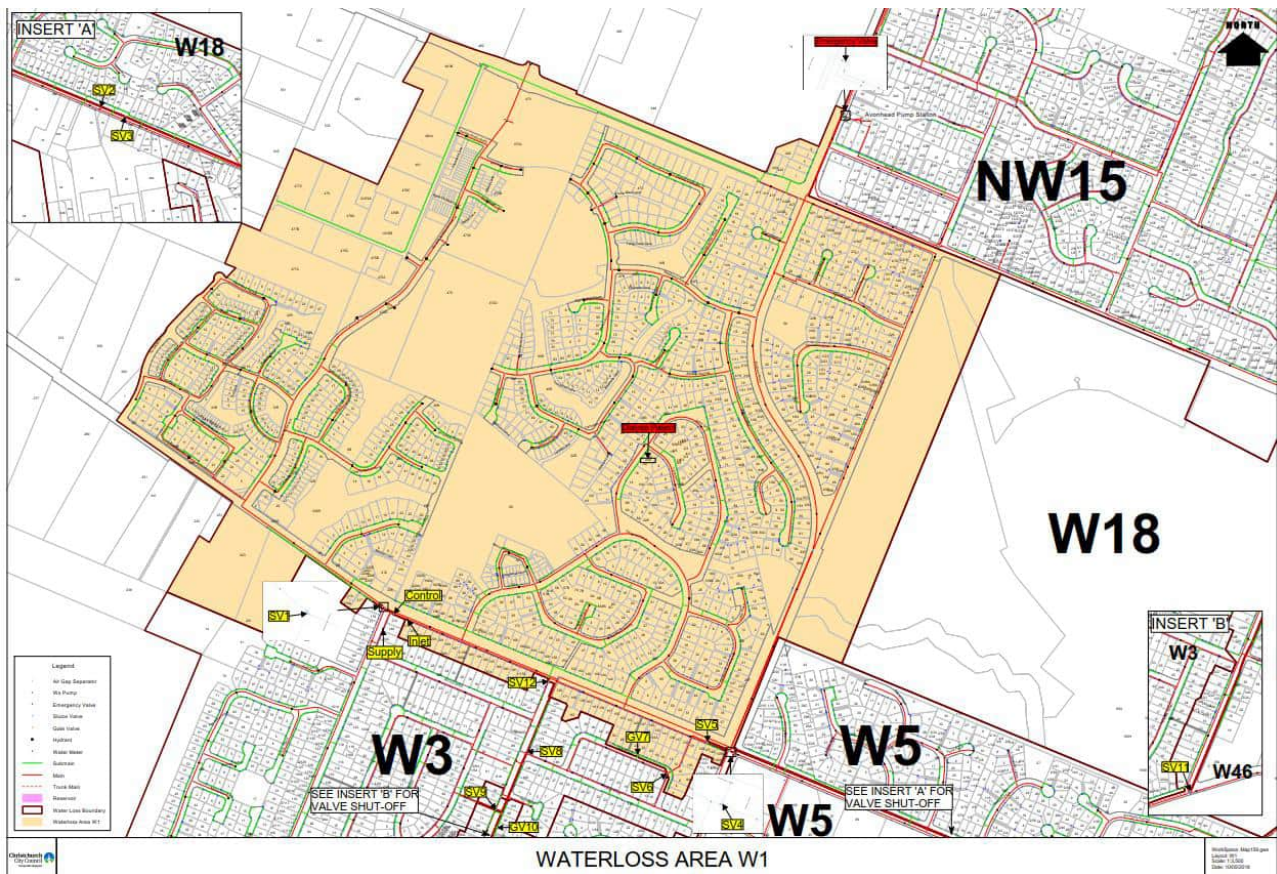
Leakage is calculated by measuring the 'minimum nightflow' in a water loss zone. This 'minimum nightflow' is measured at a time of low demand (i.e. at night, during winter) when we assume the flows are purely generated by unavoidable leakage (very small leaks that are unable to be detected with equipment; dependent on pipe age, material, network pressure and network layout) and actual leakage (leaks that can be identified and repaired).

The Council has a contract in place with Detection Services South Island Ltd for the provision of water loss and leak detection services. Contract [CN4600003636](#) was created in 2021 and is for an initial term of two years with right of renewal for 3 years on a 1+1+1 basis. The contract includes water loss nightflow testing and leak detection surveys in all Council supplies. Each water supply area is surveyed approximately every 5 years.

The nightflow test methodology is as follows:

- The contractor isolates a water loss zone and performs a flow test to measure the water usage at a time when water consumption is considered to be lowest (i.e. at night, preferably winter) – known commercial high water consumers are monitored
- If the nightflow test result is high compared to previous tests then the contractor carries out a leak detection survey – deploying acoustic loggers on valves and hydrants to indicate the general area of a leak, followed up with a walk over ground microphone survey to pinpoint the actual leak location
- Leaks on Council pipes are repaired by Citycare and significant leaks on private property are reported to the property owner
- After all leaks on Council pipes have been repaired the contractor carries out a second nightflow test to confirm the nightflow has reduced
- The nightflow result and the number of water connections in each water loss zone are then used for calculating the overall leakage.

Figure 2.1 is an example of how a water loss zone is isolated on the test night. Once all the valves are closed, nightflow testing is carried out at the 'supply / control / inlet' location, using a portable setup consisting of two hydrant standpipes, a flow meter and data logger (logs water flow and pressure).



**Figure 2.1: Example of Water Loss Zone Isolation for Testing**

The nightflow results are used to calculate the Infrastructure Leakage Index (ILI) for each water loss zone. The ILI is the ratio of the Current Annual Real Losses (CARL) – established by minimum nightflow testing – to the system-specific Unavoidable Annual Real Losses (UARL), which take into account system pressure, the length of water mains and submains and the number of water connections. Detailed guidance can be found in the Water New Zealand Water Loss Guidelines<sup>6</sup>.

**ILI = Current Annual Real Losses (CARL) / Unavoidable Annual Real Losses (UARL)**

CARL (litres/service connection/day) = established by minimum nightflow testing

UARL (litres/service connection/day) =  $(18 \times L_m + 0.8 \times N_c) \times P$

$L_m$  = length of mains and submains (km)

$N_c$  = number of service connections

$P$  = average operating pressure (m)

The ILI is a non-dimensional performance indicator, which is used worldwide for operational management and benchmarking of water losses. Calculations for Council water supply zones are saved in TRIM [19/1067614](#). The calculated ILI for each water supply is provided in the supply specific water safety plans.

<sup>6</sup> Lambert & Taylor, 2010: Water Loss Guidelines. Water New Zealand: [www.waternz.org.nz/Folder?Action=View%20File&Folder\\_id=101&File=100503\\_waterloss\\_guidelines.pdf](http://www.waternz.org.nz/Folder?Action=View%20File&Folder_id=101&File=100503_waterloss_guidelines.pdf)

The LeaksSuiteLibrary.com website<sup>7</sup> collates global information on ILIs and provides a performance classification system and that allows for benchmarking. The website also provides recommended strategies for improvement. Information on how to interpret ILIs is summarised in Figure 2.2.

While minimum nightflow testing is considered to be an accurate means to establish CARL there are the some limitations to the Council's methodology, which may have an impact on the data:

- Currently no allowance is made for residents utilising water at night (e.g. flushing the toilet, using washing machines or dishwashers)
- No seasonal adjustment has been made for residential irrigation systems
- Some nightflow testing in 2017 and 2018 was carried out later than usual (spring rather than winter) which meant that increased consumption for irrigation was likely and minimum nightflow numbers were higher.

This means that the reported leakage rates are higher than actual. The Council is planning to develop allowances for customer night use and irrigation to refine the data so that the ILIs more accurately reflect network performance.

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<sup>7</sup> The LeaksSuiteLibrary website, accessed 14/9/2019: <https://www.leakssuitelibrary.com/uarl-and-ili/>



Low and Middle Income Countries	High Income Countries	Leakage Performance Category LPC	Calculated ILI for this System	General Description of LPCs A to D (LPC limits for Low and Middle Income Countries are double those for High Income Countries)	Recommend Actions for each LPC range	A	B	C	D
ILI range	ILI range								
Less than 3	< 1.5	A1		Further loss reduction may be uneconomic unless there are shortages; careful analysis needed to identify cost-effective improvement	Investigate pressure management options	Yes	Yes	Yes	
3 to < 4	1.5 to < 2	A2			Investigate speed and quality of repairs	Yes	Yes	Yes	
4 to < 6	2 to < 3	B1		Potential for marked improvements; consider pressure management, better active leakage control practices, and better network maintenance	Check economic intervention frequency	Yes	Yes		
6 to < 8	3 to < 4	B2			Introduce/improve active leakage control	Yes	Yes	Yes	
8 to < 12	4 to < 6	C1		Poor leakage record; tolerable only if water is plentiful and cheap; even then, analyze level and nature of leakage and intensify leakage reduction efforts	Identify options for improved maintenance		Yes	Yes	
12 to < 16	6 to < 8	C2			Assess Economic Leakage Level	Yes	Yes		
16 to < 24	8 to < 12	D1		Very inefficient use of resources; leakage reduction programs imperative and high priority	Review burst frequencies		Yes	Yes	
24 or more	12 or more	D2			Review asset management policy		Yes	Yes	Yes
					Deal with deficiencies in manpower, training and communications			Yes	Yes
					5-year plan to achieve next lowest band			Yes	Yes
					Fundamental peer review of all activities				Yes

**Figure 2.2: International Leakage Performance Classification System**

## 2.4 Asset Assessment and Intervention Framework

The Asset Assessment and Intervention Framework (AAIF) project has improved the lifecycle management and renewals planning at Christchurch City Council. This has been implemented for three waters pipe assets and will ultimately be extended to cover all three waters assets. The AAIF project aims to:

- Provide a consistent approach for lifecycle management
- Increase confidence in Council's asset management outcomes
- Provide transparency to stakeholders
- Speed up the renewals planning process by automating processes
- Reduce the risk of errors from use of large spreadsheets
- Reduce the human resource risk of losing significant amounts of institutional knowledge through the loss of a single staff member.

### 2.4.1 Methodology

Renewal planning under AAIF uses multi-criteria analysis across a number of categories or schema. Schema completed for water supply pipes include:

- Condition
- Repairs, maintenance and operation
- Vulnerability
- Consequence of failure.

A score of 1 (very good) to 5 (very poor) is assigned to each pipe for each schema.

**Condition** scores are derived from laboratory testing and analysis of pipe samples where these are available and the remaining useful life is defined based on these results. Laboratory testing results are limited by cost and practicality. Where laboratory test results are unavailable a condition grade is estimated based on pipe material and age, and this is used to assess how far an asset is through its theoretical useful life. Theoretical useful life figures are reviewed every three years based on laboratory test results and experience of failures throughout the network.

**Repairs, maintenance and operations** scores are defined based on the number of failures that have occurred on each pipe, taken from repairs and maintenance data records.

**Vulnerability** grades are based on the exposure of each pipe to environmental conditions that can cause failure in the specific pipe material. Vulnerability scores are based on proximity to pump stations (transient pressures can reduce pipe life), whether the pipe is above or below the groundwater table (exposed to groundwater corrosion), and proximity to trees.

**Consequences of failure** on service delivery are the maximum of two grades, one for the number of properties/people who would lose water in a pipe failure and another for the importance of individual properties to the community. This information identifies and maps vulnerable customer groups, including hospitals, schools and rest homes. In addition, the location of home renal dialysis patients is mapped in SmartMap and this information is updated weekly.

Importance ratings are listed Table 2.2.

**Table 2.2: Importance ratings for property types**

Importance Rating	Facility or Property Type
1	All properties in residential or rural land use zones as defined in the Christchurch District Plan except where a higher importance rating is required as per following rows.
2	All properties in commercial or industrial land use zones as defined in the Christchurch District Plan except where a higher importance rating is required as per following rows.
3	<ul style="list-style-type: none"> <li>• School and childcare facilities</li> <li>• Properties registered with Council as high water users</li> </ul>
4	<ul style="list-style-type: none"> <li>• General Practitioners offices</li> <li>• Rest homes</li> <li>• Emergency Services (FENZ, NZ Police, Ambulance)</li> <li>• Corrections Department residential facilities</li> <li>• Justice Department facilities</li> </ul>
5	<ul style="list-style-type: none"> <li>• Lifelines Utility facilities essential for a lifeline service to be provided</li> <li>• All facilities used for Civil Defence purposes</li> <li>• Hospitals</li> </ul>

Other consequence of failure schema are scored based on a number of parameters that can increase the consequences of failure in terms of interruption to supply. To estimate the relative likelihood of failure of each and every pipe, the scores for condition, repairs and maintenance and vulnerability were added together. The scores ranges from 3 (very good) to 13 (very poor).

This information is available on a GIS dashboard:

(<https://gis.ccc.govt.nz/portal/apps/opsdashboard/index.html#/120e360f35934ddf9d65eb32c1127a2b>).

Dashboards for each water supply scheme, which includes asset information along with likelihood of failure and infrastructure leakage index data, are provided in the supply specific water safety plans. Dashboards for Christchurch can be generated in the GIS portal as required.

### 2.4.2 Asset renewals

The AAIF tool gives us a prioritised draft renewals list for the Long Term Plan. Asset engineers then apply engineering judgement to optimise renewals projects and to co-ordinate with other infrastructure portfolios (e.g. roads) to produce a final pipe renewals list.

While water main and submain replacement has the majority of the budget due to the size of the network, the Council also has condition assessment and asset replacement programmes in place for other water supply assets such as wells, pumps, reservoirs and buildings. Replacing assets in poor condition and built to older standards with new assets built to current standards in the Council's Infrastructure Design Standards and Construction Standard Specifications improves water safety.

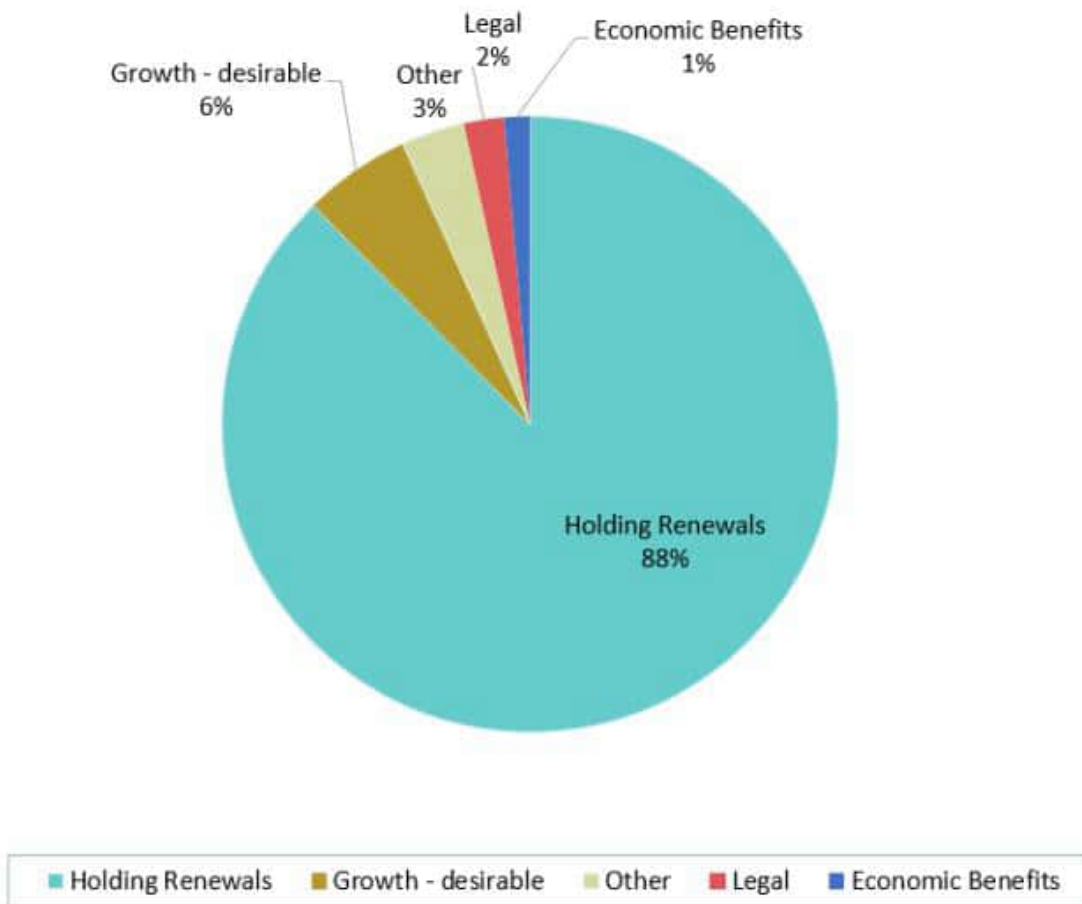
### 2.4.3 Water supply budget

The 10 year budget in the 2021-2031 Long Term Plan for water supply is \$837 million, and the 30 year forecast in the Infrastructure Strategy is \$2,093 million (including inflation). The majority of this is planned for renewing water supply assets, particularly pipes, with \$344 million planned for renewing mains and \$43 million for renewing submains over the next 10 years. These may change (increase or decrease) through future annual plans and long term plans. Information relating to budget process, including stakeholder input, is outlined in section 1.1.5.

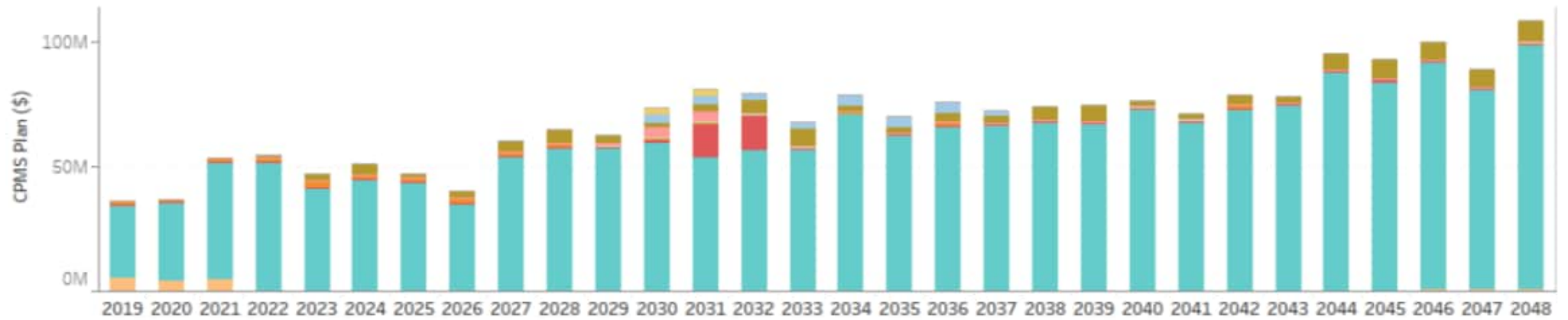
Figure 2.3 and Figure 2.4 show the projected capital expenditure over the next 30 years for water supply infrastructure by prioritisation category. Figure 2.3 shows the split of the total 30 year spend. Inflation in



included in both graphs. Table 2.3 shows the inflation figures that were assumed for capital and operating expenditure for the Infrastructure Strategy.



**Figure 2.3: Water Supply – Percentage Capital Expenditure by Prioritisation Category**



**Figure 2.4: Water Supply – Long Term Projected Capital Expenditure by Prioritisation Category**

**Table 2.3: Assumed Inflation Rates**

Inflation (%)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29-FY48
Capital expenditure	-	2.00%	2.10%	2.10%	2.10%	2.20%	2.30%	2.40%	2.40%	2.50%	2.40%
Operating expenditure	-	2.10%	2.30%	2.30%	2.30%	2.40%	2.50%	2.50%	2.60%	2.70%	2.50%

## 2.5 Water quality characteristics

### 2.5.1 Water quality incidents and responses

The Council has a water sampling programme in place, with water testing carried out by its own laboratory. The sampling programme and procedures have been developed in collaboration with Citycare and the Council to ensure it meets or exceeds the DWSNZ requirements. Staff in the Three Waters & Waste Unit are immediately notified if there is any contamination, in accordance with *Raise an Alert regarding a Test Showing Water Contamination* (see overview in Figure 2.5; more detail is provided behind each item in Promapp). To ensure the appropriate people are contacted, and to reduce the response time to an incident, there is a template that is completed by the Laboratory team (

DRINKING WATER CONTAMINATION EVENT – LABORATORY – INITIAL NOTIFICATION				
DATE & TIME OF SAMPLING				
SITE SAMPLED				
TEST RESULTS	E. COLI/100 mL		TOTAL COLIFORMS/100 mL	
KEY STAKEHOLDERS	PHONE	NAME	ROLE	CONFIRMATION
INFORMED IMMEDIATELY (BY PHONE CALL)	[REDACTED]	Jeanette Gower	Team Leader – Water and Wastewater Operations (CCC)	<i>(Enter Y when done)</i>
		<i>(Add name if contacted)</i>	Water and Wastewater Operations On Call Supervisor (CCC)	
		Veronica Zefferino	Team Leader Quality & Compliance (CCC)	
		[REDACTED]	Transgression Response Contract Lead (Citycare Water)	
		[REDACTED]	Reservoir Security, Well Heads, Pump Station & Chlorination Lead (Citycare Water)	
ADDITIONAL SAMPLING SITES	<i>(Details or N/A)</i>			
RESULTS AVAILABLE	DATE		TIME	
ADDITIONAL INFO				
REPORT ATTACHED (check)	<i>(Enter Y)</i>			

Figure 2.6 and TRIM [19/625032](#)). This also ensures there is consistency in how incidents are recorded.

A situation report is initiated by the CCC Response Lead to summarise the event, keep track of actions taken (TRIM [19/625076](#)) and then review the effectiveness of the response and undertake a Root Cause Analysis. The Quarterly Compliance Meetings include reviewing any events that have occurred in the last quarter. In additional quarterly meetings between the Quality and Compliance and the Water and Wastewater Operations teams review responses to events including incorporating any ‘lessons learnt’ into current operations or future responses. The Incident reviews are conducted using a standardised template (see TRIM [19/625081](#)). Meeting minutes, any findings and recommendations are recorded in the template and saved in

TRIM: [FOLDER10/688](#). Annual reviews of the Water Safety Plan include the incident review and lessons learned documents that are produced following events (as discussed in section 10) and are incorporated in the internal water safety plan review checklist (Appendix A).

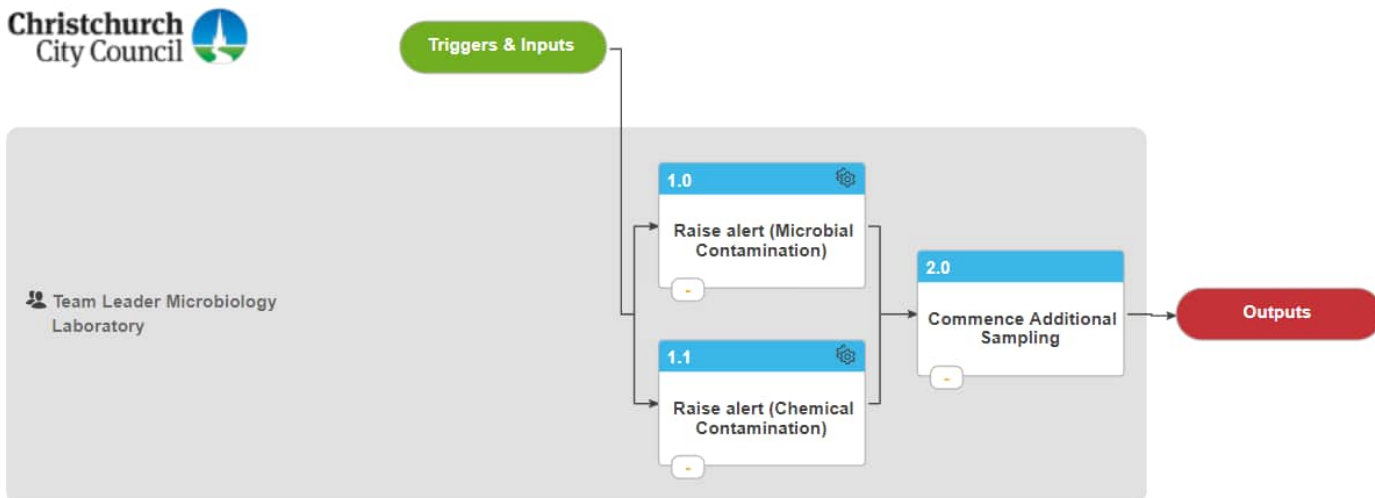
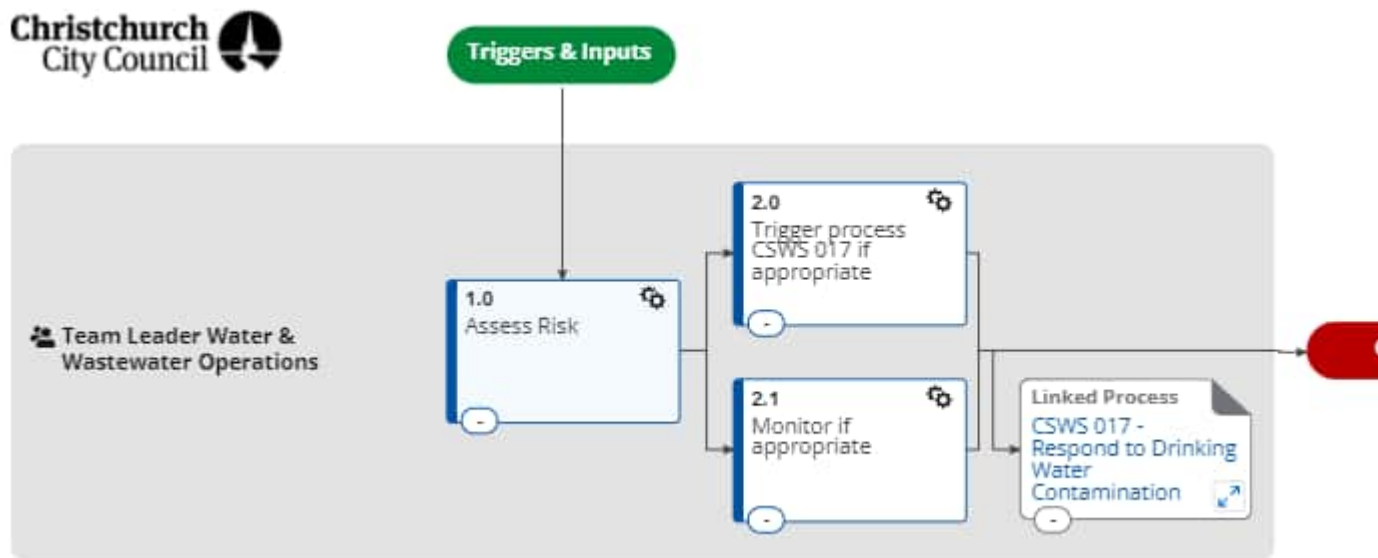


Figure 2.5: Raise an Alert regarding a Test Showing Water Contamination flow diagram

DRINKING WATER CONTAMINATION EVENT – LABORATORY – INITIAL NOTIFICATION				
DATE & TIME OF SAMPLING				
SITE SAMPLED				
TEST RESULTS	E. COLI/100 mL		TOTAL COLIFORMS/100 mL	
KEY STAKEHOLDERS	PHONE	NAME	ROLE	CONFIRMATION
INFORMED IMMEDIATELY (BY PHONE CALL)	[REDACTED]	Jeanette Gower	Team Leader – Water and Wastewater Operations (CCC)	<i>(Enter Y when done)</i>
		<i>(Add name if contacted)</i>	Water and Wastewater Operations On Call Supervisor (CCC)	
		Veronica Zefferino	Team Leader Quality & Compliance (CCC)	
		[REDACTED]	Transgression Response Contract Lead (Citycare Water)	
		[REDACTED]	Reservoir Security, Well Heads, Pump Station & Chlorination Lead (Citycare Water)	
ADDITIONAL SAMPLING SITES	<i>(Details or N/A)</i>			
RESULTS AVAILABLE	DATE		TIME	
ADDITIONAL INFO				

REPORT ATTACHED (check)	<i>(Enter Y)</i>

**Figure 2.6: Contamination event laboratory initial notification template**



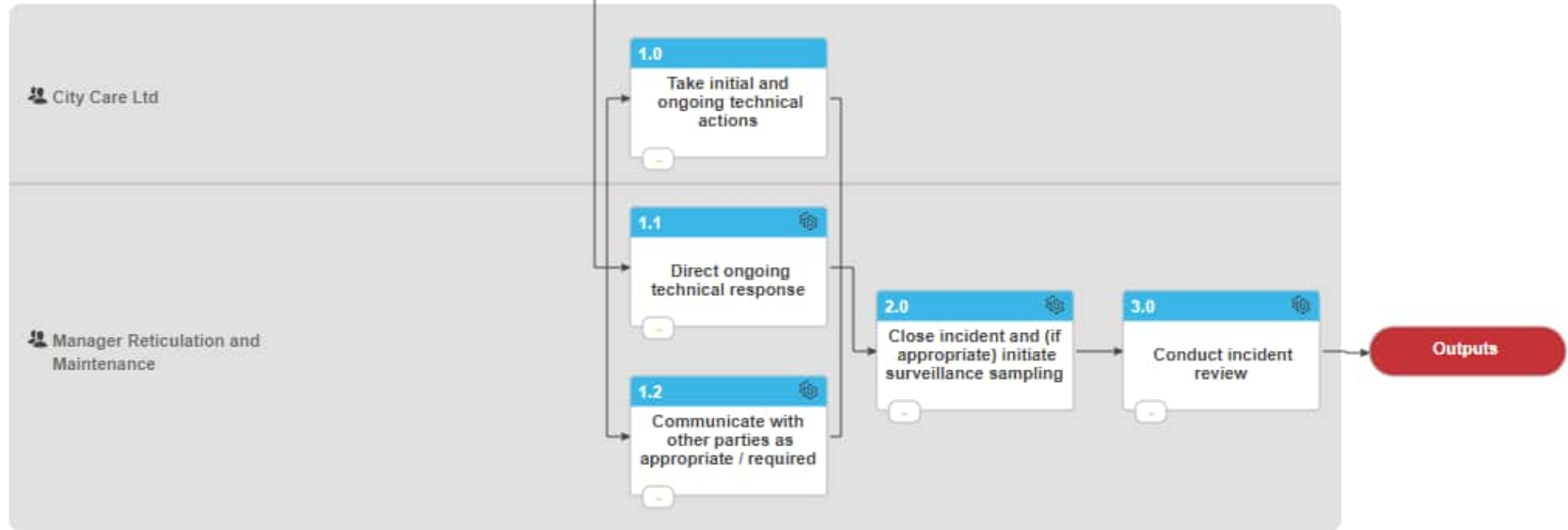


Figure 2.7: Respond to Drinking Water Contamination

# 3 Hazards and Hazardous Event Identification and Risk Assessment

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## 3.1 Council risk assessment methodology

Each supply element of the water supply is exposed to risk events of varying likelihood and consequence. In establishing a management plan, the level of risk to public health and operations within each Council water supply needs to be understood, quantified and managed.

The risk assessment includes identifying hazardous events and their likely causes. Hazardous events are defined as events that introduce hazards to, or fail to remove them from, the water supply. To ensure consistency in the risk assessment approach, two risk methodology development workshops were held in February 2019. During these workshops, three existing risk methodologies (2018 WSP / MoH / Global CCC risk) were compared and the proposed methodology for the 2019 risk assessment workshops was developed and agreed on by all attendees, which included most of the staff who were involved in the following risk workshops. A Drinking Water Assessor attended the first of these workshops.

The events and causes listed in the risk register were determined in risk assessment workshops held between March and May 2019. Workshops were attended by planning, technical services, customer services, operations and maintenance staff as well as the Drinking Water Assessor and Citycare. Likelihood and consequence scoring was done by means of expert judgement by the workshop attendees. In June and July 2020 a review of the final 2019-risk assessment methodology was undertaken following feedback from the 2019 Christchurch/Lyttelton WSP assessment. The risk registers were also reviewed to ensure alignment. Attendees at risk assessment workshops are listed in appendices in the supply-specific water safety plans.

A risk rating for each possible hazardous event was agreed based on the likelihood of the event occurring (Table 3.1) and the consequences if it occurred (

Table 3.2). The matrix is based on five categories of likelihood and five categories of consequence (Table 3.3) established in internal staff workshops attended by the Drinking Water Assessor and Ministry of Health staff.

The New Zealand Drinking-water Safety Plan Framework<sup>8</sup> (Ministry of Health, 2018) allows a water supplier to establish its own approach to hazard identification and risk assessment methodology. The Handbook for Preparing a Water Safety Plan<sup>9</sup> (Ministry of Health, 2019) provides examples of likelihood and consequence ratings. The Council developed its own risk assessment methodology taking into account the examples given in the Handbook and the World Health Organisation Water Safety Plan Manual 2009, which says that the aim of the risk assessment should be to distinguish between significant and less significant risks.

The likelihood rating scale descriptions adopted by the Council are stricter than the descriptions in the Handbook. For example, the Handbook defines the likelihood description of 'Unlikely' as 'Occurs more often than once every five years and up to once per year'. The Council likelihood rating scale rates such an event as 'Possible' instead of 'Unlikely' which, for a risk that has a 'Minor' consequence, would change the risk rating from Low (using the Handbook likelihood scale) to 'Medium' (using the Council likelihood scale).

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<sup>8</sup> Ministry of Health, 2018: New Zealand Drinking-water Safety Plan Framework:  
<https://www.health.govt.nz/publication/new-zealand-drinking-water-safety-plan-framework>

<sup>9</sup> Ministry of Health, 2019: Handbook for Preparing a Water Safety Plan:  
<https://www.health.govt.nz/publication/handbook-preparing-water-safety-plan>



**Table 3.1: Likelihood Rating Scale Applied to Hazardous Events**

Likelihood Frequency	Score	Likelihood Description
<b>Almost Certain</b>	5	Occurs several times per month
<b>Likely</b>	4	Occurs several times per year but no more than once per month
<b>Possible</b>	3	Occurs several times in a 5-year period but no more than once per year
<b>Unlikely</b>	2	Occurs once every 5 to 50 years
<b>Rare</b>	1	Occurs only in exceptional circumstances or less than every 50 years.

The consequence ratings in Table 3.3 take into account impacts on public health and impacts on water supply operations, with the higher rating of the two being used in the risk assessment table.

The Council makes two distinctions around microbial contamination of the water supply and the consequential impacts on public health:

- Between minor and major microbial contamination, which reflects the potential amount of pathogens that could enter in the water supply. For example, minor microbial contamination includes contamination from shallow groundwater or minor seepage through a reservoir roof, whereas major microbial contamination includes sewage overflow into source water or a dead animal in a reservoir. This distinction is made on the basis that there is a dose response relationship between the concentration of pathogens in the water and the probability of infection. It is informed by the causes of major water outbreaks around the world<sup>10</sup>.
- Based on the number of people being supplied with water, the more people being supplied with water, the greater the consequential impact – using 5,000 people as the threshold. This was discussed in depth at the March 2019 workshop with Drinking Water Assessor Kirsty McLeod, who agreed and advised that it was standard practice in public health to prioritise efforts on areas which would have the biggest impact.

This means that there is a range of consequences from moderate (minor microbial contamination affecting less than 5,000 people) to major (minor microbial contamination affecting more than 5,000 people, or major microbial contamination affecting less than 5,000 people) to catastrophic (major microbial contamination affecting more than 5,000 people). This compares with the Handbook examples which suggests major consequence for an outbreak of widespread illness affecting a sub-population and a catastrophic consequence for an outbreak of widespread illness affecting most of the population.

Pathogenic risks are also considered based on the level of potential contaminant entering the water supply (i.e. minor vs major contamination). For example, minor microbial contamination includes contamination from shallow groundwater or minor seepage through a reservoir roof, whereas major microbial contamination includes sewage overflow into source water or a dead animal in a reservoir. This distinction is made on the basis that there is a dose response relationship between the concentration of pathogens in the water and the probability of infection. **Error! Reference source not found.** provides descriptors for levels of response in light of their effect on public health risks and shows how these are linked in to the emergency response levels. A moderate event aligns with emergency level 3 (less than 10 E. coli /100mL detected) and a major event aligns with emergency level 4 or 5 (more than 10 E. coli /100mL detected).

Chemical and radiological risks have been ranked based on their potential to cause acute, chronic or possible harm to people. According to DWSNZ Guidelines chapter 9, in the radiological context, the MAV is intended to indicate a level above which the radioactive content of the water should be investigated further and an assessment of all relevant radiological issues undertaken. The MAV is thus more of a guideline than necessarily

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<sup>10</sup> Hrudehy & Hrudehy, 2014: *Ensuring Safe Drinking Water: Learning from Frontline Experience With Contamination*

an absolute maximum. It is also intended to be clear however, that at levels below the MAV, there is no need for further assessment and therefore the consequence ranking is minor.

For risks that are associated with both public health and operational/water continuity hazards, public health consequences take priority over operational consequences.

**Table 3.2: Consequence Rating Scale Applied to Hazardous Events**

Incident/Emergency level (Note: Sitrep required for Level two and higher)		Incident	Description of level	
			Impact on Public Health	Impact on Operations
Level 5 <b>(Catastrophic consequence)</b>	Significant event, which involves multiple agencies working together to respond and resolve the situation.  <i>Lead by Civil Defence or other relevant external agency</i>  <i>3 Waters Lead - Manager Service Excellence</i>  <b>Notification:</b> Taumata Arowai – As soon as practicable	Widespread occurrence of waterborne contamination (microbiological or chemical)  <u>OR</u>  Presence of cyanotoxins in distribution network	Major microbial contamination, possibly deaths expected, that affects >5,000 people  <u>OR</u> Acute harm to people: via gross persistent exceedance of one or more chemical MAVs (e.g. more than 5x MAV) <ul style="list-style-type: none"> <li>For lead (plumbosolvent source), this is over a 24hr sample period</li> <li>Presence of cyanotoxins in distribution network</li> </ul>	High level of monitoring and incident management required
		Water supply unable to be maintained/ expected to be unable to be maintained	Potential for use of alternative unsafe supplies	Major disruption of service (over 24 hours and >500,000 customer hours)
		Declared civil defence natural disaster	Impact could cause widespread disease/illness	Complete failure of systems
Level 4 <b>(Major consequence)</b>	Major event, which could involve multiple agencies working together to respond and resolve the situation.  <i>Lead by 3 Waters - Manager Service Excellence</i>	More than 10 E.coli per 100 ml detected at the treatment plant with contamination also within the distribution system.  <u>OR</u>  Alert from District Health Board that surveillance information suggests widespread cases of illness in the	Major contamination, widespread illness, possibly deaths expected that affects <5,000 people  <u>OR</u>  Minor contamination (1 - <10 E Coli) causing widespread illness that affects >5,000 people  <u>OR</u>	Systems significantly compromised and abnormal operation
				High level of monitoring and incident management required

	<p><b>Notification:</b> Taumata Arowai - As soon as practicable (In case of any unplanned shut down exceeding 8hrs Taumata Arowai should be notified within 24hrs)</p>	<p>community are drinking-water related (more than 10 cases)</p>	<p>Occurrence of waterborne contamination affecting a sub population (eg school)</p>	
		<p>Long term exceedances of a chemical MAV</p>	<p>Potential acute harm to people from exceedance of a short term MAV</p> <p>OR</p> <p>Chronic harm to people from long-term exceedance of MAV.</p>	<p>Major disruption of service (8 to 24 hours and 20,000 to 500,000 customer hours)</p>
<p>Level 3 <b>(Moderate consequence)</b></p>	<p>Moderate event. Other agencies not involved with response. Taumata Arowai consulted with. 3 Waters and Waste respond and resolve the situation. <i>Lead by 3 Waters – Water and Wastewater Operations</i></p> <p><b>Notification:</b> Taumata Arowai - As soon as practicable</p>	<p>Detection of E.coli (&lt;10) or significant increase in background concentrations of other indicators (eg Total Coliforms) <u>OR</u></p> <p>Specific pathogens at the treatment plant or in distribution system <u>OR</u></p> <p>Preventive measure failure in combination with corrective action failure associated with Critical Control Point (CCP) <u>OR</u></p> <p>Repeated exceedances of one or more chemical MAVs (ie, above but close to the MAV) <u>OR</u></p> <p>Alert from District Health Board that surveillance information suggests cluster of illness in the community is drinking-water related (1 - 9 cases) <u>OR</u></p> <p>Widespread exceedance of aesthetic GV <u>OR</u></p> <p>Cyanobacteria found in source water</p>	<p>Minor microbial contamination that affects &lt;5,000 people</p> <p>OR</p> <p>Possible harm to people (exceedance of Chemical MAV, including radiological)</p> <p>OR</p> <p>Widespread exceedance of aesthetic GV with possible harm to people</p> <p>OR</p> <p>Cyanobacteria found in source water</p>	<p>Significant modification to normal operation but manageable</p>

		Unplanned failure of infrastructure (including treatment facilities) resulting in failures in treatment or unplanned water outages for consumers lasting more than 8hrs and less than 24 hours		Increased monitoring Disruption to service (4 to 8 hours and 500 to 20,000 customer hours)
Level 2 <b>(Minor consequence)</b>	Moderate event. Other agencies not involved with response. Taumata Arowai may be consulted with. 3 Waters and Waste respond and resolve the situation. <i>Lead by 3 Waters – Water and Wastewater Operations</i>	Reoccurrence of previous event with increase in background indicators. Unplanned failure of infrastructure, which results in transmission line break. Loss of network pressure <u>OR</u> Exceedance of 50% of DWSNZ MAV <u>OR</u> Area with exceedances of aesthetic GV	Local area with exceedance of aesthetic GV (several complaints)  OR Isolated exceedance of MAV  OR Possible harm to people in the future (exceedance of half the chemical or radiological MAV)  One or more chemicals at greater than 50% of MAV	Manageable disruption in the ability to supply water (e.g. pressure) for more than 4hs and < 8hs
				Short disruption of service (1 to 4 hours and 20 to 500 customer hours)
Level 1 <b>(insignificant consequence)</b>	Minor event. Other agencies not involved with response. Taumata Arowai may be consulted with. 3 Waters and Waste respond and resolve the situation. <i>Lead by 3 Waters – Water and Wastewater Operations</i>	Exceedance of a DWSNZ guideline (GV) or Acceptable range of Aesthetic determinand	Isolated, single exceedance of aesthetic Guideline Value, some complaints <ul style="list-style-type: none"> <li>• colour</li> <li>• smell</li> <li>• taste</li> </ul>	Little if any disruption to normal operations, usually covered as a public complaint/notification
		Unplanned failure of infrastructure or source supply, where water quality or supply is unlikely to be compromised or an alternative process is available to provide drinking water.		Very short disruption of service (up to 1 hour and <20 customer hours)
		Water restrictions required to enable supply continuity		Increased monitoring to confirm trends

Guidance for the overall assessment of the hazardous events based on their likelihood and consequence rating was taken from the 2009 World Health Organization Water Safety Plan Manual<sup>11</sup>.

A semi-quantitative risk prioritisation approach was used whereby each likelihood and consequence category received a score between 1 and 5 (1 being best, 5 being worst). The scoring system is outlined in Table 3.3. The risk score – the product of the likelihood and consequence scores – determines the overall risk rating, as per Table 3.4.

Where the risks have been grouped, the Council’s evaluation of the risk has been determined using the greatest risk case. For example, the reservoir with the greatest risk profile was used to consider the likelihood and consequence of an event occurring for all reservoirs.

As noted above, the likelihood ratings are one step more conservative than the Handbook example ratings and the consequence ratings are in some cases one step less conservative than the Handbook (e.g. major microbial contamination affecting less than 5,000 people is rated by the Council as major, whereas the Handbook example rating is catastrophic). The net effect is that the risk score is the same or more conservative. By way of example, introduction of contamination in and around a water storage tank in Wainui due to access by animals/birds:

- Using the Council risk methodology, the residual likelihood is unlikely (occurs once every 5 to 50 years) and the consequence is major, which results in a medium risk rating.
- Using the Handbook risk methodology instead, the residual likelihood would be rare (occurs less than or equal to once every five years) and the consequence would be catastrophic, which would also result in a medium risk rating.

An example of where the Council risk methodology has resulted in a more conservative risk score than the Handbook risk methodology is: introduction of contamination in the distribution system due to no/inadequate/faulty/incorrectly installed backflow prevention device in Akaroa/Takamātua:

- Using the Council methodology, the residual likelihood is unlikely and the consequence is moderate, which results in a medium risk rating
- Using the Handbook risk methodology instead, the residual likelihood would be rare and the consequence would be major, which would result in a low risk rating.

**Table 3.3: Semi-Quantitative Risk Prioritisation Approach for Risk Rating**

		Consequence					Score
		Insignificant	Minor	Moderate	Major	Catastrophic	
Likelihood	Rare	1	2	3	4	5	1
	Unlikely	2	4	6	8	10	2
	Possible	3	6	9	12	15	3
	Likely	4	8	12	16	20	4
	Almost Certain	5	10	15	20	25	5
Score		1	2	3	4	5	

<sup>11</sup> World Health Organization, 2009: Water Safety Plan Manual:  
[https://www.who.int/water\\_sanitation\\_health/publications/publication\\_9789241562638/en/](https://www.who.int/water_sanitation_health/publications/publication_9789241562638/en/)

**Table 3.4: Relationship between Risk Score and Overall Risk Rating**

<b>Risk Score</b>	1 - 5 <sup>1</sup>	5 <sup>2</sup> - 9	10 - 15	16 - 25
<b>Risk Rating</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>	<b>Extreme</b>

<sup>1</sup> risk score combination 'almost certain/insignificant'

<sup>2</sup> risk score combination 'rare/catastrophic'

### 3.2 Risk assessment, uncertainty and acceptability

While it is recognised that a range of factors contribute to the consequence of an event including economic, environmental, public health and operational impacts, this document only considers impacts on public health and operations. This is in line with the Water Safety Plan’s focus on public health. The impacts to public health and operations are considered separately. Where an event has an impact on both public health and operations, the highest-ranking consequence is used. Overall, emphasis is placed on public health risks.

#### Maximum levels of risk and mitigated risk

The Risk Table gives details of the maximum risk and the residual risk. The maximum risk rating is the level of risk that a hazardous event poses on the water supply if there were no preventive measures in place and all barriers failed. The residual risk rating takes into account current preventive measures.

#### Risk uncertainty and acceptability of risks

Hazard identification and risk assessment are activities of (informed) judgement and inevitably contain uncertainty and limitations. Uncertainty arises from factors such as lack of complete knowledge or variability/inconsistency of data and/or information. These uncertainties and limitations need to be understood and taken into account when determining the acceptability of risks. Risk uncertainty descriptors are provided in Table 3.5 and are referenced in the risk assessment table.

**Table 3.5: Risk uncertainty descriptors**

<b>Level of Uncertainty</b>	<b>Description</b>
Certain	<ul style="list-style-type: none"> <li>There are at least five years of drinking water quality monitoring data from the Treatment Plant and Distribution Zone available that is compliant with the requirements of the Drinking Water Standards for New Zealand in terms of number of samples, days of the week used and days between samples. The data has been collated and analysed, and variability is predictable.</li> <li>The hazardous event and preventive measures/processes involved are thoroughly understood.</li> <li>There are operational measures/control points in place that deal with the hazard (e.g. high turbidity divert settings, automatic shut-down of WTP on certain conditions), and the robustness of these measures/controls is confirmed by at least five years of associated data or results.</li> </ul>
Confident	<ul style="list-style-type: none"> <li>There are at least two years of drinking water quality monitoring data from the Treatment Plant and Distribution Zone available that is compliant with the requirements of the Drinking Water Standards for New Zealand in terms of number of samples, days of the week used and days between samples. The data has been collated and analysed, and variability is predictable.</li> <li>There is a good understanding of the hazardous event and preventive measures/processes involved.</li> <li>There are operational measures / control points in place that deal with the hazard (e.g. high turbidity divert settings, automatic shut-down of WTP on certain conditions) , and the robustness of these measures/controls is confirmed by at least two years of associated data or results..</li> </ul>



Level of Uncertainty	Description
Reliable	<ul style="list-style-type: none"> <li>There is at least one year of drinking water quality monitoring data from the Treatment Plant and Distribution Zone available that is compliant with the requirements of the Drinking Water Standards for New Zealand in terms of number of samples, days of the week used and days between samples. The data has been collated and analysed, and variability is predictable.</li> <li>There is a good understanding of the hazardous event and preventive measures/processes involved.</li> <li>There are operational measures/control points in place that deal with the hazard (e.g. high turbidity divert settings, automatic shut-down of WTP on certain conditions) , and the robustness of these measures/controls is confirmed by at least one year of associated data or results..</li> <li>In some cases, depending on the hazardous event, other monitoring data such as age dating results, groundwater modelling results, asset database records and more may be considered in the uncertainty assessment, with rationale provided why it is considered 'reliable'.</li> </ul>
Estimate	<ul style="list-style-type: none"> <li>There are limited monitoring data available.</li> <li>There is a reasonable understanding of the hazardous event and preventive measures/process involved.</li> <li>There are manual operational measures/control points in place that deal with the hazard with limited data or results.</li> </ul>
Uncertain	<ul style="list-style-type: none"> <li>There is limited or no monitoring data available.</li> <li>The hazardous events or preventive measures/processes are not well understood.</li> <li>There are no operational measures/control points in place that deal with the hazard.</li> </ul>

Table 3.6 outlines the levels of risk the Council considers:

- Acceptable, for which it will take no additional actions to further reduce the risk
- Unacceptable, for which additional actions / improvements will be taken.

**Table 3.6: Acceptability of risks**

Residual Risk	Level of Uncertainty	Acceptability	Management Actions
Low Risk	Certain, Confident, Reliable	Acceptable	Manage within existing processes, adopting continuous improvement.
	Estimate, Uncertain	Acceptable	
Medium Risk	Certain, Confident, Reliable	Acceptable	Risk Score 6-7: Manage within existing processes, adopting continuous improvement.
	Estimate, Uncertain	Unacceptable	Implement short-term measures, and investigations to reduce level of uncertainty as soon as possible.

Residual Risk	Level of Uncertainty	Acceptability	Management Actions
<b>High Risk</b>	Certain, Confident, Reliable	<b>Unacceptable</b>	Implement short-term measures immediately, longer-term risk reduction measures need to be a priority.
	Uncertain	<b>Unacceptable</b>	Implement short-term measures immediately, and investigations to reduce level of uncertainty as soon as possible.
<b>Extreme Risk</b>	Certain, Confident, Reliable	<b>Unacceptable</b>	Implement short-term measures immediately, emergency plans on stand-by, longer-term risk reduction measures given top priority.
	Estimate, Uncertain	<b>Unacceptable</b>	Implement short-term measures immediately, emergency plans on stand-by. Implement investigations immediately to reduce level of uncertainty.

The Council has determined that a medium risk where the level of Uncertainty is classified as ‘Certain’, ‘Confident’, or ‘Reliable’ is an acceptable risk, as illustrated in Table 3.6. As the Council has adopted stricter likelihood rating scale descriptions than the descriptions provided in the Handbook (refer to 3.1), a medium risk as assessed by Council would still be likely to be assessed as a low risk under the Ministry of Health guidance.

Unacceptable risks requiring improvements have been identified in the respective capital, operational and procedural improvement tables. The responsibility for ensuring progress on the improvement, the timeframe for the improvement, and possible practical steps to carry out the improvement are also included in the tables.

To ensure that the work is undertaken, responsibilities have been assigned to the relevant Council staff. Roles and responsibilities are likely to change and therefore are required to be checked as part of the annual internal WSP review process.

The live Risk Table and associated Improvement Tables as well as plausible combinations of hazards or hazardous events that result in an increased level of risk to the water quality are located in the supply specific water safety plans.

### **3.3 Risk assessment table**

Please refer to the supply-specific water safety plans.

### **3.4 Plausible combinations of hazards**

Please refer to the supply-specific water safety plans.

### **3.5 Unacceptable risks**

Please refer to the supply-specific water safety plans.

# 4 Existing Preventive Measures and Barriers to Contamination

## 4.1 Introduction

Multi-barrier risk management is considered the best practice approach to supply drinking water as it identifies barriers that prevent contamination from entering the water at every step from source to tap. The quality of water supplied by Christchurch City Council to consumers is secured through the use of multiple barriers to the entry of contaminants. Barriers to contamination considered in this plan extend from catchment to the end supply to consumers.

The four types of barriers are:

- Preventing hazards entering the raw water
- Removing particles and hazardous chemicals from the water
- Killing or inactivating pathogens in the water
- Maintaining the quality of the water in the distribution system.

In addition to considering barriers at each step in the physical supply chain (source, treatment, distribution, reticulation) barriers have also been considered for each step in supply management process.

## 4.2 Preventative measures – approaches, definitions and application

The use of the terms ‘full’ and ‘partial’ preventative measures has been adopted to help in identifying the robustness and efficacy of the preventative measure(s). The definitions adopted by council are described in Table 4.1.

**Table 4.1: Preventive Measures Definition**

Term	Definition
Full preventative measure	A preventative measure that reduces the likelihood and/or consequence of a risk.
Partial preventative measure	A preventative measure that reduces the risk but not necessarily the likelihood and/or consequence. These include measures that may be in force periodically, policies and guidelines or measures that may not be in place across the entire network.
Event detection	Not a preventative measure but is a process or procedure in place to identify potential issues with the water supply. An issue detected through these measures are likely to trigger investigations

Council considers that a combination of multiple partial measures can, in some instances, reduce the likelihood and/or consequence of a hazard.

The primary preventive measures and barriers to contamination, and their effectiveness are discussed in the supply-specific water safety plans.

### 4.3 Additional mitigation measures

In addition to the measures discussed in the supply-specific water safety plans, the following measures also assist in providing barriers in the distribution network.

#### Dedicated maintenance contractor

Council's principal maintenance contractor is Citycare Water. The Maintenance Contract has specific requirements on the contractor to ensure that the integrity of the water supply system so that the water quality is not compromised.

Contract clause 12 '*Cleanliness, Hygiene and Contamination Certificate*' outlines the contractor's obligations, and has the following objectives:

- comply with regulatory requirements
- afford a high level of security against mains contamination.

All distribution system maintenance is undertaken in a sanitary manner by our Maintenance Contractor Citycare Water and their Authorised Water Supply Installers. Operators are trained and experienced and thus they implement hygienic practices during pipe repairs.

#### Authorised Water Supply Installer Register

Council requires all new pipework installations or the renewal of existing assets to be undertaken by Authorised Water Supply Installers<sup>12</sup>.

Each water supply reticulation work site is required to have an Authorised Installer on site who controls the work. Authorised Installers are experienced individual workers who have been assessed by Council staff and who have committed to ongoing training towards a water industry qualification.

Authorised Installers are required to comply with 'Schedule D: Techniques & procedures for preventing contamination of Christchurch's Potable Water Supply System' of the 'Conditions for Approval as a Water Supply Authorised Installer'. This outlines the necessary actions and precautions that all contractors are to take in order to afford a high degree of confidence that, when there is work carried out on the system, the water supply network is not put at unnecessary risk of contamination.

#### 'Strike' system to encourage high quality work

Authorised water supply installers who carry out work that is not in accordance with Council requirements are issued with breach notices. A contractor who has received 3 notices within a 12-month period is removed from the register and is no longer able to work on the Council's water supply network. This system has proven beneficial in terms of raising contractors' awareness of work standards and hygiene requirements.

#### Approved chlorination contractors

Council requires all new water supply mains and sub mains to be pressure tested, chlorinated and bacteriologically tested in order to minimise the risk of contamination of the water supply network.

Experienced, Council approved personnel must carry out chlorination<sup>13</sup>.

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<sup>12</sup> <https://ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-water-supply-installers>

<sup>13</sup> <https://ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/chlorination-contractors>

The use of approved chlorination contractors ensures that all pipework is adequately chlorinated and appropriate water testing takes place.

### Permit to Work system

The Council introduced the Permit to Work system<sup>14</sup> for works on the water supply and wastewater networks. Every contractor working on the Council's water supply infrastructure must obtain a Permit to Work from the Council before starting work. Permits to Work are held by the Council and are distributed to its principal maintenance contractor. The purpose of the Permit to Work system is to ensure that Council:

- Has visibility of what is happening in its networks
- Can notify its principal maintenance contractor of work carried out by others, in case an after-hours response is required
- Can notify the applicant of any special conditions and precautions they should take in doing the work, and any contingencies and remedial actions required.

### Water loss and leak detection contract

Christchurch City Council has a contract in place with Detection Services South Island Ltd as outlined in section 2.3.1.

## 4.4 Corrective Actions

In addition to preventative measures discussed in section 4.3 and in the supply-specific water safety plans, the following corrective actions also assist to eliminate the cause of a nonconformity in water quality in the distribution network and to prevent recurrence in the distribution network.

### Supply agreement with ProTranz Earthmoving Ltd for water tanker services

The option of providing water via tanker to key areas is a fall back preventative measure to ensure the community continues to receive safe drinking water in the event of supply source, treatment or distribution issues. The Council has a contract in place for delivery of potable water to Banks Peninsula in general and specifically Duvauchelle with Protranz (Trim [CN4600002743](#)) a registered water carrier, to ensure that services are available 24 hours per day, with the ability to provide the services continuously for up to 5 days as well as required response times. These services must always comply with the Ministry of Health "*Guidelines for the Safe Carriage and Delivery of Drinking-water*" and Drinking Water Standards for New Zealand (current at the time the contract was signed). Emergency situations requiring water tankering include: a major water mains break requiring the local reservoir to be replenished when the repair has been completed, or when a water mains repair takes more than eight hours to complete and a tanker is required to supply potable water to affected properties using a number of water taps fixed to the rear of the tanker.

### Flush points

There are flush points located throughout the network. These are used as and when required, when we either are notified of issues around water quality, through customer complaints or water sampling results. They are also used to flush the network after any replacement or repair work to any fittings and fixtures in the distribution network.

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<sup>14</sup> <https://ccc.govt.nz/consents-and-licences/construction-requirements/permit-to-work>

## 4.5 Summary of existing preventive measures

A summary table of the existing preventive measures for hazards and hazardous events and the barriers that are in place is provided in the supply-specific water safety plans.



# 5 Identification of Additional Preventive Measures and Improvement Plan

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## 5.1 Improvements to address unacceptable risks

The supply-specific risk assessment tables include an assessment of each risk's acceptability in light of the likelihood, consequence and uncertainty. The Council has developed an improvement plan that includes several procedural improvements as well as capital improvements, which will address the unacceptable risks and help deliver a safer and more robust water supply.

All improvement items related to unacceptable risks have been assigned the highest priority. The responsibility for ensuring progress on the improvement, the timeframe for the improvement, and possible practical steps to carry out the improvement are also included in the tables. To ensure that the work is undertaken, responsibilities have been assigned to the relevant Council staff. Roles and responsibilities are likely to change and therefore are required to be checked as part of the annual internal water safety plan review process. Senior management has endorsed these improvements by approving the full water safety plan, reflected in the signatures provided on page 2.

Detailed information on water supply improvements is provided in the supply-specific water safety plans.

## 5.2 Potential additional improvements

The Council continuously works on improving water supply delivery services and has identified additional areas where procedural improvements could be implemented. These items have a lower priority than those in section 5.1 and will be addressed when and if staff resources and funding is available.

# 6 Operational Procedures

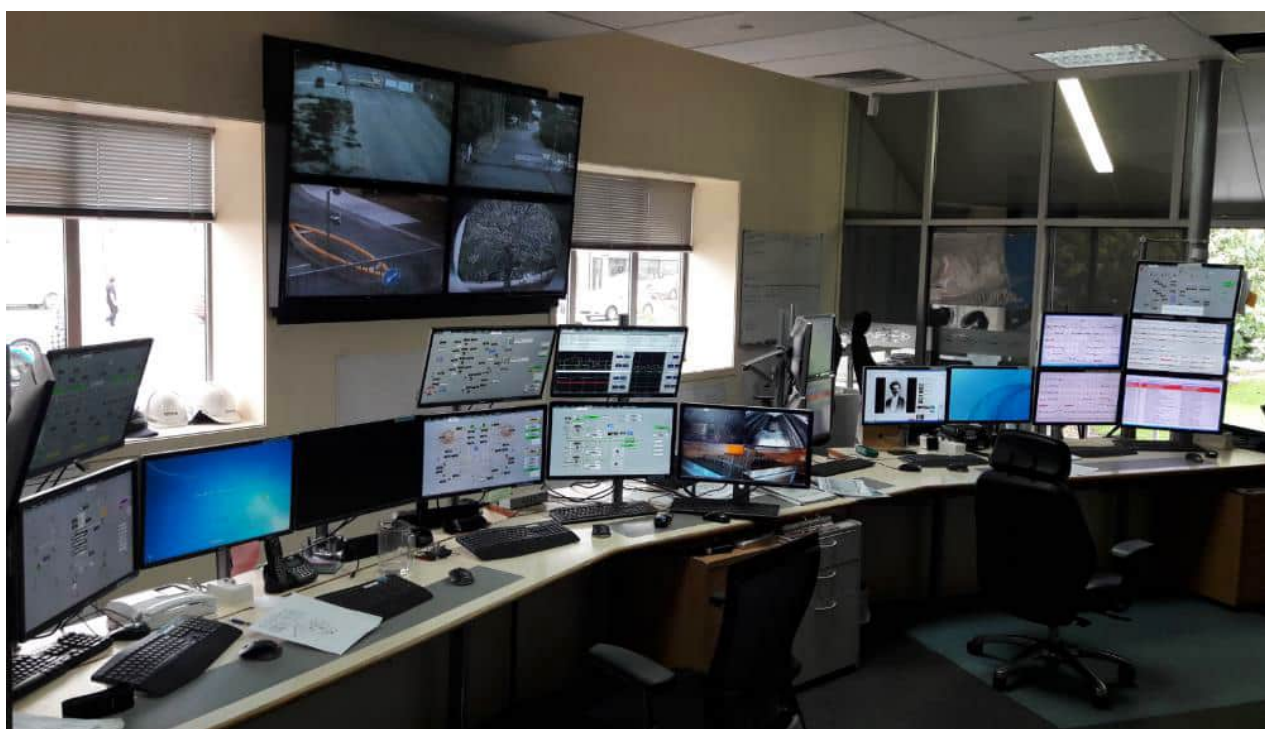
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## 6.1 Christchurch and Lyttelton

### 6.1.1 System operations

The daily operation of the Christchurch City and Lyttelton water supplies is the responsibility of the Council. The Three Waters & Waste Network Operations Team is a team of instrument, telemetry, electrical and network control experts that have oversight of the water supply network SCADA system (including pump stations, reservoirs) from a dedicated control room located on the grounds of the Christchurch Wastewater Treatment Plant.

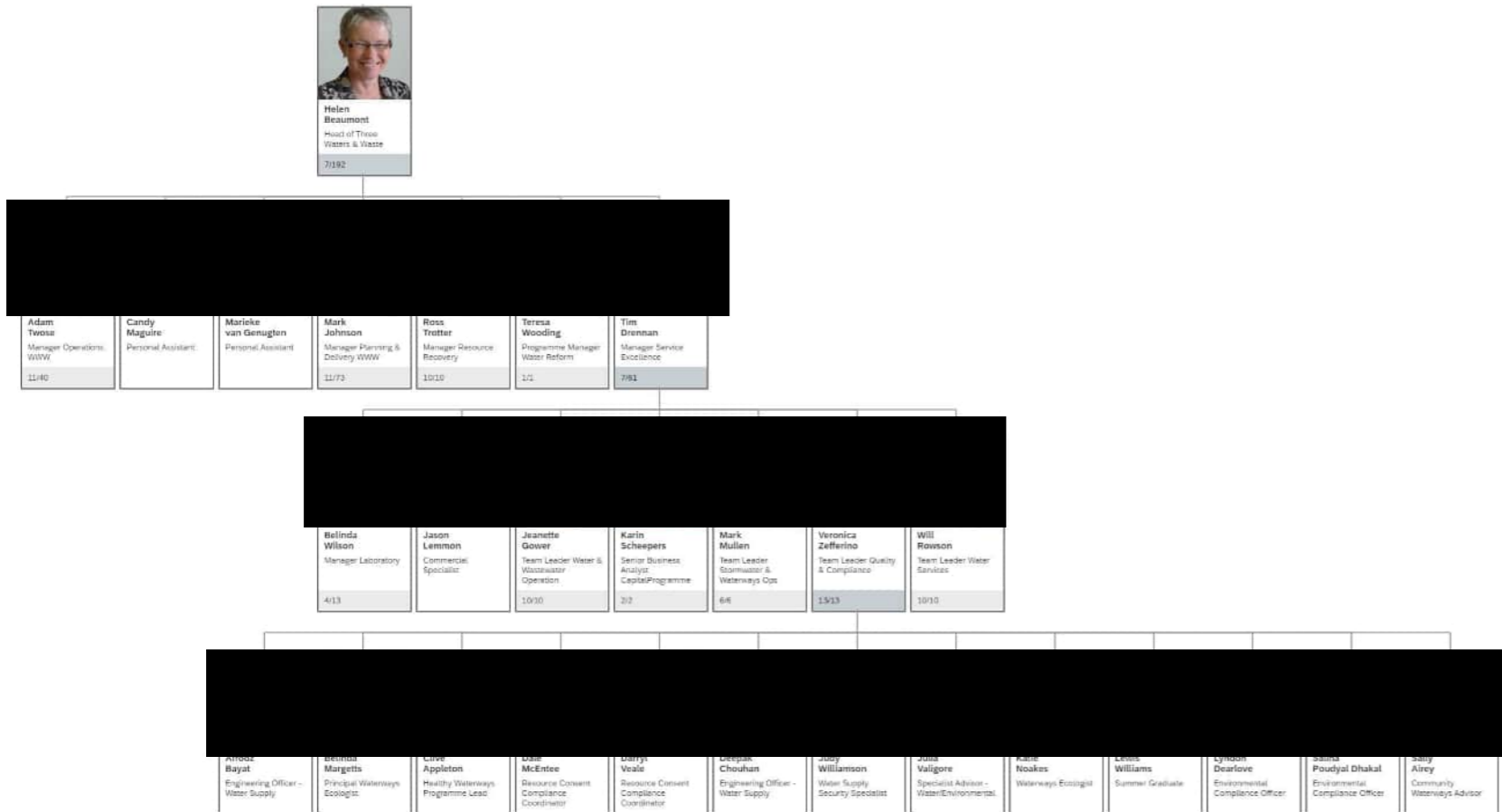
The SCADA system is used for monitoring and controlling the Council's drinking water, wastewater and stormwater infrastructure. This includes treatment plants on Banks Peninsula. This SCADA also hosts the Tsunami Warning System. Remote terminal units (RTUs) generally operate each station automatically, however the centrally located operators can manually control stations connected to the SCADA system. Information relating to the SCADA system is provided in Section 2.2.



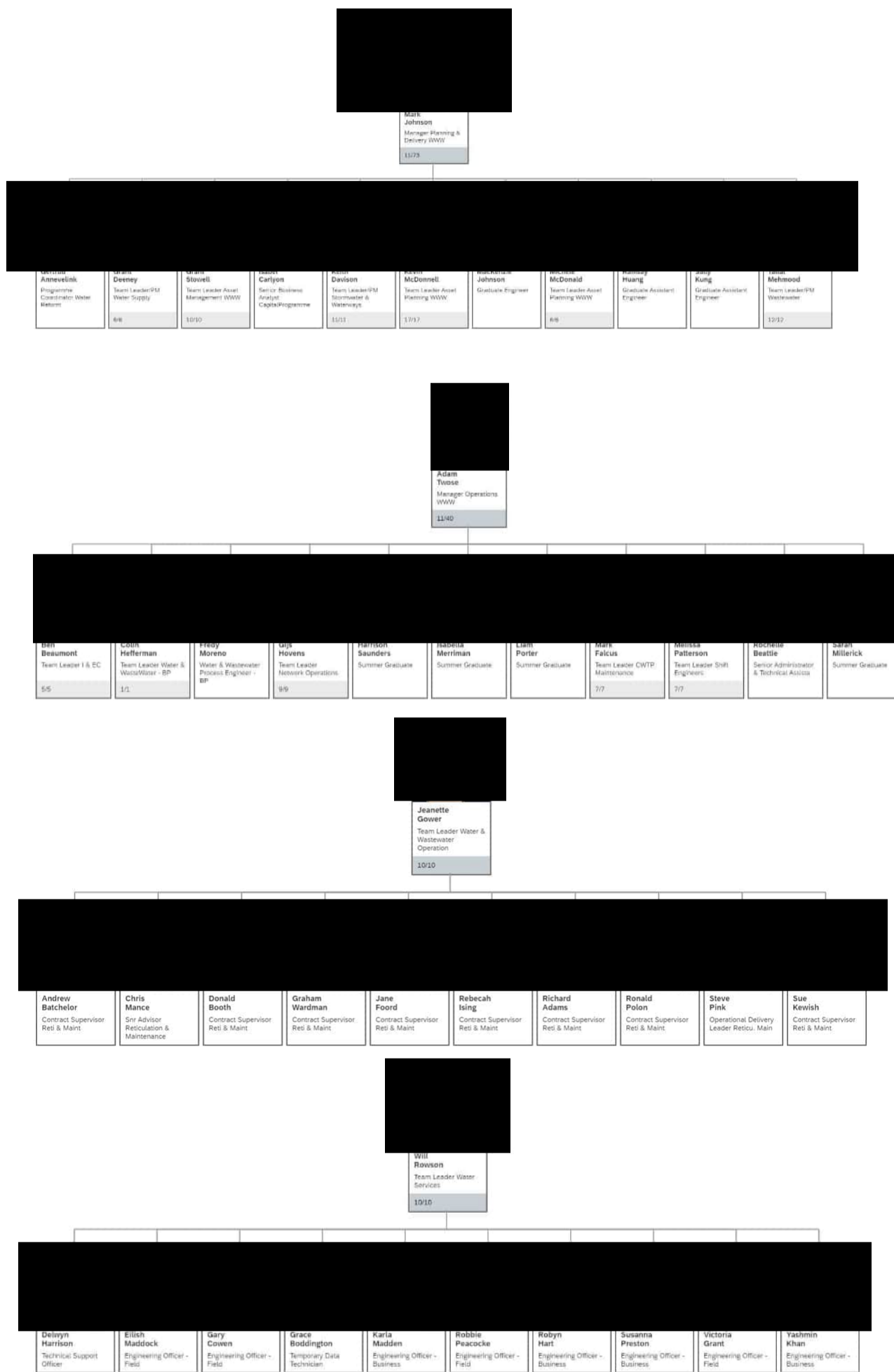
**Figure 6.1: Network operations control room**

The Council, together with the nominated maintenance contractor, is also responsible for monitoring the water supply and for ensuring that there is a rapid response to alarms and any contamination identified within the network. Figure 6.2 and 6.3 provide an overview of the Council management structure in place for managing the water supply and identifies team roles and responsibilities. The live organisational chart can be viewed in Council's PDP (Plan Develop Perform) system.

**Figure 6.2: Three Waters & Waste Unit Management Structure/ Quality and Compliance Team**



**Figure 6.3: Three Waters Planning and Delivery Teams**



### 6.1.2 Operations manuals

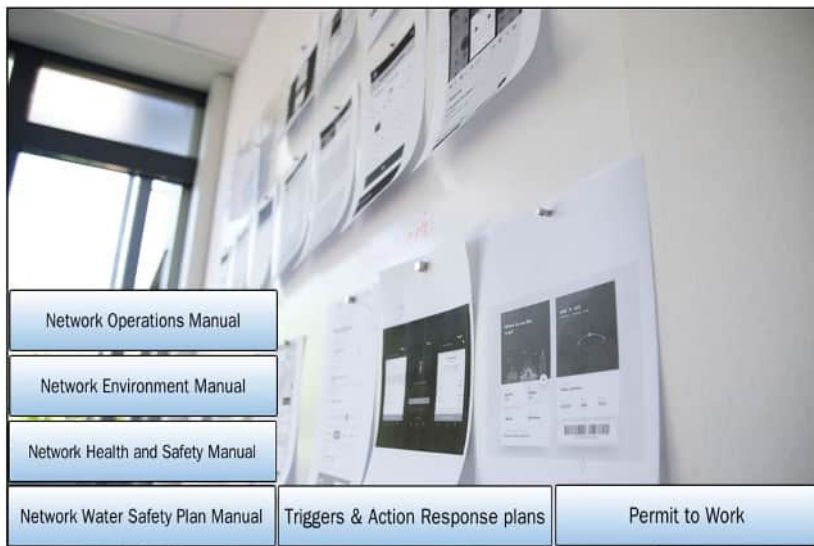
Network controllers have oversight of the water supply network SCADA system. A sharepoint site on the Council’s intranet<sup>15</sup> (Figure 6.4) has been developed as a document information system to provide quick and easy access to the information required by the network controllers to safely operate the water supply



**Figure 6.4: Network operations homepage**

The ‘People’ sharepoint page provides shortcuts to the on call register, team members and leave planners. The ‘Process’ sharepoint page (Figure 6.5) contains shortcuts to operations manuals relevant to the water supply network.

Process



**Figure 6.5: Process webpage with shortcuts to the operations manuals**

The draft Network Operations Manual ([TRIM://19/1048910](http://intranet.ccc.govt.nz/Teams/CityServices/3WatersWaste/NetOps/default.aspx)) has been developed by the network controllers. It documents the system for operating the Council’s 3 Waters & Waste infrastructure, including potable water, wastewater, stormwater, landfill gas, and tsunami warning systems. The purpose of this manual is to ensure

<sup>15</sup> <http://intranet.ccc.govt.nz/Teams/CityServices/3WatersWaste/NetOps/default.aspx>

that the network control team operates this infrastructure in a standardised manner to consistently meet all customer and stakeholder requirements.

The draft Potable Water Zone Manual ([TRIM://19/1054164](#)) forms part of the Network Operations Manual. This manual contains general information for the operation of any potable water zone as well as information for the operation of specific zones (zone manuals), including:

- Operating objectives
- Operating strategy
- Zone descriptions
- SCADA operation information
- Standard operating procedures (SOPs) relevant to the operation and maintenance of all potable water sites
- Possible changes to make potable water operation and network monitoring easier.

The draft Potable Water Zone Manual also contains links to the ten individual potable water zone manuals.

The draft Network Environment Manual ([TRIM://20/355601](#)) also covers the Council's 3 Waters infrastructure. The purpose of this manual is to ensure that the network control team operates this infrastructure in accordance with all environmental consent compliance requirements, and in a manner that reduces environmental impacts and maximises operating efficiency.

The 'Plant' sharepoint page (Figure 6.6) provides shortcuts to key operational manuals and schematics of the primary and secondary water supply zones. The primary water supply zones are those that are served directly by pump stations with wells. The secondary water supply zones are those that are serviced from reservoirs on the hills (these are fed from the primary water supply zones).

The water supply primary zones schematic (Figure 6.7) provides information on the 142 wells at 50 primary pump station sites, major pipelines and the valves between supply zones. The schematic is interactive and allows individual zones to be displayed, as shown in Figure 6.8. At the individual zone level, it is also possible to select individual pump stations and the relevant reference information, including design, operation, maintenance and site specific risk assessment information (Figure 6.9).

## Plant



**Figure 6.6: Plant webpage with water supply schematics and key manuals**

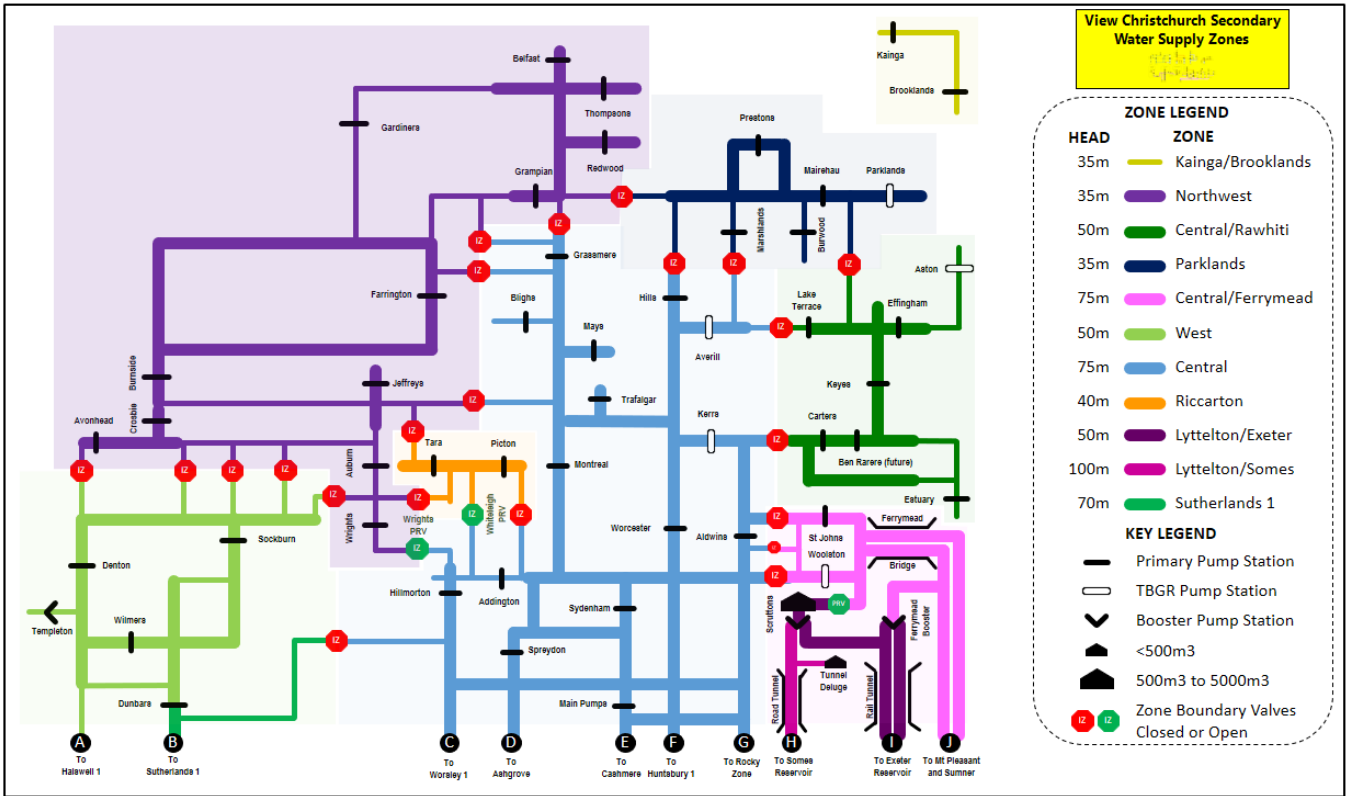


Figure 6.7: Water Supply Primary Zones

Manual : Parklands Zone (PARK) - 19/1290242

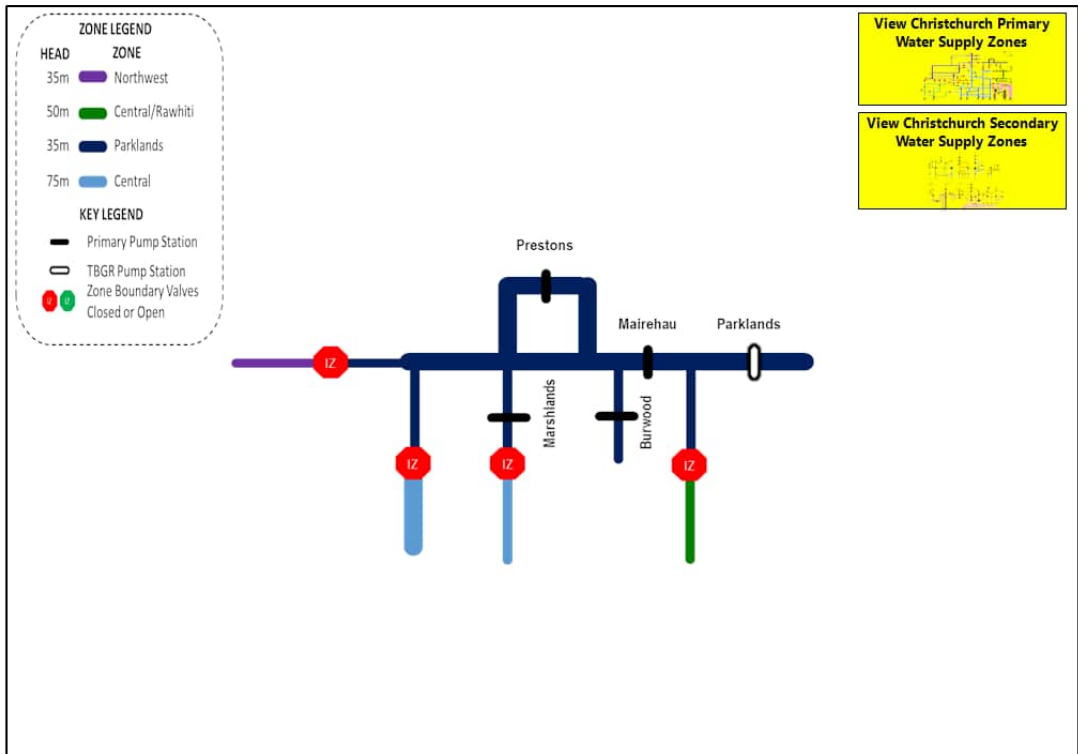


Figure 6.8: Example of individual water supply zone breakdown



# Prestons Pump Station

Back to Parklands Zone

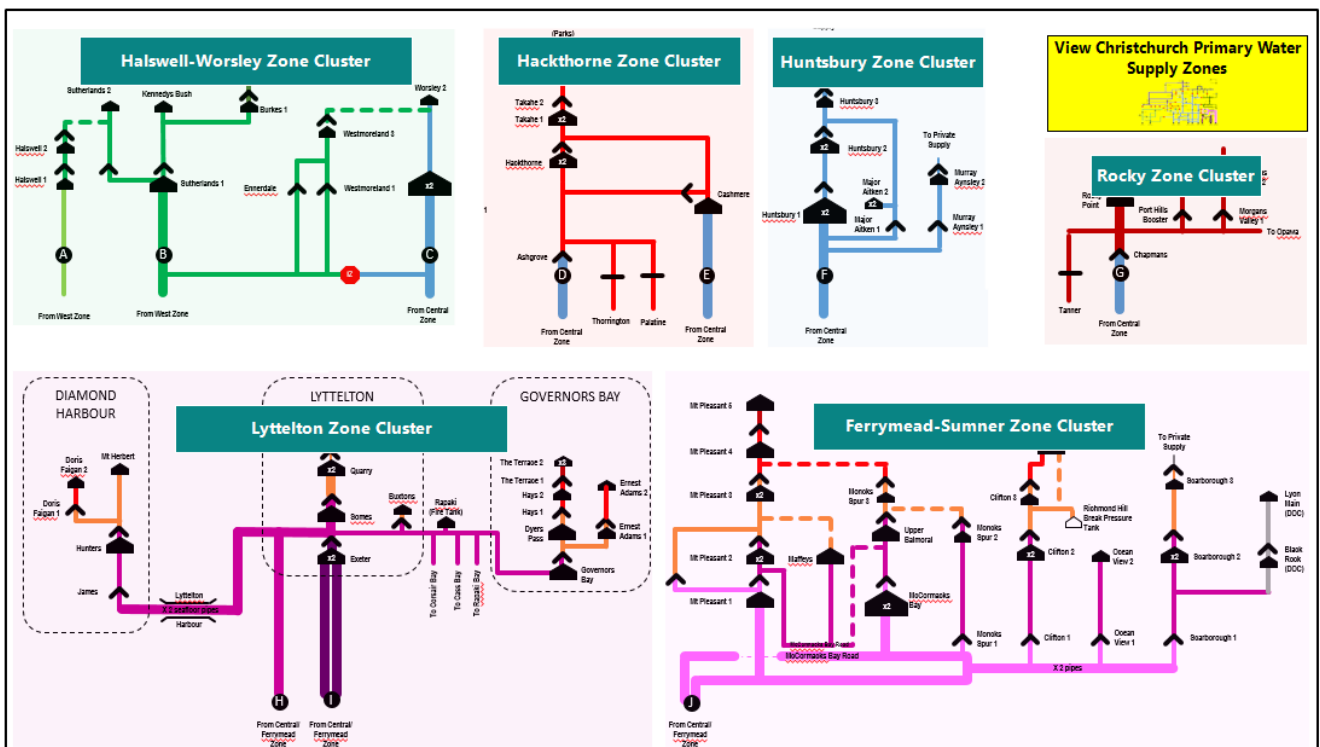


## Pump Station Reference Doc's

✓ Title	TRIM
Site Specific Risk Management plan	trim://19/437269
Pump Station Manual	trim://19/1290284
Process & Instrumentation	trim://14/514890
Resource Consents - to take water (global)	trim://18/1160425
Resource Consents - to store diesel	trim://15/118424
O&M manual 1	trim://18/411425
Design & Construction	trim://FOLDER17/643
Maintenance	trim://FOLDER17/644
Site Security Inspection	trim://20/398244

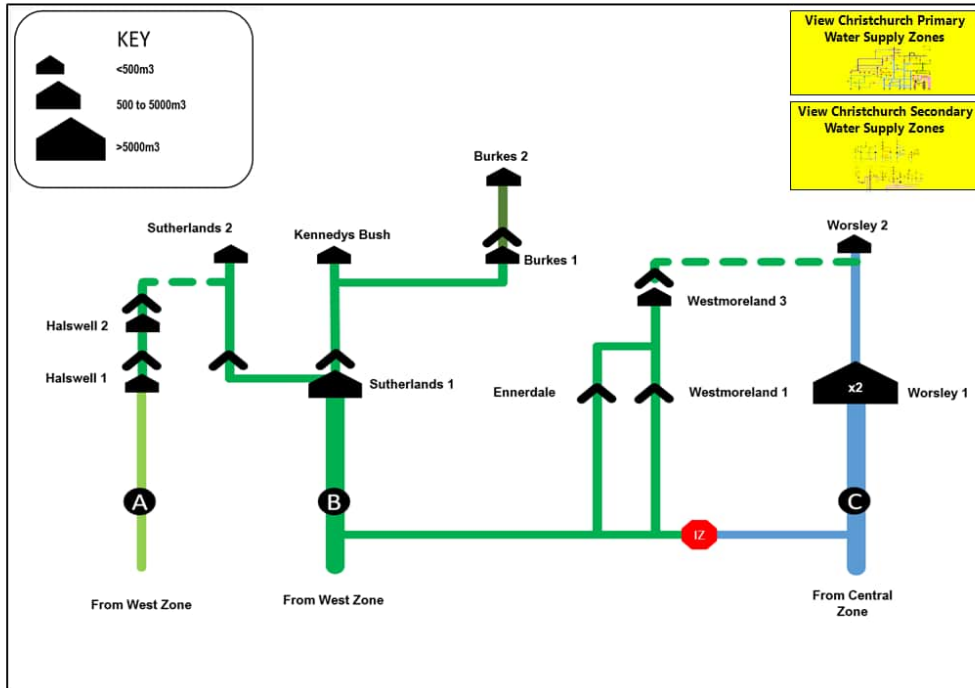
**Figure 6.9: Example of individual pump station reference information**

Information is also available on a separate schematic for water supply secondary zones (Figure 6.10). Water supply secondary zones include booster pumps and reservoirs. As with the water supply primary zones, the water supply secondary zones allow individual zones to be displayed (Figure 6.11). At the individual zone level, individual reservoirs can be selected and the relevant reference information, including the reservoir manual, maintenance and security assessment information (Figure 6.12). The reservoir manuals contain site-specific information on equipment, resource consents, operating notes and SCADA operation information.



**Figure 6.10: Water supply secondary zones schematic**

## Halswell-Worsley Zone



**Figure 6.11: Example of individual water supply secondary zone schematic**

## Sutherlands 1 Pump Station

[Back to Halswell-Worsley Zone](#)



### Pump Station Reference Doc's

✓ Title	TRIM
Reservoir Manual	<a href="#">trim://19/1299644</a>
Design & Construction	<a href="#">trim://FOLDER16/1240</a>
Maintenance	<a href="#">trim://FOLDER14/694</a>
Site Security Inspection	<a href="#">trim://20/398244</a>

**Figure 6.12: Example of specific reservoir information in the water supply secondary zones**

The 'Performance' webpage (Figure 6.13) contains the shortcuts to the Network Controllers shift logs (Figure 6.14). This version on Sharepoint removes the need for spreadsheet-based records. A procedures manual has been developed to support this change ([TRIM://20/719794](#)). The shift logs are a record of events that have occurred during a network controller's shift and a record of the actions taken. These logs are visible to the Network Operations and Instrumentation, Electrical and Control teams. The shift logs can be displayed day by day, for the last seven days, or filtered by person, date, or specific system (for example, "potable" designation will provide all logs for the potable water system). Shift logs of the previous 24 hours are emailed

out to all members of the Network Operations and Instrumentation, Electrical and Control teams. In addition, shift logs attach directly to the relevant pump station (Figure 6.15).

### Performance



**Figure 6.13: Performance webpage with shortcuts to the daily shift log information**



**Figure 6.14: Sharepoint daily shift log page**

- Home
- Plant
  - CHCH Primary Water Supply Zone
  - CHCH Secondary Water Supply Zone
  - Waste Water
  - Storm Water
  - Landfill Gas
  - Tsunami Warning System
  - Banks Peninsula Network
- People
  - Team Members
  - Leave Planners
  - Collective Employment Agreement
- Process
  - Triggers & Action Response Plans
  - Permit to Work
- Performance
  - Daily Shift Log - New Item
  - Daily Shift Log - All Items
  - Shift Log How To Videos
  - Plan
  - Recent**
  - NewDailyShiftLogs
  - Network Operations Induction
  - Site Contents

## Main Pump Station

[Back to Central Zone](#)



### Pump Station Reference Doc's

✓ Title	TRIM
Site Specific Risk Management plan	trim://19/406569
Pump Station Manual	trim://19/1155940
Process & Instrumentation	trim://17/826002
Process & Instrumentation	trim://19/67104
Resource Consents - to take water (global)	trim://18/1160425
O&M manual 1	trim://15/1160081
O&M manual 2	trim://15/1160010
Design & Construction	trim://FOLDER16/1136
✓ Maintenance	trim://FOLDER14/590
Site Security Inspection	trim://20/398244
UV Disinfectant 1	trim://FOLDER19/1144
UV Disinfectant 2	trim://FOLDER19/1145

### Daily Shift Logs

Created	ID#	Designation	Commentary Summary	Action Taken Summary	CCCCcontact	Party/Notified	Created By
8/07/2020 12:35 p.m.	286	Main Pumps	WP6 run for sampling only.	0			Mallett, Chris
7/07/2020 7:30 a.m.	270	Main Pumps	Pump 3 Fault	Call CCL to investigate			West, Bruce
6/07/2020 11:48 a.m.	261	Main Pumps	Well 5 main pumps back in service, cleared for use	0			West, Bruce
5/07/2020 9:26 a.m.	242	Main Pumps	P3 tripped on overload	CCL Electrician called out (Tony S) to investigate		City Care Elec On Call	Kerr, Murray
1/07/2020 6:55 p.m.	216	Main Pumps	only run well pumps 5 & 6 for testing till further	I've put an information tab on both wells 5&6 put	Baker, Ian	Gijs Hovens	Fraser, Grant
15/06/2020 7:07 p.m.	67	Main Pumps	intruder alarm civil defence were doing a fire dr	CCL called to attend		City Care Mech On Call	Fraser, Grant
12/06/2020 9:32 a.m.	53	Main Pumps	Heritage pump positive break undertaken at main pu	0			Hovens, Gijs

**Figure 6.15: Daily shift log information attached to individual pump stations (only available to network controllers)**

### 6.1.3 System maintenance

The maintenance of the Christchurch water supply is outsourced under contract to Citycare Water. The responsibilities of both Council and the Contractor are detailed in the management contract and they are also outlined in the Water Supply Asset Management Plan. The Council's service contract lists the day to day requirements for safe maintenance of the water supply. All relevant documents are stored in TRIM folder: [TRIM://CN4600000778](https://trim.govt.nz/trim/19/4600000778).

A separate Contract Management Plan (CMP) has been prepared by Citycare Water to describe processes that have been specifically developed for the Christchurch City Council Maintenance of City Water and Wastewater Network Contract, as well as signposting Citycare Water's normal business processes under which the contract will be delivered. The document is stored in TRIM: [19/458749](https://trim.govt.nz/trim/19/458749). This plan covers the Christchurch City Council Maintenance of City Water and Wastewater Network Contract which includes the urban Christchurch and Lyttelton Harbour water supplies.

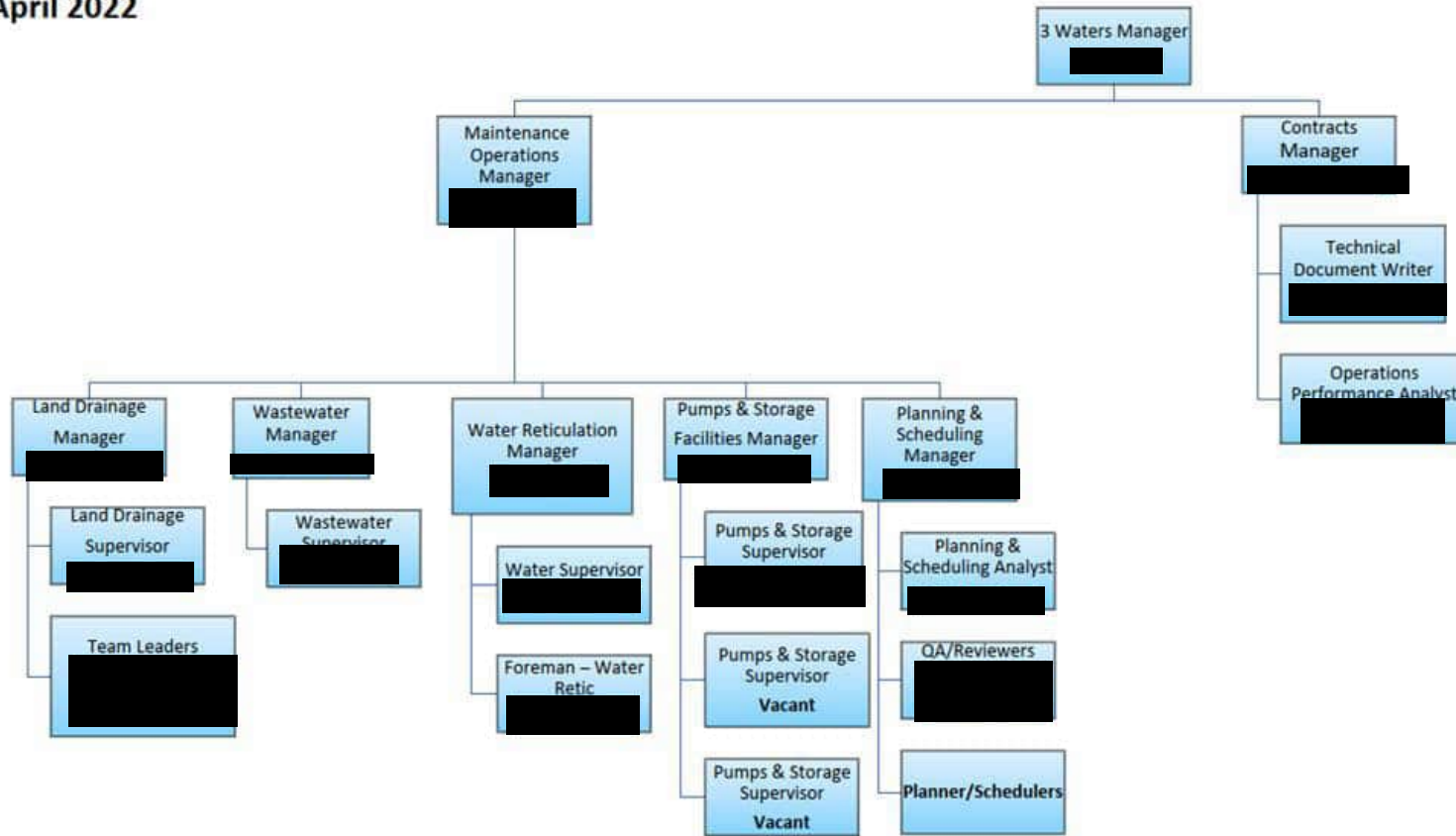
This plan has been prepared to address all contract requirement of the Council and to meet the management needs of Citycare Water. The plan is reviewed annually to ensure it is kept up to date.

Key service requirements are:

- Be an outstanding service provider of quality Water and Wastewater Services and meet the client's expectations of quality, cost and service
- Reduce the costs of the service to the Christchurch City Council
- Achieve a quality and level of service higher than that which existed prior to the commencement of this contract
- Be (and be seen to be) innovative
- Obtain measurable outcomes
- Support Christchurch City Council's operations and enable future growth.

Citycare, together with the Council, is also responsible for monitoring the water supply and for ensuring that there is a rapid response to contamination identified within the network. The organisation chart for Citycare Water operations team is shown in Figure 6.16.

**Citycare Christchurch 3 Waters Maintenance Team**  
**19 April 2022**



**Figure 6.16: Citycare Water Supply Operations Structure n**



## 6.2 Banks Peninsula

### 6.2.1 System management

The operation of the Banks Peninsula Water Treatment Plants (including source management) is managed by Council through a dedicated Water and Wastewater Banks Peninsula team under the leadership of the Manager Operations. The operation and maintenance of the water distribution system and downstream reservoirs is outsourced under contract to Citycare Water. The responsibilities of both the Council and the Contractor are detailed in the maintenance contract and they are outlined in the Water Supply Asset Management Plan. The Council's service contract lists the day to day requirements for safe operation and maintenance of the water supply. All relevant documents are stored in TRIM folder: [TRIM://CN460000778](#).

A separate Contract Management Plan (CMP) has been prepared by Citycare to describe processes that have been specifically developed for the Christchurch City Council Maintenance of City Water and Wastewater Network Contract, as well as signposting Citycare's normal business processes under which the contract will be delivered. The document is stored in TRIM: [19/458749](#).

This plan was prepared to address all contract requirements of the Council and to meet the management needs of Citycare. The plan is reviewed annually to ensure it is kept up to date.

Key service requirements to be met are:

- Be an outstanding service provider of quality Water and Wastewater Services and meet the client's expectations of quality, cost and service
- Reduce the costs of the service to the Christchurch City Council
- Achieve a quality and level of service higher than that which existed prior to the commencement of this contract
- Be (and be seen to be) innovative
- Obtain measurable outcomes
- Support Christchurch City Council's operations and enable future growth.



## 6.3 Operational and maintenance staff training

Key Council staff and Citycare Water staff hold various qualifications that include but not limited to:

- National Diploma in Drinking Water Level 5 – Water Treatment
- National Certificate in Water Reticulation (Service Person) – Level 4
- National Diploma in Water Treatment (Drinking Water Assessor)
- National Certificate in Water Treatment or National Certificate in Reticulation (Planned and Preventative Maintenance – Level 3 for Technicians)
- Bachelor of Engineering degrees in Mechanical, Civil, Natural Resources and Environmental Engineering
- Chartered Professional Engineer accreditation.

In addition to the above specific qualifications, operational staff receive formal (via a training provider such as WSP) and informal training (via product suppliers) on matters such as:

- Maintenance of filters
- UV system monitoring and maintenance
- Calibration of equipment
- Operational commissioning
- Drinking water sampling
- Use of SCADA
- Laboratory systems and processes
- Use of Drinking Water Online.

Training records for each employee are stored in Council and Citycare Water's respective human resources record system. Qualification certificates for the key Citycare staff are stored in TRIM [20/1128593](#). The training records for the Council's Three Waters Operations teams are stored in TRIM [12/282284](#).

Citycare Water's normal process is for a competent person or trainer to provide formal training and then undertake a competency check and sign off the person. This is repeated at a set time to ensure the person remains competent. If deemed appropriate, a job shadowing process is used.

Council staff are also encouraged to develop a training plan, which outlines the wants and needs in respect to training relevant to individual job responsibilities. For network controllers, their induction consists of 3 to 6 months training with an experienced network controller. The trainer then decides when the network controller is ready to operate.

## 6.4 Operations and maintenance manual and contractor's plan

Operations and maintenance manuals for each of the water supplies are included in the supply-specific water safety plans.

For the Christchurch/Lyttelton water supply, the manuals help to:

- Understand the operation and maintenance of the pump station as a whole and the various components that make up the system
- Specify how equipment should function as designed

- Specify how equipment should be operated and maintained
- Provide guidance on the functional and process control software.

These plans include:

- Scope of service
- Notifiable events
- Location of sites and quick reference guides
- Standard operating procedures
- Key contacts
- Sample check sheets with notes for accurate completion of the check sheet.

In addition, some pump stations have site specific Contractor's Plans. Rounds check sheets are used by Citycare to ensure there is consistency in inspections across the water supply network. Copies of Citycare's check sheets are stored in TRIM [19/1039731](#).

For Banks Peninsula supplies, the Contractor's Plans outlines the methodologies and resources that Citycare Water use to operate and maintain the water treatment plants. The plan covers:

- Resource consent information
- Treatment process flow chart
- Monitoring and reporting
- Site management
- Associated operational procedures.

Procedures aim to protect human health, assets, and the environment while minimising disruption of the water supply to the community. Rounds checksheets are used by Citycare to ensure there is consistency in inspections across the water supply network.

The Operations and Maintenance Manuals and the Contractor's Plan interact with each other yet have a slightly different focus. The Operations and Maintenance Manual is a comprehensive document that provides all the details necessary about the pump station as well as individual pieces of equipment to help the maintenance staff keep everything running smoothly. The Contractor's Plan has been traditionally written by Council's nominated maintenance contractor Citycare Water and builds on the Maintenance Manuals, adding much more detail on maintenance schedules and procedures that are unique to the supply and the maintenance contract deliverables.

A new contract is planned to roll out from 1st July, this has been written jointly with Citycare Water and Council staff both heavily involved. The new contract will have much greater clarity of the work required along with greater visibility of work completed against Council assets through exception reporting (Power Bi dashboards) and systemised scoring that is shared "live" with the Contractor. This will ensure an open and transparent recording of performance against performance criteria.

The contractor's plan is reviewed annually. These reviews are focused on ensuring there is alignment with the water safety plans and their implementation as well as ensuring an assets maintenance lifecycle is optimised.

The Council holds a water supply network operations, planning and improvement coordination meeting fortnightly. Water safety plans are a standing agenda item. Meeting minutes are in TRIM: [FOLDER09/2180](#).

## 6.5 Standard operating procedures

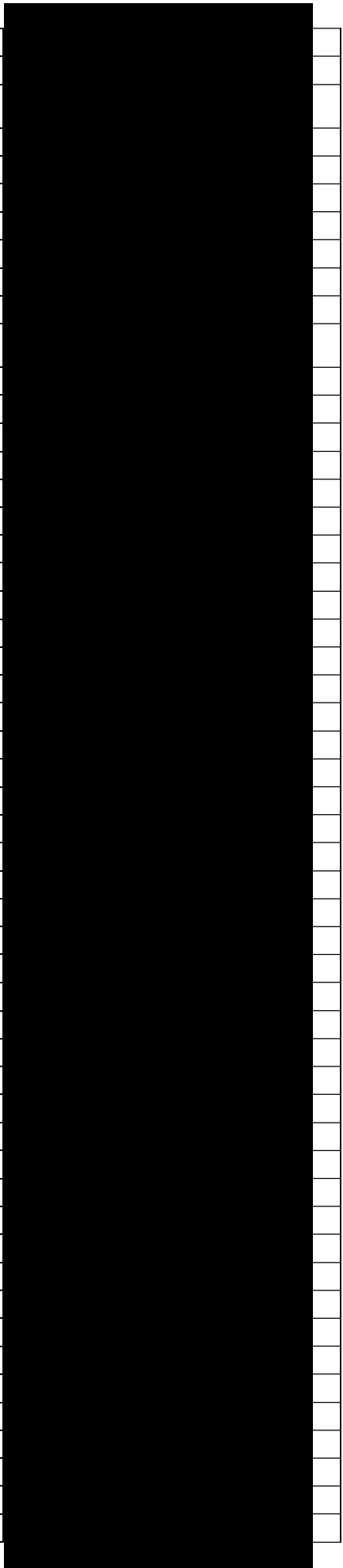
Citycare Water has developed and maintains comprehensive standard operating procedures which apply to all aspects of water supply operations and maintenance. These procedures are listed in Table 6.1 Where there is a specific water supply stated this is due to instrumentation/processes specific to that water supply rather than general application.

**Table 6.1: Citycare Water Standard Operating Procedures**

Name	Issue Date	Document Owner
Access System Maintenance.docx	12/09/2019	
Accessing Rounds in Mem-Tab.docx	20/07/2020	
AC-ROV 100 Internal Tank Inspections.docx	4/10/2019	
AC-ROV 100 Maintenance and On-site Checks.docx	4/10/2019	
AC-ROV 100 Reviewing – Silt Levels and Internal Condition Inspection.docx	8/10/2019	
Air Valve Cleaning and Flushing.docx	12/09/2019	
Alarm and Controls Testing.docx	12/09/2019	
Anchor Point Certification.docx	12/09/2019	
Application of Herbicides.docx	26/03/2021	
As Built Survey Responsibilities.docx	1/08/2015	
Asbestos Cement Pipe Handling.docx	15/10/2018	
Asbestos in Soil.docx	30/04/2021	
Asset Condition Grading.docx	12/09/2019	
Asset Data Validation and New Asset Pickup.docx	12/09/2019	
Backflow Prevention Device and RPZ Maintenance.docx	24/02/2020	
Backwash Tank Maintenance.docx	31/07/2019	
Bolted Joints.docx	24/01/2018	
Bore and Wellhead Inspection and Maintenance (Minor).docx	12/09/2019	
Bore and Wellhead Maintenance (Major).docx	12/09/2019	
Bulk Loading Assets to Rounds.docx	22/06/2020	
Building Clean.docx	12/09/2019	
CCTV As Built Survey.docx	5/07/2018	
CCTV Auditing RN Interrogation.docx	5/07/2018	
CCTV Field Reviewing.docx	5/07/2018	
CCTV Health, Safety and Environmental Monthly Reporting.docx	5/07/2018	
CCTV Incident Reporting.docx	5/07/2018	
CCTV KPI Status Definitions.docx	5/07/2018	
CCTV Lateral Inspections.docx	5/07/2018	
CCTV Loading Assets.docx	5/07/2018	
CCTV Loading Job Request RNs.docx	5/07/2018	
CCTV Loading Jobs in CEM_CAM.docx	5/07/2018	
CCTV Loading Manhole Uncovers_Locates.docx	5/07/2018	
CCTV Management of ACM Packages.docx	5/07/2018	
CCTV Managing Media.docx	5/07/2018	
CCTV Managing Noise.docx	5/07/2018	
CCTV Managing Reports and Deliverables.docx	5/07/2018	
CCTV Pole Camera Review.docx	27/07/2020	
CCTV Resident Consultation.docx	5/07/2018	
CCTV Resurvey_Reburn Process.docx	5/07/2018	
CCTV Review Scoping.docx	5/07/2018	
CCTV Reviewing.docx	5/07/2018	
CCTV Root Investigations.docx	5/07/2018	
CCTV Scoping of Works.docx	5/07/2018	
CCTV Survey In-House Reviewing.docx	5/07/2018	
CCTV Survey Inspection.docx	5/07/2018	
CCTV Work in Rail Corridors.docx	5/07/2018	
CCTV Works - Incident Reporting.docx	1/08/2015	
CCTV Works - Managing Residents at Night.docx	25/01/2018	
CCTV Works - Plant Audits.docx	25/01/2018	
CEM – Completing a Round.docx	25/01/2018	
Check and Maintain Diesel Tank Levels.docx	5/02/2021	
Chemwatch.docx	25/01/2018	
Chlorinating Water Pipelines.docx	25/01/2018	
Chlorinating Water Pipes.docx	4/07/2018	
Chlorine Dosing Pump Maintenance.docx	31/07/2019	
Chlorine Machine Maintenance.docx	12/09/2019	
Clear Blocked Pump.docx	12/09/2019	
Construct Inspection Chambers-Sumps.docx	29/01/2018	
Contaminated Land Management.docx	30/04/2021	
Contract Work Reactive.docx	29/01/2018	

Coronavirus – Residential Site Visits.docx	3/04/2020
COVID Omicron Phase 3 Case Management.docx	24/04/2018
COVID-19 Level 2 Field Staff SOP - Water.docx	8/09/2021
COVID-19 Level 3 Field Staff SOP - Water.docx	31/08/2021
COVID-19 Level 4 Field Staff SOP - Water.docx	24/08/2021
Crane Certification.docx	12/09/2019
Crane Maintenance.docx	12/09/2019
Creating and Loading Rounds.docx	27/07/2020
Creating DCAR Reports.docx	27/07/2020
Creating Water BCTI Invoices.docx	18/05/2020
Critical Risk - Energy Sources (Electricity and Overhead Lines).docx	31/10/2018
Critical Risk - Hazardous Substances Management.docx	28/10/2020
Critical Risk - Lifting Operations.docx	2/09/2019
Critical Risk - Live Traffic.docx	21/12/2017
Critical Risk - Mobile Plant.docx	2/09/2019
Critical Risk - Powered Plant and Equipment.docx	2/09/2019
Critical Risk - Working at Height.docx	13/10/2020
Critical Risk Standard - Powered Cutting Equipment - Angle Grinders.docx	8/03/2022
Critical Risks - Confined Spaces.docx	24/08/2020
Critical Risks - Excavations and Trenches.docx	26/11/2018
Cutting Pipes.docx	1/08/2015
Dewatering Management.docx	1/08/2015
Dewatering.docx	1/08/2015
Disinfection of Water Repairs - Type A (Less than 3m).docx	26/08/2019
Disinfection of Water Repairs - Type B (Up to 24m).docx	26/08/2019
Door and Window Maintenance.docx	12/09/2019
Dosing of Chlorine in Reservoir and Suction Tanks.docx	4/07/2018
Download Software Settings.docx	12/09/2019
Drawing Water from City Council Fire Hydrant.docx	1/08/2015
Dunedin City Council Drinking Water Reservoir Cleaning.docx	20/07/2020
Dust Management.docx	1/08/2015
Electrical Check (Minor).docx	12/09/2019
Electrical Check.docx	12/09/2019
Electro Fusion.docx	29/01/2018
EMS for Emergency Spills.docx	30/08/2018
Environmental Management Practices - Daily Work Activities.docx	9/11/2017
Fences, Walls and Retaining Walls Maintenance.docx	12/09/2019
Field Testing Backflow Devices.docx	20/05/2020
Fire Extinguisher Maintenance.docx	12/09/2019
Fire Hydrant and Sluice Valve Maintenance.docx	4/07/2018
Flow Meter Calibration for Compliance.docx	12/09/2019
Generator Maintenance (Minor).docx	12/09/2019
Gethomesafe Alert Response Protocol - Citycare Water.docx	6/07/2020
Graffiti Removal.docx	12/09/2019
Ground, Mowing and Gardening.docx	12/09/2019
Hand-Held Concrete Saw Operation.docx	15/01/2020
Hazardous Substances Management - Managing Spills.docx	18/09/2017
Hazardous Substances Management.docx	1/08/2015
Health and Safety Risk Management Flowchart.docx	18/08/2020
Hydrants Attendance - Flow and Pressure Testing.docx	1/08/2015
Hydrants Attendance - Painting and Checking.docx	1/08/2015
Hydrants Attendance - Pressure Testing After Pipe Burst.docx	1/08/2015
Hydrants Attendance - Water Quality Flush.docx	1/08/2015

Inspection and Testing - QA Record Sheets.docx	1/08/2015
Inspection of Services.docx	1/08/2015
Inspections, Maintenance and Monitoring of Backwash Irrigation Systems - Birdlings Flat.docx	21/08/2019
Installing A Dead End.docx	1/08/2015
Installing Backflow Devices.docx	20/05/2020
Installing Fire Hydrants.docx	1/08/2015
Installing Water Fittings on Existing Pipelines.docx	1/08/2015
Instrument Calibration.docx	12/09/2019
Iron Bacteria Management - Birdlings Flat.docx	21/08/2019
Isolation and Lockout.docm	2/09/2019
Jetting and Combo (Jetting and Sucker Truck) Operations.docx	17/02/2021
Job Safety and Environmental Analysis (JSEA).docx	5/12/2017
Joint and Pipe Laying.docx	1/08/2015
Lifting Heavy Backflow Lids.docx	3/10/2019
Loading CCTV Jobs into CAM and CEM.docx	19/04/2018
Loading Manhole Uncovers, Locates.docx	19/04/2018
Location Services.docx	19/04/2018
Lock Maintenance.docx	12/09/2019
Logged Contract Events.docx	21/05/2020
M8 Testing.docx	4/07/2018
Maintaining Emergency Sawhorse.docx	12/09/2019
Management of ACM Packages.docx	19/04/2018
Management of Chlorine Solution.docx	4/07/2018
Manhole Fall Arrester Inspection and Maintenance.docx	19/04/2018
Manhole Locate, Expose, Raise.docx	19/04/2018
Manholes.docx	19/04/2018
Manifold Repair - Replace - Installation.docx	19/04/2018
Manual Collection of Run Hours.docx	5/02/2021
Maritime Responsibilities.docx	30/08/2018
Mechanical Bolt Type Couplings for HDPE.docx	19/04/2018
Mobile Generator Operation.docx	25/09/2019
Noise Management.docx	21/04/2018
On Site Health and Safety Interactions.docx	9/07/2018
Operating a Hand Sickle.docx	14/05/2015
Operating a Weed Torch.docx	21/04/2018
Operating Mobile Plant Near Waters Edge.docx	14/07/2021
Operating Plant On or In Water.docx	26/04/2018
Operation of a High Pressure Cleaner.docx	26/04/2018
Operation of a Petrol Powered Line Trimmer.docx	26/04/2018
Operation of a Spider Remote Controlled Mower .pdf	16/08/2021
Operation of a Stihl MM 55 Edger.docx	26/04/2018
Operation of All-Terrain Vehicles (ATVs).docx	1/10/2022
Operation of an Outfront Mower.docx	27/04/2018
Operation of Trailers.docx	27/04/2018
Operation of Truck Mounted Cranes.docx	27/04/2018
Overflow Valve Clearing.docx	12/09/2019
Overhead Services - Working Near.docx	26/11/2018
Paint External.docx	12/09/2019
Paint Internal.docx	12/09/2019
Paving Operation.docx	27/04/2018
Permit To Work System.docx	6/09/2018
Pinhole Repairs (Service Lines).docx	27/04/2018
Pipe Bursting.docx	27/04/2018



Pipe Capping.docx	27/04/2018
Pipe Laying - Water.docx	27/04/2018
Pipe Wrapping.docx	27/04/2018
Prepare Project Site Three Waters.docx	29/04/2018
Prevention of Contamination to Water Supply.docx	18/08/2020
Process of SWKCMP Through to Fbil on Contract Events.docx	11/06/2020
Project Environmental Management.docx	29/04/2018
Pump Faults.docx	30/04/2018
Pump Performance Testing (Water Supply).docx	12/09/2019
Pump Performance Testing.docx	12/09/2019
Pump Station Inspection - 6 Monthly.docx	30/04/2018
Pump Station Inspection - Inspection leading to pump removal.docx	30/04/2018
Pump Station Inspection - Monthly.docx	30/04/2018
Pump Station Inspection - Weekly.docx	30/04/2018
Quoted Work - Property.docx	13/02/2019
Raw Water Tank - Cleaning.docx	31/07/2019
Reactive Maintenance of Blocked Main.docx	30/04/2018
Removal and Replacement of a Valve or Hydrant.docx	30/04/2018
Repair - Replace Tapping Bands.docx	30/04/2018
Repair Hydrant or Valve.docx	30/04/2018
Repair Service Connection.docx	30/04/2018
Request for Bacteriological Testing.docx	4/07/2018
Reservoir Condition Assessment (Internal) and Clean.docx	12/09/2019
Reservoir Sand Inspection.docx	12/09/2019
Reservoir Water Security Inspection.docx	12/09/2019
Safe Handling of Chemicals at CDC Water Treatment Plants.docx	20/07/2020
Safe Handling of Chemicals at Treatment Plants.docx	4/07/2018
Sediment Control Management.docx	30/04/2018
Setting Up Levels for Pipework.docx	30/04/2018
Shoring - Timbering.docx	1/05/2018
Shutting off and Reinstating the Water Supply.docx	1/05/2018
Sign Maintenance.docx	12/09/2019
Small Plant Workshop.docx	1/05/2018
Standard Methodology for Reactive and Drainage Maintenance.docx	1/05/2018
Steam Cleaning - Water Blaster.docx	1/05/2018
Submersible Bore Pump Removal.docx	12/09/2019
Submersible Pump Inspection and Servicing (minor).docx	12/09/2019
Surface Box Maintenance.docx	5/02/2021
Surface Pump Inspection.docx	12/09/2019
Temporary Chlorination Operations Manual - Pigeon Bay.docx	15/10/2019
Testing Pipelines.docx	29/01/2018
Thermal Imaging.docx	12/09/2019
Toby Repairs.docx	1/05/2018
Toby Replacement.docx	1/05/2018
Treated Water Reservoir Inspection.docx	31/07/2019
Treated Water Reservoir Maintenance - Pigeon Bay.docx	21/08/2019
Trench Excavation.docx	2/05/2018
Trench Reinstatement.docx	2/05/2018
Tributary Maintenance.docx	30/08/2018
Under Pressure Tapping on Water Mains.docx	4/07/2018
Unplanned Emergency Water Shutoffs.docx	4/07/2018

Utility Clashes and Tomo Detection.docx	2/05/2018	
Valve or Hydrant Installation.docx	2/05/2018	
Valve or Hydrant Replacement.docx	2/05/2018	
Valve Shut Tagging and Recording.docx	21/03/2018	
Water - Duplicate Events.docx	18/05/2020	
Water Enhancements.docx	2/05/2018	
Water Maintenance Workflow Management.docx	4/07/2018	
Water Reservoir Lid Sealing.docx	4/07/2018	
Water Sampling with 24 hours 3700 Portable Sampler (Lead).docx	22/03/2021	
Water Stops.docx	2/05/2018	
Work Flow Management - Below Ground Wellheads.docx	9/12/2020	
Work Flow Management - Water Reservoir.docx	9/12/2020	
Working in Hydro Excavated Trenches, Shafts, Pits.docx	2/05/2018	
Workplace Fatigue.docx	1/11/2018	

## 6.6 Operational monitoring and inspection

The Citycare Contractor’s Plan (refer to section 6.4) outlines the operational monitoring and inspections for the Council’s water supplies.

Citycare uses electronic check sheets to perform routine monitoring and inspections. The data is uploaded into Citycare’s Event Manager and available to Council staff who have access to the system. Examples of completed checksheets are available in the site specific water safety plans.

Event Manager is Citycare’s own management tool. Everyone in Citycare has access to Event Manager, it is used to assign, manage all events and jobs. More information about Event Manager is available at <https://www.citycare.co.nz/capabilities/citycares-proprietary-technology-solution/>. The Council has access to certain parts of Citycare’s Event Manager. Standard operating procedures (SOPs) relating to Event Manager are in TRIM: [19/1074497](#).

DWSNZ and consent related sampling and monitoring data is stored in the WaterOutlook platform. All Water Outlook data is accessible to Council staff, Citycare staff and contractors with responsibilities for drinking water via password protected user accounts. User accounts can be limited to only the areas relevant to them. Details of the sampling, monitoring and reporting required of Citycare are outlined in Contractors Plan. Water take data, required by the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010, is transferred automatically to Environment Canterbury and they receive an annual report.

Table 6.2 outlines the responsibilities of the respective organisations for water sampling and monitoring sampling.

**Table 6.2: Water sampling and monitoring responsibilities**

<b>Drinking Water DWSNZ and Resource Consents</b>	<ul style="list-style-type: none"> <li>• CCC Laboratory staff sample plants per DWSNZ and resource consents</li> <li>• Laboratory test and forward results to CCC and Citycare</li> <li>• Citycare prepare consent reports and notifications for CCC</li> <li>• CCC liaise with Environment Canterbury and Taumata Arowai</li> </ul>
<b>Process Monitoring</b>	<ul style="list-style-type: none"> <li>• Citycare Water conduct additional sampling and monitoring as required</li> </ul>



## Maintenance Schedules

The Council has agreed levels of service with Citycare. To achieve these levels of service, Citycare have developed rounds that address planned activities. The rounds are reviewed as required and performance against the levels of service reviewed monthly as part of the performance appraisal for Citycare. Round information is available in Citycare's Event Manager. Schedules are generated in advance to enable them to be reviewed if required. An example of rounds forward planning TRIM: [19/1060232](#).

## Operational set points

Information on operational set points is contained in the supply-specific water safety plans.

## 6.7 Operational reporting

Operational issues detected by network controllers through the network SCADA are addressed by acknowledging the alarm fault and making changes to the network operations via SCADA or calling out the maintenance contractor to investigate the fault, depending on the fault type.

Water quality reporting occurs between laboratory staff and staff in the Three Waters & Waste Unit. Reporting of and response to contamination incidents is described in section 2.5.1.

Water take consent related sampling, monitoring, and reporting is reported via the WaterOutlook platform and transferred automatically to Environment Canterbury.

## 6.8 Maintenance reporting

Reporting from Citycare Water to the Council occurs via multiple pathways. Formal reporting includes:

- Monthly contract report
- Monthly consent reporting
- Sampling and testing reports from the Council laboratory
- Incident reporting (health and safety and any transgression type issues)
- Investigation reports (if required)
- Monthly treatment operations meeting
- Site specific alarms via SCADA
- Joint audits by the Council Operational Delivery Leader Reticulation & Maintenance and the Council, Team Leader Water and Wastewater Treatment

In addition, informal reporting is done via emails, phone conversations and joint site visits.

Maintenance activities are logged in Citycare Water's Event Manager and the Council has access to certain parts of this. Day to day activities are generally logged on the Treatment Plant Round electronic check sheets (Banks Peninsula) or on the water supply rounds check sheets (Christchurch/Lyttelton). Operational issues are generally reported by phone as soon as possible, followed by emails. If an incident occurs Citycare Water's Incident Reporting System is used, followed by investigations if required.

## 6.9 Critical control points

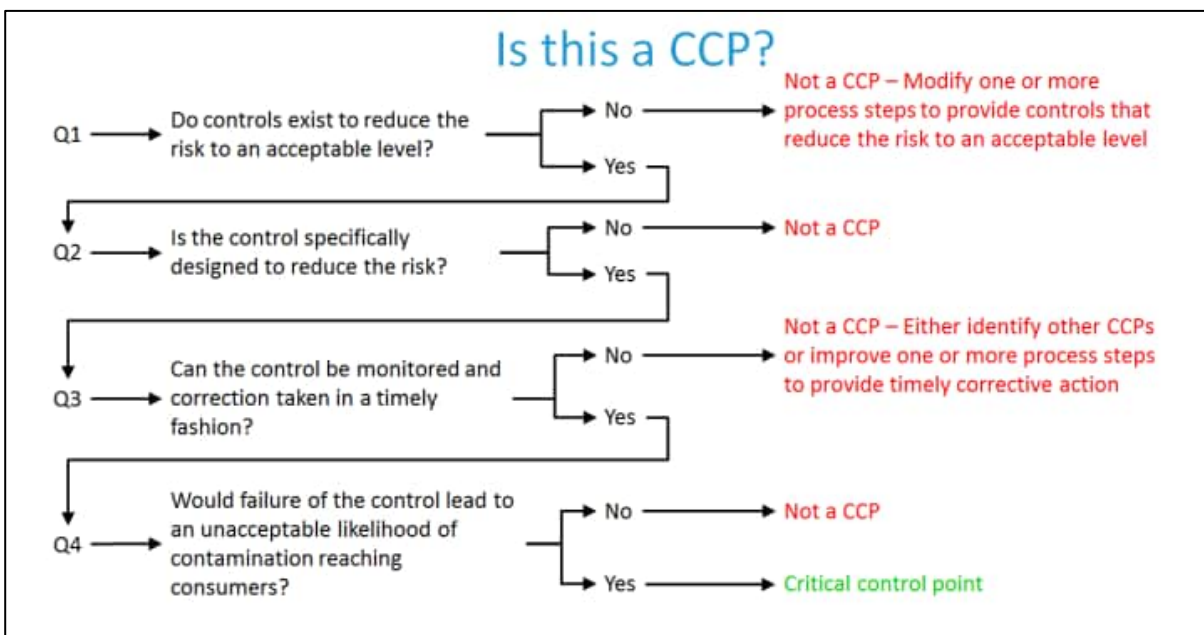
Control points whose functioning is essential for protecting the consumers from hazards are critical control points (CCPs). Critical control points formalise control over water supply elements that provide important

controls over hazards (contaminants). For a water supply element to be classifiable as a CCP, it needs to have the following attributes:

- a) at least one operational parameter that can be monitored to provide a check on the performance of the supply element
- b) at least one operational parameter that can be sampled, or read, frequently enough that suppliers can make a timely response to prevent harm to consumers in the event of loss of control at that CCP (monitoring should be continuous)
- c) performance limits can be set to show when optimum control is lost and corrective action needed
- d) corrective actions defined so that in the event of performance limits not being met the operator knows how to respond to the situation
- e) critical limits on the operational parameter(s) that if exceeded, because corrective actions have failed to regain control and maintain safe water, signal the need to shut down the supply (and/or initiate 'contingency plans').

Figure 6.17 outlines a decision tree to help determine whether or not a water supply element can be classified as a CCP.

Section 6.7 of the supply-specific water safety plans contain the critical control points for each supply.



**Figure 6.17: Decision tree for identifying critical control points**

## 6.10 Corrective actions

Corrective actions for parameters outside the normal operating ranges are outlined in the Critical Control Point sections of the supply-specific water safety plans.

# 7 Verification Monitoring Programme

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The effectiveness of the water safety plan is determined by verification monitoring, which assesses the drinking water quality at the point at which it is supplied to the consumer's property. The assessment makes use of water quality testing and consumer complaints. The latter provides an important source of information about the aesthetic properties of the water.

Verification monitoring provides another check on the effectiveness of the preventive measures, although the information it provides is retrospective.

## 7.1 Drinking water quality monitoring

The basis for assessing drinking-water quality in New Zealand is compliance with the Drinking-water Standards for New Zealand (DWSNZ). The DWSNZ specify monitoring requirements which are dependent on a water supply's size and treatment characteristics.

The responsibility for drinking water compliance sits with the Council's 3 Waters & Waste Quality & Compliance Team. There is a Service Level Agreement in place between the Quality & Compliance Team and the 3 Waters & Waste Laboratory Team which outlines roles and responsibilities with respect to drinking water compliance sampling. The agreement details staff responsibilities for:

- maintenance of the monitoring plan and the sampling schedule
- sample collection
- sample analysis
- collation, recording, assessment and reporting of results
- notification procedures for transgression events.

The agreement is updated at the beginning of each financial year. The FY 2020-21 version is stored in TRIM: [20/1046545](#).

Drinking water compliance sampling schedules are currently prepared using the Water Information New Zealand system (WINZ). While it is acknowledged that WINZ has been replaced by Drinking Water Online for the annual compliance survey process, Council staff felt that Drinking Water Online was not a reliable tool for preparing comprehensive drinking water compliance sampling schedules. WINZ continues to be used. All quarterly drinking water compliance sampling schedules are stored in TRIM folder: [FOLDER09/2233](#).

The 3 Waters & Waste Laboratory uses the QLims software for sample reporting. Data is exported from QLims and uploaded into Drinking Water Online for the annual drinking water compliance survey. With the change in water supply regulator from the Ministry of Health to Taumata Arowai on 15<sup>th</sup> November 2021 Drinking-Water On Line is no longer nationally used to assess drinking water compliance but will continue to be used by CCC if on a month by month contract.

## 7.2 Drinking Water Compliance Monitoring

WaterOutlook is a cloud-based system for data management and reporting. WaterOutlook is operating within approximately 60% of New Zealand local government and provides a high level of audit integrity. Council is using WaterOutlook as a reporting tool aggregating together electronic (typically SCADA) and manual data streams for compliance reporting purposes. Detailed information on compliance monitoring is provided in section 7 of the supply-specific water safety plans.

## 7.3 Performance monitoring

Council sets levels of service to measure its performance through its annual and long-term plans. Performance against these levels of service is reported in Council's Annual Reports. These levels of service are a component of Council's short term evaluation of results, outlined in section 7.5.

## 7.4 Consumer satisfaction

The Council has two methods of assessing consumer satisfaction: through the annual Residents General Service Satisfaction survey and through customer service requests.

### 7.4.1 Customer satisfaction

The Residents General Service Satisfaction survey's main focus is measurement of satisfaction with Council services and facilities. This includes general services that most or all residents in the city use (e.g. water supply, waste collection and roads). A representative sample of all residents aged 18 and over has been used to obtain resident satisfaction levels and compare them with the corresponding Level of Service performance measures and targets set out in the Long Term Plan. Residents are asked to rate their satisfaction with the reliability, responsiveness and quality of Council's water supply.

### 7.4.2 Customer Service Requests

Customer service requests deal with the more immediate and urgent consumer complaints relating to the water supply. Consumers are able to notify the Council of water problems at any time via:

- Council's call centre. This is the Council's main number and it is available in the White Pages or on the Council's website under 'Contact Us'. There is also a free call number for the Banks Peninsula area provided with the White Pages listing.
- Online via the 'report an issue' form available on both the Council's website homepage and water supply webpage. On the homepage, customers can click the link report and are taken to a page where they are asked what they want to report. 'Water problem' is the first option available. This same page is also accessible from the 'Water and Drainage' menu webpage as well as the 'Water supply' webpage as the first item available to customers.
- Visiting one of the Council's service centres during their open hours
- The *Snap Send Solve* smartphone app can be used by members of the public to report issues. The app works by identifying the location the photo is taken using the phone's GPS data and then sends an email to the Council from the user's email address, including the incident type, notes, address of incident, photo, and contact details. The reports are loaded into SAP Hybris (Council's customer service request platform) once received by the call centre and allocated to the relevant Council department. This app is primarily used to report water leaks by consumers.

### 7.4.3 Complaints

The Council has established procedures for handling consumer complaints. Customer Services representatives load the consumer enquiries and complaints into the Council's SAP Hybris system. This information is then received by the Team Leader Water Services to triage and action. As the Water Services Team receives requests for service that are often time critical, the procedure for actioning and responding to these requests has been outlined in the process document *Action Three Waters Customer Service Requests* to ensure consistency in the way complaints are dealt with.

In completing the form to send complaints or issues through to the Water Services Team, Customer Services representatives are prompted to input information as comprehensive as the consumer can provide, including:

- Name of caller

- Contact information (address and phone number)
- Problem that is occurring and description
- Priority - reviewed by staff in the 3 Waters and Waste unit once the job has come through Hybris
- Follow-up action requested by customer making the complaint.

Customer complaints are recorded against the Council's key performance indicators (KPIs) for water supply. These are:

- Pressure/low flow
- Clarity
- Odour
- Taste.

## 7.5 Short-term evaluation of results

SAP Hybris reports have been developed make short-term evaluation of results available to a wider range of 3 Waters & Waste staff. While this information is currently only available to be viewed by staff with a Hybris login, reports are available in TRIM [FOLDER09/2233](#) and accessible to all 3 Waters staff and updated monthly for reporting. The information for the 2020-2021 financial year is in TRIM [20/1130306](#).

As described in section 1.1.5, the Council sets levels of service through its Long Term Plan and Annual Plan process. For water supply this includes the mandatory non-financial performance measures required by the Department of Internal Affairs for DWSNZ bacterial and protozoal compliance, leakage, fault response times and customer complaints. In addition, there are levels of service for customer satisfaction, the volume of water abstracted, compliance with resource consents and electricity consumption.

The Council's levels of service for fault response time are reflective of the KPIs in the maintenance contract with Citycare. For some jobs, this requires Citycare to respond to jobs within specified timeframes. For example, water leaks in zone 1 have a 1 hour response time and a 2 hour response time in zone 2. Zone 1 covers Christchurch City and the Lyttelton Harbour Basin, zone 2 covers the Banks Peninsula area beyond the Lyttelton Harbour Basin. Achievement against these KPIs is recorded in the job information and response through the Hybris system.

Performance against the Council's agreed levels of service in the Annual Plan are reported monthly via reports provided through the Council's PDP (Plan Develop Perform) system. This includes an explanation about any levels of service that are at risk of not being met. This report is provided to the Council's Finance and Performance Committee. The agendas and minutes of these meetings are available on the Council's website<sup>16</sup>.

The Council's Annual Report<sup>17</sup> reports on performance against its levels of service, financial expenditure against its budget, what work it has completed in the past year and what work it plans to undertake in the next year.

This review of performance against levels of service is used to review those levels of service through the Annual Plan and Long Term Plan process, including whether the budget required to meet those levels of service is sufficient.

Water safety plan actions and associated issues and non-conformance are discussed at the bi-monthly Water Supply Network Operations, Planning and Improvement Coordination meetings which are attended by staff

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<sup>16</sup> <https://ccc.govt.nz/the-council/meetings-agendas-and-minutes>

<sup>17</sup> <https://ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/plans/annualreport>

from Three Waters Network Operations, Asset Planning, Asset Management, Quality & Compliance and Water & Wastewater Operations teams. These meetings scope is to:

- identify issues with respect to potable water supply services – that needs to be resolved through the planning and improvement processes,
- obtain feedback on key planning and asset management activities which may impact the delivery of a reliable and safe drinking water
- provide a platform for joint decisions and recommendations in pursuit of faster and improved resolutions

They also provide an opportunity to consider any incidents, operational procedures or risks that may need to be addressed and updated in the water safety plans.

Bimonthly Three Waters & Waste reports provided to the Council's Three Waters, Infrastructure and Environment Committee include information on drinking water quality monitoring, DWSNZ compliance, water safety plan compliance, information about ongoing capital works, and other operational matters. The reports are prepared by Council staff and provide elected members the opportunity to evaluate and ask questions regarding the performance of the water supply programme. The agendas and minutes of these meetings are available on the Council's website<sup>18</sup>.

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<sup>18</sup> <https://ccc.govt.nz/the-council/meetings-agendas-and-minutes>

# 8 Management of Incidents and Emergencies

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## 8.1 Previous incidents and emergencies

The review of previous incidents and emergencies assists with identifying the types of incidents and emergencies that may occur, and the impact that they are likely to have on the water supply. Information on previous incidents and emergencies is provided in section 8 of the supply-specific water safety plans.

## 8.2 Incident and emergency response plan

The Council has developed contingency plans to manage incidents and emergencies in relation to water supply.

The Council's standard procedures and contingency plans for water supply are in Promapp and are listed in Table 8.1. They are stored in TRIM: [20/1130688](#) and [19/456790](#) (index). These procedures are common across all Council water supplies.

All procedures are currently being updated and transferred into Council's process mapping system Promapp (<https://go.promapp.com/ccc>). These processes and procedures are developed alongside and supplied to contractors with responsibilities associated with the Council's water supply network. The level of emergency is determined for each event. Points are identified throughout the procedure mapping where escalation of the event is considered taking into account the type of event, the magnitude, population affected and estimated response time to remedy water supply issue. Relevant staff are automatically notified of updates to procedures in Promapp.

Responses to incidents and emergencies are immediately triggered by notification of an event or service disruption. Incident responses are primarily managed through the procedures contained in Promapp. However, if the scale of the incident escalates, there are opportunities identified for increasing the level of management and coordination required to respond.

Section 2.5.1 outlines the Promapp process for responding to a water quality incident (*Respond to Drinking Water Contamination*, Figure 2.7). This process includes a trigger process for assessment of an event to determine whether it is 'significant' and needs to escalate to process *Respond to Significant (Unplanned) Event (City Services)*. also includes an incident review with all parties involved in the response and a review of the response process. Significant events are investigated as part of. *A Request a Boil Water Emergency Mobile Alert* is incorporated into and *Inform Public about Water Contamination Event*, outlining the requirements for using the emergency mobile alert system.

For incidents and emergencies where there is significant impacts on water supply, treatment and distribution, Business Continuity Plans have been developed to cover the staff roles and responsibilities to enable the business to keep operating should key risks to the city's water supply eventuate. The Business Continuity Plans are designed to enable services to recover quickly post a disaster or major incident and enable the restoration of essential services as quickly as possible. The decision making process for invoking Business Continuity Plans is shown in Figure 8.1 and the business continuity procedures relevant to water supply are listed in Table 8.1.

The Council's Three Waters & Waste Unit uses these Business Continuity Plans as part of Civil Defence exercises and have a training programme in place to regularly test elements of the units Business Continuity Plan. A record of all exercises is taken with lessons learned and areas for improvement. These exercise reports are stored in TRIM document management system (TRIM: [FOLDER09/2593](#) and [FOLDER13/205](#)). Separate folders are also created in TRIM for events. Recent examples of events the Council have been involved in

include Flooding July 2017 ([FOLDER16/2069](#)), Tropical Cyclone Gita ([FOLDER17/5341](#)), Port Hills Fire ([FOLDER16/120](#)) and Coronavirus COVID-19 ([FOLDER20/89](#)).

The Council participates in regular Civil Defence exercises. Exercising procedures in the Three Waters & Waste Business Continuity Plan are not be seen as replacing the need for Civil Defence and Emergency Management exercises, rather they are complementary to such exercises. Some incidents covered in the Three Waters & Waste Business Continuity Plan will not trigger a Civil Defence and Emergency Management response but could have significant impact on the business. The emergency procedures relevant to this Water Safety Plan are listed in Table 8.2 and the Business Continuity Plan is stored in TRIM: [18/9624](#) and [18/67443](#) (index).

The Council has a training programme in place to test staff responses to incidents. The most recent training on 9 and 16 July 2020 was focused on transgression training – responding to drinking water contamination. Records relating to incident training are found in TRIM: [FOLDER20/894](#).

The communication of, and training in Business Continuity Procedures is an essential part of improving business resilience and improving the recovery of an organisation post disaster or major incident. To this end all key stakeholders in these procedures are regularly drilled in their operation and the procedures are reviewed annually and tuned to recognise changes in:

- Levels of service
- Changes in assets and procedures in 3 Waters or other Council Units interrelated with 3 Waters
- Personnel
- Legislation
- Lessons learned from exercises, actual incidents and disasters.

Potential incidents and emergencies and the existing preventative measures to address them are identified in section 3.4 (plausible combinations of hazards) of the supply-specific water safety plans.





## 8.3 Index of procedural documents

**Table 8.1: Procedural Documents and Reference Links**

Procedure
Respond to Significant (unplanned) Event (City Services)
Review, Update and Notify Changes to Renal Dialysis List
Undertake Flow Test
Manage Major Loss of Water Supply
Emergency Response to Burst Pipes
Undertake Planned Backflow Assessments
Inform Public about Water Contamination
Implement Water Supply Restrictions for Christchurch City
Implement Water Supply Restrictions for Banks Peninsula
Manage Burst Water Main or Leak on Private Property
Create Repair Requests for Residential Water Meters
Create Vegetation/Foliage Letter for Residential Water Meters
Manage Planned Water Shut Off
Respond to Drinking Water Contamination
Process New Water Connection Application (Service Centre)
Manage Hydrant Standpipe Compliance, Restrictor & Water Meter Tampering
Undertake Unplanned Emergency Water Supply Shut Off
Process Significant Damage Claim
Generate Significant Damage Summary Report
Ensure Compliance of Drinking Water Sampling
Action a new standard water connection (non-consent)
Create Water Meter Equipment Number
Replace Water Meter in SAP
Decommission Water Meter in SAP
Process Ended Parcel of Land for Water Meters
Bring Below Ground Well Head Back Online - unplanned
Process Network Operations Permit To Work Request
Respond to Security Alarm at Potable Water Supply Site
Respond to Alarm indicating Potential Flooding of Station
Monitor Access to Council Water, Stormwater & Wastewater Stations
Raise Alert re: Test Showing Drinking Water Contamination
Assess Risk of Drinking water Contamination
Replacement of a Suspected Seized Water Meter
Manage water leaks on private property
Manage water supply leaks on multiple private properties
Alignment of water meters to properties
Requesting Invoice for Monthly Claim of Hydrant Standpipe Contract
Pump Station Power Outage
Fuel spill
Determine Enforcement Action Required
Plan acceptance prior to construction for 3 Waters
Request a Boil Water Emergency Mobile Alert <sup>#</sup>

*Note: Not all processes have been reviewed and finalised; ongoing reviews and updates will take place at scheduled 2 yearly intervals or after a major incident.*

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**Table 8.2: Three Waters and Waste business continuity procedures related to water supply**

Section		Procedure
Storm Water and Land Drainage		SCADA and/or Telemetry Failure (3 Waters)
		Major Power Failure (3 Waters and >4 hours)
		Loss of Manpower (3 Waters Pandemic, Lack of Market Resource etc.)
Water Supply and Treatment Activity		Aquifer Contamination
		Medium to Long Term Degradation of Aquifers
		Physical Terrorist Attack on Assets (3 Waters)
		Cyber Attack on 3 Waters PLC, SCADA and IT Systems
		Earthquake (3 Waters)
		Water Demand exceeds Consent Water Take
	Water Supply Treatment Plant Process Failure	

*Note: Not all processes have been finalised as part of the Council's ongoing reviews and updates.*

## 8.4 Levels of emergency

To ensure there is a consistent understanding of the hazard threat level, emergency level descriptors have been developed to define and assign a level of emergency to each type of possible incident/emergency (see Table 8.3: Consequence Rating Scale Applied to Hazardous Events, which integrates the levels of emergency in with the risk level responses). The emergency level descriptors are incorporated into the Promapp procedural documents to assist staff to determine the range of emergency levels that may apply, which will depend on the specific event.

Internal training is being undertaken to ensure that all staff are immediately aware of the seriousness of an incident /emergency situation and the response required.

# 9 Documenting and Reporting

## 9.1 Management of documentation and records

As a local government organisation the Council is subject to the requirements of the Public Records Act 2005, so adherence to this policy by all Council staff and functions is mandatory. The Council must maintain full and accurate records of its affairs, and these records must be accessible for subsequent reference until their disposal is authorised. External contractors, consultants and service providers creating and processing information on behalf of the Council must adhere to the Council's records management policy and associated procedures also. The Council's Records Management Policy is found in TRIM [17/991692](#).

The Council uses the TRIM (Content Manager) system as its primary document management system. Each water supply asset and facility has its own functional location where relevant documents and information is stored in accordance with the Council's records and document management policy. TRIM uses a three level structure to manage and store documents (Figure 9.1). Documents in TRIM are stored in classifications based on Council functions rather than Council units, teams or locations (Figure 9.2). Version control boxes are included at the start of key documents, such as water safety plans.

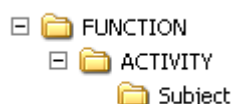


Figure 9.1: TRIM Three level structure

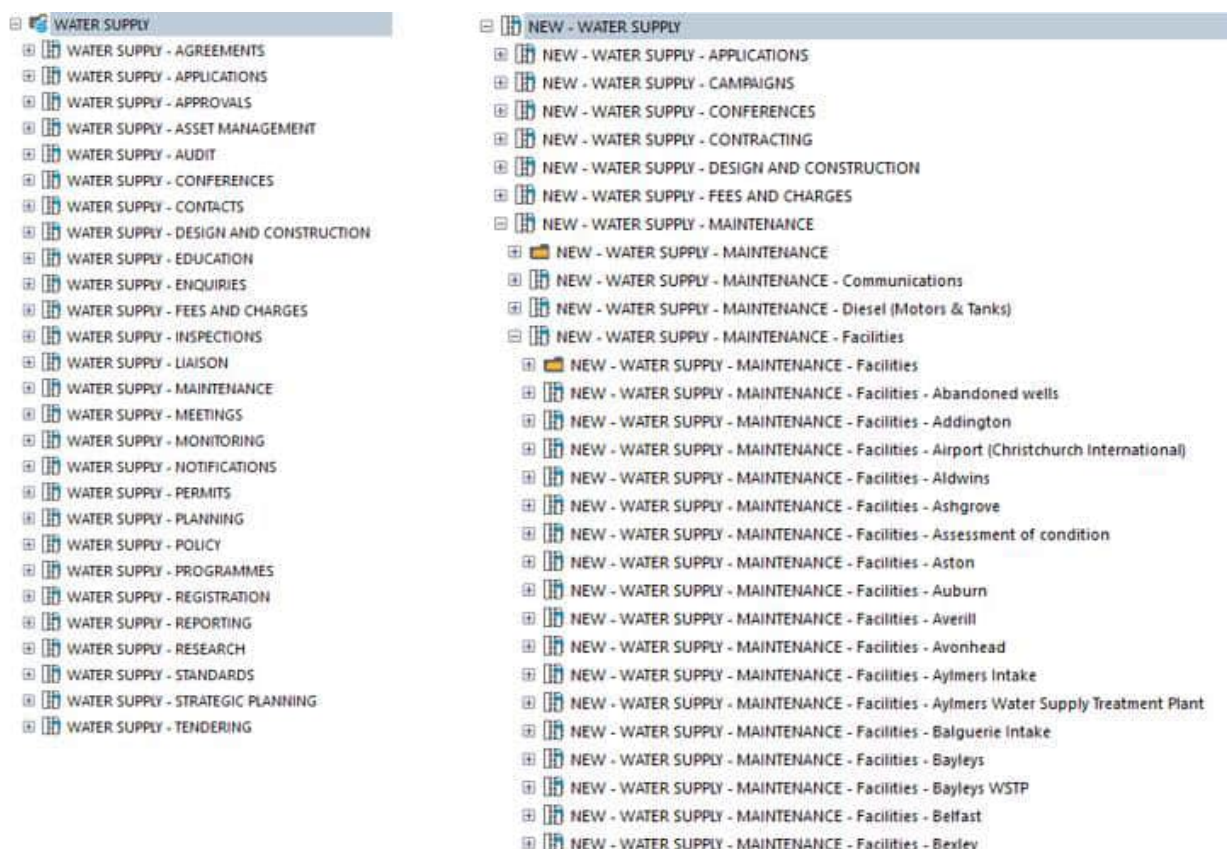


Figure 9.2: TRIM classifications for water supply

Physical asset information is kept in the asset register, which is stored in SAP. Asset management is undertaken to ensure alignment with ISO55000:2014 Asset Management – Overview, Principles and Terminology.

A register of key documents relating to Three Waters & Waste assets is found in TRIM [19/1306436](#). The register also includes information on responsibilities around the update of the documents.

Water supply related processes and procedures are stored in Promapp (refer to Table 8.1 and Table 8.2). Each water supply process is documented in Promapp with a process owner/author and a review date which ensures that the processes are reviewed regularly and by a knowledgeable member of staff. Reviews of the water supply related processes and procedures in Promapp can also be triggered by an incident requiring the use of a Promapp procedure, changes in information or legislation, or a change of process owner/author.

Drinking water quality is stored in the 3 Waters & Waste Laboratory data management software QLims. The laboratory is IANZ accredited and meets all requirements with respect to maintaining the chain of custody for all drinking water samples.

Operational data is stored in SCADA and WaterOutlook. Various reports and dashboards have been created in WaterOutlook and are shared across the organisation.

Citycare has its own document management system and information about this is available in TRIM [20/1128679](#).

Section 1.4 describes the Quality Management System that Council intends to develop and implement for its drinking water supply processes. This system will ensure that documentation pertinent to all aspects of drinking-water management is developed, maintained and made available to all employees, and that mechanisms are in place to ensure employees read, understand and adhere to documentation procedures.

## 9.2 Reporting

Reporting takes place at various frequencies and levels of detail both internally and externally. Table 9.1 summarises both internal and external reporting requirements in relation to water safety and supply. In addition to the reports outlined in the table, various dashboards and reports have been set up in WaterOutlook that allow quick access to summarised and trend data. WaterOutlook provides functionality that allows any entered data to be extracted into an ad-hoc report, presented in Excel format.

In addition to formal reporting, there is regular reporting between Citycare and the Council. For Banks Peninsula, there are daily conversations between the Council's Reticulation & Maintenance Operational Delivery Leader and either Council's Team Leader, Water and Wastewater Treatment or Pump and Storage Supervisor to discuss the weather forecast and ensure that the appropriate preparations and preventative measures are in place where heavy rain is forecast. There are also monthly meetings with Council's Reticulation & Maintenance Operational Delivery Leader and Council's Team Leader, Water and Wastewater Treatment and Pump and Storage Supervisor to discuss plant conditions/issues or any outstanding repairs, and senior management meetings on the overarching aspects of the maintenance contract.

For Christchurch/Lyttelton, there is regular reporting between Citycare, and the Council with twice weekly meetings with the Council's Team Leader Water and Wastewater Operations and Citycare's Maintenance Manager to discuss plant conditions/alerts or any outstanding repairs. There are also monthly meetings the Council's Team Leader Water and Wastewater Operations and Citycare's Maintenance Manager to discuss key performance indicators and contract management.

Reports and associated documents are stored in TRIM and shared with relevant stakeholders and staff by the report authors, team leaders, or management.

**Table 9.1: Internal and external reporting requirements**

<b>Internal reports</b>				
<b>Report name</b>	<b>Recipient</b>	<b>Purpose</b>	<b>Frequency</b>	<b>Responsibility</b>
Three Waters & Waste reports	Three Waters Infrastructure and Environment Committee	Provides information on drinking water quality monitoring and compliance, ongoing capital works and other operational matters.	Bimonthly	3 Waters staff, presented by Head of 3 Waters & Waste
Levels of Service and KPI's	Council	Monitors achievement against within Council's PDP (Plan Develop Perform) system	Monthly	3 Waters staff
Water supply programme report	Audit and Risk Management Committee	Monitors performance and compliance	Quarterly	Head of 3 Waters & Waste
Council Briefings/ Decision/ Information Reports	Executive Leadership Team (ELT) and/or Councillors	Prepared by staff when issues arise that require councillors and/or ELT to be briefed or make a decision. Report templates ensure Council are briefed on issues such as risk, legal obligations, financial considerations, other options.	As required or requested	Various 3 Waters & Waste staff (issue dependent)
<b>External reports</b>				
<b>Report name</b>	<b>Recipient</b>	<b>Purpose</b>	<b>Frequency</b>	<b>Responsibility</b>
Annual Drinking Water Survey (in Drinking Water Online) <sup>1</sup>	Ministry of Health / Taumata Arowai	Council contributes information annually for these reports on focussed on bacteriological, protozoal and chemical compliance with DWSNZ, the status of water safety plans, and meeting legislative requirements.	Annual / monthly (draft ruel)	Water Supply Security Specialist
Resource consent compliance reports	Environment Canterbury	Compliance with resource consents and to comply with the National Environmental Standard - Resource Management (Measurement and Reporting of Water Takes) Regulation 2010	Annual	Resource Consent Compliance Coordinator
National Performance Review	Water NZ	Performance comparison of drinking water, wastewater and stormwater service provision in New Zealand. Council provides information on drinking water, wastewater and stormwater services.	Annual	Resource Consent Compliance Coordinator
Annual Plan, Long Term Plan, Council meeting reports and minutes	Consumers	Plans and reports on strategic planning and budgets to assist public understanding of where ratepayer money is being spent and what the critical projects are for the district.	As produced	Council Secretaries
Transgression Incident / reports	Taumata Arowai	Provides record of investigation into transgression cause, corrective action and recommendations to prevent reoccurrence.	Following water quality failure	3 Waters & Waste staff involved in the response

This will be updated once reporting requirements to Taumata Arowai are clarified



# 10 Investigations

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## 10.1 Investigative studies

Through the Promapp incident and emergency procedures, situations that may result in the need for an investigation are identified. The procedures for activating, planning and carrying out investigations of instances of unsatisfactory performance of the drinking-water supply are also recorded in these incident response processes.

Bimonthly reports to the Council's Three Waters, Infrastructure and Environment Committee inform the Committee of the results of any investigations that may have occurred.

In addition to problem-targeted investigations, the Councils is constantly investigating opportunities to improve drinking water supply and distribution. The purpose of these strategic investigations is primarily to improve safety and reliability of supply and to provide reliable information to assist with long-term planning, such as new technologies or modelling of water availability and demand.

Planned investigations for each water supply are identified in the supply-specific water safety plans.

Investigations can also be initiated by customer complaints. Customer complaints are loaded into the Council's Hybris system by Customer Services representatives to be triaged and actioned by the Team Leader Water Services. All complaints are investigated with the outcome and actions taken recorded once a job is resolved. As these complaints have address identifiers, if there is a geographical cluster of complaints, a wider investigation is undertaken. The outcomes of these investigations are reported on in the bimonthly 3 Waters & Waste report to the Council's Three Waters, Infrastructure and Environment Committee.

## 10.2 Validation of equipment, processes and practice

Validation collects evidence to establish that preventive measures are capable of performing at the expected level. The regular re-validation of procedures, treatment processes and associated controls (e.g. shutdown mechanisms or return to service after cleaning etc) ensures their effective operation and adequate control, especially if a process or component has been physically changed or an operational setting changed. Validation processes are summarised in the supply specific water safety plans.

Validation of equipment is being undertaken by Citycare Water under the maintenance contract. The contractor's plan includes standard operating procedures (SOPs) where required. For the Banks Peninsula Water treatment plants validation of equipment is undertaken by Council.

The Council has a general methodology agreement with Environment Canterbury for the Council's water takes (TRIM [14/664240](#)). This agreement covers compliance with Water Takes Regulations and includes guidance on meters to be used, where they are to be fitted and verification methodology requirements. While there is a five yearly re-verification process, there is an expectation that the Council will use its real-time continuous monitoring to identify conditions that will affect flow meter measurement accuracies and address them at the time. An annual water take summary report is also required to be produced with supporting compliance data for each bore owned and operated for public water supply. These reports are found in TRIM [FOLDER10/38](#).

# 11 Oversight, Review and Continual Improvement

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## 11.1 Long-term evaluation of results

The Council's long-term evaluation of results is focused on water quality monitoring and system performance. The long-term evaluation of results is the responsibility of the Three Waters & Waste Quality & Compliance team and is undertaken annually through a number of different reports.

The conditions of the Council's water take consents for drinking water supplies requires the Council to report annually on water usage.

The Council monitors and reviews its performance against its levels of service. The levels of service have remained reasonably consistent for water supply and reports are available for the 2006/2007 financial year onwards as the Banks Peninsula District Council and Christchurch City Council amalgamated in March 2006. Annual reports identify areas needing immediate attention with a full review every three years as part of the Long Term Plan process contributes to the funding and development of the water supply network over a ten year period.

The Council records information relating to DWSNZ compliance and transgression information and has provided it annually for the Ministry of Health's annual report on drinking water quality. Information on the Christchurch water supply network can be evaluated from the Annual Review of Drinking water Quality in New Zealand 2006/2007 onwards.

The Council uses the Water New Zealand National Performance Review as a benchmark to evaluate its performance against other similarly sized councils in New Zealand. The Council has been involved in this annual national performance review since the 2007/2008 report.

The Council also has long-term monitoring of leakage rates across the distribution network. As well as providing an ongoing indication of the condition of the distribution network. Monitoring leakage is also used to identify if there is water that cannot be accounted for, indicating an illegal take or connection that can be investigated.

The long-term evaluation of results may necessitate changes to the water safety plan if emerging issues constitute previously unidentified risks. This is undertaken as part of the annual internal water safety plan review process. The water safety plan is resubmitted to Taumata Arowai when any significant changes have occurred. Where any uncertainty exists regarding the significance of changes, Taumata Arowai will be consulted to determine whether the water safety plan needs to be re-submitted.

Section 17A of the Local Government Act 2002 requires the Council carry out service delivery reviews. These reviews are a method of determining whether the existing means for delivering a service remain the most efficient, effective and appropriate means for delivering that service. The first review for three waters was carried out in 2017 and another was completed in 2020. Reviews are required to be carried out no later than six years following the last review.

## 11.2 Audit of drinking water quality management

The water safety plan is reviewed annually to make certain that it is effectively encouraging improvements to the water supply operations and management. Responsibility for driving the review process lies with the Three Waters & Waste Quality & Compliance Team.

The Water Safety Plan programme control group will meet monthly to discuss or follow up any water safety plan actions or resolve issues of non-conformance. This group is also responsible for undertaking the annual



and five year reviews and updates of the water safety plan. Both the annual and five yearly review process involve:

- 1) Checking that reporting lines, roles and responsibilities are still up to date and in place.
- 2) Reviewing the day to day operation of the water supply by:
  - a) reviewing the incident record or log book for each water supply and learning lessons from the incident
  - b) checking whether any problems have been found during the regular checks and maintenance schedules.
- 3) Determining if satisfactory progress has been made against the improvement plan.
- 4) Addressing any new or reduced risks arising from modification, additions or changes made to the supply since the last water safety plan was completed.
- 5) Compliance with DWSNZ.

In order to facilitate an efficient internal audit process a checklist has been developed (see Appendix A).

As part of the Council's operational and risk management process, there are regular reviews of our processes, performance and priorities throughout the year, which form an element of continual management auditing over our key risks. These reviews include:

- A six-monthly review of the processes and procedures (captured in ProMapp). The Reticulation & Maintenance Operational Delivery Leader (Banks Peninsula), the Team Leader Water and Wastewater treatment and Reticulation & Maintenance contract supervisors (Christchurch/Lyttelton) review the processes and procedures related to water contamination response procedure, testing water supply catchments and wells and ensuring reporting systems are in place to report any results over set limits for response to confirm the water safety plans are being used and kept up to date covering specific risks to the water supply zones. The Water & Wastewater Operations team reviews the processes and procedures relating to monitoring of chlorine levels and chlorine dosing procedures, the response by contractors to alarms, lab water sampling and reporting and evidence of contractor competency training.
- Assessment of the data from SCADA is undertaken on a daily basis and WaterOutlook is reviewed regularly by the BP Operations Team members. If issues are identified, further assessment is undertaken to determine the options to resolve the issue.
- The Manager Service Excellence 3 Waters & Waste and the Banks Peninsula Water and Waste water Ops Team Leader, Team leader Water and Wastewater Treatment and Reticulation & Maintenance contract supervisors (Christchurch/Lyttelton) undertake monthly reviews to ensure Contractors and staff in the field are actively managing and monitoring operations of the network assets with required response plans in place for potential events. The review audits the monthly report provided in WaterOutlook against designated work schedules and against monitoring and maintenance checklists. Work undertaken, such as recalibration of equipment is recorded in the reports with dates and feedback on the work done by individual staff.
- The Team Leader Water & Wastewater Operations proactively monitors any failure in core services so that the Council can identify at risk assets and notify the Asset Management team for potential inclusion in the reactive or proactive renewal programme. Citycare provides pipe samples and failure/condition codes from failures to assist with this. Pipe samples are analysed by the WSP Material Testing and Analysis laboratory and the results are used to inform the renewals programme.

- There are six monthly reviews to confirm that the Council rules regarding the "chain of cleanliness" in Construction Standard Specification and Approved Water Supply installer specifications are being adhered to by all contractors and authorised water supply installers. The report also includes auditing of chain of cleanliness by the contracts engineers in the Technical Services & Design team and Water & Wastewater Operations team are up to date and that only approved water supply installers are working on the Council's water supply.
- Manager Operations undertakes a six monthly review of water treatment plants to ensure they are operating in accordance with DWSNZ requirements. The report also covers maintaining and auditing existing Water Safety Plans and undertaking drinking water quality monitoring in line with DWSNZ.
- Asset Management Plans are reviewed every three years to ensure they are up to date and renewal programmes are based on the best available data and information so that work is prioritised to the most critical assets.
- The Business Continuity Plan for Three Waters & Waste is reviewed annually.

The outcome of these reviews are provided to the Head of Three Waters & Waste, the General Manager – City Services and/or the Chief Executive as appropriate. Information is also provided in the bimonthly report to the Three Waters, Infrastructure and Environment Committee.

### **11.3 External audit of drinking water quality management**

#### **Water safety plans**

The Drinking Water Assessor, until late 2021, had carried out three yearly implementation audits to ensure that water suppliers operate their water supplies in accordance with the water safety plans. Where non-conformances were identified by the Drinking Water Assessor, the water supplier was required to put in place an action plan to mitigate the non-conformances. The findings of the most recent audit undertaken on 10 December 2018 is stored in TRIM [19/63869](#). All non-conformances have been addressed. Details of implementation audits, non-conformances and recommendations are captured in TRIM [14/629039](#).

The Council has a register in place for non-conformances and their associated corrective actions and actively works through the issues. Staff work through the action plan to address each of the non-conformances in accordance with the timeframes agreed with the Drinking Water Assessor. Staff also report on the water safety plans to the Audit and Risk Management Committee annually, and on the status and detailed progress against the action plans, to address any non-conformances, to the Three Waters, Infrastructure and Environment Committee as part of the bimonthly report on the Three Waters & Waste services.

#### **Water testing accreditation**

Water testing to ensure compliance with the DWSNZ is undertaken by the Council's laboratory staff. The staff training, processes and equipment for water sampling and analysis undertaken by the Council's Laboratory undertakes regular external audits as it is IANZ accredited. To maintain its accreditation, there are ongoing scheduled reassessment visits. These visits ensure that the technical and quality systems continue to meet the criteria for accreditation and continue to work effectively.

Full technical (routine) reassessments are usually carried out at three yearly intervals. These reassessments are similar to initial assessments for accreditation and ensure organisations are properly equipped and able to demonstrate their competence on an ongoing basis. Surveillance visits, to confirm that the management systems are continuing to operate effectively and meeting accreditation criteria, are carried out annually between the full technical reassessments.

## Contractor audit

For Banks Peninsula, the Reticulation & Maintenance Operational Delivery Leader undertakes an audit of Citycare's maintenance of network reservoirs, pump stations and reticulation work approximately every six months. These audits are undertaken with Citycare's Pump and Storage Manager.

For Christchurch/Lyttelton, an audit of Citycare's maintenance of reservoirs, pump stations and water treatment plants is undertaken by the Work Maintenance Supervisor/Auditor approximately every six months. This audits are undertaken with the Maintenance Manager from Citycare.

As part of these audits, the treatment plants are inspected and an audit check sheet is completed. The audits include checking both Council's and Citycare's Rounds records, Health and Safety and HSNO records and grounds maintenance. Water Outlook reports for Water Treatment Plants can be downloaded to check for compliance. As part of the audit process the site condition and accuracy of records is assessed. Follow up audits are undertaken if there are issues identified in the initial assessment

## Quarterly drinking-water compliance meetings

Until late 2021 quarterly compliance meetings took place between the Council and the Drinking Water Assessor. The purpose of these meetings was to assess progress against the DWSNZ compliance requirements for all plants and zones and compliance with the Health Act. Feedback from the meetings was used to implement improvements, which, depending on the nature of the improvements, may also be documented in the water safety plan.

Internal quarterly compliance meetings have continued to be ran by the Quality and Compliance team. These involve a review of the monitoring data, Wateroutlook reports, compliance supporting activities and any events that have occurred during the quarter. Internal compliance reports are prepared and submitted to senior Three Waters management and a memo prepared to inform senior leadership at CCC. These document are stored in TRIM [Folder09/2282](#).

## 11.4 Review by senior leadership

The water supply system performance is continually reviewed.

The Water Supply Security Programme Steering Group meets fortnightly. Representation on this programme steering group includes the Head of Three Waters & Waste, Programme Manager – Water Reform, Manager Planning and Delivery, as well as staff from Three Waters & Waste, Legal Services, Office of Chief Executive, Communications and Finance.

The purpose of these meetings is to review progress on water safety improvements and water safety plans. Agendas are prepared for these meetings and actions noted. Minutes of these meetings are recorded and filed in TRIM [FOLDER19/1022](#) (Water Supply Security – Programme Management).

In addition to the programme steering group, reports on the water safety plan status are provided to the Audit and Risk Management Committee and there are bimonthly Three Waters & Waste reports provided to the Three Waters, Infrastructure and Environment Committee. These reports are prepared by Council staff and provide elected members on committees the opportunity to evaluate and ask questions regarding the performance of the water supply programme.

## Amendments to the Water Safety Plan

Full reviews of the Water Safety Plan are reviewed and signed off by the Head of Three Waters, the General Manager – Infrastructure Planning and Regulatory Services and the Chief Executive. Where there are minor amendments made to the Water Safety Plan, these amendments will be signed off by the Head of Three

Waters. All revisions and sign offs are recorded in the Version Control and Approvals section of the Water Safety Plan.

# Appendix A Internal Water Safety Plan Review Checklist

Area	Check	Action required	Action By	Date
Management	<ul style="list-style-type: none"> <li>• Have roles or responsibilities changed in the last 12 months?</li> <li>• Have personnel changed in the last 12 months?</li> </ul>			
Training	<ul style="list-style-type: none"> <li>• Are all new staff aware of the water safety plan?</li> <li>• Are all new staff adequately trained for their job role and aware of public health risks?</li> </ul>			
WSP Document Maintenance	<ul style="list-style-type: none"> <li>• Have key water supply documents been updated in the last 12 months?</li> <li>• Do all staff and operators have the latest version of the water safety plan?</li> </ul>			
Tracking Incidents and Improvements	<ul style="list-style-type: none"> <li>• Have there been any incidents affecting the water supply in the last 12 months?</li> <li>• What actions were taken to remedy the incident?</li> <li>• Was the action taken effective?</li> <li>• Have the improvements/ preventive measures identified in the water safety plan been actioned?</li> </ul>			
Tracking Operational Procedures	<ul style="list-style-type: none"> <li>• Have the 'what to check' and 'corrective actions' (Operational Procedures) identified in the water safety plan been added to the appropriate manual or operational contract?</li> </ul>			
Assessing	<ul style="list-style-type: none"> <li>• Has the risk register been updated in line with completed improvements (upgraded and new assets) and operational changes?</li> </ul>			
Risks	<ul style="list-style-type: none"> <li>• Has the water supply been assessed for new risks?</li> <li>• Have these risks been recorded in the water safety plan risk register?</li> </ul>			

# Appendix B SCADA System Screenshots

Tue 10/09/2019  
08:55:21

User: None

Domain: ArchestrA

Hide Tags

Active Generators: 0

System Select: All

Site Select

Shortcuts

Overview (CCPwWe, CCPwRo, CCPwRi, CCPwPa, CCPwIn, CCPwNW)

Active Diesels: 0

<b>2 GRASS</b> 0m <sup>3</sup> /hr   637kPa 100% Secure	<b>2 BLIGH</b> 214m <sup>3</sup> /hr   676kPa 67% Secure	<b>12 MAYS</b> 0m <sup>3</sup> /hr   666kPa 5% Secure	<b>0 HILLS</b> 452m <sup>3</sup> /hr   754kPa 65% Secure	<b>6 LAKET</b> 0m <sup>3</sup> /hr   733kPa 52.67% Secure	<b>0 KEYES</b> 187.40m <sup>3</sup> /hr   479.37kPa 93.5% Secure	<b>9 CARTE</b> 0m <sup>3</sup> /hr   470kPa 5% Secure	<b>1 ASTON</b> 98m <sup>3</sup> /hr   487kPa Secure	<b>0 KAING</b> 24m <sup>3</sup> /hr   373kPa Secure
<b>1 ADDIN</b> 249m <sup>3</sup> /hr   662kPa Secure	<b>1 MONTR</b> 0m <sup>3</sup> /hr   672kPa Secure	<b>1 TRAFI</b> 0m <sup>3</sup> /hr   695kPa 94.20% Secure	<b>5 AVERI</b> 0m <sup>3</sup> /hr   1kPa Secure	<b>1 KERRS</b> 372m <sup>3</sup> /hr   774kPa Secure	<b>3 EFFIN</b> 0m <sup>3</sup> /hr   479kPa Secure	<b>3 ESTUA</b> 99m <sup>3</sup> /hr   539kPa 92% Secure	<b>BROOK</b> 0.00m <sup>3</sup> /hr   380kPa Secure	
<b>2 HILLM</b> 288m <sup>3</sup> /hr   666kPa 88% Secure	<b>3 SPREY</b> 243m <sup>3</sup> /hr   686kPa 90% CC Electricians	<b>1 SYDEN</b> 0m <sup>3</sup> /hr   676kPa 74% CC Fitters	<b>0 MAINP</b> 456m <sup>3</sup> /hr   683kPa 91.50% Secure	<b>0 WORCE</b> 495m <sup>3</sup> /hr   725kPa Secure	<b>3 ALDWI</b> 0m <sup>3</sup> /hr   735kPa Secure	<b>2 STJOH</b> 222m <sup>3</sup> /hr   735kPa 72% Secure	<b>3 WOOLS</b> 464m <sup>3</sup> /hr   733kPa 83.63% Secure	
<b>AVONH</b> 173m <sup>3</sup> /hr   349kPa Secure	<b>CROSB</b> 235m <sup>3</sup> /hr   386kPa Secure	<b>1 BURNS</b> 340m <sup>3</sup> /hr   409kPa Secure	<b>2 WRIGH</b> 0m <sup>3</sup> /hr   350kPa Secure	<b>3 AUBURN</b> 0.41m <sup>3</sup> /hr   393kPa 64.02% CC Fitters	<b>4 JEFFR</b> 70.50m <sup>3</sup> /hr   382.32kPa Secure	<b>0 FARRI</b> 216m <sup>3</sup> /hr   424kPa Secure	<b>2 HAREW</b> 0m <sup>3</sup> /hr   323kPa Secure	<b>1 GRAMP</b> 116m <sup>3</sup> /hr   433kPa 89.42% Secure
<b>2 MARSH</b> 0m <sup>3</sup> /hr   413kPa Secure	<b>0 BURWO</b> 0m <sup>3</sup> /hr   411kPa Secure	<b>MAIRE</b> 0m <sup>3</sup> /hr   62kPa Secure	<b>PARKL</b> 1m <sup>3</sup> /hr   410kPa Secure	<b>6 PREST</b> 279m <sup>3</sup> /hr   420kPa 84.76% Secure	<b>0 GARDI</b> 0m <sup>3</sup> /hr   414kPa 84.26% Secure	<b>REDWO</b> 146m <sup>3</sup> /hr   456kPa Secure	<b>3 THOMP</b> 0m <sup>3</sup> /hr   425kPa CC Fitters	<b>5 BELFA</b> 0m <sup>3</sup> /hr   480kPa Secure
<b>SUTHV</b> Secure	<b>SPARV</b> Secure	<b>0 DUNBA</b> 0m <sup>3</sup> /hr   529kPa 100% Secure	<b>0 WILME</b> 316.85m <sup>3</sup> /hr   429.69kPa 84.1% Secure	<b>2 SOCKB</b> 593m <sup>3</sup> /hr   447.08kPa 77.5% Secure	<b>DENTO</b> 549m <sup>3</sup> /hr   363kPa 5.05m Secure	<b>1 TEMPL</b> 40m <sup>3</sup> /hr   419kPa Secure	<b>1 PICTO</b> 234m <sup>3</sup> /hr   554kPa Secure	<b>1 TARA</b> 0m <sup>3</sup> /hr   500kPa Secure

Worsleys 1: 96% / 14 m<sup>3</sup>/hr

Huntsbury 1: 98% / -93 m<sup>3</sup>/hr

McCormacks Bay: 91% / -126 m<sup>3</sup>/hr

CCC Total Flow: 6633 m<sup>3</sup>/hr

### Potable Water Site & Station Overviews

Christchurch City

- Fe** Ferrymead
- Ce** Central Page 1
- Ce** Central Page 2
- NW** North West
- Pa** Parklands
- Ri** Riccarton
- Ro** Rocky
- We** West
- It** Independent
- Ha** Hackthorne
- Pa** PW Operations Primary
- Pa** PW Operations Secondary

Banks Peninsula

- BF** Birdlings Flat
- PB** Pigeon Bay
- AK** Akaroa
- DV** Duvauchelle
- Wn** Wainui
- Ly** Lyttleton
- DI** Diamond
- GB** Governor's Bay
- AK** Ak Water TP
- Pa** Pw Operations 1

### Storm Water Site & Station Overviews

Christchurch City

- 01** Chain 01
- 02** Chain 02
- 03** Chain 03
- Pa** SW Operations 1

### Waste Water Pump Station Overviews

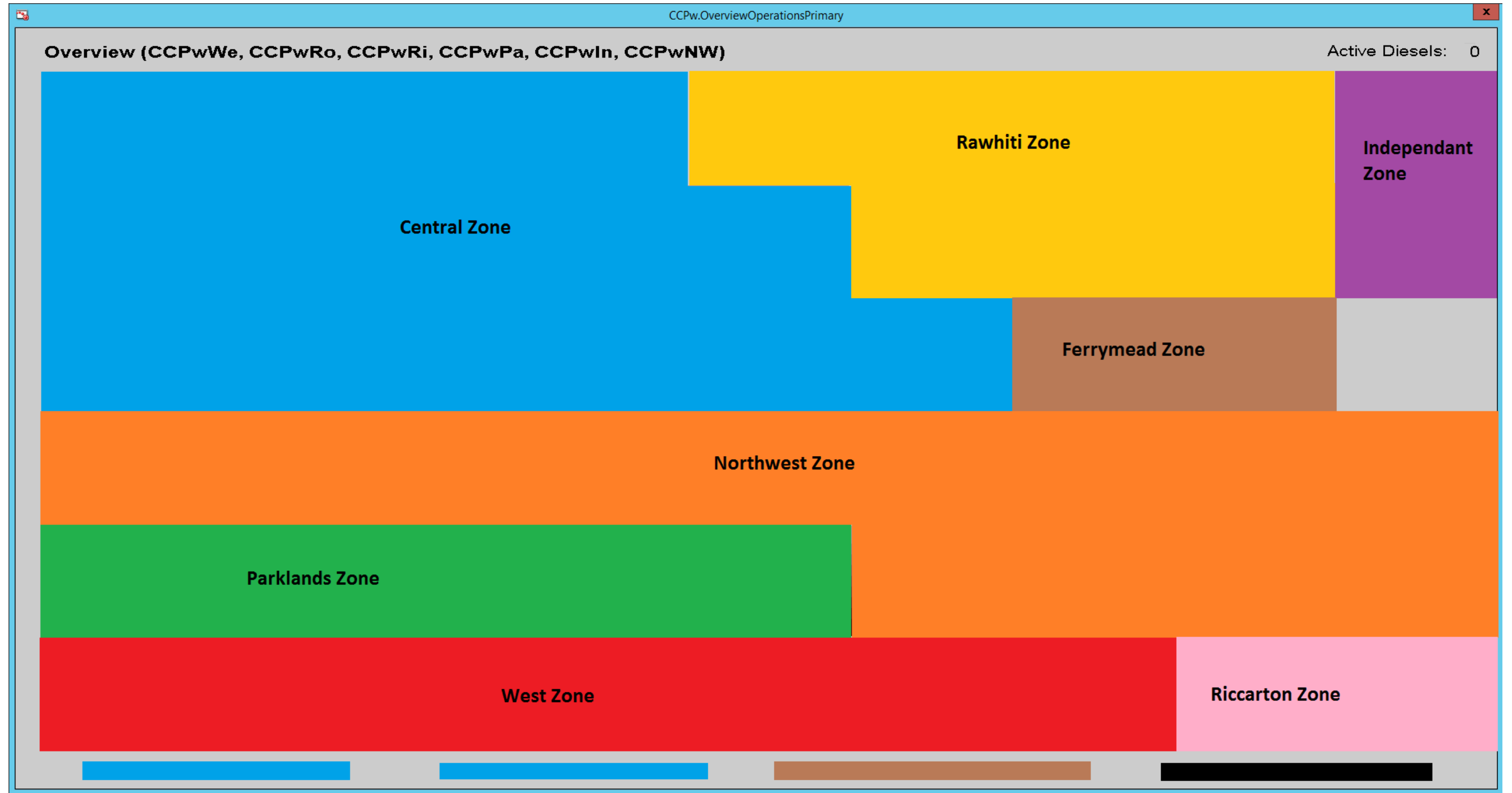
Christchurch City

- 01** 01 Page 1
- 01** 01 Page 2
- 11** 11
- 01 & 11** 01 & 11
- 15** 15
- 28** 28
- 36** 36
- Pa** WW Operations 1
- Pa** WW Operations 2
- Pa** WW Operations 3
- Pa** WW Operations Network
- Pa** Lift Station 1
- Pa** Lift Station 2

Banks Peninsula

- AK** Akaroa
- DI** Diamond
- DV** Duvauchelle
- GB** Governor's Bay
- TB** Tikao Bay
- Ly** Lyttleton
- Pa** Ww Operations 1

SCADA Network Control - Potable Water Supply (Primary) Stations



SCADA Network Control – Potable Water operations primary window zones

Region Map Current Alarms Alarm History Events History Trends Reports Tue 10/09/2019 08:55:45 User: None Domain: ArchestraA Hide Tags Active Generators: 0 System Select: All Site Select: Minimap Shortcuts

CCPw.OverviewOperationsSecondary

### Overview (CCPwWe, CCPwRo, CCPwRi, CCPwPa, CCPwIn, CCPwNW) Active Diesels: 0

<b>0</b> VICTO A 13m3/hr 93% Secure	<b>0</b> MORG2 A 1 97% Secure	<b>0</b> MAFFY A 91% Secure	<b>0</b> OCEA2 A 99% Secure	<b>0</b> SCAR3 A 87% Secure
<b>0</b> BURK1 1 2285.46kPa 90.32% Secure	<b>1</b> TAKAH A 1 2 92% 92% Secure	<b>0</b> WEST3 21.0m3/hr 93.22% Secure	<b>0</b> MORG1 A 1 2 Secure	<b>0</b> MAJOR A 1 2 30m3/hr Secure
<b>0</b> MURR2 A 94% Secure	<b>0</b> MTPL5 A 95% Secure	<b>0</b> OCEA1 A 1 2 637kPa Secure	<b>0</b> SCAR2 A 1 2 95% 95% Secure	
<b>0</b> SUTH2 A 91.68% Secure	<b>0</b> HACKT A 1 2 97% 97% Secure	<b>0</b> WEST1 A 1 2 1119.81kPa Secure	<b>0</b> PORTH A 1 2 930kPa 627kPa Secure	<b>0</b> HUNT4 A 99% Secure
<b>0</b> MURR1 A 1 2 Secure	<b>0</b> MTPL4 A 1 2 85% Secure	<b>0</b> CLIF4 A 96% Secure	<b>0</b> SCAR1 A 1 2 578kPa Secure	
<b>0</b> SUTH1 A 1 2 3 4 -19.78m <sup>3</sup> /hr 941.28kPa 1470.83kPa 84.08% Secure	<b>0</b> ASHGR A 1 2 3 0m3/hr 1038kPa Secure	<b>3</b> ENNER 1 2 3 930.85kPa Secure	<b>0</b> ROCKY A 91.30% Secure	<b>1</b> HUNT3 A 1 2 86% Secure
<b>0</b> CASHM A 1 2 69% Secure	<b>0</b> MTPL3 A 1 2 89% 89% Secure	<b>0</b> CLIF3 A 1 2 86% Secure	<b>0</b> MONC3 A 1 2 97% Secure	
<b>0</b> HALS2 A 1 0.00m <sup>3</sup> /hr 96.60% Secure	<b>2</b> THORR M 1 0m3/hr 0kPa Secure	<b>0</b> WORS2 A 99% Secure	<b>0</b> TANNE A 1 52.99m <sup>3</sup> /hr 795.04kPa Secure	<b>0</b> HUNT2 A 1 90% Secure
<b>0</b> UPPER A 1 2 98% Secure	<b>0</b> MTPL2 A 1 86% 86% Secure	<b>0</b> CLIF2 A 1 2 100% 100% Secure	<b>0</b> MONC2 A 1 87% Secure	
<b>0</b> HALS1 A 1 2 15.08m3/hr 585.57kPa 93.30% Secure	<b>2</b> PALAT M 0m3/hr 1077kPa Secure	<b>0</b> WORS1 A 1 2 14m3/hr 108kPa 96% 96% Secure	<b>0</b> CHAPM A 1 2 0.00m <sup>3</sup> /hr 786.99kPa Secure	<b>0</b> HUNT1 A 1 2 -69m3/hr 108kPa 793kPa 98% Secure
<b>0</b> MCCOR A 1 2 -126m3/hr 39kPa 91% 91% Secure	<b>0</b> MTPL1 A 1 2 3 369m3/hr 84% Secure	<b>0</b> CLIF1 A 1 2 Secure	<b>0</b> MONC1 A 1 2 627kPa Secure	

Worsleys 1: 96% / 14 m3/hr    Huntsbury 1: 98% / -69 m3/hr    McCormacks Bay: 91% / -126 m3/hr    CCC Total Flow: 6671 m3/hr

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Christchurch City

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#### Storm Water Site & Station Overviews

Christchurch City

- 01 Chain 01
- 02 Chain 02
- 03 Chain 03
- SW Operations 1

#### Waste Water Pump Station Overviews

Christchurch City

- 01 01 Page 1
- 01 01 Page 2
- 11
- 01 & 11
- 15
- 28
- 36
- WW Operations 1
- WW Operations 2
- WW Operations 3
- WW Operations Network
- Lift Station 1
- Lift Station 2

Banks Peninsula

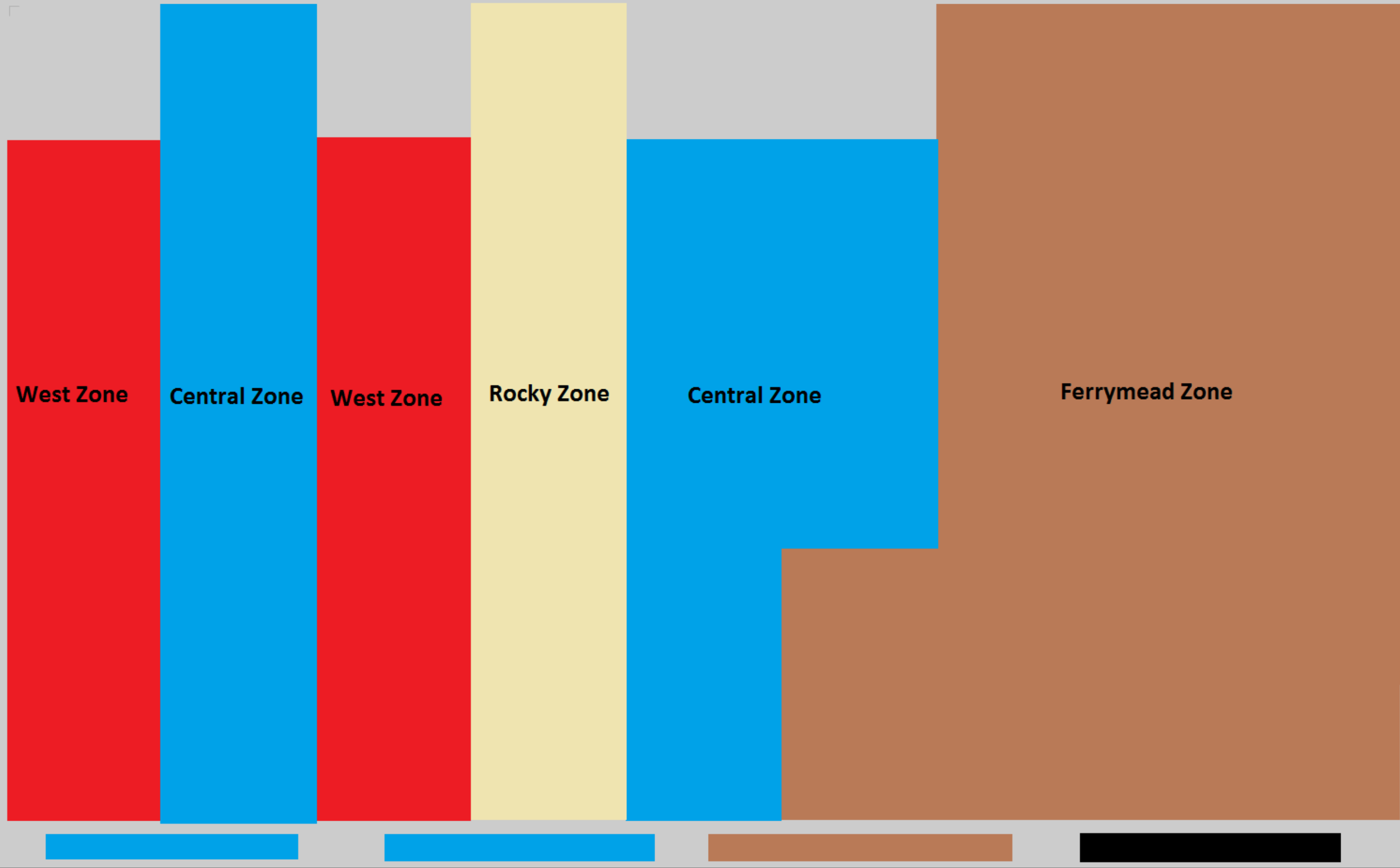
- AK Akaroa
- DH Diamond
- DV Duvauchelle
- GB Governor's Bay
- TB Tikao Bay
- LY Lyttleton
- Ww Operations 1

SCADA Network Control - Potable Water Supply Secondary (Lift) Stations and Reservoirs

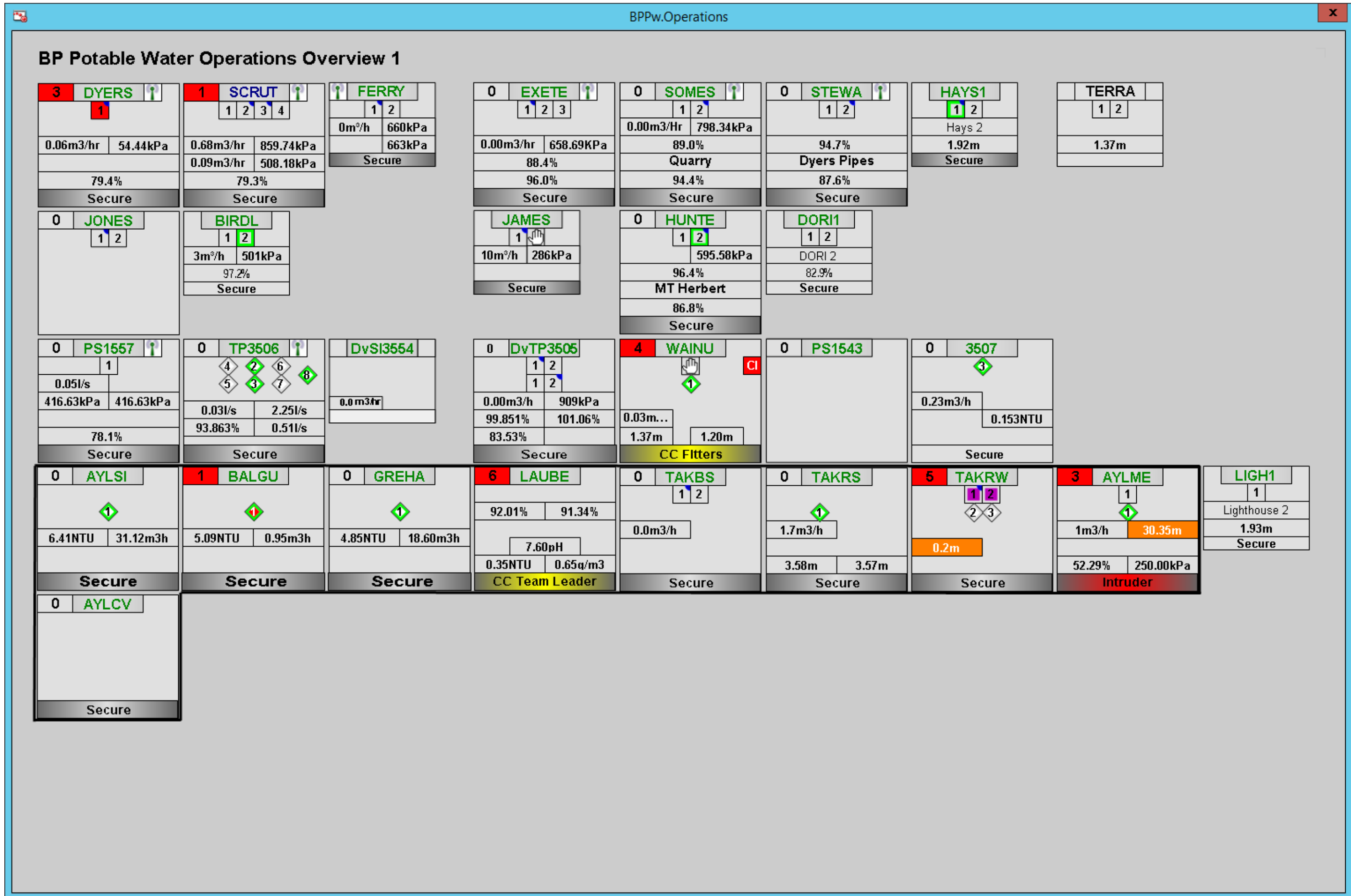


Overview (CCPwWe, CCPwRo, CCPwRi, CCPwPa, CCPwIn, CCPwNW)

Active Diesels: 0



SCADA Network Control – Potable Water Supply Secondary (Lift) Stations and Reservoirs



SCADA Network Control - Banks Peninsula operations window includes pumps supplying to the Lyttelton Harbour Basin

Region Map Current Alarms Alarm History Events History Trends Reports Tue 10/09/2019 08:55:45 User: None Domain: ArchestraA Hide Tags Active Generators: 0 System Select: All Site Select: Minimap Shortcuts

CCPw.OverviewOperationsSecondary

### Overview (CCPwWe, CCPwRo, CCPwRi, CCPwPa, CCPwIn, CCPwNW) Active Diesels: 0

<b>0</b> VICTO A 13m3/hr 93% Secure	<b>0</b> MORG2 A 1 97% Secure	<b>0</b> MAFFY A 91% Secure	<b>0</b> OCEA2 A 99% Secure	<b>0</b> SCAR3 A 87% Secure
<b>0</b> BURK1 1 2285.46kPa 90.32% Secure	<b>1</b> TAKAH A 1 2 92% 92% Secure	<b>0</b> WEST3 21.0m3/hr 93.22% Secure	<b>0</b> MORG1 A 1 2 Secure	<b>0</b> MAJOR A 1 2 30m3/hr Secure
<b>0</b> MURR2 A 94% Secure	<b>0</b> MTPL5 A 95% Secure	<b>0</b> OCEA1 A 1 2 637kPa Secure	<b>0</b> SCAR2 A 1 2 95% 95% Secure	
<b>0</b> SUTH2 A 91.68% Secure	<b>0</b> HACKT A 1 2 97% 97% Secure	<b>0</b> WEST1 A 1 2 1119.81kPa Secure	<b>0</b> PORTH A 1 2 930kPa 627kPa Secure	<b>0</b> HUNT4 A 99% Secure
<b>0</b> MURR1 A 1 2 Secure	<b>0</b> MTPL4 A 1 2 85% Secure	<b>0</b> CLIF4 A 96% Secure	<b>0</b> SCAR1 A 1 2 578kPa Secure	
<b>0</b> SUTH1 A 1 2 3 4 -19.78m <sup>3</sup> /hr 941.28kPa 1470.83kPa 84.08% Secure	<b>0</b> ASHGR A 1 2 3 0m3/hr 1038kPa Secure	<b>3</b> ENNER 1 2 3 930.85kPa Secure	<b>0</b> ROCKY A 91.30% Secure	<b>1</b> HUNT3 A 1 2 86% Secure
<b>0</b> CASHM A 1 2 69% Secure	<b>0</b> MTPL3 A 1 2 89% 89% Secure	<b>0</b> CLIF3 A 1 2 86% Secure	<b>0</b> MONC3 A 1 2 97% Secure	
<b>0</b> HALS2 A 1 0.00m <sup>3</sup> /hr 96.60% Secure	<b>2</b> THORR M 1 0m3/hr 0kPa Secure	<b>0</b> WORS2 A 99% Secure	<b>0</b> TANNE A 1 52.99m <sup>3</sup> /hr 795.04kPa Secure	<b>0</b> HUNT2 A 1 90% Secure
<b>0</b> UPPER A 1 2 98% Secure	<b>0</b> MTPL2 A 1 86% 86% Secure	<b>0</b> CLIF2 A 1 2 100% 100% Secure	<b>0</b> MONC2 A 1 87% Secure	
<b>0</b> HALS1 A 1 2 15.08m3/hr 585.57kPa 93.30% Secure	<b>2</b> PALAT M 0m3/hr 1077kPa Secure	<b>0</b> WORS1 A 1 2 14m3/hr 108kPa 96% 96% Secure	<b>0</b> CHAPM A 1 2 0.00m <sup>3</sup> /hr 786.99kPa Secure	<b>0</b> HUNT1 A 1 2 -69m3/hr 108kPa 793kPa 98% Secure
<b>0</b> MCCOR A 1 2 -126m3/hr 39kPa 91% 91% Secure	<b>0</b> MTPL1 A 1 2 3 369m3/hr 84% Secure	<b>0</b> CLIF1 A 1 2 Secure	<b>0</b> MONC1 A 1 2 627kPa Secure	

Worsleys 1: 96% / 14 m3/hr    Huntsbury 1: 98% / -69 m3/hr    McCormacks Bay: 91% / -126 m3/hr    CCC Total Flow: 6671 m3/hr

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- AK Ak Water TP
- Pw Operations 1

#### Storm Water Site & Station Overviews

Christchurch City

- 01 Chain 01
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- 03 Chain 03
- SW Operations 1

#### Waste Water Pump Station Overviews

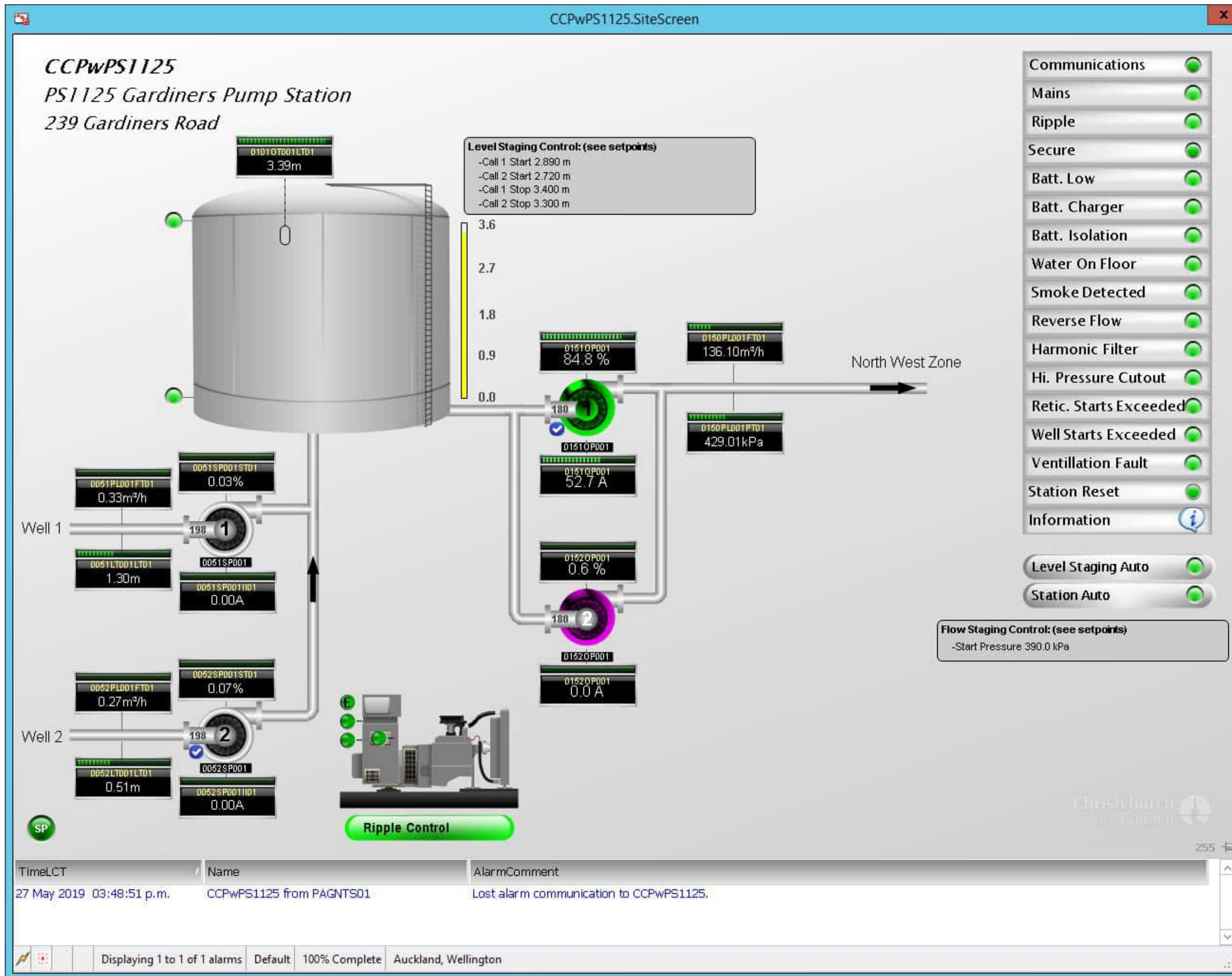
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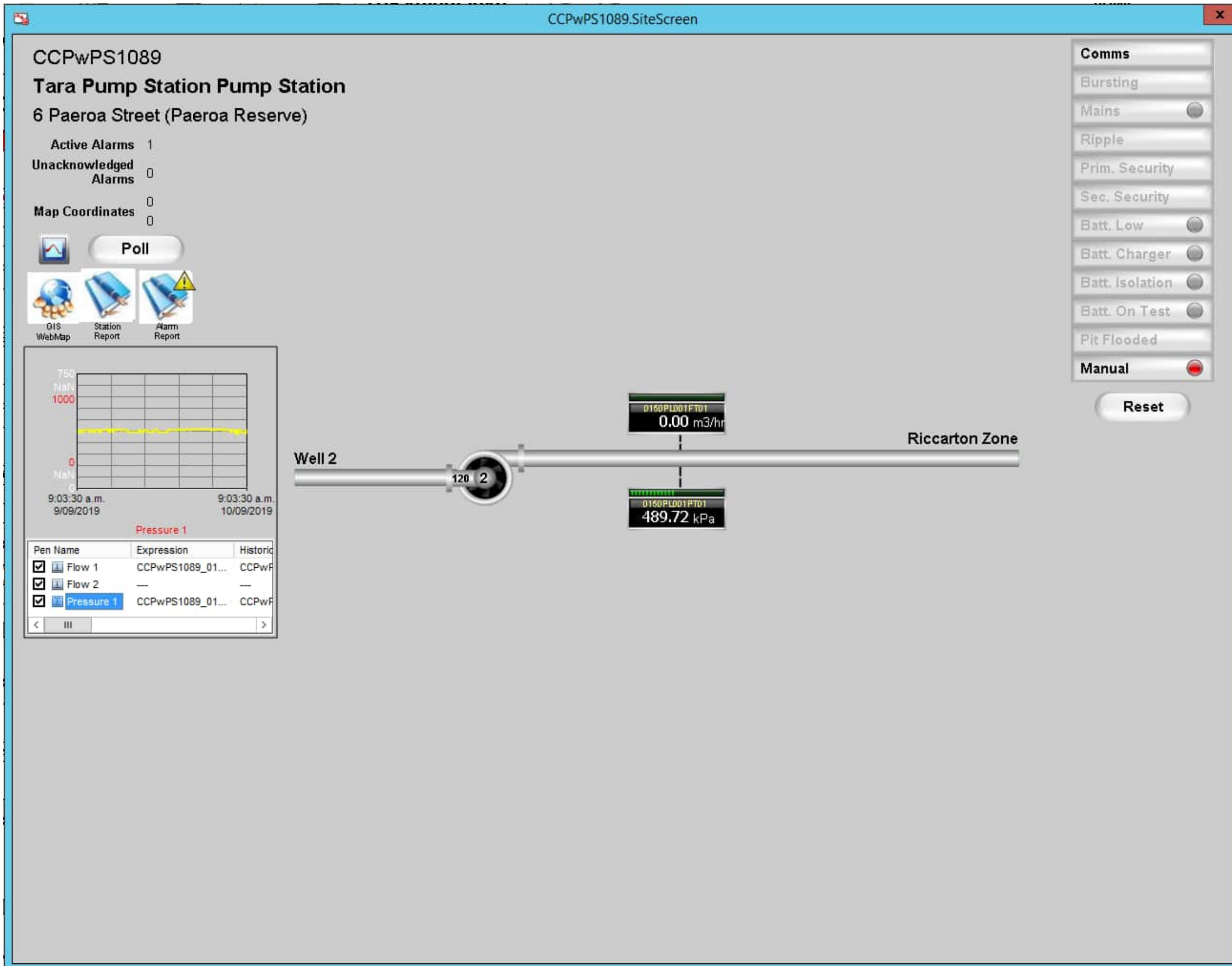
Banks Peninsula

- AK Akaroa
- DH Diamond
- DV Duvauchelle
- GB Governor's Bay
- TB Tikao Bay
- LY Lyttleton
- Ww Operations 1

Example of SCADA Network Control Data Visibility – Secondary supply zone reservoirs

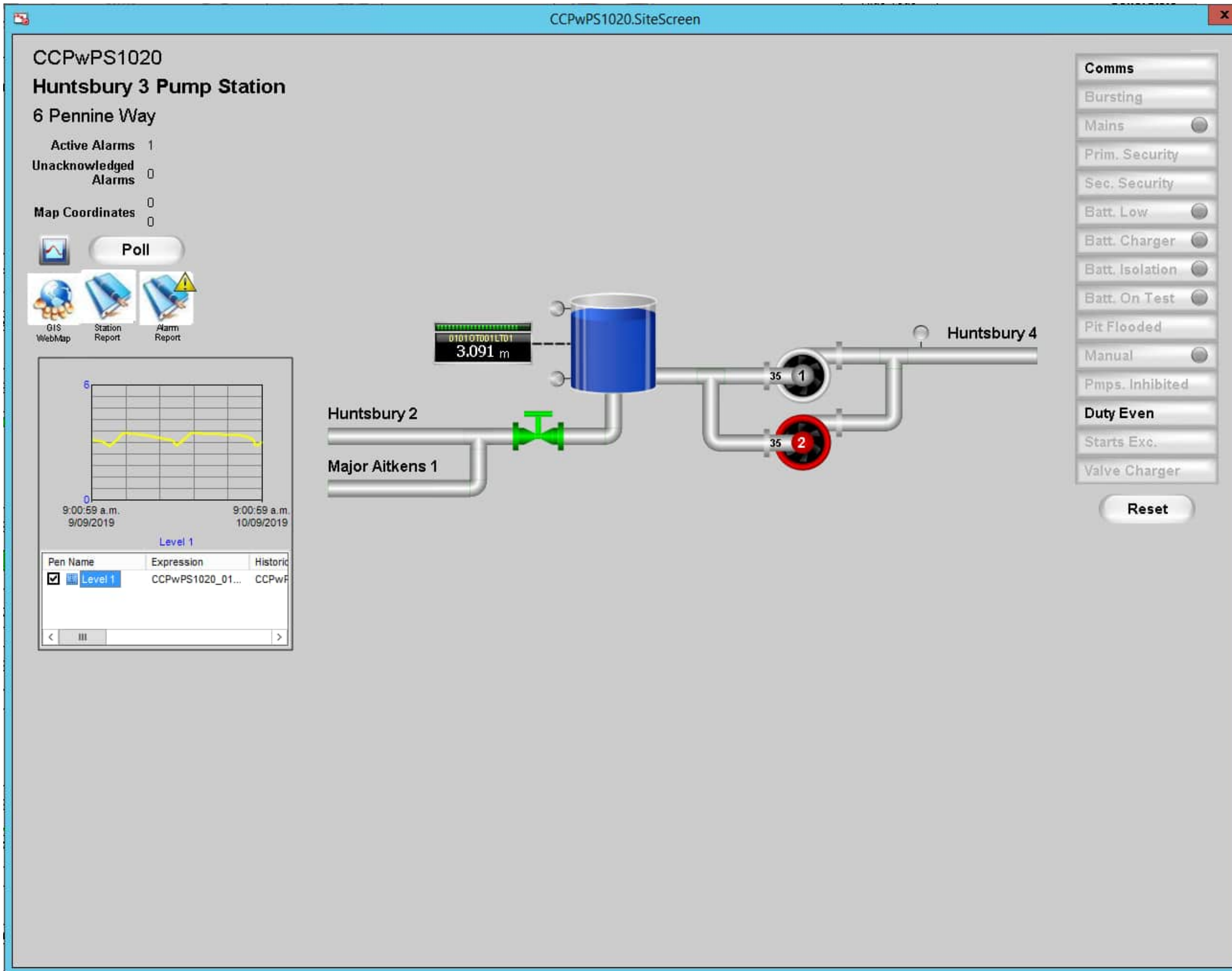


Example of SCADA Network Control Data Visibility – Gardiners Primary Pump Station with 2 Wells and suction tank (Northwest Zone)

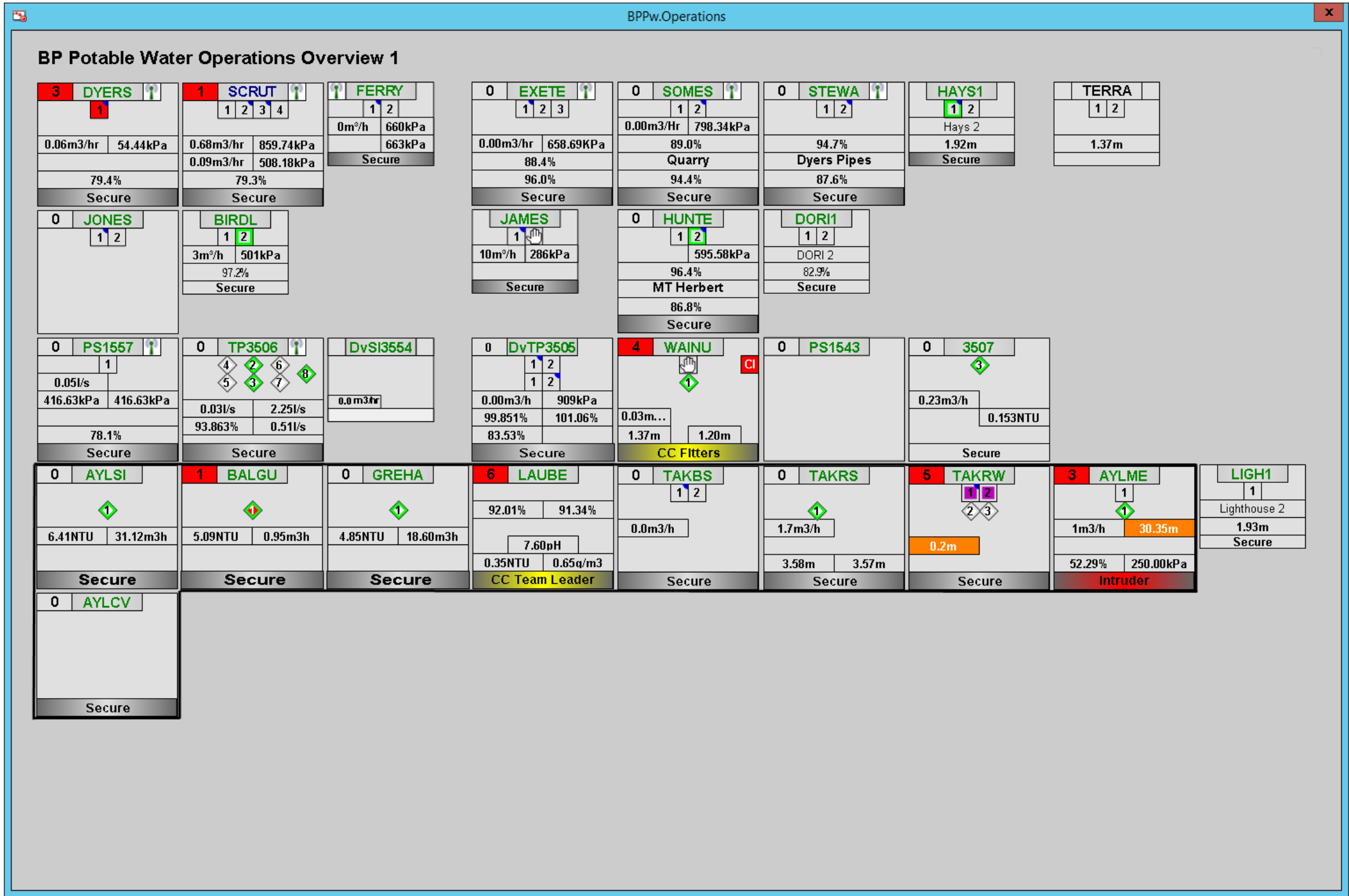


Example of SCADA Network Control Data Visibility – Tara Primary Pump Station with 1 Well (Riccarton Zone)





Example of SCADA Network Control Data Visibility – Huntsbury 3 Reservoir and Lift Station



SCADA Network Control - Potable Water Supply Banks Peninsula Stations