

HAVE YOUR SAY

Te Wai Ora o Tāne Draft Integrated Water Strategy

Ōtautahi Christchurch and Te Pātaka o Rākaihautū Banks Peninsula

Consultation open until Sunday 14 July 2019

ccc.govt.nz/ourwater





Image above: Gathering raupo – Photo courtesy Te Rūnanga o Ngāi Tahu

Cover image: Kayaking on the Ōtākaro Avon River – Kelvin McMillan

Rārangi ūpoko Contents

Whakarāpopototanga whakarae Executive summary	i
Te tuatahi Part one:	
Tāhuhu korero Technical and background information	1
1. Kupu Whakataki Introduction	2
Te tuarua Part two:	
Te Rautaki The Strategy	7
2. Te kaupapa matua Purpose	8
3. Te whakakitenga Vision	8
4. Ngā mātāpono arataki Guiding Principles	9
5. Ngā take rautaki Strategic Issues	10
6. Ngā whāinga Goals	18
7. Ngā paetae Objectives	21
Te tuatoru Part three:	
Whakatinanatanga Implementation	39
8. Te whakatinanatanga Stepwise and parallel Implementation	40
9. Ngā rauemi me ngā āheinga Resources and capability	41
10. Te aroturuki me te arotake Monitoring evaluation and review	42
Appendix A Legislative and policy context	44
Appendix B References	48

How to give feedback

You can provide your feedback in a number of ways:



Fill out the submission form at:
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Mail your feedback to:

Freepost 178
Attention: Tessa Zant
Integrated Water Strategy
Public Information & Participation Unit
Christchurch City Council
PO Box 73016, Christchurch 8154

Postage is free (you don't need a stamp)



Email your feedback and any attachments to:

engagement@ccc.govt.nz

with 'Water Strategy' in the subject line. Please make sure you include your full name and address with your submission.



Deliver to:

Civic Offices, 53 Hereford Street, or at drop-in sessions (see back cover for details)

Submissions must reach us before consultation closes on Sunday 14 July 2019

Whakarāpopototanga whakarae

Executive summary

Water supply, wastewater, stormwater, surface water and groundwater form a fundamental part of the life of the community. Christchurch City Council has a responsibility to ensure that its water services, infrastructure and water taonga are managed in a manner that supports the environmental, social, cultural and economic wellbeing of current and future generations. In this regard we work with Environment Canterbury, which has responsibilities for environmental resources management. The broader legislative and policy context is described in Appendix A.

Our vision to guide that management is:

Te wai ora o Tāne **Water for Life** Valuing water and water services for people and the environment

The vision recognises the importance of water, as taonga, to the life of the community of Ōtautahi Christchurch, while also recognising the significant cultural values associated with water. Achieving the vision will mean that Christchurch's water resources and taonga are managed in an integrated way to provide people, communities and future generations with access to safe and sufficient water resources, maintain the integrity of freshwater ecosystems and manage hazards from flooding and sea level rise.

An Integrated Water Strategy will both recognise and support the ongoing recovery activities following the earthquakes, and set a path for our future management of our water resources and water services and associated infrastructure.

It will establish the strategic direction for our sustainable long-term management of water resources and related infrastructure. The draft strategy focuses on water supply, wastewater and surface water including stormwater and flood management.

Principles that have guided the development of the draft strategy are: integration, longevity, touchstone, place-making, flood management, international best practice, efficiency and kaitiakitanga.

The strategy recognises and incorporates the Urban Water Principles - Ngā Wai Manga recommended by central government's Urban Water Working Group:

- **Papatūānuku** – Our relationship with the land – papatūānuku – will pre-determine our relationship with water
- **Ngā wai tuku kiri** – Our waters are a gift of life provided to us by our tupuna
- **Tāngata** – Our environments are places of human occupation
- **Te hāpori me te wai** – The community's love and care for water is enduring
- **Tiakina mō apōpō** – In building future resilience, our connectedness with the environment is our strength

This draft strategy addresses eleven key strategic issues, relating to managing wastewater discharges, ensuring long term water supply, responding to stormwater management, flooding, and potential sea level rise issues, improving water quality and waterway health, and ensuring that the community values its many different types of water resources

1. Different perceptions of the 'value' of the waters
2. Poor state of some waterways
3. Vulnerability of Christchurch's groundwater source to contamination
4. Wastewater overflows and effects on surface water
5. Treated wastewater discharges into Akaroa Harbour
6. Stormwater discharges and effects on surface water
7. Flooding and flood management
8. Responding/adapting to the anticipated effects of sea level rise on water resources and related infrastructure
9. Long term availability of water for water supply
10. Long term sustainable wastewater treatment and disposal
11. Infrastructure efficiency and resilience

To address these strategic issues, the draft strategy contains four goals, 11 objectives and some suggested approaches to achieve the vision. The goals align with the 2018-28 Community Outcomes, as well as the 'strategic priorities' identified in our Strategic Framework².

In summary, the goals and general approach to achieving each of the goals of the draft strategy is as follows.

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

- Increasing awareness – to encourage and engage the community to value and respect the multiple uses of our water resources through advocacy and outreach programmes, demonstration projects that highlight the values of water, and considering the water services charging structure and the way information is conveyed to the community.
- Enhancing natural and cultural values (including ecology, amenity, recreation, heritage and landscape) – through initiatives such as demonstration projects, protection of existing waterway and wetland systems, encouraging and facilitating wetlands, waterways enhancement and naturalisation, addressing stream depletion, facilitating the adoption of water sensitive design and promoting water conservation.

Goal 2: Water quality and ecosystems are protected and enhanced

- Improving water quality and enhancing the natural, cultural and ecological values of waterways – through continuing the existing Stormwater Management Plan approach to management of stormwater quality, increasing focus on sediment control measures, implementing source control and water sensitive design, wetlands and waterways enhancement and naturalisation, and where possible retrofitting water quality mitigation for existing developed areas.
- Reducing the effects of wastewater overflows – by network upgrades, targeting efforts to address overflows and reducing inflow and infiltration.
- Understanding groundwater sources and their vulnerability to contamination – through targeted investigations, further implementation of source protection, and restrictions on excavation below groundwater level.

- Recognising the importance of robust data management and modelling to demonstrate performance.

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

- Understanding the extent, effect and risk of flooding, and managing effects and adapting to flooding risks – by continuing the existing programme of investigations and physical works in the interim, while developing, communicating to the community and then implementing a risk based approach to managing the effects of flooding using options appropriate to specific situations.
- Understanding risks due to sea level rise and consequences resulting from climate change, and developing an adaptive response.

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

- Managing assets across all disciplines in an integrated manner to maximise attributes such as place making, collaborative benefits, eco-system service harmonies which may not be realised when assets are developed in isolation for a single discipline.
- Managing stormwater collectively wherever practicable in order to maximise efficiency, cost effectiveness and ease of maintenance. Encouraging on-site stormwater management using water sensitive design where collective stormwater management is not feasible (such as areas where urban intensification and redevelopment of industrial and business land is prevalent).
- Managing wastewater systems to meet community needs – including through reviewing and revising trade waste and biosolids management and developing long term solutions for Christchurch's future growth and for the disposal of treated wastewater from the Akaroa Harbour communities.
- Managing water sources to meet reasonable demands – by improving understanding of water sources and water use, implementing demand management projects and securing access to water supplies

- Infrastructure efficiency and resilience – by utilising a risk based approach, proactive monitoring, and the implementation of intelligent technology.
- Managing resources collaboratively. Water resources management is complex and requires collaborative integrated work programme across Council units and between stakeholders.

To guide actions to meet the goals and vision of the draft strategy eleven objectives have been identified as follows.

Note that objectives are not listed in any order of priority.

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 3	Enhancement of ecological, cultural and natural values Enhance the ecological, cultural and natural values (including amenity, recreation, customary use, heritage and landscape) of the waterways within the Christchurch urban area and settlements.
Objective 4	Water quality improvement Improve the water quality of surface water resources to protect ecosystem health and provide for contact recreation, food gathering, mahinga kai and cultural values.
Objective 5	Wastewater overflows management Reduce and work towards eliminating the effects of wastewater overflows.
Objective 6	Flood risk Understand the likely extent and effects of flooding, and the risk posed by flooding.
Objective 7	Flood management and adaptation Manage and adapt to the effects of flooding using natural systems, planning tools, community adaptation and infrastructure solutions.
Objective 8	Sustainable wastewater systems Manage the effects of the wastewater systems to meet community needs for environmental, social, cultural and economic sustainability over the long term.
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.

¹Christchurch City Council (2018). Community Outcomes <https://ccc.govt.nz/the-council/how-the-council-works/20182028-vision/community-outcomes>

²Christchurch City Council (2018). Strategic Framework (August 2018) <https://ccc.govt.nz/assets/Uploads/2018-Strategic-Framework.pdf>

A suite of approaches to support the objectives and goals are put forward and are listed below.

Option	Objective(s) to be addressed
7.1-1 and 7.3-1 Advocacy and Outreach	1. Awareness and engagement 3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement
7.1-2: and 7.3-2 Demonstration Projects – waterway naturalisation	1. Awareness and engagement 3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement
7.1-3 Facilitate Water Sensitive Design	1. Awareness and engagement
7.1-4 Improve public understanding of the cost of water services	1. Awareness and engagement
7.1-5 and 3-7 Waterways and wetlands enhancement and naturalisation	1. Awareness and engagement 3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement
7.2-1 Proactive risk-based asset renewals	2. Efficient and resilient infrastructure
7.2-2 Proactive monitoring of condition	2. Efficient and resilient infrastructure
7.2-3 Intelligent technology	2. Efficient and resilient infrastructure
7.2-4 Continuing to manage for 6 core values for stormwater and flood management	2. Efficient and resilient infrastructure
7.3-3 Continue and enhance the implementation of the current approach to stormwater management	3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement
7.3-4 Increased sediment control	3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement
7.3-5 Waterway vegetation management	3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement
7.3-6 and 7.5-1 Wastewater and stormwater network upgrades and real time control technology	3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement 5. Wastewater overflows management
7.3-8 Appropriate policy and plan provisions for water sensitive design	3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement
7.3-9 Development of stormwater discharge standards	3 and 4. Enhancement of ecological, cultural and natural values and water quality improvement
7.4-2 Effects based network consent	5. Wastewater overflows management
7.4-3 Reducing inflow and infiltration to the public network	5. Wastewater overflows management
7.4-4 Repair/renewal of private sewer laterals	5. Wastewater overflows management
7.5-1 Continue the current approach for flooding and flood management	6 and 7. Flood risk and flood management and adaptation management
7.5-2 Continue to develop a risk based approach to flood management	6 and 7. Flood risk and flood management and adaptation management
7.5-3 Communicate a risk based approach to the community and foster community support	6 and 7. Flood risk and flood management and adaptation management
7.5-4 Implement options tailored to address flood management in specific circumstances	6 and 7. Flood risk and flood management and adaptation management
7.6-1 Trade waste management	8. Sustainable wastewater systems

Option	Objective(s) to be addressed
7.6-2 Biosolids management with multiple paths for beneficial reuse	8. Sustainable wastewater systems
7.6-3 Develop a long term wastewater treatment and collection solution to accommodate Christchurch's future growth	8. Sustainable wastewater systems
7.6-4 Reduce the generation of wastewater at source	8. Sustainable wastewater systems
7.6-5 Agree with community on a long term solution for the treated wastewater discharges into Akaroa Harbour	8. Sustainable wastewater systems
7.7-1 and 7.8-4 Support research and monitoring programmes to better understand groundwater vulnerability to contamination and Improve the understanding of groundwater sources	9 and 10. Groundwater protection and improvement in understanding of aquifer system 11. Sustainable water supply
7.7-3 Restrictions on excavating and filling below groundwater level	9 and 10. Groundwater protection and improvement in understanding of aquifer system 11. Sustainable water supply
7.7-4 Partner with Environment Canterbury and neighbouring district councils	9 and 10. Groundwater protection and improvement in understanding of aquifer system 11. Sustainable water supply
7.8-2 Source protection	9 and 10. Groundwater protection and improvement in understanding of aquifer system
7.8-1 Improve understanding of water use and develop a water demand management programme	11. Sustainable water supply
7.18-2 Implement pressure management zones	11. Sustainable water supply
7.8-3 Implement 'smart' water network operation	11. Sustainable water supply
7.8-5 Secure access to the Christchurch groundwater supplies	11. Sustainable water supply
7.8-6 Enable reuse and harvesting	11. Sustainable water supply
7.8-7 Enhance management of below-ground well heads	11. Sustainable water supply
7.8-8 Collaboration with other territorial authorities to retain control of public infrastructure	11. Sustainable water supply

The draft strategy recognises the various roles of local, regional and national governments as well as public and private organisations and the general public, and how each can contribute to realising the draft strategy's vision.

The draft strategy also supports the implementation of the Canterbury Water Management Strategy, in particular with respect to the following targets: ecosystem health and biodiversity, kaitiakitanga, drinking water, recreational and amenity opportunities, water-use efficiency and environmental limits.



Te tuatahi **Part one:**

Tāhuhu korero
**Technical and background
information**

1. Kupu whakataki Introduction

1.1 Why develop an Integrated Water Strategy?

Water resources play a fundamental part in providing for the needs of, and shaping the community. The Christchurch City Council provides water supply, wastewater and stormwater services and infrastructure throughout the District. Waterways and coastal waters also form a fundamental part of both the landscape and lives of the community.

The Draft Integrated Water Strategy (the draft strategy) is a high level overarching strategy developed to consider all of these different water resources, values and demands, and set a framework to help us manage them in an integrated way over at least the next 100 years. The strategy also provides for the requirements of working with manawhenua under the National Policy Statement on Freshwater 2014 (Freshwater NPS) and other statutory and non-statutory plans, policies and strategies.

The draft strategy recognises our responsibilities to ensure water services and infrastructure support environmental, social, cultural and economic well-being of current and future generations. In fulfilling these responsibilities we work with the community and with Environment Canterbury, which is responsible for environmental resource management.

1.2 Our water resources

Christchurch's freshwater resources include springs, streams, rivers, lakes, wetlands, lagoon, estuaries and high-quality groundwater. These water resources are an important part of the unique culture and the natural values of the area, shaping the landscape and Christchurch's heritage.

Water is fundamentally important to Ngāi Tahu, highly valued by the community for recreation, and crucial to the health of the environment in which the community lives.

Christchurch's water infrastructure includes:

- groundwater and surface water sources for community drinking water supply and the infrastructure that conveys water from source to end-user, including treatment where necessary
- wastewater collection, treatment and discharge network
- stormwater collection, detention, treatment and conveyance and disposal network.

The actual and potential adverse effects of discharges of stormwater (and sometimes wastewater) to the streams, rivers, estuaries, harbours and into land in Christchurch need to be managed, as do any effects of flooding.

The potential effects of climate change will also need to be responded or adapted to over the duration of the draft strategy.

1.3 Integration

Three Council strategies relating to the sustainable management of Christchurch's water resources were adopted by the Council between 2009 and 2013:

- Water Supply Strategy 2009 – 2039
- Surface Water Strategy 2009 – 2039
- Wastewater Strategy 2013

Although efforts to take account of other water resources and their inter-relationships were made during the

development of each of the existing water-related strategies, the extent to which this could be achieved was relatively limited. This has led to the development of the Integrated Water Strategy.

The Integrated Water Strategy will sit within the context of the work being undertaken by the Canterbury community under the Canterbury Water Management Strategy. The strategy will also sit within the work being undertaken to fulfil requirements under the Freshwater NPS, and the establishment of Te Hononga, a joint Council-Ngāi Tahu initiative and work programme.

1.4 Scope

The draft strategy covers respect and stewardship of the water resources within Christchurch through the sustainable and integrated management of Christchurch's water supply (including its groundwater sources), wastewater and surface water (including stormwater and flooding).

Also included within the draft strategy is an overall approach for addressing impacts of sea level rise on waterways, stormwater management and flood management. The draft strategy also covers working relationships with Ngāi Tahu.

The draft strategy primarily considers matters over which we and/or the local community can manage or influence. Matters pertaining to water resources on a regional or national level are managed through a variety of other policy and regulatory instruments, such as the Canterbury Water Management Strategy, the Land and Water Regional Plan, the Resource Management Act, national environmental standards and national policy statements.

1.5 Development of the Draft Integrated Water Strategy

The draft strategy has been developed as part of our Healthy Environment strategies programme. The process for developing the strategy is outlined in Figure 1-1. The next step for this draft is public consultation.

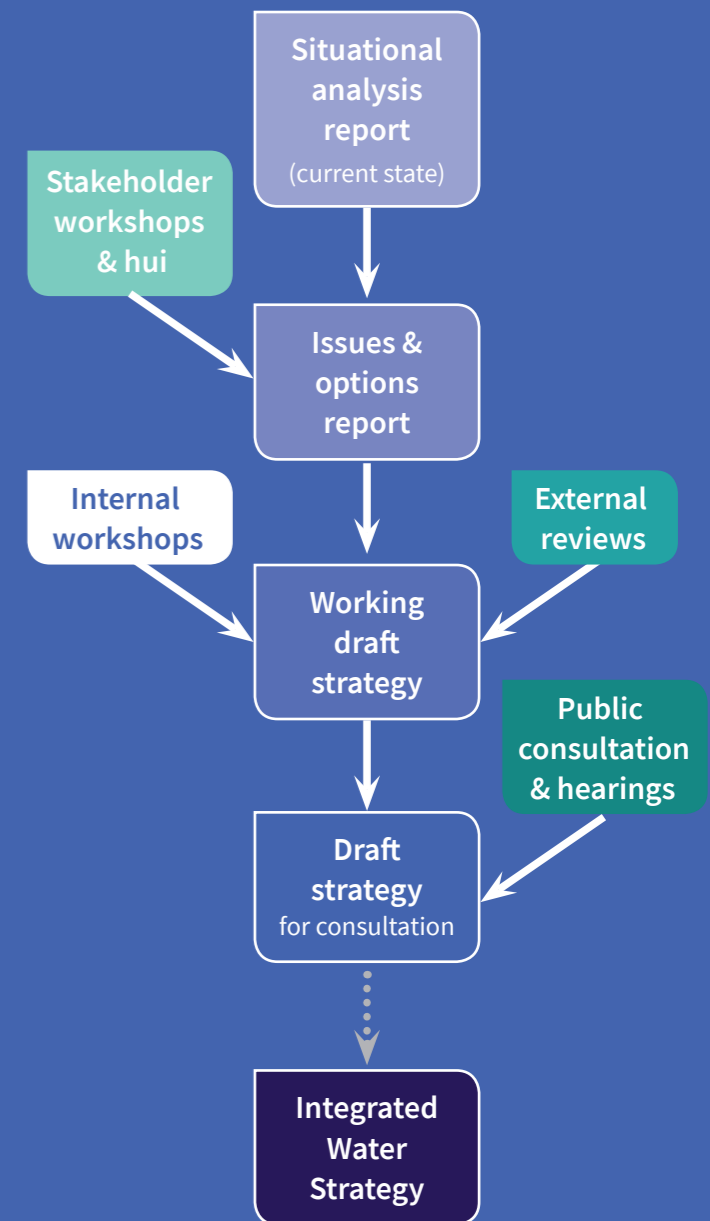


Figure 1.1. Development Process; Integrated Water Strategy

The relationship of the Integrated Water Strategy to other Council plans, strategies and policies is shown in Figure 1-2.

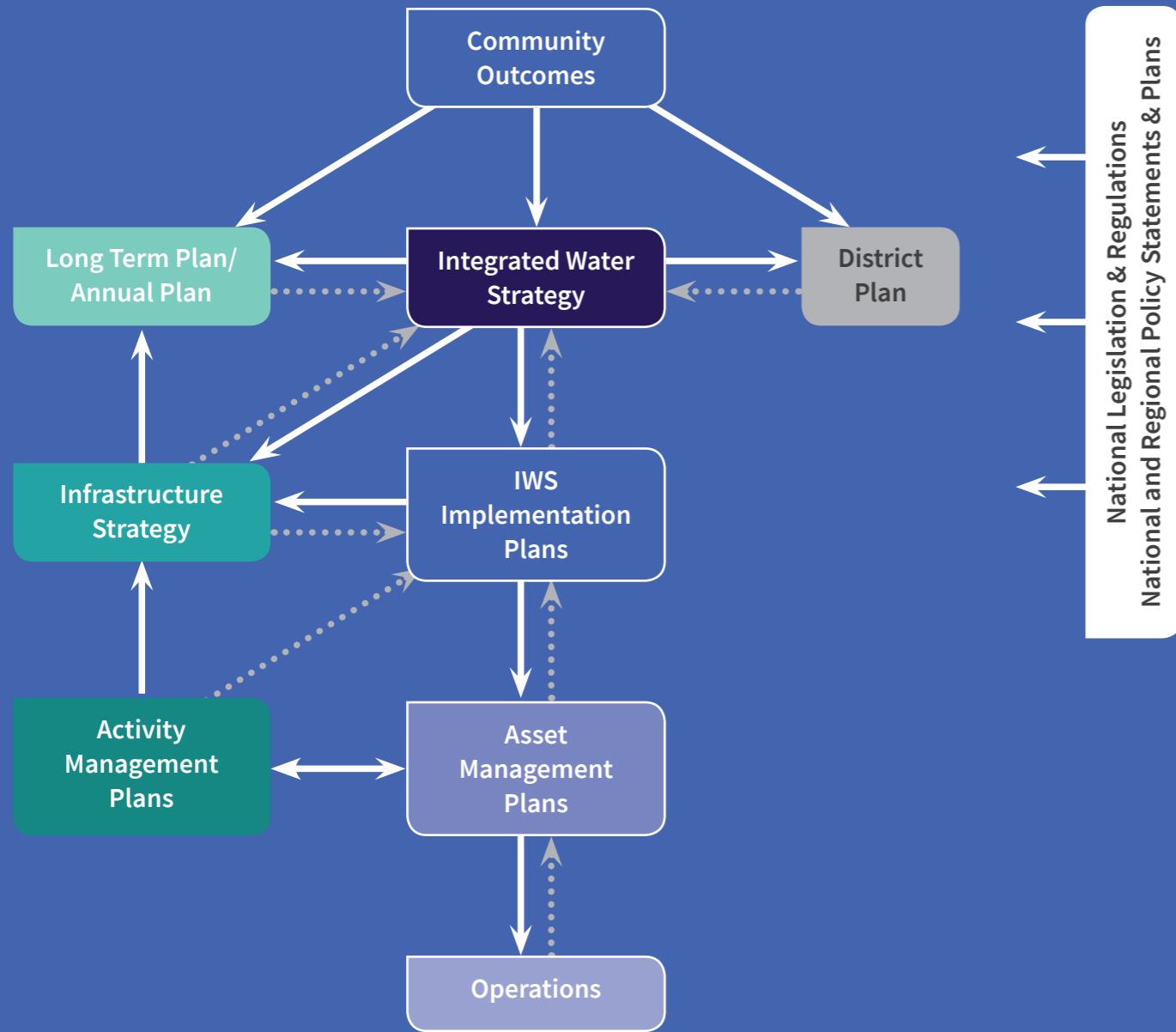


Figure 1.2. Relationships of the Integrated Water Strategy within Council

1.6 Legislative and policy context

There are a series of legislative and policy drivers for the preparation of the draft strategy, including:

- Te Tiriti o Waitangi Treaty of Waitangi
- Resource Management Act 1991
- Local Government Act 2002
- Health Act 1956, as amended
- Mahaanui Iwi Management Plan 2013
- National Policy Statement for Freshwater Management, as amended
- National Environmental Standard for Sources of Human Drinking Water
- New Zealand Coastal Policy Statement 2010

- Canterbury Regional Policy Statement
- Regional Coastal Environment Plan for the Canterbury Region
- Canterbury Land and Water Regional Plan
- Christchurch District Plan
- Waimakariri River Regional Plan (2004, as amended)
- Canterbury Water Management Strategy

A summary outline of relevant legislative and policy drivers is contained in Appendix A.

The work of the zone committees and other parties in implementing the Canterbury Water Management Strategy will be relevant to implementing the Integrated Water Strategy.



Statutes and policies influencing water management

Te tuarua **Part two:**

Te Rautaki **The Strategy**

2. Te kaupapa matua Purpose

The purpose of the draft strategy is to provide strategic direction for:

- sustainable and integrated management of water resources and taonga and guardianship of that asset
- integrated management of related infrastructure and services
- managing the effects of water infrastructure on surface, coastal and groundwater resources
- guiding Council decision making including how we will involve, work with, and reflect manawhenua values and community interests in freshwater management and decision making.

The draft strategy is a high-level long term strategy. A series of short, medium and long term goals have been identified to allow the community, manawhenua and the Council to meet the strategy's vision.

3. Te Whakakitenga Vision

Te wai ora o Tāne -
Water for life

Valuing water and water services for people and the environment

Achieving the vision means that Christchurch's water resources are managed in a sustainable, adaptive and integrated way to:

- provide people, communities and future generations with access to safe and sufficient water resources
- maintain the integrity of freshwater ecosystems
- manage hazards from flooding and sea level rise.

4. Ngā mātāpono arataki Guiding principles

We developed the following principles to guide the preparation of the draft strategy:

- **Kaitiakitanga** – Kaitiakitanga “entails an active exercise of responsibility in a manner beneficial to the resource” in which responsibility is two-fold: “ultimate aim of protecting mauri” and “the duty to pass the environment to future generations in a state which is as good as, or better than, the current state”. This guiding principle, of actively seeking to protect our water resources and improve their state for future generations, is the keystone of the strategy.
- **Integration** – the strategy needs to provide guidance to other Council strategies and plans, and provide an opportunity to integrate the management of water services, other Council infrastructure, in particular parks and roading, and water resources.
- **Longevity** – the strategy should not be time bound, but will be intergenerational, while also being aspirational yet pragmatic, affordable, ‘real’ and achievable.
- **Touchstone** – an Integrated Water Strategy is fundamental to our activities serving and benefiting the community. It will be a tool to be used in discussions internally within the Council and in interactions with the public.
- **Place-making** – the strategy needs to be cognisant of the concept of place-making (bringing the community with the Council into the development of spaces, recognising community values, liveability, cultural values and amenity) and integrating the use of green space and open space assets with water management.
- **Flood management** – the strategy acknowledges that surface water and floodplain management will become increasingly important to provide the community with liveable spaces and for addressing the effects of ongoing environmental changes such as climate change, sea level rise and changes to groundwater.
- **International best practice** – the strategy must draw on appropriate international experience and best practice to facilitate and advance continuous

improvement, using comparable examples with relevant drivers to demonstrate where strategy outcomes have been achieved successfully elsewhere to demonstrate that they are achievable, pragmatic and worthwhile.

- **Efficiency** – there is a need to rationalise the three existing water-related Council strategies, to respond in the short-term to the effects of the earthquakes and to maximise the cross-benefits when considering replacement or new assets.

The Urban Water Working Group, led by the Ministry for the Environment, developed five key principles that have also informed the draft strategy:

- **Papatūānuku** – Our relationship with the land – papatūānuku – will pre-determine our relationship with water. This principle incorporates protection and enhancement of ecosystem health through integrated planning; ‘green infrastructure engineering and mitigating impacts on waterbodies at or near source.
- **Ngā Wai Tuku Kiri** – Our waters are a gift of life provided to us by our tupuna. This principle recognises the whakapapa and relationship that mana whenua have with the waters in their rohe.
- **Tāngata** – Our environments are places of human occupation. The two-pronged focus of this principle is recognition of community aspirations and values for their urban spaces along with the consideration of full life cycle costs and benefits in building and infrastructure investment decisions.
- **Te Hāpori Me Te Wai** – The community's love and care for water is enduring. Underpinning this principle are growing and nurturing kaitiakitanga of water ecosystems, along with providing for meaningful and quality information to support decision-making and behaviour change.
- **Tiakina Mō Apōpō** – In building future resilience, our connectedness with the environment is our strength. Included within this principle is the need for improving community resilience and conserving our water resources

³As expressed in the Mahaanui Iwi Management Plan 2013.

⁴Urban Water Principles - Ngā Wai Manga, in Urban Water Principles: Recommendation of the Urban Water Working Group. Ministry for the Environment, October 2018



5. Ngā take rautaki Strategic issues

Eleven key strategic issues have been identified.

The following discussion briefly outlines each of the key issues (in no priority order), highlighting why they are key strategic issues. This gives context to the development of the goals, objectives and preferred options encompassed in the draft strategy.

5.1 Different perceptions of the ‘value’ of the waters

The community has different and often conflicting perceptions of the ‘value’ and appropriate associated uses of the waters. During the engagement workshops prior to the preparation of the draft strategy, the ‘wonderful, clean water’ within the District was identified. For some members of the community, the way water is used does not match the high quality and value of the resource.

Ngāi Tahu have a longstanding relationship to water resources, including specific rights, interests and values that are fundamental to ongoing identity and wellbeing. Water is considered a taonga first and foremost and something to be protected in its natural state. This covers all forms of water, including water conveyed by drains.

Why is it a key issue?

Understanding the multiple uses and values of water is essential for driving change. If all uses of water are understood and valued, particularly surface waterways and sources of potable water, this will enable the draft strategy’s vision to be achieved. Furthermore, we are committed to working with iwi and hapū to identify and provide for manawhenua values and interests in freshwater management.



Shopping carts in the Avonhead area, Ōtākaro Avon River

5.2 Poor state of waterways

Surface water catchments in the urban area and rural settlements are subject to contamination from a combination of stormwater, wastewater overflows and other inputs such as sediment and animal and waterfowl contamination.

Generally, in Christchurch, poorer waterway health is recorded in urban areas of the district, and better waterway health is recorded in rural areas. Receiving waterbodies, such as Te Ihutai, Te Waihora, Wairewa and the bays and harbours of the Peninsula also have water quality issues that require improvement.

Cultural Health Assessments of the Te Ihutai Avon-Heathcote Estuary and Pūharakekenui Styx catchments show that these water bodies are in a state of poor cultural health, and on the whole do not meet basic standards for cultural use. The protection, and indeed enhancement, of instream values are essential in providing for these basic health and safety needs.

Why is it a key issue?

Good waterway health (i.e. water quality and habitat) is necessary for the protection of public health and safety, to safeguard the life-supporting capacity and ecosystems of surface water bodies, and in recognition of the need to provide for Māori cultural values. There is an increasing focus nationally on freshwater quality, and the community has clearly identified aspirations for improved waterway health throughout Christchurch.



Diesel pollution in a portion of Addington Brook, June 2006

5.3 Vulnerability of Christchurch’s groundwater source to contamination

The Christchurch metropolitan drinking water source is high quality groundwater. However, there are emerging trends in relation to the potential risk of contamination of Christchurch’s groundwater sources in shallow aquifers, which need to be better managed. Following the 2016 outbreak of campylobacteriosis in Havelock North there has been greater scrutiny of ‘secure’ groundwater sources, greater rigour with which drinking water sources are assessed for security and questions raised about reliance on ‘secure’ groundwater status for untreated drinking water supplies.

Recent groundwater studies in the Waimakariri and Christchurch-West Melton groundwater zones indicate that groundwater in deeper aquifers north of the Waimakariri River flows under the river and into the deeper aquifers in the Christchurch-West Melton groundwater zone. Models show that the movement of groundwater is likely to result in a slow increase in nitrate levels in the deeper aquifers in the Christchurch-West Melton zone over 50 to 100 years.

Ecosystem health in groundwater is also affected by contaminants. Tiny invertebrates living in groundwater (stygo fauna) are thought to ‘purify’ the water in which they live, by feeding on organic matter and maintaining void spaces in the groundwater systems in a clean condition to maintain porosity (to enable flow) and oxygen. Stygo fauna can be adversely affected by contaminants such as nitrates, pesticides and heavy metals.

Why is it a key issue?

The general public perception appears to be of a well-protected aquifer system, however the degree of protection varies. Not all of the Christchurch metropolitan area lies above well-protected confined aquifers. The availability of high quality groundwater for public water supply is an extremely valuable natural resource for Christchurch, and potentially significant health, economic and environmental effects could result from contamination if groundwater is not appropriately protected.

Rising levels of nitrates in groundwater in the Waimakariri zone would influence the source of Christchurch’s drinking water, raising concerns about future risk to human and ecosystem health. A recent Danish epidemiological study found that at nitrate-nitrogen levels in drinking water at or above 0.87 mg/L there was a statistically significant increase in risk of colorectal cancer.⁵

The level at which groundwater ecosystem health may be maintained has been assessed at anywhere from 3.9 mg/L to protect 90% of aquatic species⁶ to an annual median of no more than 0.55 mg/L nitrate-nitrogen as the appropriate level to protect stygo fauna in the groundwater at Te Waikoropū Springs.⁷

5.4 Wastewater overflows and effects on surface water

Without exception, wastewater networks around the world have overflows. Christchurch is no different. This has been exacerbated by damage to the wastewater network caused by the 2010/2011 earthquakes.

Overflows of wastewater are an ongoing concern for the community, particularly manawhenua who seek the elimination of overflows to provide for safe cultural use, including mahinga kai. Therefore continually working towards solutions to manage, minimise and potentially eliminate overflows is critical.

Why is it a key issue?

Wastewater network overflows can adversely affect the water quality and ecology of waterways, can cause a public health risk, and are culturally unacceptable. However the actual effects are often less than might be perceived by the community due to the events being temporary and sporadic in nature and occurring at the time of higher flow and greater dilution in the receiving waters. There is a challenge therefore in managing wastewater network overflows to address the community, cultural and ecological concerns, without unnecessarily devoting large amounts of funds that could be used elsewhere to improve water quality.

⁵ Jorg Schullehner et al, Nitrate in drinking water and colorectal cancer risk: A nationwide population-based cohort study, International Journal of Cancer, 2018. Note that the study referred to 3.87 mg/L nitrate, which is equivalent to 0.87 mg/L nitrate-nitrogen.

⁶ From the National Policy Statement on Freshwater as updated in 2017. Note that the NPS addresses surface waters only, not groundwater.

⁷ Expert panel consensus to the Te Waikoropū Springs Water Conservation Order Special Tribunal.

5.5 Treated wastewater discharges into Akaroa Harbour

Two wastewater treatment plants at Akaroa and Duvauchelle discharge treated wastewater into Akaroa Harbour. There is a dual issue for these discharges – the concern of the community and Ōnuku Rūnanga about ongoing discharges to the harbour (notwithstanding the wastewater is treated to reasonably high levels), and the issue for the Council of the feasibility, practicality and cost of land disposal or land contact of the treated wastewater.

Why is it a key issue?

Discharging treated wastewater to the harbour is offensive to members of the community. The discharge is particularly offensive to Ōnuku Rūnanga, whose preference is for the treated wastewater to be taken out of the harbour and irrigated onto land. We need to find a solution that balances the concerns of the community and Ōnuku Rūnanga, and environmental effects with appropriate use of ratepayer funds.



Signage near Akaroa wastewater outfall

5.6 Stormwater discharges and effects on surface water

The quality of stormwater has a significant effect on surface water quality. Stormwater from urban catchments contains a wide range of contaminants ranging from suspended sediments, nutrients and micro-organisms to chemical contaminants, metals and synthetic hydrocarbons. Untreated stormwater entering streams during the first flush of rain following a dry period typically contain high concentrations of contaminants. These discharges impact on both instream ecology and water quality as well as community use, recreation and customary and cultural uses.

Why is it a key issue?

Ongoing management of stormwater is essential and necessary to protect the quality of the groundwater and surface water resources of Christchurch. However, the design, development and installation of stormwater treatment can be expensive and complex, particularly in already developed areas where retrofitting devices is the only feasible option. In addition, 'hard' infrastructure alone is not likely to achieve a degree of contaminant reduction needed for substantive surface water quality improvements. Other 'source control' initiatives, such as behaviour change (e.g. switching to copper-free brake pads and being more vigilant on sediment discharge from construction sites) will be needed as well.



Retention basin drainage covers at Wigram Skies - Kelvin McMillan

5.7 Flooding and flood management

The main rivers in the Christchurch metropolitan area – the Ōtākaro Avon, Ōpāwaho Heathcote, Huritini Halswell and Pūharakekenui Styx – have spring-fed base flows which originate from the shallow aquifers underlying the area. These rivers have relatively small surface water catchments which respond quickly to local rainfall, and cause flooding beyond the river and tributary channels from time to time.

The hill suburbs of Christchurch and the short, steep stream catchments of Te Pātaka o Rākaihautū Banks Peninsula receive a higher annual average rainfall than the flat lands, and experience higher intensity rainfalls as well. This, combined with the steep terrain, can result in high velocity flood flows, soil erosion, landslips and short term flooding.

The 2010/2011 earthquakes have also affected flooding. An increase in the incidence of flooding is most evident in areas close to waterways, and where soft ground has settled and thus become more flood prone. The earthquakes also had a significant effect on the capacity of surface waterways to convey floodwaters, as lateral spread has narrowed channels and so reduced their capacity.

In some areas, groundwater is very close to the ground surface and inhibits the infiltration of floodwaters into the soil. This increases runoff, which may worsen flooding and sometimes leads to prolonged standing surface water.



Ōtākaro Avon River flooding, March 2014

Why is it a key issue?

Flooding ranges from nuisance flooding such as on roads or private property which may limit access or cause inconvenience, to flood water affecting infrastructure and entering dwellings, causing significant damage or threatening life safety. Under the Health Act 1956, the Christchurch District Drainage Act and the Local Government Act, we have a responsibility to provide for the health and safety of the community and maintain a duty of care with respect to managing drainage, and the effects of flooding. Flooding and flood management are also clearly linked to the issue of the effects of sea level rise, groundwater level rise and the anticipated effects of climate change. It is also important to consider the need to provide for flood management areas and devices such as retention basins, wetlands and swales that can help provide solutions for integrated flood and water management

5.8 Responding/adapting to the anticipated effects of climate change and sea level rise

Sea level rise has significant implications for the district (in terms of increased coastal inundation, shallower groundwater, higher flooding levels (including river flooding) and accelerated coastal erosion. Increased salination of freshwater resources as well as potential changes to ecology, including subsequent changes to mahinga kai resources are also issues.

Coastal areas in the east of the Christchurch metropolitan area, low lying land in the mid to lower Ōtākaro Avon River catchment and lower Ōpāwaho Heathcote River catchment, and low lying areas in the main Akaroa Harbour settlements are particularly vulnerable. Sea level rise and shallowing of groundwater level in some areas, combined with extreme storm events will exacerbate the risk of inundation, and also increase the likelihood of the Ōtākaro Avon and Ōpāwaho Heathcote Rivers overtopping their banks, which since the earthquakes, now happens on a king tide along the lower Ōpāwaho Heathcote River. Pūharakekenui Styx River is also vulnerable from tidal flooding overtop of the existing sand dunes bordering Brooklands Lagoon.

In some instances, shallowing of groundwater has resulted in the water spilling out at the surface and preventing floodwaters from soaking into the soil.

Such areas have already experienced prolonged spells of standing water. The frequency and extent of these issues is likely to increase with climate-change induced shallowing of groundwater levels.

Why is it a key issue?

Sea level rise and associated coastal erosion will pose a risk to water services infrastructure in coastal areas in Christchurch. Wastewater pipelines, pump stations and other critical utility infrastructure in low lying coastal areas will potentially be affected by sea level rise. Stormwater networks in low-lying areas may suffer from backwater effects, raised groundwater levels and impeded drainage. Roading pavements, which are designed assuming normally dry ground conditions, will deteriorate quickly where groundwater is very shallow. There is a significant reduction in pavement strength due to the ingress of water, which damages and weakens supporting subgrade layers, and can cause, for example, increased number and size of potholes.

Current planning is based on current predicted sea-level rise. The Council and the community need to be mindful that predictions may change and future sea-level rise may be greater than currently forecast. Development of dynamic adaptive planning pathways will be required in order to inform decisions in light of the uncertainty with sea-level rise predictions.



Storm waves in the estuary at South Brighton, 2009

5.9 Long term availability of water for water supply

The Christchurch metropolitan area has an abundant source of very high quality groundwater. However, the exact capacity and availability of the overall aquifer is unknown, and the alternative water sources (e.g. Waimakariri River) would be significantly more expensive than the current supply. In addition, several Te Pātaka o Rākaihautū Banks Peninsula schemes already have limited water sources. Catchment and groundwater protection may not be adequate, particularly in Te Pātaka o Rākaihautū Banks Peninsula, which could lead to future water quality and availability issues. Also a concern for the community is the extent to which large-scale water takes from the same aquifers as those used for Christchurch's public water supply may affect our ability to acquire additional water takes to respond to future demand.

Why is it a key issue?

Access to high quality drinking water is important and high quality drinking water should be used appropriately to ensure the long term availability of the existing water sources, to support guardianship of our drinking water sources particularly in light of the impacts of climate change. There are also significant social, health, cultural, environmental and economic costs of not providing a reliable and safe source of water supply to the community.



Aylmers Stream intake

5.10 Long term sustainable wastewater treatment and disposal

Wastewater treatment and disposal needs for the Christchurch metropolitan area have been addressed for the next 20 years at least. As the Christchurch metropolitan area expands to the north and southwest, the cost of conveying wastewater from these growth areas to the Christchurch Wastewater Treatment Plant in Bromley will increase. Beyond 2040, Christchurch's wastewater treatment and disposal system may require changes to accommodate these growth areas.

The immediate challenge for managing the wastewater systems is to provide a long term solution to the treated wastewater discharges into Akaroa Harbour that addresses the concerns of the community and the Ōnuku Rūnanga.

Why is it a key issue?

We are developing long term wastewater treatment and disposal solutions that can accommodate future growth while balancing lifecycle costs of new assets against community and cultural concerns and environmental effects. There is the opportunity to develop more integrated solutions in the long term along with multiple paths for beneficial reuse of biosolids. Further, as disposal of treated wastewater directly into waterbodies is not acceptable to manawhenua we are actively collaborating with Papatipu Rūnanga to develop appropriate solutions for wastewater management.

5.11 Infrastructure efficiency and resilience

There have been increased water and wastewater pipe failures compared to pre-earthquake due to both age related deterioration as well as earthquake damage. A significant number of assets created in post-war construction booms are reaching the end of their lives and will require renewal. Significant infrastructure repairs are also underway to address the effects of the earthquakes.

We want to increase the resilience of the three waters infrastructure. We need to further develop a proactive risk based approach to asset management that balances long term affordability for the ratepayer against the cost of managing the asset risks. There is also a need to look at environmental infrastructure that provides additional services in relation to flood management, stormwater retention and treatment as well as ecological and cultural outcomes.

A Board of Inquiry investigation into the 2016 campylobacteriosis outbreak in Havelock North highlighted the need for greater oversight of the safety and security of both the source of community drinking water supplies and the infrastructure that delivers drinking water to customers.

Additionally there are other initiatives affecting three waters services

- A review of the manner in which water supply, wastewater and stormwater services are delivered in New Zealand is underway. Proposals include a separate national regulatory body to direct and oversee provision of the three waters services and possible 'supra-regional' public drinking water suppliers. We remain committed to local control over three waters services integrated with all other community services.
- Ministry of Health has updated drinking water standards and is reviewing the regulatory framework for drinking water.

Another issue for parts of Christchurch has to do with small settlements that are not serviced with a public water supply. For some of these communities drinking water is provided through a private scheme. Residents in other settlements rely on their own bores or rainwater as their drinking water source. Consideration of whether to provide a public reticulated supply to currently unserved settlements will require consideration of benefits afforded to those settlements against the costs of providing a public water supply, which can be high for more remote settlements.

Emerging contaminants are another area which can present challenges for manage water resources. Emerging contaminants are substances have not been commonly monitored but may have the potential to cause adverse effects on human health or ecosystem health.

Why is it a key issue?

In addition to earthquake damage, there is an approaching 'bow wave' of aging pipes and associated infrastructure that need renewal due to historic city growth patterns leading to large lengths of pipes needing renewal over a similar time period. The additional renewal requirements have the potential to impact on the affordability of rates and innovative solutions are required to improve efficient use and renewal of infrastructure.

For the groundwater-sourced public water supply to remain untreated, both the source and the infrastructure that deliver the water must be deemed 'secure'. The challenge for us is to ensure that Christchurch's drinking water is demonstrably safe and does not require residual treatment.

There is also the need for us to develop and retrofit additional stormwater, flood and wastewater treatment infrastructure. We need to ensure that infrastructure types are fit for purpose in the long term and to consider non-asset solutions where practical. Involving the community and in particular manawhenua in the design and development of water infrastructure is critical.



Wastewater pipe damaged in February 2011 earthquake

6. Ngā whāinga Goals

There are four goals for achieving the strategic vision, which align with the 2018–28 Community Outcomes⁸ as well as the ‘strategic priorities’ identified in our Strategic Framework⁹.

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

All life depends on water. Good quality water is essential for quality public health and wellbeing. Water is also valued for many other reasons, including its ecological function and role in maintaining biodiversity, its core relationship to Ngāi Tahu culture and identity (including mahinga kai), its landscape, amenity, recreational value, and its role in supporting agriculture and industry.

For Ngāi Tahu, the relationships and obligations of people to place are fundamental and are held and passed down by whakapapa. Present generations hold the responsibility of being kaitiaki and for ensuring that the essential elements of life are passed on in an equal or improved state of health. This can only be achieved by strong rules, policies, strategies we enforce which protect the taonga status of waterbodies and provide for ongoing customary and cultural use.

Within the community, people have different perceptions of the ‘value’ of all types of water, including stormwater and wastewater resources. This includes different priorities and understanding of the value the multiple uses of the city’s water resources e.g. ecology, recreation, food gathering, receiving environment for discharges.

The key elements of this goal are:

- Increasing awareness – to encourage and engage the community to value and respect the multiple uses of our water resources through advocacy and outreach programmes, demonstration projects that highlight the values of water, and considering the water

services charging structure and the way information is conveyed to the community.

- Enhancing natural and cultural values (including ecology, amenity, recreation, heritage and landscape) – through initiatives such as demonstration projects, protection of existing waterway and wetland systems, encouraging and facilitating wetlands, waterways enhancement and naturalisation, addressing stream depletion, facilitating the adoption of water sensitive design and promoting water conservation.

Goal 2: Water quality and ecosystems are protected and enhanced

Achieving a high standard of water quality in Christchurch’s surface and groundwater is essential for improving the ecosystem health of water resources, protecting and restoring Ngāi Tahu values associated with surface water resources and supporting a range of recreation activities on and around waterways. Good water quality adds to the amenity value of surface waterways, and is essential in the Te Pātaka o Rākaihautū Banks Peninsula streams and rivers and the Christchurch aquifers which supply drinking water to the Christchurch community.

Springs, streams, rivers, lakes and associated wetlands provide important ecosystem values, and are essential to the existence of plants, invertebrates, fish and birds. The estuaries, coastal lagoons (hāpua), harbours and the coastal marine area connected to these waterbodies are also important and must be protected and enhanced.

The key elements of this goal are:

- Improving water quality and enhancing the natural, cultural and ecological values of waterways – through continuing the existing Stormwater Management Plan approach to management of stormwater quality, increasing focus on sediment control measures, implementing source control and water sensitive design, wetlands and waterways enhancement and naturalisation, and where possible retrofitting water quality mitigation for existing developed areas.

- Reducing the effects of wastewater overflows – by network upgrades, targeting efforts to address overflows and reducing inflow and infiltration.
- Understanding groundwater sources and their vulnerability to contamination – through targeted investigations, further implementation of source protection, and restrictions on excavation below groundwater level.

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

The Christchurch metropolitan area is naturally flood prone, much of it is formed on vast areas of drained swamps and wetlands, and there are significant flood plains within its boundaries. Managing high flows in urban waterways and stormwater from new and existing developments and reserving space for the natural flow of the waterways are necessary to reduce the risk of flooding to the community – in other words, ‘making room for the river’. In Te Pātaka o Rākaihautū Banks Peninsula, the shorter steeper catchments present their own challenges in terms of managing flooding in the small settlements. The ongoing management of lake, estuary and coastal lagoon openings and levels (including Te Roto o Wairewa Lake Forsyth and Te Waihora Lake Ellesmere) in conjunction with manawhenua, affecting landowners and the community are also important.

Sea level rise has implications for the district in terms of increased coastal inundation, shallower groundwater, particularly in coastal areas and along tidal stretches of the rivers, higher flooding levels and erosion. It is therefore necessary to take a long term view and have a flexible approach to the management of flooding and sea level rise that enables the community to understand the risks and make timely adaptations when pre-defined conditions or triggers are met.

The key elements of this goal are:

- Understanding the extent, effect and risk of flooding, and managing effects and adapting to flooding risks – by continuing the existing programme of investigations and physical works in the interim, while developing, communicating to the community and then implementing a risk based approach to managing the effects of flooding using options appropriate to specific situations.



Eel grabbing a morsel

- Understanding risks due to sea level rise and consequences resulting from climate change, and developing an adaptive response.

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

Managing water in a sustainable and integrated way is an over-arching goal that covers the long term sustainability of the water supplies and the wastewater treatment and disposal systems. This also encompasses the integration of the waters and the renewal of aging infrastructure. The principle of kaitiakitanga requires Council to take a long term and balanced approach to water management with a focus on solutions and cultural and community outcomes, including recreation and mahinga kai. It also highlights the important connection between water quantity (managing abstraction and recharge) and water quality (treatment and discharge) and the natural flows in the surface waters.

The key elements of this goal are:

- Managing assets across all disciplines in an integrated manner to maximise attributes like place-making, collaborative benefits, eco-system service harmonies which may not be realised when assets are developed in isolation for a single discipline.
- Managing stormwater collectively wherever practicable in order to maximise efficiency, cost effectiveness and ease of maintenance. Encouraging on-site stormwater management using water sensitive design

⁸ Christchurch City Council (2018). Community Outcomes <https://ccc.govt.nz/the-council/how-the-council-works/20182028-vision/community-outcomes>

⁹ Christchurch City Council (2018). Strategic Framework (August 2018) <https://ccc.govt.nz/assets/Uploads/2018-Strategic-Framework.pdf>

where collective stormwater management is not feasible (such as areas where urban intensification and redevelopment of industrial and business land is prevalent).

- Managing wastewater systems to meet community needs – including through reviewing and revising trade waste and biosolids management and developing long term solutions for Christchurch’s future growth and for the disposal of treated wastewater from the Akaroa Harbour communities.
- Managing water sources to meet reasonable demands – by improving understanding of water sources and water use, implementing demand management projects and securing access to water supplies.
- Infrastructure efficiency and resilience – by utilising a risk based approach, proactive monitoring and the implementation of intelligent technology.
- Managing resources collaboratively. Water resources management is complex and requires collaborative integrated work programme across Council units and between stakeholders.

The draft strategy supports the implementation of the Canterbury Water Management Strategy (CWMS), as shown in the following table.

CWMS target	Relevant draft strategy goal(s)	Relevant draft strategy objective(s)
Ecosystem health/biodiversity	1, 2	1, 2, 3, 4
Kaitiakitanga	1, 3, 4	1, 3, 4, 5, 9
Drinking water	1, 4	9, 10, 11
Recreational and amenity opportunities	1, 2	1, 3, 4
Water-use efficiency	1, 4	2, 5, 11
Environmental limits	1, 2	4, 4, 8, 9

Note that other Council policies and strategies also support the implementation of the Canterbury Water Management Strategy, including but not limited to the Biodiversity Strategy, the Infrastructure Strategy, the Economic Development Strategy, the Energy Action Plan, the Sustainable Energy Strategy and the Sustainability Policy.

7. Ngā paetae Objectives

While some of the issues outlined in Section 5 are those for which we can exercise some degree of direct control, for other issues we will need support from manawhenua, the wider community, regional and central governments, and other stakeholders in order to the objectives of the draft strategy.

The objectives are not listed in any order of priority.

7.1 Objective 1: Awareness and engagement

Increase awareness and engage with the community and mana whenua regarding the multiple uses and values of water

Current situation

Encouraging and engaging the community to value and respect the multiple uses of water will enable a culture shift to a future where all uses of water are valued.

There are numerous causes of contamination in the urbanised areas and community behaviour can influence many of these; for example sediment from construction, bacteria from waterfowl and dog faeces, and dumping of litter into the waterways. Residential properties pay targeted rates for the three water services but these charges are not specifically shown on the rates bill. The typical public perception is that the supply of drinking water is virtually free and unlimited. Most residential properties are metered but some meters cover more than one property. Residential meters are read every two years and information on water use is only sent to high water users. Per capita water consumption is higher than other New Zealand cities that have universal metering and volumetric pricing.

Suggested approaches

Works aimed at achieving this objective should seek to link to joint work programmes with Ngāi Tahu Papatipu Rūnanga and Mahaanui Kurataiao where relevant and appropriate.

1. Advocacy and outreach

The need for a ‘step-change’ in the way people value Christchurch water was identified in the stakeholder workshops. Advocacy and outreach initiatives would be the foundation to support other suggested approaches implemented for the draft strategy, valuing all of the waters needs to become a ‘top-of-mind’ issue for the majority of the population to achieve the ‘step-change’ required to a future where the waters are valued by all.



Kā pūtahi (Kaputone) Creek – Kelvin McMillan



Council Ranger John Parry with students in the Learning Through Action's Freshwater Frolicking programme

2. Demonstration projects

Stakeholders have suggested demonstration projects as an interim measure for naturalising the waterways in the Christchurch metropolitan area. This recognises the potentially large scale and cost of the works necessary to fully implement naturalisation. Implementation of projects to protect areas of springs and naturalising existing piped waterways would support mana whenua aspirations, ensuring relevant Ngāi Tahu Papatipu Rūnanga are involved, and provide demonstrations of the value of water and waterways.

3. Facilitate water sensitive design

Water sensitive design seeks to protect and enhance natural freshwater systems, sustainably manage water resources, and mimic natural processes to achieve enhanced outcomes for ecosystems and communities. The community has expressed a desire for water sensitive design measures such as rainwater harvesting and greywater reuse to be made easier to incorporate into new or renovated houses or housing developments. This suggested approach has linkages to a related approach to address objective 3.

4. Improve public understanding of the cost of water services

Our current charging structures are targeted rates for water supply, wastewater and stormwater services. This approach means that, unless they are high water

users (typically non-residential customers charged for their excess water use on a volumetric basis), all customers of our water services pay a common rate for each water service regardless of the volume consumed or produced. Changing our water services charging structure was raised as an option during engagement workshops.

5. Waterways and wetlands enhancement and naturalisation

Encouraging and facilitating naturalisation works in key identified waterways and wetlands can assist the community to value water, and to improve the state of the District's waterways. Works could be Council initiated or developed in collaboration with developers and/or local communities, or undertaken by community groups (with our support).



Cashmere Stream Care Group members removing weeds from the Stream – Karen Whitla, Cashmere Stream Care Group

Proposed ways of measuring achievement of the objective:

- Annual average residential consumption of drinking water in litres per resident per day
- Peak day water supplied per connected property (L/connection/day)
- Assessment of the state of the Takiwā.

7.2 Objective 2: Efficient and resilient infrastructure

Ensure efficient use of three waters infrastructure and ensure the resilience of entire networks (including natural waterbodies) over the long term through timely asset renewal and/or better alternative solutions.

Current situation

There have been increased water supply and wastewater pipe failures due to both age related deterioration and earthquake damage. Damage to stormwater and land drainage assets including damaged pipes and pump stations, as well as stopbanks and box drains was also caused by the earthquakes. We have started work towards a proactive risk based approach to asset renewal that takes into account asset criticality, condition and performance.

In addition, the 2017 Government Inquiry into the Havelock North drinking water issues has resulted in a trend towards a more rigorous assessment of water supply security. We initiated a programme of works to upgrade below-ground wellheads to regain the 'secure' status of the metropolitan Christchurch water supply. Re-attainment of secure status will enable us to retire the temporary chlorination of the metropolitan Christchurch public water supply put in place from March 2018.

Ngāi Tahu have played a prominent and influential role in the re-build of Ōtautahi Christchurch, particularly around designing the urban environment in a way that respects the taonga status of its waterways. Ngāi Tahu wish to maintain this role and ensure that improved infrastructure is developed that reflects Ngāi Tahu values.



Earthquake damaged pipe – City Care

Suggested approaches

There may be opportunities for projects undertaken to meet objective 2 to link to joint work programmes with Ngāi Tahu Papatipu Rūnanga and Mahaanui Kurataiao Ltd.



Pump station, Aranui, is an example of greater infrastructure resilience

1. Proactive risk-based asset renewals

Development of formal procedures for assessment of asset criticality, condition and performance is the first stage to improve our renewal planning approach. The second stage requires development of processes and guidelines for renewals criteria, renewals modelling and identification of opportunities to renew a group of assets that are inter-related. A key supporting action is the asset data capture, verification and validation programme, particularly for Te Pātaka o Rākaihautū Banks Peninsula infrastructure which has the greatest data gaps.

2. Proactive monitoring of condition

Condition based monitoring is the process of systematic data collection and evaluation to identify changes in performance or condition of a system, or its components, so that remedial interventions can be planned in a cost effective manner to maintain reliability and ensure continued service for customers. Condition-based monitoring is seen as a national and international best practice.

3. Intelligent technology

Intelligent technology would be used to improve infrastructure asset renewal and/or to enable more efficient use of existing infrastructure.

4. Continuing to manage for the six core values for stormwater and flood management

For over 20 years, we have focused on a multi-value and multi-party approach to stormwater and flood management. By identifying six core values – ecology, drainage, culture, heritage, landscape and recreation – as the drivers for improved surface water, stormwater

and flood management, we have begun to translate legislative requirements and community aspirations into tangible reflections of a more sustainable approach to asset management.

5. Emerging contaminants

We will continue to monitor scientific evidence regarding emerging contaminants.

Proposed ways of measuring achievement of the objective:

- Water main breaks per 100km per year, targeting a decreasing year-on-year trend
- Wastewater collection system dry weather overflows per 1000 connected properties per year, targeting a decreasing year-on-year trend.

7.3 Objectives 3 and 4: Enhancement of ecological, cultural and natural values and water quality improvement

3: Enhance the ecological, cultural and natural values (including amenity, recreation, customary use, heritage and landscape) of waterways

4: Improve the water quality of surface water resources to protect ecosystem health and provide for contact recreation, food gathering and cultural values.

Current situation

Concern over the quality of rivers and streams has been consistent in feedback from the community and manawhenua.

The highly urbanised catchments such as the Ōtākaro Avon and Ōpāwaho Heathcote Rivers have poorer ecological health, whereas the less urbanised areas, such as the upper reaches of the Pūharakekenui Styx River, the Ōtukaikino catchment and many of the Te Pātaka o Rākaihautū Banks Peninsula waterways have much better ecological health.

Suggested approaches

Where appropriate works undertaken to achieve these objectives should link to joint work programmes with Ngāi Tahu Papatipu Rūnanga and Mahaanui Kurataiao Ltd.

1. Advocacy and outreach and Demonstration projects

These two approaches are shared in common with the suggested approaches 1 and 2 for objective 1.

2. Continue and enhance implementation of the current approach to stormwater management

The Stormwater Management Plans being prepared as part of the Comprehensive Stormwater Network Discharge Consent consider a number of measures for implementation in particular catchments or areas of catchments, such as:

- continuing a comprehensive surface water quality monitoring network to prioritise areas for stormwater management upgrading and treatment
- assessing stormwater network expansion and treatment and storage improvement opportunities
- requiring greenfield and significant infill residential developments to construct stormwater detention and treatment systems or connect to an existing collective mitigation system
- exploring options for retrofitting existing infrastructure
- undertaking stormwater network drain clearing practices
- working with landowners, and commercial and industrial land users to address on-site stormwater management practices
- installing rainwater gardens and investigating pavement types
- implementing large-scale measures such as sedimentation and detention ponds and wetlands where suitable land is available

Our current aim is for all of the catchments in the Christchurch District to be covered by a Stormwater Management Plan by 2020.

Controlling contaminants at source would lead to an improvement in the state of waterways in Christchurch. Some of these controls require a nationwide, co-ordinated response and we could advocate to central Government for this.

3. Increased sediment control

Sediment discharges are a frequent cause of adverse effects in Christchurch's surface waterways, including Whakaraupō Lyttelton Harbour and Akaroa Harbour. Conditions are placed on resource consents for developments, but there are a number of other measures that could be instituted to increase control over the effects of sediment discharges such as:

- land use controls to limit vegetation clearance and overgrazing in areas identified as priorities for addressing sediment discharge
- improved mitigation of sediment discharges from road corridors and cuttings
- monitoring and enforcement of erosion control.



Planting for erosion control, Bowendale Park – Kelvin McMillan

4. Waterway vegetation management

Aquatic vegetation clearance is undertaken, both in-channel and along banks, throughout many of our waterways to maintain channel capacity for flood flows and recreational use. The removal of this vegetation can remove habitat and food for animals, such as fish, and can result in the discharge of sediment when plants along banks are removed.

Stakeholder workshops identified the option of adjusting vegetation removal practices to take into account the ecological values of waterways, such as controlling growth of flag iris in the lower Ōtākaro Avon River and refraining from 'shaving' banks along areas of the Ōtākaro Avon and Ōpāwaho Heathcote Rivers to support inanga spawning in these areas.

5. Stormwater and wastewater network upgrades and real-time control technology

Wastewater and stormwater network upgrades and real time control technology also have a significant role to play in improving the resilience of the networks. Increasing the resilience of the network will both improve the ability of the network to cope with further seismic or other natural hazard events, and also reduce the potential for adverse effects from discharges from damaged or inadequate areas of the networks.



Rusting roof



Canada geese along Ōtākaro Avon River – Kelvin McMillan

Wastewater and stormwater network upgrades and real time control technology also have a significant role to play in improving the resilience of the networks.

Continuing to consider and, where possible address capacity constraints at the time of installing new and replacing existing infrastructure provides a cost effective solution for managed improvements. Additional consideration and implementation of real-time control technology to make use of spare network capacity offers further opportunities to reduce overflows.

6. Wetlands and waterways enhancement and naturalisation

Continuing naturalisation works of key identified wetlands and waterways, and protection of existing waterbody and wetland systems, should form an important measure to assist the community to value water and to improve the state of the District's waterways.

Our Waterways, Wetlands and Drainage Guide (WWDG) could be used to assist with this work.

7. Implementation of water sensitive design

The basic approach of water sensitive design is described in relation to suggested approach 3 under objective 1, in relation to enabling the community to implement water sensitive design measures. Water sensitive design can also be applied at multiple scales, for structure planning, subdivision and site development. It is appropriate for both greenfield sites and brownfield redevelopment. It can have a significant positive effect in reducing adverse effects on water quality and can reduce the effects of downstream flooding by delaying discharges and utilising ground soakage to reduce immediate runoff.



Knights Stream restoration riffle and fish pass

A combination of regional policy statement, regional plan and district plan provisions would facilitate adoption of water sensitive design into developments where collective stormwater systems do not exist or have insufficient capacity. We are directly responsible only for district plan provisions. To implement this option we work closely with Environment Canterbury to ensure the regional planning framework appropriately facilitates the adoption of water sensitive design.



Stormwater control, Tait Industrial Park – Kelvin McMillan

8. Development of stormwater discharge standards

Through a regulatory mechanism, such as the Comprehensive Stormwater Network Discharge Consent or section 35 of the Water Supply, Wastewater and Stormwater Bylaw 2014, standards for stormwater discharges could be developed. These standards could aid in limiting the concentration of affected contaminants in stormwater, and thence to receiving surface water bodies.

Proposed ways of measuring achievement of the objective:

Enhance ecological values	Quantitative Macroinvertebrate Community Index scores
Decreasing sediment inputs	Fine sediment percent cover of stream bed Maximum concentrations of Total Suspended Sediment in surface water
Reducing copper, lead and zinc levels	Maximum concentrations of dissolved copper, lead and zinc in surface water and sediment
Reducing nutrient levels	Maximum total macrophyte cover of the stream bed Maximum filamentous algae cover of the stream bed
Mana whenua values	Cultural Health Index (CHI) and State of Takiwā scores

7.4 Objective 5: Wastewater overflows management

Reduce and work towards eliminating, the effects of wastewater overflows.

Current situation

Wastewater network overflows can adversely affect the water quality and ecology of waterways, and may pose a public health risk. The overflows are also considered culturally offensive to Ngāi Tahu who either maintain or have aspirations to carryout mahinga kai food gathering practices. Ngāi Tahu oppose wastewater overflows and wish to see the elimination of untreated wastewater into waterways.

Challenges for managing wastewater overflows and community perception include:

- Pre-earthquake some parts of the wastewater network had insufficient capacity to convey storm flows. Stormwater inflow and groundwater infiltration entering the wastewater network has significantly increased as a result of the earthquakes, resulting in a further reduction in capacity.
- Rapid post-earthquake housing development on the periphery of the Christchurch metropolitan area, together with new housing intensification areas arising from the Land Use Recovery Plan, and the potential for further intensification as a result of provisions in the Christchurch District Plan, has placed, and is likely to continue to place, considerable additional pressure on the capacity of parts of the network.
- Experience in Christchurch, nationally and overseas has demonstrated the difficulty of significantly reducing inflow and infiltration. Once the easily identified sources have been determined and resolved and treated (such as significant individual illegal stormwater connections), there would then be a diminishing level of return on investment in inflow and infiltration reduction programmes.

Suggested approaches

Works aimed at achieving this objective could link to joint work programmes with Ngāi Tahu Papatipu Rūnanga and Mahaanui Kurataiao where relevant and appropriate.

1. Wastewater network upgrades

To date, infrastructure construction projects have been designed to both provide capacity for growth and to address wet weather overflow reduction. Preliminary post-SCIRT wastewater modelling results show that



Warning sign, Ōtākaro Avon River, after 22 February 2011 earthquake

the wastewater network is worse than before the 2010/2011 earthquakes.

Continuing to co-ordinate capacity improvements with renewal of infrastructure provides a cost effective solution for managed improvements. Additional consideration and implementation of real-time control technology to make use of spare network capacity offers further opportunities to reduce overflows.

Increased use of pressure and vacuum sewer systems (or other smart systems) is expected to progressively reduce levels of inflow and infiltration within local catchments. This should be undertaken in parallel with improvements to the stormwater systems in those catchments to maximise the benefits of these types of wastewater systems.

2. Effects based wastewater network consent

There are environmental, social and cultural pressures regarding management of wastewater overflows. However the traditional approach to catchment management focused on managing wastewater overflows risks spending large sums of money for little benefit in terms of actual community outcomes unless stormwater contamination is also addressed. An integrated effects-based network overflow consent would assess total catchment pollution from both stormwater and wastewater discharges, so that mitigation efforts and infrastructure spending can be prioritised based on cost effective and risk based water quality outcomes.

3. Reducing inflow and infiltration

There is a clear link between wastewater overflows and inflow and infiltration into the wastewater network. Inflow can be reduced by measures such as addressing illegal household stormwater connections to the wastewater network and sealing vents on wastewater manholes to exclude stormwater from the system. Increased use of pressure and vacuum sewers will reduce levels of infiltration and also therefore reduce overflows.



Pressure wastewater system, east-central Christchurch – Stronger Christchurch Infrastructure Rebuild Team (SCIRT)

4. Encouraging or requiring repair/renewal of private sewer laterals

Private laterals are not our responsibility but can be a significant source of infiltration to wastewater networks and potential groundwater contamination, particularly where laterals are in poor condition, or earthquake damaged.

Private lateral upgrades will help to reduce wastewater overflows and improving the state of Christchurch's surface waterways as well as reduce the potential for groundwater contamination resulting from untreated wastewater leakage affecting surface groundwater quality.

Proposed ways of measuring achievement of the objective:

- Reducing frequency of overflows, reported as the annual number of overflows per 1000km of pipe.

7.5 Objective 6 and Objective 7: Flood risk and flood management and adaptation

6: Understand the likely extent and effect of flooding, and the risk posed by flooding

7: Manage and adapt to the effects of flooding using natural systems, planning tools, community adaptation and infrastructure solutions

Objectives 6 and 7 are grouped together as they both relate to flooding and flood management

Current situation

We already have in place a comprehensive approach to flooding and flood management that dates back to the early work of the Christchurch Drainage Board at the start of the twentieth century. However, the earthquakes had a significant effect on both flood management assets and the waterways of Christchurch, particularly in the Christchurch metropolitan area. The increase in flooding as a result of the earthquakes is most evident in areas close to the waterways, where soft ground has settled and thus become more flood prone.

Suggested approaches

Works aimed at achieving these objectives could seek to link to joint work programmes with Ngāi Tahu Papatipu Rūnanga and Mahaanui Kurataiao where relevant and appropriate.

1. Enhance the current approach for flooding and flood management

We have a multi-value management and treatment philosophy, and has begun preparing comprehensive Stormwater Management Plans. Stormwater Management Plans for all areas will have been prepared by 2020, the implementation of the recommendations of these plans will be a longer term exercise.

Flood models across the city are also being updated. A comprehensive and integrated city-wide assessment of flood-risk will help us to better understand the implications of management decisions being made, and to make appropriate decisions around how to address flood risk in an integrated way.

Monitoring of shallow groundwater level across the city will improve flood modelling accuracy and help inform decisions.

District Plan provisions to address known flood hazard (including defining flood management areas) have been developed and implemented. The continued development of flood models to cover the full area of the city and the unfolding effects of sea level rise mean that District Plan provisions will continue to evolve.

The earthquakes had a significant effect on flood management assets and the waterways of the district, particularly in the Christchurch metropolitan area. In response, we launched the Land Drainage Recovery Programme in 2012. There are a range of physical defences proposed in the programme, including stopbanks, pump stations, waterway channel modifications (widening, re-grading, bank trimming), floodwater storage and property level defences (such as house raising).

2. Develop a risk based approach to managing the effects of flooding

Best practice for flood risk mitigation is to develop a risk based approach. Decisions on floodplain management in the lower reaches of our major rivers need to be made within an 'all hazards' framework. We have already taken the first steps towards a risk based approach to flood management:

- Delivering an integrated approach to flood modelling across the city
- Developing a financial model to feed into the integrated city-wide flood modelling, to enable the economic costs of options to be considered against each other
- Undertaking a multi-hazards analysis to inform decisions on floodplain management in the lower reaches of our major rivers
- The work under the Land Drainage Recovery Programme and other Council projects consider at a local scale the options and costs of particular flood management or mitigation options for specific sites, balancing those against the residual consequences of flooding, and prioritising actions

A system that is adaptive and responsive to change needs to be developed and flood management processes and procedures developed so that:

- Sustainable flood plain development and risk management are a normal part of business and community activities and development
- People are informed and understand and accept the level of flood risk in Christchurch



Flooding on Christchurch-Akaroa Road, August 2012

- A combination of measures (such as those outlined above) is instituted, rather than reliance on single approaches in isolation
- Long term outcomes rather than short term measures are considered
- Integrated catchment and floodplain management is undertaken as a matter of course
- Natural processes and systems are understood and taken into account
- Climate change and variability are factored in.

We will continue to work with other territorial authorities, Environment Canterbury and the Government to develop appropriate flood mitigation responses.

3. Communicate a risk based approach to the community and foster community support

Best practice for a risk based approach to flood management emphasises the need for conversations with the affected communities about the options and approaches – particularly in relation to responses that do not involve structural measures.

A conversation needs to be held with the community about feasible and realistic levels of service in relation to management of flooding across Christchurch, informed by the outputs of the current modelling, additional modelling, the works under the Land Drainage Recovery Programme, and the development of the Stormwater Management Plans, noting the uncertainty resulting from climate change.

4. Implement options tailored to address flood management in specific circumstances

The implementation of a whole-of-catchment approach that includes a range of tools to address flood risk is an important component of a risk based approach to flood management. Our existing programme of Stormwater Management Plans offers an opportunity to move further towards whole-of-catchment integrated floodplain management and a risk based approach.

A number of tools exist for flood management. Some of these were canvassed in stakeholder workshops as part of the development of the draft strategy, including:

- Review of operation and management regimes - provides opportunities to maintain the inlet capacity of the stormwater system, to reduce the incidence of nuisance flooding
- Development of multi-use areas - where appropriately sited public open space can be used as flood detention areas and to reduce the effects of downstream flooding. The Residential Red Zone in the Ōtākaro Avon catchment is an opportunity to 'make room for the river', by re-aligning the stopbanks onto a more stable foundation away from the present water edge
- Property specific interventions - such as house purchase, house tanking, raising floor levels, relocation, and development of commercial properties to withstand the effects of flooding
- Engineering solutions - such as stopbanks, stormwater detention and ponding areas, in order to delay the impacts of climate change and allow prolonged occupation of areas at risk of flooding.
- Development of District Plan provisions aimed at limiting development in flood-prone areas is also likely to play an important role in integrated floodplain management

Other tools suggested through available best practice include:

- Ongoing communication and education plans to inform people of flood risk
- Naturalising areas to achieve better management of stormwater
- Advice to landowners on flooding and mitigation options
- Land purchase.



Tay Street Drain #1 check valves, part of Flockton Basin flood mitigation works

Proposed ways of measuring achievement of the objective:

- For each flooding event, the measure is the number of habitable floors affected (expressed per 1000 properties connected to the stormwater system), targeting a decreasing event-by-event trend for similar sized events. Use modelling to demonstrate year by year improvements.

7.6 Objective 8: Sustainable wastewater systems

Manage the effects of the wastewater systems to meet community needs for environmental, social, cultural and economic sustainability over the long term

Current situation

The immediate challenge for managing the wastewater systems is to provide a long term solution to the treated wastewater discharges into Akaroa Harbour that addresses the concerns of the community and Ōnuku Rūnanga.

Wastewater treatment and disposal needs for the Christchurch metropolitan area have been addressed for the next 20 years at least. Beyond 2040, Christchurch's wastewater treatment and disposal system may require changes to accommodate the new areas of growth in the north and southwest.



Trickling filters, Christchurch Wastewater treatment plant - Kelvin McMillan

Suggested approaches

There may be opportunities for projects undertaken to meet objective 8 to link to joint work programmes with Ngāi Tahu Papatipu Rūnanga and Mahaanui Kurataiao Ltd.

1. Improved trade waste management

The Trade Waste Bylaw 2015 includes measures to advance waste minimisation and cleaner production, and other measures to protect the wastewater infrastructure and natural waterways.

Improved management of trade waste could include regulatory or non-regulatory mechanisms to encourage trade waste customers to pre-treat at source.



Biosolids dryer, Christchurch wastewater treatment plant

2. Biosolids management with multiple pathways for beneficial reuse

The current biosolids management approach is centralised dewatering and thermal drying of biosolids at the Christchurch Wastewater Treatment Plant to stabilise the material and minimise volume (this includes trucking of biosolids from the Akaroa Harbour plants to Christchurch for processing). The dried biosolids are then trucked to the West Coast for beneficial use in remediation of the Stockton Coal Mine land. Reuse is also consented in Chaney's Forest or the material can go to landfill. An opportunity exists to reconsider biosolids treatment and reuse, particularly from the Akaroa Harbour wastewater treatment plants. There may be opportunities for multiple paths for beneficial reuse of biosolids in the future.

3. Develop a long term wastewater treatment and collection solution to accommodate future growth

The Christchurch wastewater treatment plant at Bromley has sufficient capacity to treat flow associated with projected growth for the next twenty to twenty five years. A shift in the city's population has already occurred to the north and to the west of the city as a result of the earthquakes and is expected to continue. This will result in longer conveyance distances and increased average retention time within the wastewater network. We need to fully investigate alternatives to centralised wastewater treatment to address wastewater treatment and disposal needs after 2040 for the Christchurch metropolitan area (including Whakaraupō Lyttelton Harbour). The alternatives include decentralised treatment, satellite treatment plants and/or sewer mining.

All three alternatives have the potential for beneficial reuse of treated wastewater due to lower volumes. An example would be as irrigation water for Council sports fields/parks and/or industrial or agricultural use. Recovery of nutrients from wastewater treatment streams, in particular the recovery of phosphorus, are opportunities for the future.

4. Reduce generation of wastewater at source

Increasing water use efficiency in domestic, commercial and industrial settings, to directly reduce the volume of wastewater being generated is currently done through education, with bylaw requirements regulating trade waste discharges.

Compliance checks are used and could be expanded as necessary to address the impact of other water users on wastewater discharges. Water demand management can lead to a reduction in the volume of wastewater volume where the measures target water use inside buildings. Reducing wastewater at source could extend to the programme of inflow and infiltration identification and reduction.

This approach links to reduction of inflow and infiltration (option 3, objective 5), trade waste management (option 1, objective 8) and water demand management (option 1, objective 11).

5. Agree with Ngāi Tahu and the community on long term solution for treated wastewater in Akaroa Harbour

We have been working on an upgrade for the Akaroa wastewater scheme and its discharge to address the ongoing concern from the local community, including Ōnuku and Wairewa Rūnanga, about the current treatment plant location at Takapūneke and the discharge of treated wastewater directly into Akaroa Harbour. The community and local rūnanga have expressed strong preferences for treated wastewater to be available for non-potable reuse and irrigation to land. A new wastewater treatment plant on an alternative site above Akaroa has been consented. We are exploring alternatives to the harbour discharge.

The discharge of treated wastewater from the Duvauchelle wastewater treatment plant into Akaroa Harbour is consented until 2023. The Duvauchelle wastewater treatment plant provides secondary treatment of wastewater and ultraviolet (UV) disinfection before discharging the treated wastewater to the Harbour via a 1.6km long outfall pipeline. Consent conditions require the investigation of alternative disposal options.

Proposed ways of measuring achievement of the objective:

- Maintain consent compliance for wastewater treatment plants; targeting 100% consent compliance.
- Percentage of biosolids diverted from landfill; targeting 100% of biosolids are diverted from landfill (assumes all biosolids diverted from landfill have beneficial reuse).

7.7 Objective 9 and Objective 10: Groundwater protection and improvement in understanding of aquifer system

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

10: 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

Objectives 9 and 10 are grouped together as they both relate to protecting the quality of water sources for drinking water supplies.

Current situation

The availability of high quality groundwater for public water supply is an extremely valuable natural resource for Christchurch and has been a source of pride for residents. Common to all groundwater sources, Christchurch's aquifers are vulnerable to contamination and, while the likelihood of contamination of the deeper aquifers is very small, the consequences would be significant, costly and potentially irreversible.

Recent groundwater monitoring and modelling has found that groundwater from deeper aquifers north of the Waimakariri River can travel under the river and into the deeper Christchurch aquifers. This is a concern due to the rising nitrate levels in groundwater in the Waimakariri zone.



Artesian bore – John Webber

A recent Danish epidemiological study has found a strong link between nitrate concentration in drinking water and increased risk of colorectal cancer when nitrate is present at concentrations at or above 0.87mg/L nitrate-nitrogen.

Suggested approaches

Works aimed at achieving this objective could link to joint work programmes with Ngāi Tahu Papatipu Rūnanga and Mahaanui Kurataiao where relevant and appropriate.

1. Support research and monitoring programmes to better understand of groundwater vulnerability to contamination

Improving understanding of the extent and potential contamination mechanisms for groundwater would help to determine actions needed to address the issue of groundwater vulnerability. This could impact on stormwater management, and improve the poor waterbody state by maintaining the quality of groundwater discharging to the District's surface waterways.

2. Source protection of drinking water supplies

For the Christchurch metropolitan area, source protection could consist of a detailed assessment of general aquifer vulnerability, a capture zone analysis for each Council drinking water well, and a contaminant inventory to identify specific risks for each well.

In particular establishment of a precautionary limit for nitrate in groundwater sources of public drinking water is needed¹⁰.

Recommendations for groundwater protection should be developed for each Council drinking water supply protection zone. Public education would be an important part of the source protection approach.

We will continue to advocate from improvements in groundwater protection at both the regional and national levels. This would form a part of our commitment 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. This links to approaches suggested for objective 11.

¹⁰ For example, the level at which groundwater ecosystem health may be maintained has been assessed at anywhere from 3.9 mg/L to protect 90% of aquatic species and 2.4 mg/L to protect 95% of aquatic species to an annual median of no more than 0.55 mg/L nitrate-nitrogen as the appropriate level to protect stygofauna in the groundwater at Te Waikoropū Springs. With respect to human health, while the New Zealand Drinking Water Standard is 11.3 mg/L nitrate-Nitrogen, a recent Danish study found an increased risk of colorectal cancer at nitrate-Nitrogen levels as low as 0.87 mg/L.

Akaroa wastewater treatment plant – Kelvin McMillan



3. Restrictions on excavation and filling below groundwater level

In areas to the west of the Christchurch metropolitan area, excavation activities (primarily quarrying for gravel extraction) represent a risk to groundwater quality, particularly in relation to the backfilling and rehabilitation of excavated areas over the unconfined aquifers. A further risk is the longer term potential for groundwater level to rise with the completion of large scale irrigation schemes on the Canterbury Plains. This could result in contact with possible contaminated backfill already in place in excavations that were at the time of excavation above the highest recorded groundwater level, but in the future could be within areas of increased groundwater levels. Controlling the depth of excavation in relation to the groundwater level, requirements for rehabilitation plans and control of material used for backfilling would help to manage the risk to groundwater quality.

A further risk is the longer term potential for groundwater level to rise with the completion of large scale irrigation schemes on the Canterbury Plains. This could result in contact with possible contaminated backfill already in place in excavations that were at the time of excavation above the highest recorded groundwater level, but in the future could be within areas of increased groundwater levels.

4. Partner with Environment Canterbury and neighbouring district councils

Suggested approaches will not be effective without partnering and engaging with Environment Canterbury and neighbouring district councils. Through its regional planning and consenting processes Environment Canterbury establishes policies and rules which manage activities which may affect groundwater quality and/or quantity.

Matters affecting groundwater are not constrained to jurisdictional boundaries. The inter-zone nitrate issue described in section 7.7 is one example. We will be unwavering in its advocacy for minimising nitrate incursion into groundwater sources used for drinking water supply.

We will continue to work collaboratively with Environment Canterbury and Waimakariri and Selwyn District Councils to promote and enhance groundwater protection.



Spring, Wai-iti Stream

Proposed ways of measuring achievement of the objective:

- Proportion of Council drinking water wells with source protection zones identified that provide specific protection/management of land use around the existing community supply wells.
- Monitoring groundwater quality of biological and chemical contaminants of concerns (e.g. nitrates) against human health and ecosystem health parameters

7.8 Objective 11: 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.

Current situation

A clear message from stakeholders, manawhenua and the community is the desire to both protect and make the best use of existing drinking water sources. The Christchurch metropolitan area and Whakaraupō Lyttelton Harbour settlements have an abundant but finite source of high quality groundwater. Several Te Pātaka o Rākaihautū Banks Peninsula schemes however have limited water source availability e.g. water restrictions are typically implemented in Akaroa during the peak summer holiday season. Options may be needed in the shorter term for Te Pātaka o Rākaihautū Banks Peninsula settlements to ensure sustainable water supplies are available.

Environment Canterbury manages water resources through its regional plans and policies. We manage water resources through our District Plan and its strategies and policies. More information about how water resources are managed by the Council and Environment Canterbury can be found in Appendix A.

We have long recognised the need to ensure the sustainability of Christchurch's groundwater and has undertaken water demand management and leakage reduction work since at least 1996.

Protection of the Christchurch aquifers from contamination and infrastructure upgrades continue to be a key priority, along with testing to provide ongoing confidence that the metropolitan Christchurch public water supply poses minimal public health risk. However, it is noted that central government is reviewing the regulatory policy arrangements for drinking water supply and some form of treatment (UV disinfection, chlorination etc.) may become more likely. Additionally, it is becoming apparent that other public health initiatives e.g. fluoridation may impact on water supply infrastructure in future.¹¹

An untreated public water supply for the Christchurch metropolitan area is embedded in Christchurch's social and cultural identity. We remain committed to providing

demonstrably safe drinking water without the need for residual disinfection.



Intake for Duvauchelle water supply, Pipers Stream

Suggested approaches

The following preferred options were identified to address this objective:

1. Improve understanding of water use and develop improved demand management programme

This option builds on the legacy of our water demand studies undertaken since 1996. Our water demand forecasting model can assess the potential impact of water demand management initiatives. Examples of water demand management interventions that could be evaluated include more frequent meter reading with results provided to residents, assessment of volumetric charging as noted in option 4 for objective 1, incentives to encourage retrofit of dual flush toilets and installation of sub-surface garden watering systems.

We will continue to work with Environment Canterbury to develop an agreed forecast for reasonable demand and reasonable availability.

2. Implement pressure management zones

Pressure management of water supply zones is a well-recognised national and international best practice with multiple benefits for extending infrastructure service life, and reducing leakage, operational costs and service interruptions. We are currently piloting the benefits of pressure management in urban Christchurch through the Rāwhiti (New Brighton) zone

¹¹ Health (Fluoridation of Drinking Water) Amendment Bill, introduced 17 November 2016. https://www.parliament.nz/en/pb/bills-and-laws/bills-proposed-laws/document/00DBHOH_BILL71741_1/health-fluoridation-of-drinking-water-amendment-bill



Waterwise campaign 2015/16

pressure management trial with the primary goal quantifying the benefits of reduced breakages, fewer service interruptions, lower leakage rates, increased asset life and lower power costs. A key finding from the earthquakes was that smaller zones also greatly assist in managing recovery of water supply systems should Christchurch experience another significant seismic event or other major disaster.

3. Implement 'smart' water supply network operation

'Smart' technologies could be used to improve network operation and reduce demands and leakage to prolong the long term availability of the water sources. Instantaneous monitoring technology can also provide an assurance as to water quality and public safety.

We have been installing water meters in recent years with the capability for conversion to 'smart' meter readings and estimate that over 50% of current meters are ready for smart communication technology to be fitted (at a cost). The key benefit of remote reading is a large reduction in the cost per reading, enabling more frequent readings (e.g. every 15 minutes). Smart metering has many benefits including early notification of leaks and meter issues and a better understanding of daily water use for each property.



Water efficiency label – Ministry for the Environment

4. Improve understanding of groundwater sources and levels

The understanding of both the Christchurch aquifers and the groundwater sources for the Te Pātaka o Rākaihautū Banks Peninsula water supply schemes needs to improve. The Christchurch aquifers are abundant, but have an unknown overall capacity and availability. In addition to the Council wells for the urban Christchurch water supply, other users including individual commercial and industrial properties have their own private bores, so overall take is also uncertain.

The Council and Environment Canterbury will collaborate with managing the shallow groundwater monitoring network formerly owned and operated by the Earthquake Commission.

We will continue to work with Environment Canterbury, the Government, universities and crown research institutes to advance our understanding of the groundwater system, including impacts of climate change and sea level rise.

This option links to option 1 for objectives 9 and 10.

5. Secure access to Christchurch groundwater sources for public drinking water supply

The Resource Management Act 1991 and the Freshwater NPS provide for the allocation of water to specific end uses. While a regional plan only has an effective life of 10 years, the establishment of a policy framework for allocation for community drinking water supplies would provide greater security of access to groundwater in the absence of resource consents.

6. Enable reuse and harvesting

Installation of on-site water sources for non-potable uses of water (e.g. garden irrigation, toilet flushing and clothes washing) could have multiple benefits including stormwater attenuation and reduction in water demands and wastewater flows to the network. Examples of on-site water sources are greywater reuse and rainwater harvesting.

Mana whenua noted that reuse and harvesting should be encouraged, particularly if residential volumetric pricing was introduced. Mana whenua consider that an advantage of residential volumetric charging could be the ability to enable incentives for incorporating reuse into sustainable house design e.g. greywater and rainwater harvesting.



Using rainwater at Riccarton Park

7. Enhance management of below-ground well heads

As one of the consequences of the 2017 Government inquiry into the Havelock North campylobacteriosis outbreak, greater rigour is being applied to the assessment of well head security. In response to that increased rigour, we are strengthening its asset management regime for all drinking water wells and well heads to maximise security of the wells. This work is being undertaken to enable us to demonstrate that, along with other initiatives such as enhanced asset management and a robust monitoring programme, delivery of drinking water can be safely delivered to residents without the need for residual disinfection for the Christchurch, Lyttelton Harbour and Brooklands-Kainga supplies. We remain committed to managing and mitigating risk of contamination of its groundwater-sourced supplies to avoid the need for residual disinfection. To that end, we will continue to work with the Canterbury District health Board and the Government.

8. Collaboration with other territorial authorities to retain control of public water infrastructure

We will continue to collaborate and share information with other city and district councils, Local Government New Zealand and central government. We will continue to advocate for ensuring that local communities have control over the provision of public water infrastructure to achieve effective integration of all community services.

Proposed ways of measuring achievement of the objective:

- Annual total volume of potable water abstracted for urban supplies in litres per person per day (where total water abstracted includes non-residential use, residential use, leakage etc.), targeting a decreasing year-on-year trend for this measure
- Real water loss in litres per connection per day, targeting a decreasing year-on-year trend for this measure.

Eastern end of Waimakariri River – Kelvin McMillan

Te tuatoru **Part three:**

Whakatinanatanga **Implementation**



8. Te whakatinanatanga Stepwise and parallel implementation

The Integrated Water Strategy is intended to be an enduring long-term strategy. Implementation of many of the preferred options is also long-term, recognising its 100 year plus horizon. Resourcing for actions arising out of the implementation plans will be determined through the Long Term Plan process. Key to this process will be recognition that budgetary priorities must include not only business-as-usual infrastructure renewals and replacements and allowance for providing for growth, but also proactive capital and operational projects to ensure the long-term sustainability of the water services infrastructure in Christchurch.

Implementation plans will need to outline means of measuring achievement of the Integrated Water Strategy (including further development of the proposed measures included in the draft strategy), and high-level cost estimates, targets and monitoring that are realistically set and periodically reviewed and reassessed. All implementation plans will consider the ongoing relationship with manawhenua and joint work programmes to be developed and implemented with Ngāi Tahu Papatipu Rūnanga and Mahaanui Kurataiao Ltd.

9. Ngā rauemi me ngā āheinga Resources and capability

The following are key parties and stakeholders with roles to play in implementing the Integrated Water Strategy:

Christchurch City Council owns and operates the water services infrastructure for Christchurch.

Ngāi Tahu, through the six local rūnanga – Te Ngāi Tūāhuriri Rūnanga, Te Hapū o Ngāti Wheke (Rāpaki), Te Rūnanga o Koukourārata, Ōnuku Rūnanga, Wairewa Rūnanga and Te Taumutu Rūnanga, supported by Mahaanui Kurataiao Ltd and Te Rūnanga o Ngāi Tahu – provide resource management skills and have mātauranga and kaitiakitanga over resources.

Environment Canterbury has statutory planning responsibilities, is active in stream care programmes and water quality monitoring, flood management responsibilities, and maintains the Waimakariri River flood protection scheme.

Waimakariri District Council and **Selwyn District Council** have the same statutory functions as the Christchurch City Council. Opportunities for greater co-ordination and co-operation should be explored.

Community and Public Health provides public health services to the community and aims to create environments, communities and families that support healthy choices and lifestyles.

The **Department of Conservation** has overall responsibility for indigenous biodiversity conservation under a range of statutory mechanisms, such as the Conservation Act 1987, Reserves Act 1977 and Wildlife Act 1953.

Fish and Game New Zealand are an angler and game bird hunter organisation with a statutory mandate to manage New Zealand's freshwater fisheries and game bird hunting, and has interests in the management of freshwater resources.

Other key groups and organisations with interests in water and water services infrastructure, public and community organisations such as Community Boards, water management zone committees, Avon-Ōtākaro Network, Ōpāwaho-Heathcote River Network and stream care groups.

The community in general and business and industry players also have key roles to play in implementing the strategy, as their actions have a direct impact on achieving the vision and goals.



Te Tīhi o Kahukura Castle Rock reflected in lower Ōpāwaho Heathcote

10. Te aroturuki me te arotake

Monitoring evaluation and review

It is intended that the strategy should be a living document that can be adjusted in the face of additional information, changing circumstances and further national and international developments in best practice over time.

The strategy should be formally reviewed on a six-yearly basis to match the Long Term Plan cycle, with a review recommended to occur in the year prior to a Long Term Plan so that specific projects or changes in priorities can be fed into that plan. The first review of the strategy is targeted for financial year 2023/24.

The implementation plans that follow the adoption of the strategy should be reviewed periodically.

Appendix A

Legislative and policy context

The management of water supply, stormwater and wastewater infrastructure and of surface water, groundwater and coastal waters sits within a comprehensive legislative and statutory framework. The key elements of that framework are outlined below.

Te Tiriti o Waitangi - Treaty of Waitangi

Te Tiriti o Waitangi established a partnership between the Crown and tangata whenua. Māori were guaranteed possession of their lands, forests, fisheries and other possessions.

The Treaty partnership requires both parties to act in good faith and to make informed decisions.

The principles of the Treaty recognise and guarantee the protection of tino rangatiratanga (sovereignty) and empower kaitiakitanga as customary trusteeship to be exercised by tangata whenua over their taonga, such as sacred and traditional places, built heritage, traditional practices and cultural heritage resources including water. Of particular importance is the principle for the Crown to actively protect Māori interests.

The requirement for Council to take into account Te Tiriti o Waitangi arises through requirements in the Local Government Act 2002 and the Resource Management Act 1991 (as amended).

The Mahaanui Iwi Management Plan 2013 (IMP)

The IMP provides a statement of Ngāi Tahu issues, objectives and policies for natural resource and environmental management. The IMP includes a chapter on the management of water which addresses the rights and values of Ngāi Tahu hapū within Christchurch associated with water, the management of activities that affect water and the cultural impact of those activities. The IMP also includes as a key policy that local authorities are required to initiate and develop processes for implementing the Mahaanui IMP in council planning and decision-making. The IMP also references and is

consistent with the Te Rūnanga o Ngāi Tahu Freshwater Policy Statement as a key part of the water management policy framework.

Local Government Act 2002 (LGA)

The LGA outlines the purpose of territorial authorities to meet the current and future needs of communities for good-quality local infrastructure, local public services and performance of regulatory functions in a way that is most cost-effective for households and businesses.

The LGA also requires territorial authorities to assess the water supply and sanitary services and provide and maintain services to the community in a manner that promotes the four wellbeings outlined in the LGA.

2014 amendments to the LGA added a requirement for territorial authorities to prepare a 30-year infrastructure strategy in conjunction with their long term planning.

Health Act 1956

Under the Health Act, it is the duty of every local authority to improve, promote and protect public health within its district. In respect to water, local authorities have an obligation to provide surface water, wastewater and water supply infrastructure (Section 25). The Health Act provides for each local authority to make bylaws for improving, promoting, or protecting public health and regulating drainage and the collection and disposal of wastewater.

Health (Drinking Water) Amendment Act 2007

The Health (Drinking Water) Amendment Act requires water suppliers to 'take all practicable steps' to comply with drinking water standards. This Act makes mandatory standards for drinking water that had previously been voluntary¹².

The Act applies to all drinking water suppliers who supply at least 25 people for at least 60 days a year.

The Act also requires that water suppliers prepare and implement public health risk management plans (water safety plans) for their supplies, along with assessments of drinking water supplies. These plans are intended to assist the drinking water suppliers in managing risks to both public water supply sources and the infrastructure and network that make up the public water supply systems, including risks such as proximity of contaminated sites to source water, leakage of contaminants into source water, and natural disasters such as earthquakes or tsunamis.

The most recent approved water safety plans for Christchurch's public water supplies are listed in the bibliography.

Resource Management Act 1991 (RMA) and RMA Framework

In order to achieve its sustainable management purpose, the RMA sets out the duties and functions of regional and territorial authorities and sets out a hierarchy of planning documents.

In regards to the management of water resources, the responsibility largely lies with regional authorities while the control of the effects of land-use activities lays largely territorial authorities.

The RMA provides for the preparation of national policy statements, national environmental standards, regional policy statements, regional plans and district plans. The most relevant documents are discussed below, and will, through their objectives, policies and rules set the resource management context for water, water services and associated infrastructure management in Christchurch.

The Canterbury Regional Plans, the Christchurch Plan, the Banks Peninsula District Plan and the Christchurch District Plan impact the management of water services and infrastructure. All activities associated with the establishment and operation of water services and infrastructure must be assessed against the rules of these plans, which will influence what and where infrastructure can be developed, how it is managed, its development cost and the timing of development.

National Environmental Standard (NES) for Sources of Human Drinking Water

Under its authority provided in the RMA the Ministry for the Environment established a NES for drinking water which became effective in mid-2008. The NES aims to ensure that land use activities do not pollute

human drinking water sources. The NES requires local governments to consider the effect of catchment activities on drinking water sources. The NES also requires that new consents affecting drinking water catchments can only be granted if the proposed activity will not result in drinking water becoming non-potable or unwholesome after treatment.

New Zealand Coastal Policy Statement 2010 (NZCPS)

Under the NZCPS local authorities have a role in safeguarding the integrity, form, functioning and resilience of the coastal environment. In relation to the management of the three waters, the NZCPS places responsibilities on regional and territorial authorities in respect of:

- Taking steps to avoid adverse effects of stormwater discharge to water in the coastal environment including:
- Avoid where practicable and otherwise remedy cross contamination of sewage and stormwater systems
- Contaminant and sediment loads in stormwater at source
- Promoting designs that reduce flows to stormwater reticulation systems at source
- Avoiding the discharge of human sewage directly to water in the coastal environment without treatment
- Ensuring adequate consideration of alternatives and being informed by tangata whenua in terms of discharging treated human sewage to the coastal marine area
- Enhancing coastal water quality

National Policy Statement for Freshwater Management (Freshwater NPS), as amended

The Freshwater NPS requires regional councils to recognise the national significance of freshwater for all New Zealanders through including provisions within their regional policy statements to set freshwater objectives and set environmental standards for all of the freshwater management units in its region.

The Freshwater NPS requires territorial authorities to give effect to the regional policy statement and include rules in their district plans that sustainably manage the demands on freshwater. The Freshwater NPS also requires local authorities to take reasonable steps to involve and work with iwi and hapū in the management of freshwater and identify tangata whenua values and interests in

¹² Drinking-Water Standards for New Zealand 2005 (Revised 2018); <https://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2018>

freshwater and reflect these values and interests when managing and making decisions regarding freshwater within the region.

Canterbury Regional Policy Statement (RPS)

Under section 75 of the RMA, the Council must give effect to the Canterbury RPS by setting out objectives, policies and methods in district plans that are consistent with the RPS. While the RPS does not place direct responsibilities on the Council for the provision and management of the three waters, the strategy must be consistent with the RPS in order to appropriately guide future district plan development and the consenting of future three waters activities to meet the requirements under the RPS, and the planning documents that sit under it.

In relation to the management of the three waters, there are four key chapters within the RPS which direct the management of water infrastructure and guide the protection of natural and physical resources and cultural values. They are Chapter 5 Land Use and Infrastructure, Chapter 7 Fresh Water, Chapter 8 Coastal Environment, Chapter 9 Ecosystems and Indigenous Biodiversity and Chapter 11 Natural Hazards.

The RPS is due for review in 2021.

Regional Coastal Environment Plan (RCEP) for the Canterbury Region

The RCEP for Canterbury controls activities within the coastal environment to promote the appropriate use of the coastal environment, and the maintenance of the natural character of the coastal environment and coastal water quality. Any three waters activities within the coastal environment or discharging to the coastal environment are subject to the rules under the RCEP.

The RCEP is scheduled to be reviewed in 2021.

Canterbury Land and Water Regional Plan (LWRP) 2017

The Canterbury LWRP establishes objectives, policies and rules for land and water management on a regional-wide basis in chapters 3, 4 and 5, and also provides for catchment-specific ('sub-regional') policies and rules in chapters 6 through 15. Rules include those for discharges to land and water and takes from surface and groundwater.

Waimakariri River Regional Plan 2004, as amended

The Waimakariri River Regional Plan recognises the need to protect both water quantity and water quality of the Waimakariri River. The purpose of the Plan is to promote sustainable management of the River and connected groundwater. Objective 5.1 seeks to 'enable present and future generations to gain cultural, social, recreational, economic, health and other benefits from the rivers, lakes and wetlands in the Waimakariri River Catchment, and from the hydraulically connected groundwater while (a) safeguarding their existing value for efficiently providing for sources of drinking water for people and their animals'.

Christchurch City District Plan

The Christchurch City District Plan, the Banks Peninsula District Plan and the Christchurch District Plan manage land use activities across Christchurch District.

Other legislation

The following are other relevant statutes and regulations: Biosecurity Act 1993, Building Act 2004, Civil Defence and Emergency Act 2002, Conservation Act 1986, Fisheries Act 1996, Hazardous Substances and New Organisms Act (1996), Heritage New Zealand Pouhere Taonga Act (2014), New Zealand Walkways Act 1990, Ngāi Tahu Claims Settlement Act 1998, Public Works Act 1981, Reserves Act 1997, Resource Management – Measuring and Report of Water Takes – Regulation 2010, Soil Conservation and Rivers Control Act 1941, Sport and Recreation New Zealand Act 2002.

Bylaws

Water Supply, Wastewater and Stormwater Bylaw 2014

This bylaw manages and regulates our water supply, wastewater and stormwater systems.

The bylaw:

- Sets out the requirements for connecting to the public water supply;
- Provides for water supply demand management;
- Establishes regulations for backflow prevention;
- Provides for protection of the wastewater network;
- Establishes conditions for connecting and discharging to our stormwater network;
- Provides rules for design of stormwater systems;

- Restricts or prohibits specified activities in relation to the stormwater network; and
- Allows for future development of minimum standards for discharges into the stormwater network.

Trade Waste Bylaw 2015

This bylaw regulates the discharge of trade waste into our wastewater network, including:

- Conditions for long-term, intermittent or temporary trade water discharges;
- Three grades of discharges: permitted, conditional and prohibited;
- Conditions for suspension or cancellation of permission to discharge trade waste; and
- Requirements for sampling, analysis and monitoring.

Canterbury Water Management Strategy (CWMS)

The CWMS is a non-statutory framework for managing water led by Environment Canterbury, Ngāi Tahu and Canterbury's District and City Councils and implemented by local communities. The Canterbury Region is split into ten zones which are each governed by a committee which is tasked with making recommendations for the best way to manage water in their area. Each zone committee is required to prepare a zone implementation programme (ZIP), which contains recommendations aimed at meeting CWMS targets in their respective zones. ZIP recommendations may be focussed on regional and/or district councils, iwi and/or other parties.

The CWMS established targets for ten subject areas:

- Ecosystem health/biodiversity
- Natural character of braided rivers
- Kaitiakitanga
- Drinking water
- Recreational and amenity opportunities
- Water-use efficiency
- Irrigated land area
- Energy security and efficiency
- Regional and national economies
- Environmental limits

The Integrated Water Strategy has a key role in contributing to the implementation of relevant recommendations put forward by the Zone Committees.

Christchurch–West Melton Zone Implementation Programme (ZIP)

This ZIP forms a package of recommendations for the zone that have been developed in consultation with key stakeholders and the general public to give effect to the Canterbury Water Management Strategy.

The Christchurch-West Melton ZIP focuses on five priority issues.

- Enhancing and managing waterways for recreation, relaxation and amenity
- Improving surface water quality and safeguarding surface water flows
- Enhancing healthy ecosystems, indigenous biodiversity, and valued introduced species and landscapes
- Safeguarding groundwater quality and flows for multiple uses
- Making efficient use of water and managing demand

Banks Peninsula Zone Implementation Programme (ZIP)

The Banks Peninsula ZIP identifies key areas of focus and includes priority outcomes and recommendations to Environment Canterbury for each area.

In relation to the three waters, recommendations in relation to water quality and wastewater include upgrading and management of water resources and infrastructure, management and prevention of discharges and contamination, further research to be undertaken, efficiency and implementation of new technologies.

Selwyn-Waihora Zone Implementation Programme (ZIP)

Five key areas of work have been established for the Selwyn-Waihora ZIP, including; nutrient and water management, water supply, Te Waihora and lowland waterways, braided rivers/upper plains/high country, and biodiversity.

Within the key areas, the priority critical issues to be addressed include setting limits for nutrients and water storage.

Appendix B

References

Aquifers - underground layers of porous rock or sand through which groundwater flows.

Biosolids - solids separated by wastewater treatment processes that has been stabilised to reduce pathogens and pest-attraction, and which can be beneficially reused.

Christchurch - the whole of Christchurch District, including the Ōtautahi Christchurch City urban area, other settlement areas in the district, Te Pātaka o Rākaihautū Banks Peninsula and all rural areas within the jurisdiction of the Council.

Christchurch metropolitan area - 'urban' Ōtautahi Christchurch, as opposed to 'Christchurch' which refers to the entire district.

Greywater - used water from sinks, washing machines, showers and baths, dish washers and similar appliances, but not including any toilet wastewater. Water from toilet flushing is known as black water.

Groundwater - water stored beneath Earth's surface in aquifers (layers of water-bearing rock or sand). Groundwater tends to be abstracted from deeper aquifers tens to hundreds of metres below the ground surface) for drinking water, whilst shallow groundwater (water within a few metres of the ground surface) may contribute to flood issues.

Inflow - when stormwater enters the wastewater network via surface ponding of stormwater entering wastewater manholes and private gully traps and via illegal cross connections between the wastewater and urban stormwater networks.

Infiltration - when groundwater or stormwater seeps into wastewater pipelines and structures through breaks or joints.

Kaitiakitanga - the intergenerational responsibility and right of tangata whenua to take care of the environment and resources upon which we depend (as defined in the Mahaanui Iwi Management Plan 2013).

Mahinga kai - the customary gathering of food and natural materials and the places where those resources are gathered (as defined in the Ngāi Tahu Claims Settlement Act 1998).

Mauri - the essential life force of all things, spiritual essence (as defined in the Mahaanui Iwi Management Plan 2013).

Non-potable - water suitable for uses other than human drinking water, such as industrial process water and landscape irrigation.

Papatipu Rūnanga - marae based councils, administering the affairs of the hapū (as defined in the Mahaanui Iwi Management Plan 2013).

Potable - water suitable for human drinking water.

Reticulation - a network of pipes and pumps.

SCIRT - Stronger Christchurch Infrastructure Rebuild Team. An alliance of Christchurch City Council, New Zealand Transport Agency, Department of Prime Minister and Cabinet, City Care, Downer, Fulton Hogan, Fletcher and McConnell Dowell established after the 2010-2011 earthquakes. The SCIRT programme was completed in 2017.

Sewer - a pipe that carries wastewater.

Sewerage system - another name for wastewater reticulation.

Stormwater - water that originates during precipitation events and snow/ice melt. Stormwater can soak into the soil (infiltrate), be held on the surface and evaporate, or runoff and end up in nearby streams, rivers, or other water bodies (surface water).

Surface water - includes drains, streams, rivers, lakes, wetlands, lagoons, springs and estuaries.

Taonga - treasure (as defined in the Mahaanui Iwi Management Plan 2013).

Wastewater - both the liquid and non-liquid portions of municipal sewage.

Water supply - all drinking water provided to households, public buildings, gardens and sports fields, and commercial and industrial customers through our water supply reticulation systems. It does not include the private residential and commercial supplies that operate in Christchurch, which are not owned or

operated by, or on behalf of, the Council. It also doesn't include 'community water supplies' operated by other organisations (e.g., Christchurch International Airport).

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Inside cover image: Gathering raupo – Photo courtesy Te Rūnanga o Ngāi Tahu

Page i: Avon River Antigua boatsheds – Kelvin McMillan

Page 1: Ōtākaro Avon River reflections in autumn – Kelvin McMillan

Page 2: A hinaki full of tuna - Photo courtesy Te Rūnanga o Ngāi Tahu

Page 6: Te Waihora Lake Ellesmere sunset – Kelvin McMillan

Page 8: Having fun at Margaret Mahy playground – Christchurch City Council

Page 10: Shopping carts in the Avonhead area, Ōtākaro Avon River – Christchurch City Council

Page 10: Diesel pollution in a portion of Addington Brook, June 2006 – Christchurch City Council

Page 12: Signage near Akaroa wastewater outfall – Christchurch City Council

Page 12: Retention basin drainage covers at Wigram Skies - Kelvin McMillan

Page 13: Ōtākaro Avon River flooding, March 2014 – Christchurch City Council

Page 14: Storm waves in the estuary at South Brighton, 2009 – Christchurch City Council

Page 15: Aylmers Stream intake

Page 16: Wastewater pipe damaged in February 2011 earthquake

Page 18: Eel grabbing a morsel

Page 21: Kā pūtahi (Kaputone) Creek – Kelvin McMillan

Page 22: Council Ranger John Parry with students in the Learning Through Action's Freshwater Frolicking programme – Parks Unit, Christchurch City Council

Page 22: Cashmere Stream Care Group members removing weeds from the Stream – Karen Whitla, Cashmere Stream Care Group

Page 23: Earthquake damaged pipe – City Care

Page 23: Pump station, Aranui, is an example of greater infrastructure resilience – Christchurch City Council

Page 24: Canada geese along Ōtākaro Avon River – Kelvin McMillan

Page 25: Planting for erosion control, Bowendale Park – Kelvin McMillan

Page 25: Rusting roof – Christchurch City Council

Page 26: Knights Stream restoration riffle and fish pass – Christchurch City Council

Page 26: Stormwater control, Tait Industrial Park – Kelvin McMillan

Page 27: Warning sign, Ōtākaro Avon River, after 22 February 2011 earthquake – Christchurch City Council

Page 28: Pressure wastewater system, east-central Christchurch – Stronger Christchurch

Page 29: Flooding on Christchurch-Akaroa Road, August 2012 – Christchurch City Council

Page 30: Tay Street Drain #1 check valves, part of Flockton Basin flood mitigation works – Christchurch City Council

Page 31: Trickling filters, Christchurch Wastewater treatment plant – Kelvin McMillan

Page 31: Biosolids dryer, Christchurch wastewater treatment plant – Christchurch City Council

Page 32: Akaroa wastewater treatment plant – Kelvin McMillan

Page 33: Artesian bore – John Webber

Page 34: Spring, Wai-iti Stream – Christchurch City Council

Page 35: Intake for Duvauchelle water supply, Pipers Stream – Christchurch City Council

Page 36: Waterwise campaign 2015/16 – Christchurch City Council

Page 36: Water efficiency label – Ministry for the Environment

Page 37: Using rainwater at Riccarton Park – Christchurch City Council

Page 37: Eastern end of Waimakariri River – Kelvin McMillan

Page 38: Nga Puna Wai – Kelvin McMillan

Page 40: Te Tihi o Kahukura Castle Rock reflected in lower Ōpāwaho Heathcote – Christchurch City Council

Page 43: Raupo, Te Waihora Lake Ellesmere – Kelvin McMillan



Drop-in-sessions

Come along to one of our drop-in sessions to talk to us about the draft strategy:

Tuesday 25 June 12–2pm
Turanga Central Library
60 Cathedral Square
Central City

Tuesday 25 June 4.30–6pm
New Brighton Board Room
Corner Beresford and Union Street
New Brighton

Wednesday 26 June 4.30–6pm
Beckenham Service Centre Board Room
66 Colombo Street
Beckenham

Saturday 29 June 2–4pm
Duvauchelle Hall
6039 Christchurch Akaroa Road
Banks Peninsula

Wednesday 3 July 3.30–5.30pm
Belfast School
700 Main North Rd
Belfast

Thursday 4 July 4.30–6pm
Upper Riccarton Library
71 Main South Road
Sockburn

Monday 8 July 4.30–6pm
Ōrauhata: Bishopdale Community Centre
13 Bishopdale Court
Bishopdale Shopping Centre

Tuesday 9 July 4.30–6pm
Woolston Community Library
689 Ferry Road
Woolston

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