2025

3 WATERS INTEGRATED SYSTEM PLAN

WATER FOR GENERATIONS:
Planning for the next 50 years

HE WAI MŌ TĀTOU, Ā, MŌ KĀ URI Ā MURI AKE NEI

DUNEDIN CITY COUNCIL | kaunihera ā-rohe o Ōtepoti

The management of drinking water, wastewater, and stormwater services is critically important and has a direct impact on the health, wellness, and quality of life of our community and the surrounding environment.

At Dunedin City Council, we've spent the past five years working alongside Mana Whenua to develop a comprehensive and robust plan to keep our drinking water, wastewater, and stormwater services reliable, safe, and affordable for the next 50 years and beyond.

The Integrated System Planning programme* (the plan) has been developed using physical investigations, complex modelling of our three waters infrastructure, technical data and input from our key stakeholders, Otago Regional Council and Taumata Arowai.

It outlines:

- what our current three waters infrastructure and services look like,
- the challenges we are facing in the future,
- what we need to achieve to protect and future-proof our assets, and
- the pathway to get there.

*The Integrated System Planning programme informs the draft DCC Infrastructure Strategy, which in turn informs the draft 9 year plan 2025-2034. Once approved by Council, the 9 year plan 2025-2034 will advance the infrastructure responses and improvements identified in ISP.

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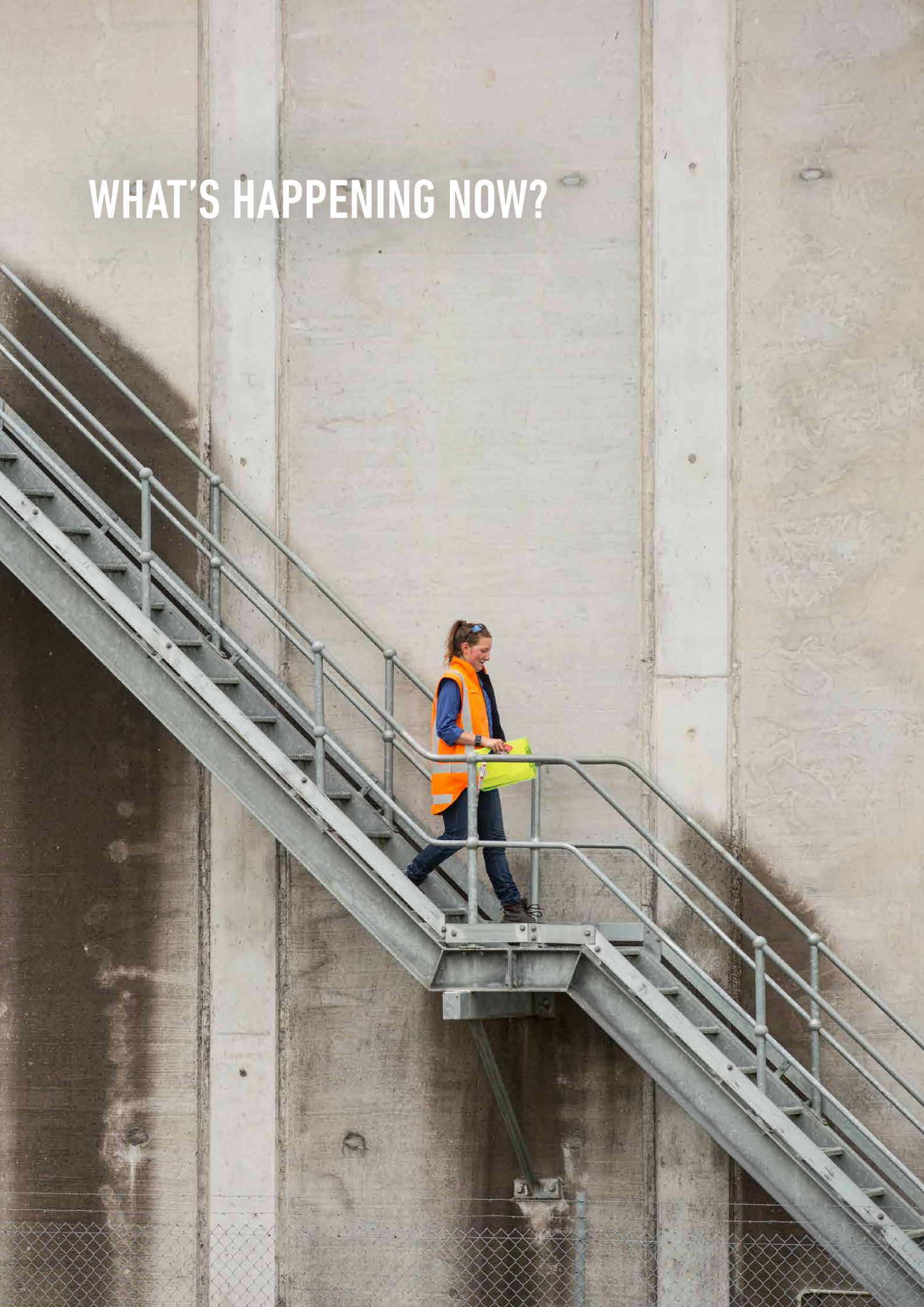
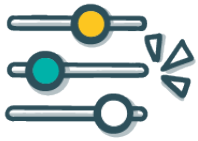
WHAT'S HAPPENING NOW?



PLANNING FOR THE FUTURE

The plan addresses challenges like ageing infrastructure, our impacts on the environment, the impacts of climate change and the need to meet new regulations. Its guiding principles are:



Efficiency

Using water and resources wisely, supporting city growth, and controlling costs for our community.

Regeneration

Protecting water health, cutting emissions, and improving community well-being.

Resilience

Preparing for climate change and ensuring our three water systems can recover from emergencies and natural disasters.

Our plan takes a big-picture approach to managing drinking water, wastewater, and stormwater systems, looking at how these services connect and allowing for smart investments that solve many challenges at once. Development of the plan involved four stages:

Stage 1: Baseline performance

Looking at how we are performing currently and identifying work needed to keep our services running now.

Stage 2: Objective setting

Identifying what we are aiming to achieve.

Stage 3: Response development

Developing a series of pathways that could take us from where we are now to where we need to be in the future.

Stage 4: Adaptive planning

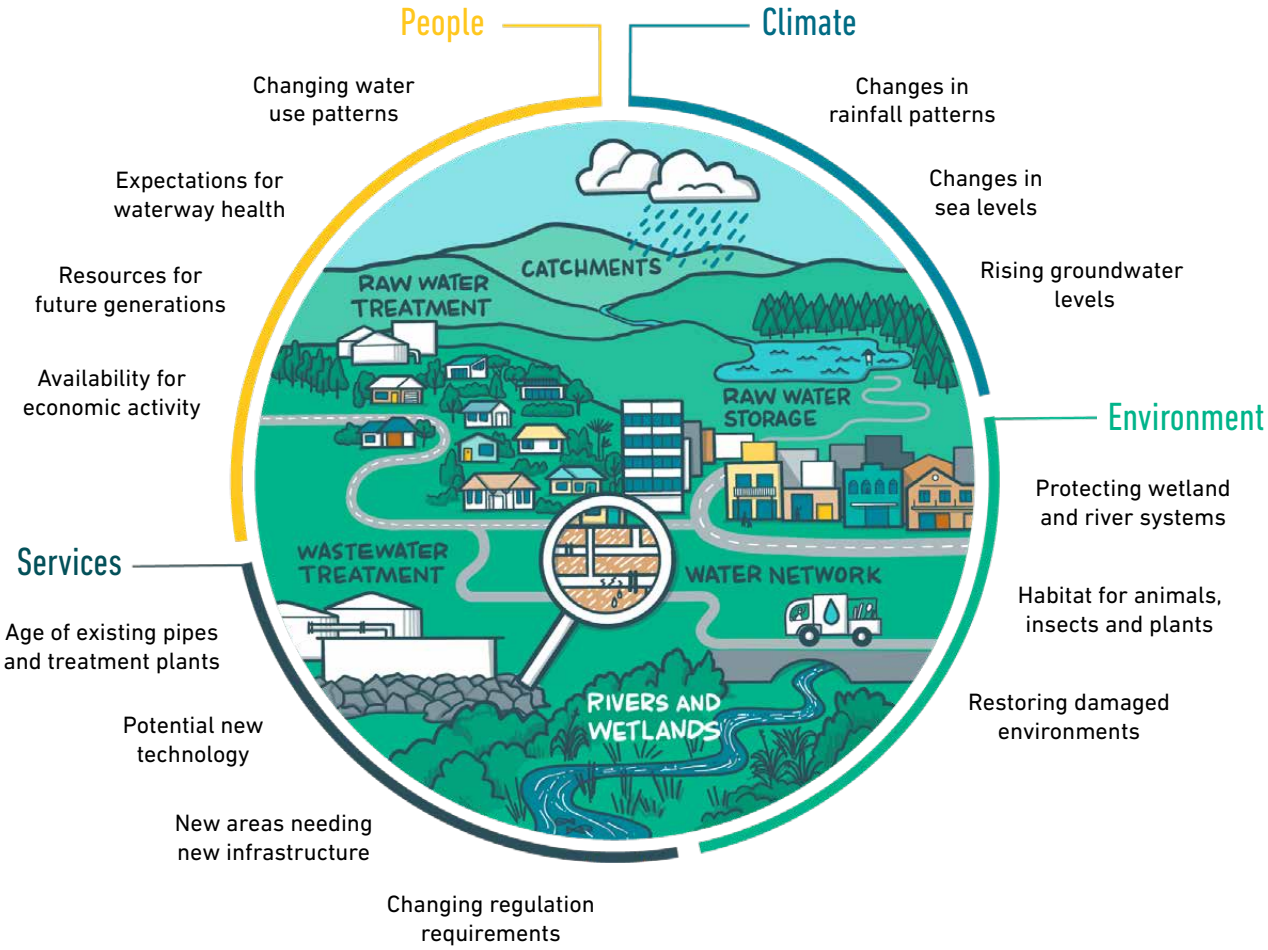
Considering the pathway options and developing a core pathway.

Recognising that the future is full of uncertainties, we have used a planning method called Dynamic Adaptive Planning Pathways (DAPP) to help us create a plan that we can adapt as the future unfolds.

This is a new and innovative approach to water infrastructure planning in New Zealand and incorporates principles from the Treaty of Waitangi into decision-making, ensuring Mana Whenua perspectives are built into future plans.

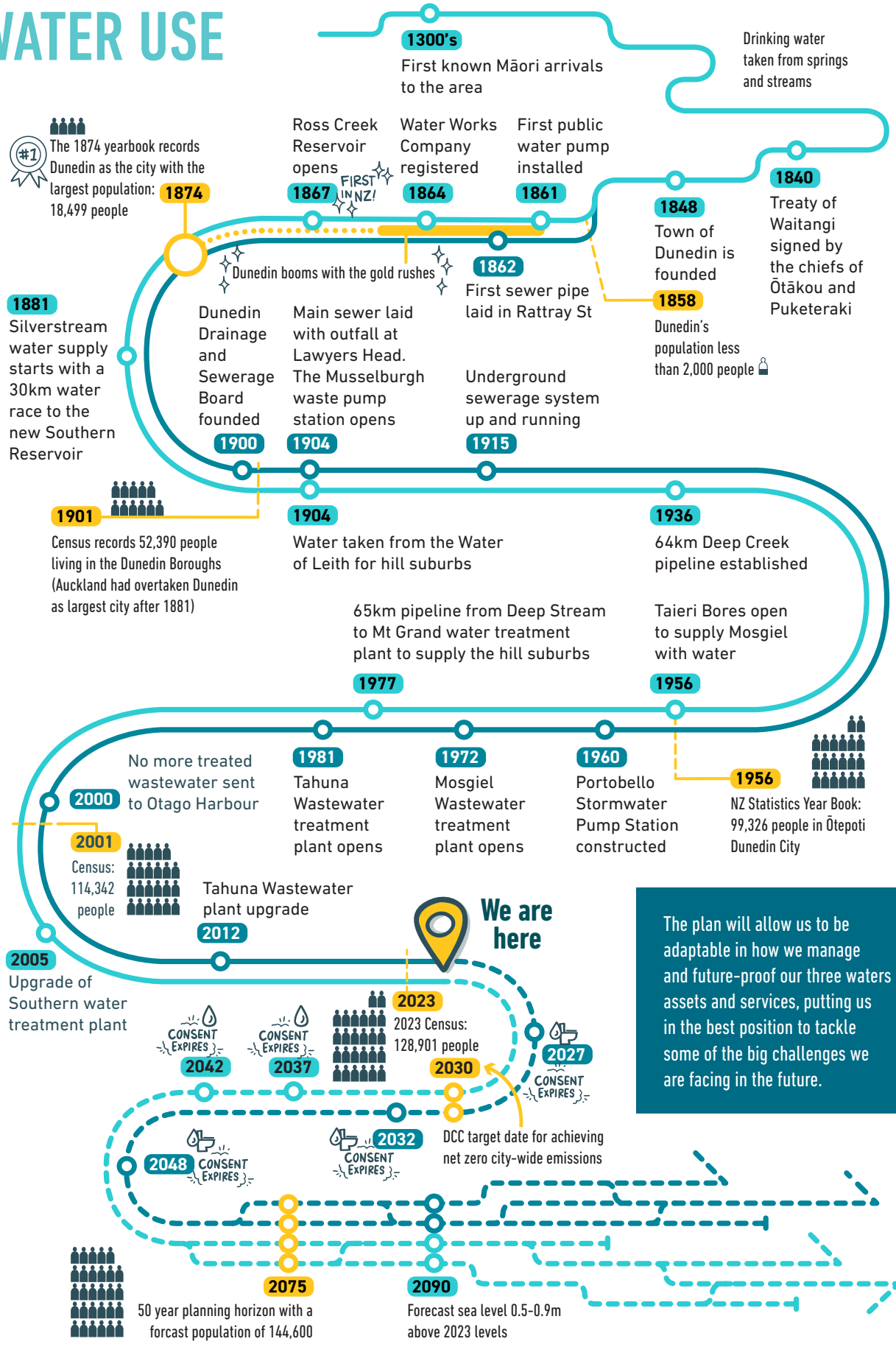
By looking at the drinking water, wastewater and stormwater systems as a whole, the plan ensures that different systems and services work well together and that any changes benefit all three water services.

The plan considers a range of factors:



Optimising our drinking water, wastewater and stormwater systems means investing in the right things at the right time while remaining flexible to future uncertainties.

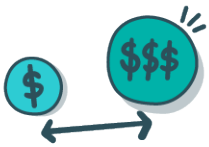
OUR CHANGING WATER USE



The plan will allow us to be adaptable in how we manage and future-proof our three waters assets and services, putting us in the best position to tackle some of the big challenges we are facing in the future.

WE'RE FACING SOME CHALLENGES

Dunedin's water supply has evolved significantly since the city's early settlement. Fast forward, several decades and we are now facing significant challenges to keeping our water services, reliable, safe and affordable.



Affordability

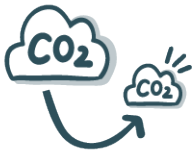
We spend millions of dollars each year keeping our assets (like treatment plants, water pipes, pumps and stormwater drains) and services running. Over time, these costs will increase. This means we need to make sure we only spend money on the right things at the right time.

Service levels

To keep our water services at a high standard, we need to make improvements to areas of flood prevention, stormwater pollution and wet weather wastewater overflows. We also need to increase the resilience of our water supplies, so we have a healthy supply of stored water if there are weather events like droughts.

Climate change

Rising temperatures, changing weather patterns and population growth are leading to an increase in water demand. At the same time, more frequent and intense rainfall events overwhelm stormwater systems, causing flooding, erosion and contamination of water sources. Sea level rise will likely also begin to impact our low-lying infrastructure.



Emission targets

We need to reduce greenhouse gas emissions, created by processes to produce safe drinking water and treat wastewater, and do our part to help Council reach its carbon emission reduction targets.

Ageing assets

Like many councils across the country, much of our key water assets (e.g. pipes, pumps and treatment facilities) are very old. Ageing water pipes are more prone to leaks, while infiltration of groundwater and stormwater into wastewater pipes and manholes is more likely when assets are old. Operating a water system with old assets is inefficient, negatively impacts the environment and makes it harder to meet regulatory requirements.

DID YOU KNOW?

Dunedin's water network is made up of 1,450km of pipes.

Turning on the tap – water

Dunedin's drinking water is sourced from multiple rivers, streams and reservoirs including the Deep Creek, Deep Stream and Silverstream catchments. Water is taken from these sources and treated at our two main water treatment plants, Mount Grand and Southern, before it is supplied to 95% of the approximately 130,000 residents across the city. The network also includes pumps and treated water reservoirs, which provide storage, manage fluctuations in demand and help meet pressure requirements. Rural areas rely on smaller water sources, including those at Waikouaiti, Outram, and Taieri.

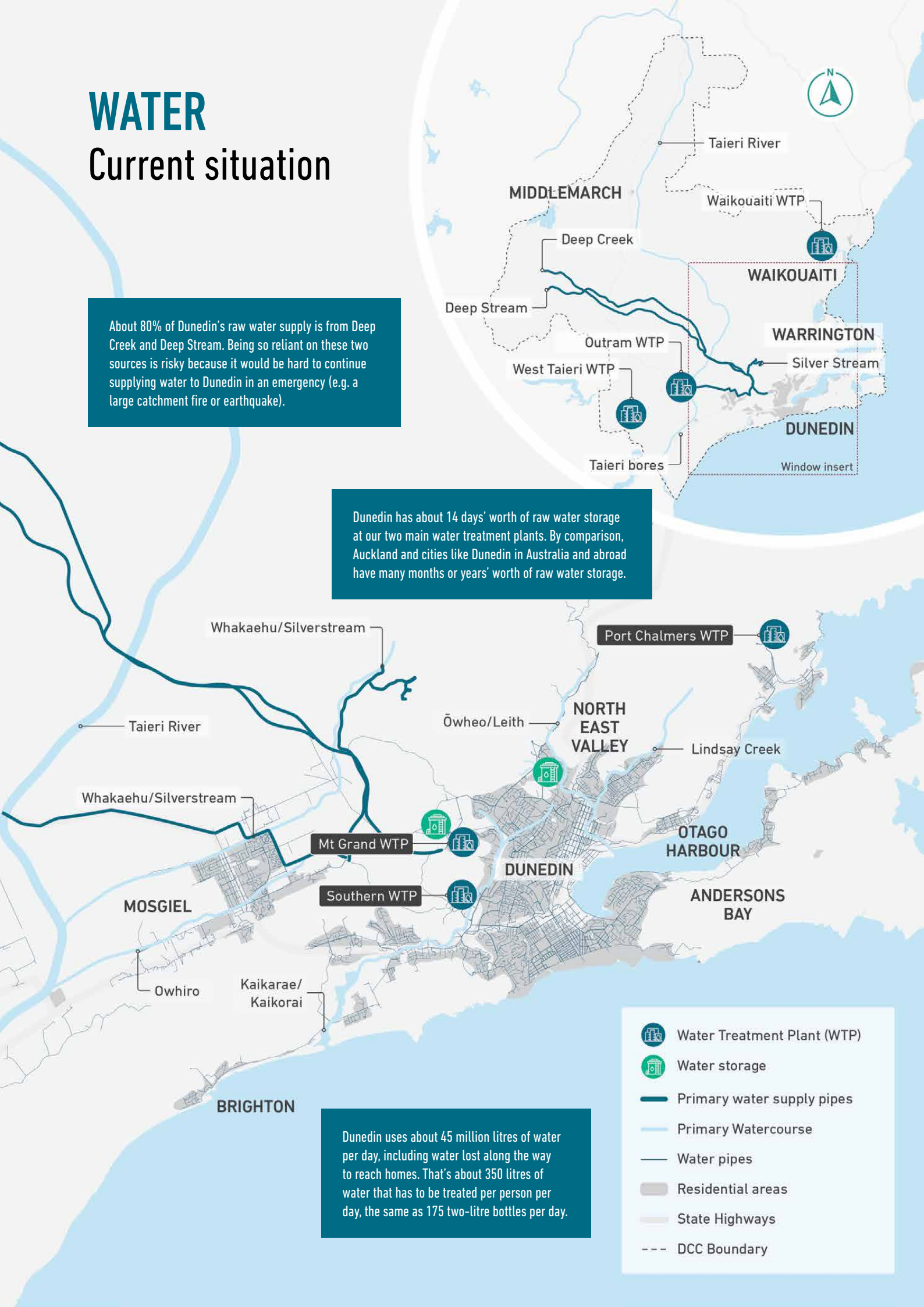
Some of the challenges to our water services and infrastructure include:

- Currently, Dunedin only has about 14 days of raw water storage. Our models show that, in the future, there may be periods of up to 60 days when we won't be able to take water from our rivers. We don't have enough storage in our system to see us through these dry periods.
- Many of Dunedin's water sources are over-allocated, and all existing water sources will need new consents by the early 2040s. It's unlikely the city will be able to take as much water from these water sources in future as it does today due to changing consent requirements.
- The relatively low volume of storage means that our water supplies are susceptible to disruptive events like pollutants entering water sources (e.g. from catchment fires) and/or other natural disasters (e.g. earthquakes).

WATER
Current situation

About 80% of Dunedin's raw water supply is from Deep Creek and Deep Stream. Being so reliant on these two sources is risky because it would be hard to continue supplying water to Dunedin in an emergency (e.g. a large catchment fire or earthquake).

Dunedin has about 14 days' worth of raw water storage at our two main water treatment plants. By comparison, Auckland and cities like Dunedin in Australia and abroad have many months or years' worth of raw water storage.



Dunedin uses about 45 million litres of water per day, including water lost along the way to reach homes. That's about 350 litres of water that has to be treated per person per day, the same as 175 two-litre bottles per day.

DID YOU KNOW?

Inflow and infiltration (I&I) is where groundwater and stormwater seep into our wastewater system. There can be as much as 10 times more water in the wastewater system when it rains due to I&I.

Down the drain – wastewater

Dunedin's wastewater system serves approximately 130,000 residents through an extensive network of wastewater treatment plants (WWTPs), pump stations, and sewer pipelines. The main treatment facilities include the Tahuna, Green Island, and Mosgiel WWTPs, along with smaller plants in communities such as Waikouaiti, Warrington, Seacliff, and Middlemarch with Tahuna being the largest and most advanced. These plants use primary and secondary treatment processes. The primary treatment process removes large solids and debris from the wastewater while the secondary treatment process further purifies the water. Wastewater sludge, which is what remains after the two treatment processes, is mostly incinerated with some being treated and sent to landfill.

Some of the challenges we are facing include:

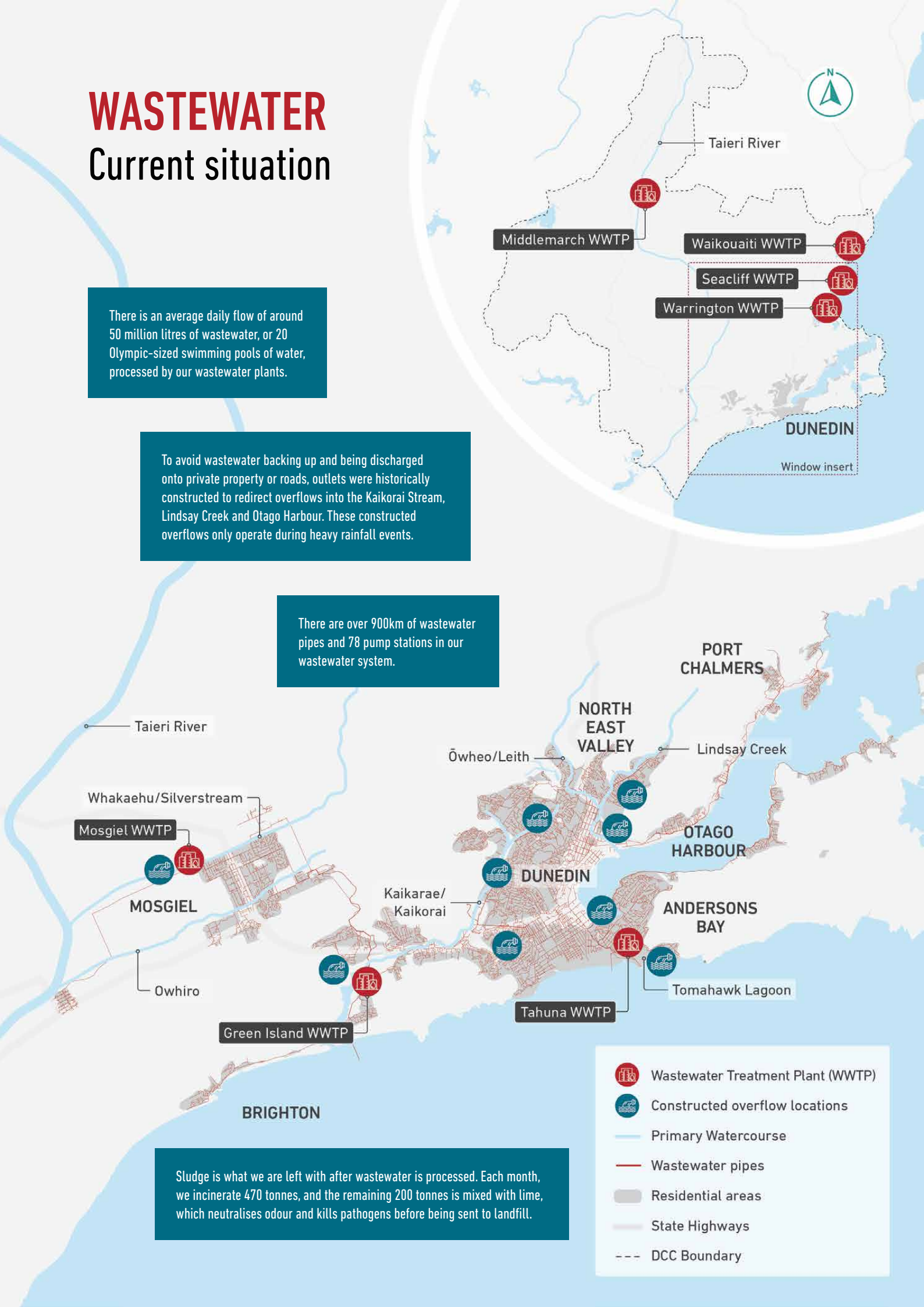
- Our wastewater assets (e.g. pumps, pipes) work well in dry weather; however, during heavy rain, stormwater and groundwater enter the old wastewater pipes (known as inflow and infiltration) and cause the system to overflow. This means raw or partially treated wastewater spills out into nearby areas, which can cause environmental contamination and pose health risks. Excessive stormwater in our wastewater system can also prevent our treatment plants from sufficiently treating the wastewater before it is discharged.
- Wastewater assets were historically designed without consultation with Mana Whenua or alignment with cultural values and protocols.
- As our systems become overwhelmed more frequently due to an increase in heavy rainfall events, it's becoming harder to comply with environmental regulations.
- One of the biggest contributors to carbon emissions produced by the three water systems, is the disposal of wastewater sludges.

WASTEWATER
Current situation

There is an average daily flow of around 50 million litres of wastewater, or 20 Olympic-sized swimming pools of water, processed by our wastewater plants.

To avoid wastewater backing up and being discharged onto private property or roads, outlets were historically constructed to redirect overflows into the Kaikorai Stream, Lindsay Creek and Otago Harbour. These constructed overflows only operate during heavy rainfall events.

There are over 900km of wastewater pipes and 78 pump stations in our wastewater system.



Sludge is what we are left with after wastewater is processed. Each month, we incinerate 470 tonnes, and the remaining 200 tonnes is mixed with lime, which neutralises odour and kills pathogens before being sent to landfill.

DID YOU KNOW?

Historically, stormwater and wastewater were often piped down the same drainage system. Over time the systems were separated and today, Dunedin has separate wastewater and stormwater systems.

From the skies – stormwater

Dunedin's stormwater network is a critical part of the city's infrastructure, designed to manage rain runoff (water that isn't absorbed into the earth during rainfall) and reduce the risk of flooding. Unlike wastewater, stormwater is discharged directly into waterways or the ocean with little to no treatment.

Some of the challenges we are facing include:

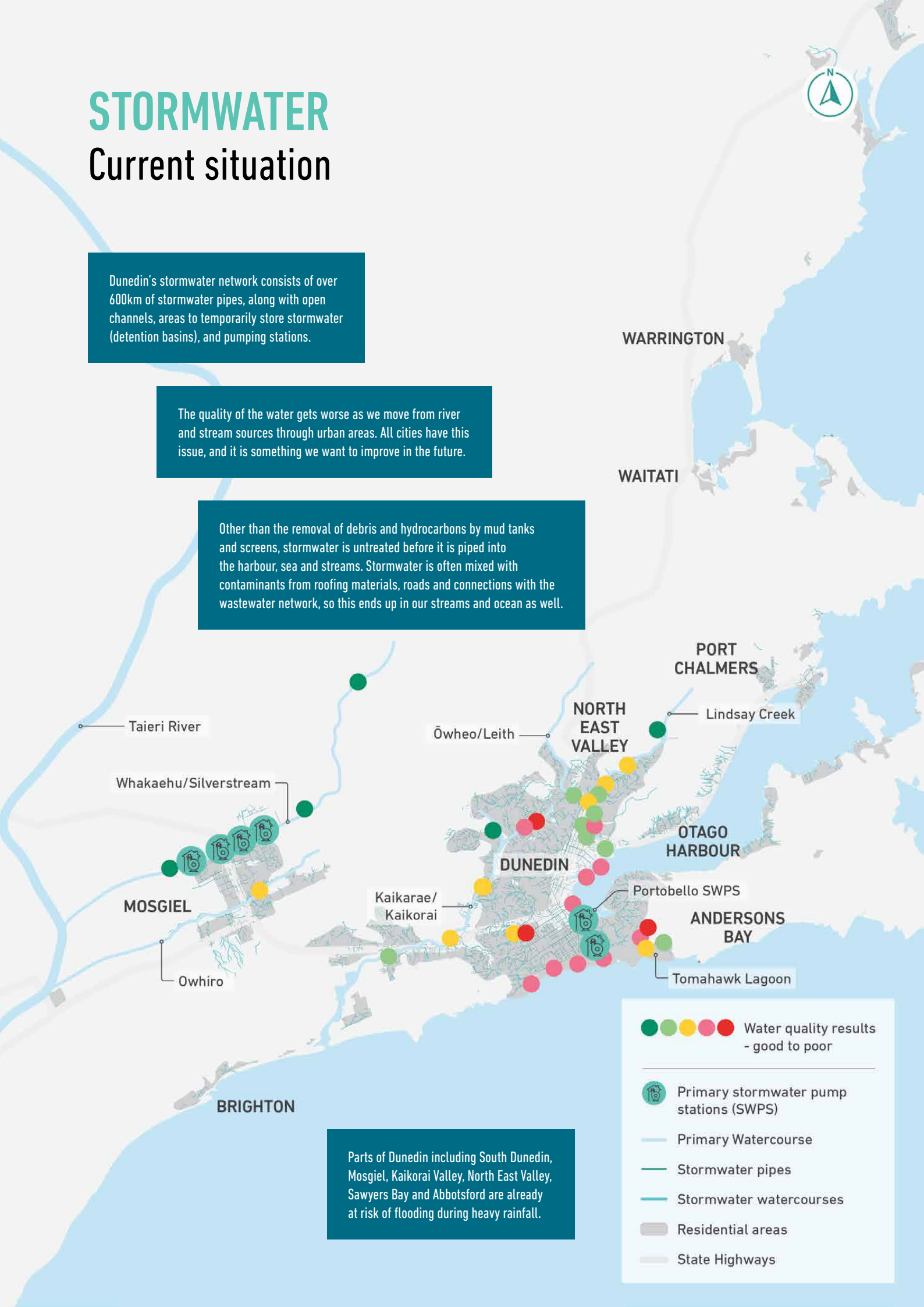
- Ageing infrastructure and rising groundwater mean excess groundwater seeps into stormwater pipes and reduces the system's capacity to manage rainwater.
- Watercourses (such as streams and rivers) provide a significant portion of Dunedin's stormwater drainage but over 70% of these are privately owned and not always well maintained, increasing flood risk.
- Climate change is expected to worsen stormwater challenges by increasing the frequency of intense rainfall events and reducing how much stormwater can be absorbed in soils in low-lying areas due to sea-level rise. A higher intensity of rainfall will also increase the risk of flooding, particularly in South Dunedin, Mosgiel, Kaikorai Valley, North East Valley, Sawyers Bay and Abbotsford.
- Stormwater runoff, particularly from roads, causes pollution of our waterways because it collects contaminants such as oil, heavy metals, sediment and litter, which are then carried into our rivers and ocean with little to no treatment.

STORMWATER
Current situation

Dunedin's stormwater network consists of over 600km of stormwater pipes, along with open channels, areas to temporarily store stormwater (detention basins), and pumping stations.

The quality of the water gets worse as we move from river and stream sources through urban areas. All cities have this issue, and it is something we want to improve in the future.

Other than the removal of debris and hydrocarbons by mud tanks and screens, stormwater is untreated before it is piped into the harbour, sea and streams. Stormwater is often mixed with contaminants from roofing materials, roads and connections with the wastewater network, so this ends up in our streams and ocean as well.



Parts of Dunedin including South Dunedin, Mosgiel, Kaikorai Valley, North East Valley, Sawyers Bay and Abbotsford are already at risk of flooding during heavy rainfall.

WHAT DOES OUR FUTURE LOOK LIKE

PLANNING FOR UNCERTAINTY

Developing a 50-year plan inevitably means that there will be uncertainties and changes that will arise over time that cannot be planned for now. To manage these uncertainties, the plan uses a planning method called Dynamic Adaptive Planning Pathways (DAPP), a decision-support process which lets us adapt our plans as we go.

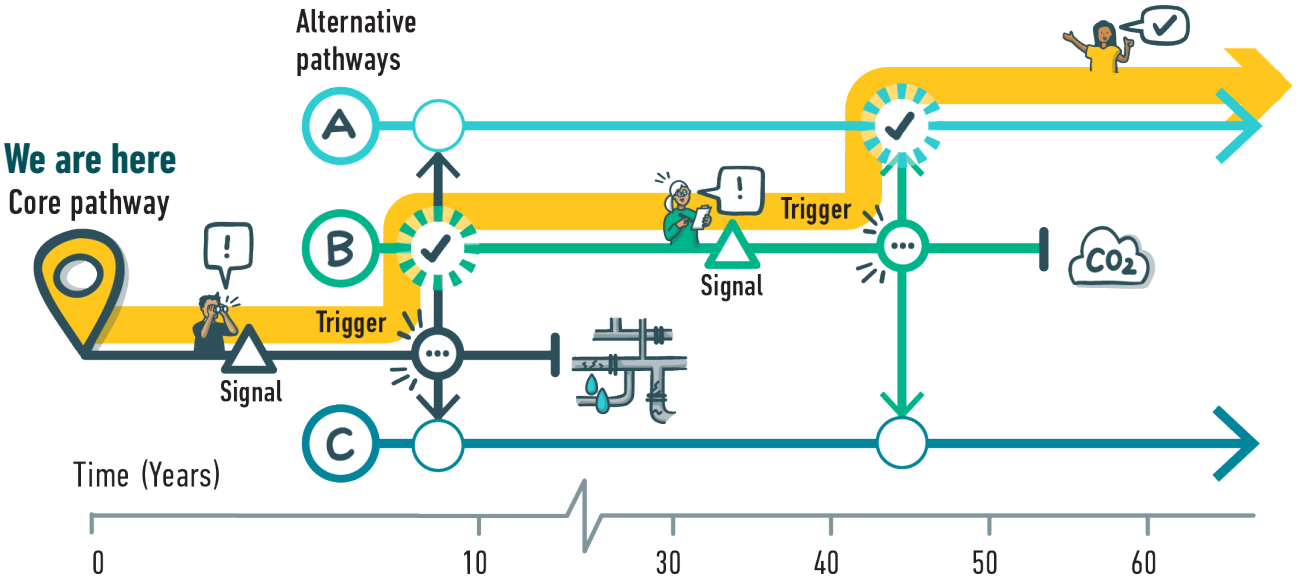
Using DAPP, a series of potential pathways are created to respond to unexpected situations or changes which might occur in the future such as changes in technology, regulations or climate.

Using this planning method, we have created different scenarios to assess what the future could look like and have set signals and decision points (triggers), so we know when we need to reconsider the pathway we are on and potentially shift to a different pathway. We will monitor our signals and triggers, so we are aware of what is happening and, if necessary, change pathways in time to avoid bigger problems.

There are two types of pathways:

- Core pathways – this is the plan we have agreed to follow right now and will continue to follow until there is a change in circumstance, which may require us to take a different approach.
- Alternative pathways – other pathways that we could take depending on what happens in the future, if there is a change in circumstance.

Each pathway includes signals and decision points (or triggers) which will tell us when we need to look at changing pathways and will allow us sufficient time to do that.



Alternative pathways – Examples include desalination (the process of removing saltwater from seawater to create drinking water) or purified recycled wastewater for drinking water or the relocation of wastewater treatment plants.

WHAT DOES OUR CORE PATHWAY LOOK LIKE

The core pathway is what we are on right now and considers what we know and the challenges we are currently facing. On this pathway, we have outlined several key actions for each of our drinking water, wastewater and stormwater services which will help us to ensure they remain safe, reliable and affordable for current and future generations of Dunedinites.

The future at a glance – water

Our existing water resources are finite and dependent on frequent rainfall. To use them more efficiently, we'll need to develop a water conservation programme to reduce water leakage and wastage. It is also likely we will need to significantly increase the amount of raw water storage we have available to ensure we can continue meeting demand and focus on keeping more water in our rivers to maintain the health of the environment and ecosystem. This means building reservoir storage and looking at alternative sources of water like groundwater (water beneath the earth's surface).

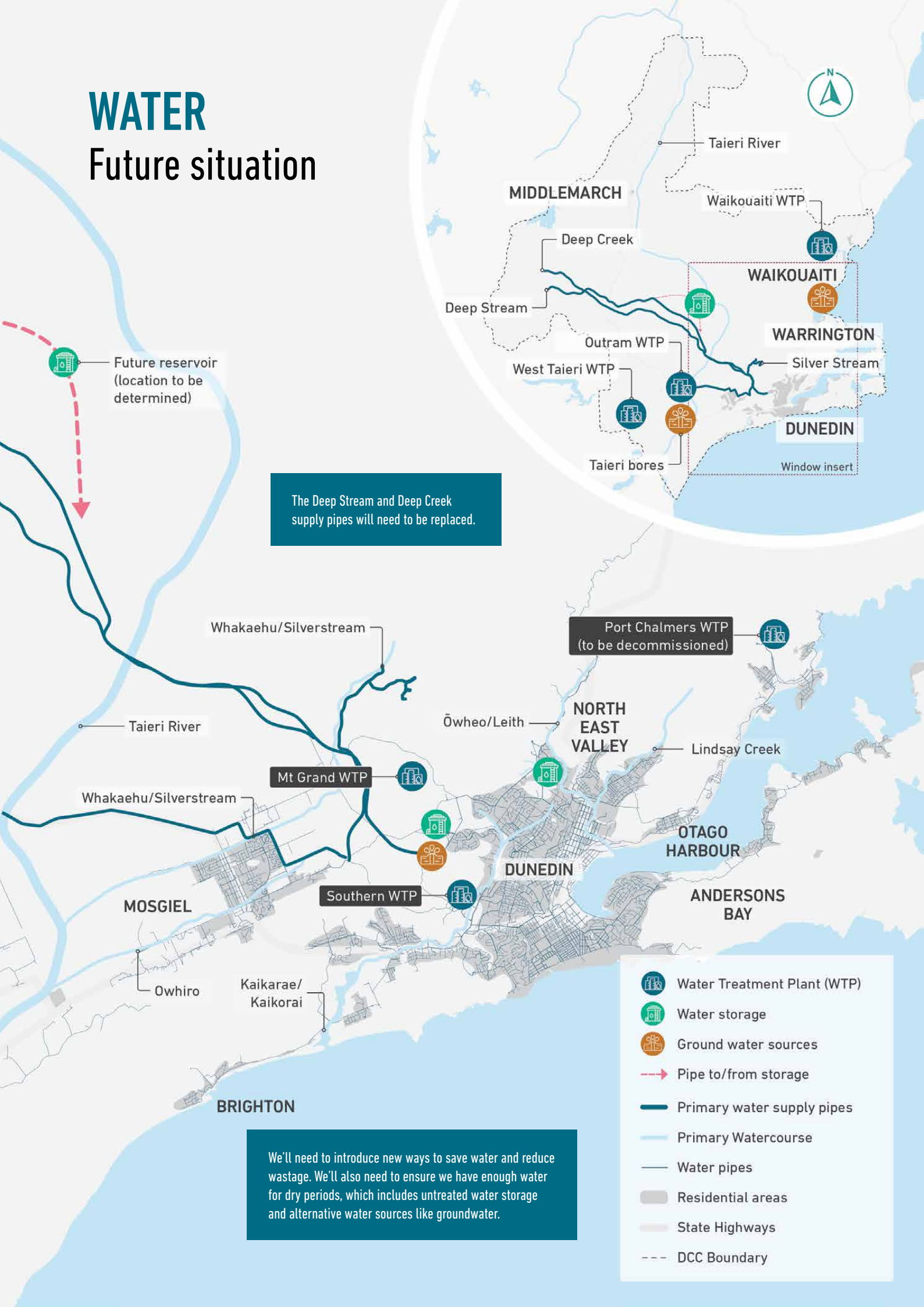
Key actions to tackle the challenges we are facing when it comes to our water system include:

- Use metering in our pipe network to help us detect leaks and improve water efficiency,
- Investigate the availability of groundwater sources, and
- Look at how we can increase the amount of untreated water we can store to cover us in dry conditions.

- Establish new groundwater sources,
- Create storage for 30 to 60 days of untreated water for the district, and
- Consider wider use of metering for both public and private water usage. This will allow us to better manage supply and demand.

- Focus our efforts on maintaining our infrastructure and conserving water.

WATER
Future situation



The future at a glance – wastewater

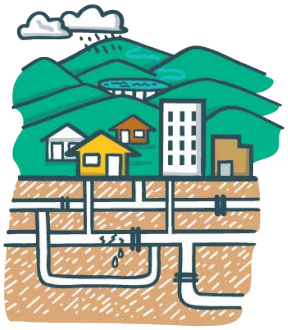
Heavy rain impacts our networks and treatment plants and causes overflows into the environment. In the future, we will need to focus on reducing how much wastewater overflows from the network by addressing inflow and infiltration (I&I) – how much stormwater seeps into wastewater pipes through cracks, leaks and improper connections – and increasing the volume of wastewater the network can manage and store.

Key actions to tackle the challenges we are facing when it comes to our wastewater system include:

- Improving the wet weather performance of our wastewater network.
- Addressing inflow and infiltration starting with the Kaikorai, Lindsay, and Leith catchments which will:
  - Reduce the volume of untreated water overflowing from our wastewater system into the surrounding environment, and
  - Improve water quality by reducing the amount of wastewater that overflows into these catchments.
- Optimise processes across the network and treatment plants to reduce greenhouse gas emissions, focusing on how we manage biosolids (nutrient-rich organic materials that come from treating wastewater which can be used as a fertilizer and in forestry and soil rehabilitation),
- Reconsent wastewater treatment plant (WWTP) discharge consents at Tahuna and Green Island,
- Decommission the Mosgiel WWTP, and
- Modify existing plants to accommodate increased capacity and culturally appropriate treatment options.

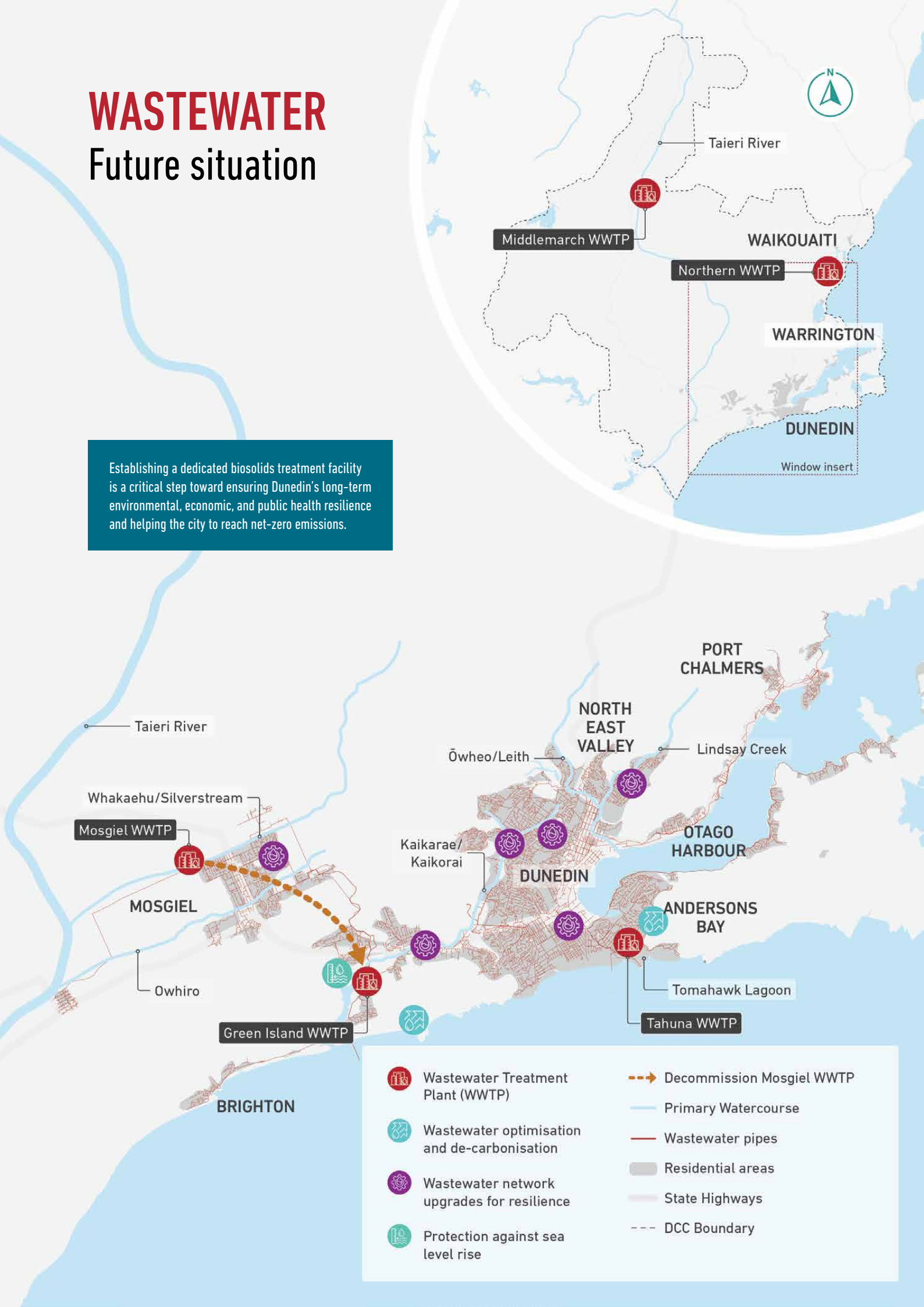
- Continue to improve water quality in areas where wastewater enters the environment by reducing the volume of untreated water overflowing from our wastewater system, and
- Continue to optimise our networks and plants, system and processes.

- Provide additional protections against sea level rise such as sea walls to protect treatment plants and pump stations in coastal hazard zones, and
- Carry out ongoing upgrades to ensure compliance with evolving standards.



WASTEWATER
Future situation

Establishing a dedicated biosolids treatment facility is a critical step toward ensuring Dunedin's long-term environmental, economic, and public health resilience and helping the city to reach net-zero emissions.



The future at a glance – stormwater

High rainfall can overwhelm our stormwater network and cause flooding while stormwater runoff can contribute to the poor health of our streams and watercourses in urban areas. In the future, we will need to develop green infrastructure solutions (such as rain gardens and wetlands) that help to reduce flooding and stormwater contamination.

Key actions to tackle the challenges we are facing when it comes to our stormwater system include:

- Prioritising green infrastructure solutions to address flooding and improve water quality, aligning with cultural values. These solutions are adaptable to climate change and offer ecological and recreational benefits. Implementation will focus on catchment-based solutions, prioritising catchments draining into Lindsay Creek, Owheo/Leith, Whakaehu/Silverstream, and Otakou/Otago Harbour, and
- Improving the management of overland flow paths (routes taken by water when the man-made drainage network is overloaded) on designated streets to enhance resilience and flood protection.

- Prioritising the Kaikarae/Kaikorai and Tomahawk Lagoon catchments for green infrastructure,
- Implementing stormwater treatment structures (such as infiltration basins, bioretention areas, and swales) in high-traffic areas to reduce contamination from roads entering the stormwater system and improve water quality, and
- Making improvements to our stormwater monitoring, for both flood resilience and water quality.

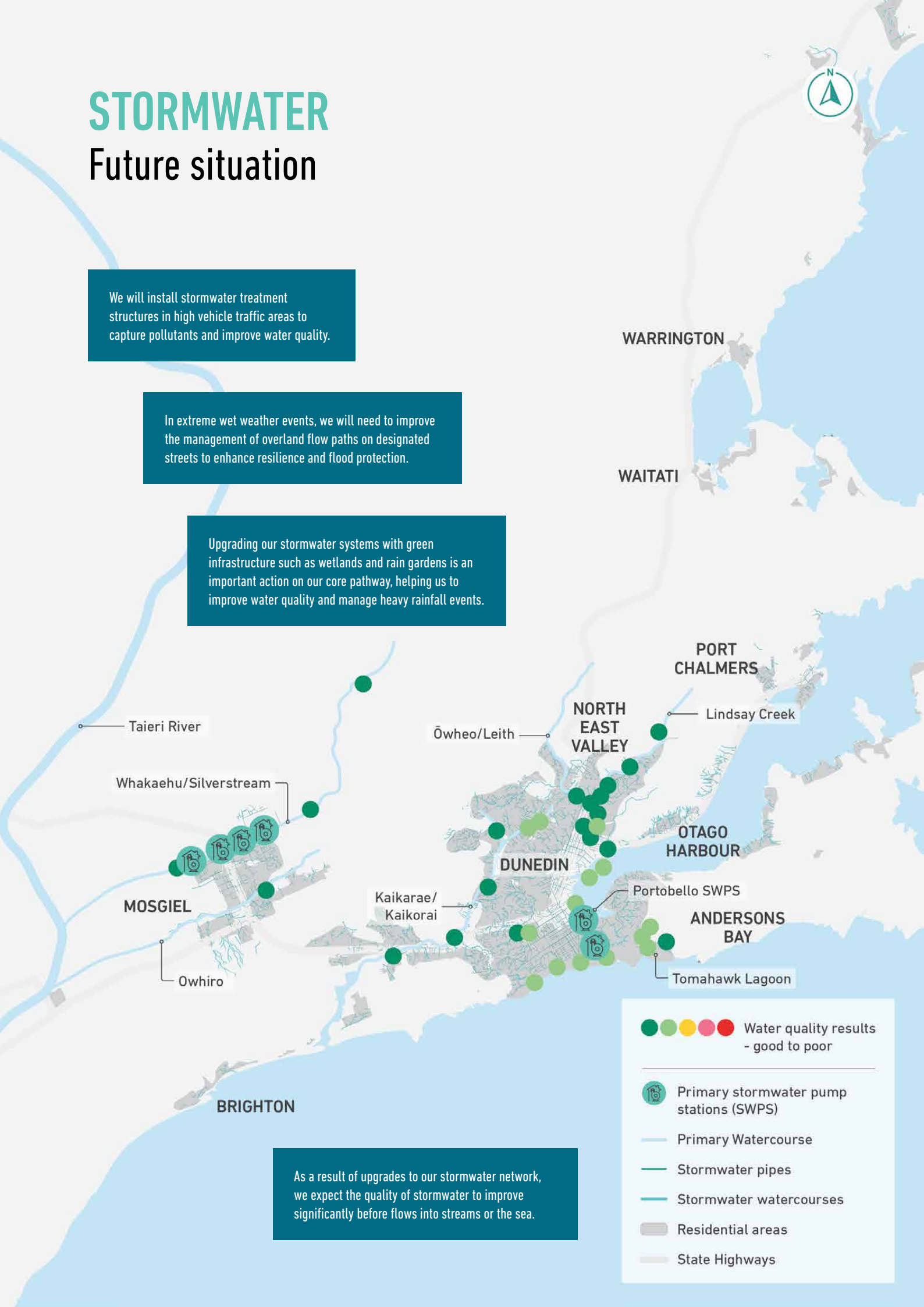
- Transition all catchments to include green infrastructure, addressing climate-driven flood risks by creating more space for water,
- Continue to invest in stormwater infrastructure and increase monitoring, and
- Consider potential retreat from high-risk flood areas in our long-term strategies.

STORMWATER
Future situation

We will install stormwater treatment structures in high vehicle traffic areas to capture pollutants and improve water quality.

In extreme wet weather events, we will need to improve the management of overland flow paths on designated streets to enhance resilience and flood protection.

Upgrading our stormwater systems with green infrastructure such as wetlands and rain gardens is an important action on our core pathway, helping us to improve water quality and manage heavy rainfall events.



As a result of upgrades to our stormwater network, we expect the quality of stormwater to improve significantly before flows into streams or the sea.

NEXT STEPS

Providing drinking water, wastewater and stormwater services and systems that are safe, reliable, affordable and align with Mana Whenua cultural values, is critical to the health and well-being of our community.

In Dunedin, our three water services and systems have developed significantly as our population and city have grown, and they have served us well. However, we're facing some major challenges now and in the future which require us to be adaptable and invest in the right things at the right time so that the money we spend in the short-term will help us to achieve our longer-term goals.

Using DAPP, we've created a core pathway which sets our direction for the coming decades, outlining the actions needed to address future challenges and how we should invest to achieve the greatest outcome for our community. We also recognise that the world is changing and that we may need to adapt our plans to respond to challenges and opportunities when they arise which is why, in addition to the core pathway, we have created a series of alternative pathways. These will allow us to change our approach if needed and give us sufficient time to do so.

Our core pathway will be delivered over the next 50 years and includes key actions to future-proof our drinking water, wastewater and stormwater services and systems. The ISP core pathway would continue in future to inform the DCC Infrastructure Strategy, which would inform the regularly updated 10-year plans. Once approved by Council, these 10-year plans advance the infrastructure responses and improvements identified in the ISP core pathway. The dynamic adaptive planning allows DCC to monitor change over time and adapt our 3W planning and service delivery to future challenges.

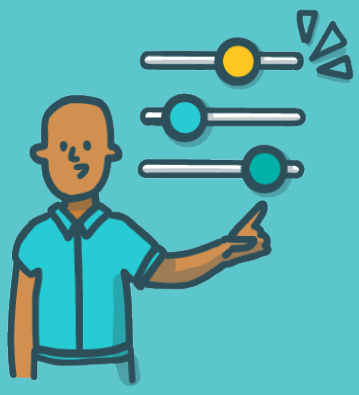
Key focuses of our core pathway include:

The provision of water efficiency and conservation measures, alternative water supplies and untreated water storage, in addition to ongoing pipe replacement.

Reducing wastewater overflows into the surrounding environment from the network by addressing inflow and infiltration.

The development of catchment-based solutions to reduce flooding impacts and improve the quality of our waterways.

These actions, along with continuous monitoring of our services and systems, will ensure we are providing the best value to our ratepayers and ensuring these vital systems are future-proofed for current and future generations.



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