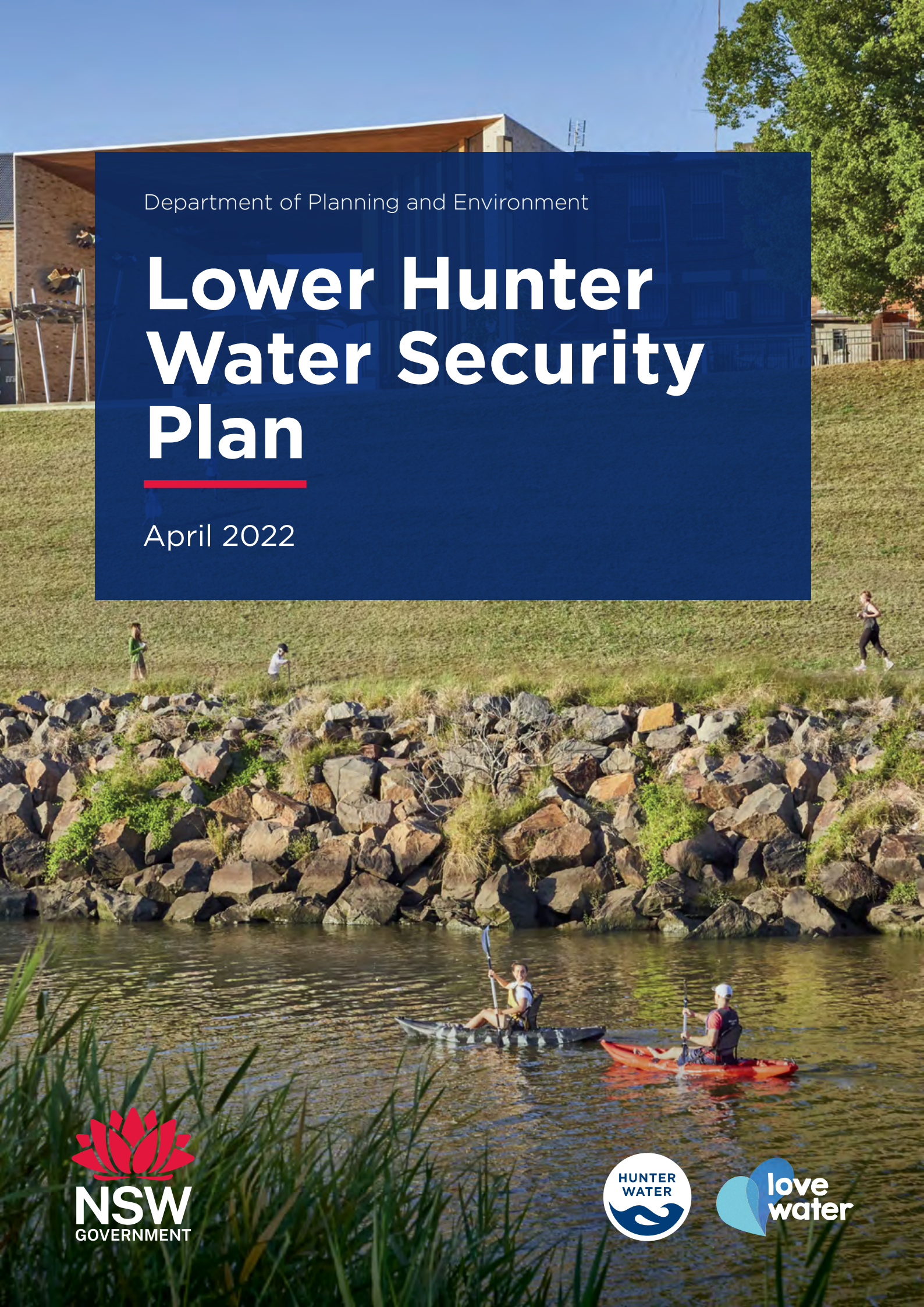

Department of Planning and Environment

Lower Hunter Water Security Plan

April 2022

NSW GOVERNMENT

HUNTER WATER

love water

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Acknowledgment of Country

The NSW Government acknowledges Aboriginal people as Australia's first people practising the oldest living culture on earth and as the Traditional Owners and Custodians of the lands and waters across NSW.

Hunter Water operates across the traditional Country of the Awabakal, Birpai, Darkinjung, Wonaruah and Worimi peoples, and recognises and respects their cultural heritage, beliefs and continuing relationship with the land and waterways of the Lower Hunter.

NSW Department of Planning and Environment recognises the intrinsic connection of Traditional Owners to Country and acknowledges their contribution to the management of landscapes, water and other natural resources across NSW.

We pay our respects to all Elders past, present and future.

The department and Hunter Water understand the need for consultation and inclusion of Traditional Owner knowledge, values and uses in water planning to ensure we are working towards equality in objectives and outcomes. We are committed to continuing future relationships and building strong partnerships with Aboriginal people.

Artwork courtesy of Saretta Fielding.
Artwork title Mariin Kaling – All for Water.

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Photography
Image courtesy of iStock.
Bridge over the Hunter River, NSW.

Minister's foreword

The Lower Hunter is a growing and prosperous region of New South Wales composed of diverse rural and metropolitan communities with broad water needs.

At the heart of the region is Newcastle, our state's second-largest city and the region's economic hub, offering residents the opportunities and benefits of a growing metropolis combined with an enviable regional lifestyle. The surrounding beach communities, rural and historic towns and regional centres are also growing and thriving.

The region is home to the Awabakal, Birpai, Darkinjung, Wonaruah and Worimi people, who for generations have maintained their deep connection and obligation to care for Country, including the lands, waterways, wetlands, and estuaries of the Lower Hunter.

The Lower Hunter's communities are at the heart of everything we do as we plan for and deliver a secure and sustainable water future. Water is our most precious resource, and we must manage it well to support our communities, ensure the health of our environment and maintain our expanding industries. The Hunter is Australia's largest regional economy, with production valued at over $40 billion per year. Water security is vital to keeping it running.

Through the Lower Hunter Water Security Plan, Hunter Water and the Department of Planning and Environment have developed a comprehensive plan shaped by community feedback that allows us to meet our water security challenges head-on. To achieve a

resilient, sustainable water supply in the face of demand pressure and a variable climate, we are welcoming new approaches and putting solutions in place now.

We worked closely with the community, local water utilities, councils, businesses and all stakeholders to find the right balance. We collaborated with the Wollotuka Institute at the University of Newcastle to better understand local Aboriginal and Torres Strait Islander peoples' water values and knowledge.

We worked closely with local councils, MPs, businesses, local water utilities and engaged extensively with the Lower Hunter community over the last three years.

The valuable feedback and contributions we heard helped guide the final Lower Hunter Water Security Plan. Pleasingly, nearly 70 per cent of the public supported our draft plan during its seven-week exhibition.

When it comes to water, there is no 'one size fits all' solution. Finalising the Lower Hunter Water Security Plan has required an in-depth understanding of the competing priorities and diverse needs of the region, by relying on the best available programs, infrastructure, and initiatives to deliver water where it is needed now and for decades to come.

In the Lower Hunter Water Security Plan, that means adopting a whole-of government approach to creating a resilient and sustainable water future for the Lower Hunter that contributes to regional health and prosperity, and is supported by the community.

The Plan prioritises safe drinking water, making the most of existing water supplies and improving the resilience of the system. Importantly, the Plan recognises that our water system is underpinned by healthy ecosystems and is essential to support liveable communities.

Through programs to boost our water efficiency, and adopting new and innovative technologies to do more with less, the Plan will meet the region's water needs in the face of future drought and support growing populations as the Lower Hunter continues to prosper.

The Lower Hunter Water Security Plan aligns with our statewide NSW Water Strategy. As the provider of water and wastewater services to the region, Hunter Water will largely deliver the Lower Hunter Water Security Plan, with support from the NSW Government.

This plan is a considerable achievement and I thank Hunter Water and the Department of Planning and Environment for their work in finalising it. I extend my thanks to the local councils of the Central Coast, Cessnock, Dungog, Lake Macquarie, Maitland, Newcastle, Port Stephens, and Singleton for their support and input.

And I thank the community for its engagement, feedback, and considerable contributions, without which we could not have shaped a final plan to best serve the Lower Hunter.

The Hon Kevin Anderson MP
Minister for Lands and Water

Hunter Water's Managing Director's foreword

For more than 125 years, Hunter Water has been supplying water, wastewater, stormwater and recycled water services to homes and businesses across the Lower Hunter region. We are proud of our record of service to our region and we are committed to continuing to do our work with excellence and to putting our customers and community at the heart of our decisions and future plans.

Hunter Water has embraced the opportunity to support the NSW Government in its efforts to ensure a secure water supply for the Lower Hunter as the region faces the challenges of a growing population, an expanding economy and changing climate conditions.

We have focused on improving the efficiency of our water system and have reduced leakage by 34% over the last four years. We have continued to work with our community to assist them in conserving water, and they have responded reducing demand by 11% in 2019-20. These actions make the most of what we have, increasing our ability to respond to drought and deferring investment to service growth. While these actions are essential, and will continue to remain a priority, by themselves they are not enough.

We have led the development of the Lower Hunter Water Security Plan because we know that we need to start planning now to make sure we can meet customer and community needs and expectations into the future. We have learned that we need to prepare for future drought before the next drought comes along and that up-front investments and actions are needed to be sure the Lower Hunter has enough water during a long and severe drought.

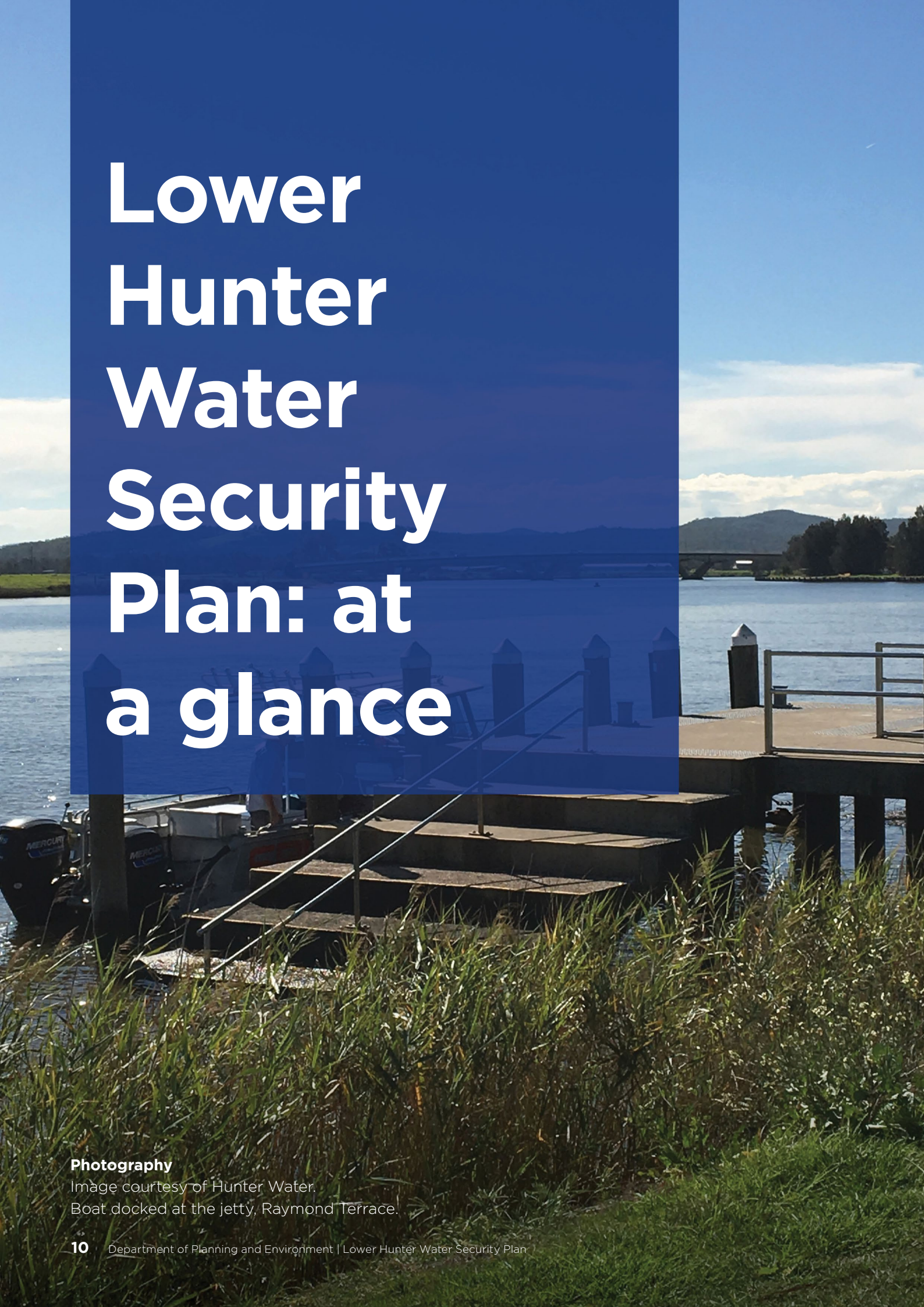
In preparing this Lower Hunter Water Security Plan, people across the region—from households and businesses to local councils and other stakeholders—have told us they want us to make better use of what we have, through continuing our efforts to reduce our demand for water, but are also open to investing in new sources of supply and improving our readiness for future droughts. We have worked with the NSW Government to reflect these views and to incorporate our community's values and aspirations in the plan.

Thank you to the many hundreds of residents and businesses from across the region that have helped shape this Lower Hunter Water Security Plan. We look forward to working collaboratively with our partners across the region to deliver the outcomes of this plan.

Darren Cleary
Managing Director, Hunter Water

Photography
Image courtesy of iStock.
Lake Macquarie, NSW.

Lower Hunter Water Security Plan: at a glance



Photography
Image courtesy of Hunter Water.
Boat docked at the jetty, Raymond Terrace.

The Lower Hunter Water Security Plan is a whole-of-government approach to ensuring the region has a resilient and sustainable water future that contributes to regional health and prosperity and is supported by the community.

Water is essential for communities across the Lower Hunter to flourish. It nurtures our natural environment, keeps our households and businesses running, contributes to green and cool spaces in our cities and towns and keeps our industries operating and our regional economies thriving. Water is deeply entwined with the spiritual, cultural, social and economic wellbeing of First Nations and Aboriginal communities across the Lower Hunter region.

The Lower Hunter Water Security Plan aims to ensure water security for the Lower Hunter for the next 40 years. The plan's goal is to provide a resilient and sustainable water future that contributes to regional health and prosperity and is supported by the community.

For the last three years we have talked to our community and customers about their values and preferences for our water future, have looked at the data on our changing climate and the expected growth in the region, and we have analysed a range of demand and supply options to reduce the amount of drinking water we use and supplement our water supplies. We also learnt from our experiences in the recent drought about what we need to do to make sure we are prepared in the future.

We know our climate is changing, but we are also learning more about underlying climate variability. We know we have to continue to find new ways to conserve and recycle water and that when we ask our community to conserve water, they have responded by making smarter water choices.

We know that the system's ability to meet demand is at risk in times of drought and the risk is likely to increase with climate change.

Increasing the diversity of the region's water supply will improve drought security and increase resilience to future uncertainties.

We also know that we need to work with First Nations and Aboriginal peoples to incorporate their water values in our planning and protect and restore the waterways, habitats and ecosystems that support liveable communities and sustain our native plants, fish and wildlife.

To meet the challenges facing the Lower Hunter's water resources, and provide a resilient and sustainable water future for our region, we need to do things differently.

We need to plan differently—The traditional planning approach for drought has too much risk and uncertainty inherent within it. We need to change our approach and bring it into line with community expectations for a secure water supply that can withstand drought.

We need to act now—To ensure we have a reliable water supply in typical conditions and in drought, we need to take steps now to increase our resilience to future droughts by continuing to invest in water conservation, increasing the capacity of our water supply system and planning for the infrastructure we may need in drought before the next drought.

We need to remain adaptive—The future is uncertain. In addition to increasing the robustness of our water systems, we need to be more adaptive in how we manage these systems. We need to adopt an approach that progressively delivers 'no-regret' actions over time while also allowing us to remain adaptable to changing conditions and respond to risks and opportunities as they arise.

Photography
Image courtesy of Destination NSW.
Sunset across Tomaree National Park, Port Stephens.

To achieve the goals and objectives of the plan—and based on community feedback and technical analysis—four strategic priorities were identified.

PRIORITY 1 **Safe drinking water**	Safe drinking water is our highest priority. We will continue to provide high-quality drinking water for the health and wellbeing of our community and the future prosperity of the region.
PRIORITY 2 **Making the most of what we've got**	We will manage our existing water resources wisely, working together with our community and stakeholders to make the most of our existing water resources, particularly before investing in new sources.
PRIORITY 3 **Improving the resilience of the system**	Our climate is changing and the future is uncertain. We will act to improve our resilience to shocks such as drought as well as remaining adaptive to future risks and opportunities.
PRIORITY 4 **Water for life**	Water is an essential part of connection to country for First Nations and Aboriginal people and supports liveable communities. Our plan will work to incorporate the values and participation of First Nations and Aboriginal people. Water supports liveable communities and our plan will seek to protect and restore our environment and ecosystems.

A program of actions has been developed to deliver on the four strategic priorities.

Increased investment will be needed to meet community expectations, service growth and ensure a water supply that is resilient to drought.

Customer bills will not change before 1 July 2025. Beyond that, the actions proposed are likely to increase annual residential customer bills by $75 to $120 on average per year (a one-off increase of between 6 and 9 per cent).

This is based on analysis over the long term, however exact bill impacts may vary depending on a range of factors such as the timing of major capital works and how the increase is phased in. Hunter Water pension rebate and hardship support measures remain in place.

Lower Hunter Water Security Plan

Our 40-year plan to provide a sustainable and resilient water supply for the Lower Hunter that improves our resilience to drought, increases the diversity of the system, meets the needs of a growing community and keeps us adaptable for the future is summarised below.

Priority 1: Safe drinking water

Protecting drinking water catchments

Continuing to invest in catchment management and protection and maintaining a multiple-barrier approach to the supply of safe drinking water.

✔ Protects water quality at the source and makes the most of existing resources.

Priority 2: Making the most of what we've got

Water conservation

Increasing investment to support the Lower Hunter community to reduce water use by 17% compared to expected, and continuing to invest in reducing network leaks.

✔ Saves precious drinking water, more time to respond to drought and defers investment to service growth.

Recycled water

Increasing recycled water use for non-drinking by 1.3 billion litres through new and expanded industrial schemes, more public open space irrigation schemes, and continuing to explore viable opportunities for recycling in new residential developments.

Engaging with the Lower Hunter community about purified recycled water and building a purified recycled water for drinking demonstration plant in the region.

✔ Reduces demand for precious drinking water, rainfall independent water supply and defers investment to service growth.

Central Coast connection

Continuing to share water with the Central Coast via the Hunter-Central Coast connection.

✔ Optimises use of existing infrastructure and allows water to be transferred to where it is needed most.

Priority 3: Improving the resilience of the system

Belmont desalination plant

Building a permanent desalination plant at Belmont to supply up to 30 million litres of water per day.

- ✔ A new rainfall independent supply and extends the time for reaching critical water storage levels in severe drought.

A Hunter Water connection to the Lostock Dam – Glennies Creek Dam pipeline scheme

Preparing to connect to the proposed Lostock Dam – Glennies Creek Dam pipeline scheme including new offtake infrastructure to supply up to 50 million litres of water per day.

- ✔ Optimises use of existing infrastructure, increases water supply diversity, and improves water security for the Upper Hunter, Lower Hunter and Central Coast.

Drought management plan

Continuing use of water restrictions in times of drought and water sharing with the Central Coast and implementing readiness activities for a drought response desalination plant at Walsh Point.

- ✔ Being prepared to ensure we can meet our community water needs through a long and severe drought.

Research and development

Continuing to investigate the Hunter River paleochannel and evaporation reduction options.

- ✔ Identify new ways to reduce demand for water and increase supply.

Monitoring, evaluation and review

Establishing actions and measures to assess the delivery of the plan.

- ✔ Helps us to be adaptable to change.

Priority 4: Water for life

Cultural values

Improving knowledge sharing and increasing involvement of First Nations and Aboriginal people in strategic water planning.

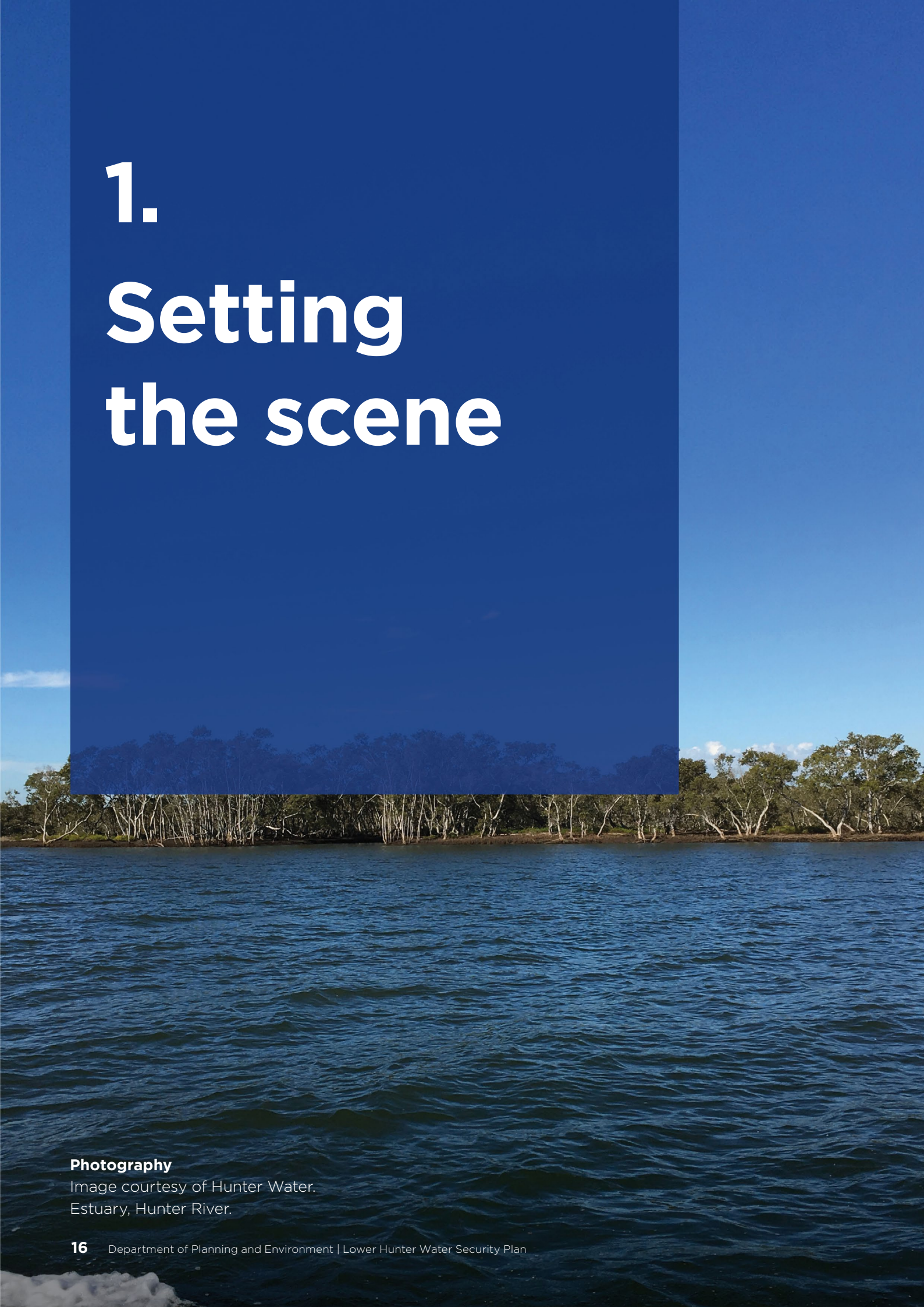
- ✔ Increased participation and water values reflected in future planning.

Water for liveable communities and circular economy

Improving the integration of land use and water planning to contribute to liveable communities.

- ✔ Green spaces, healthy waterways and a more sustainable lifestyle for the Lower Hunter community.

1.
Setting the scene



Photography
Image courtesy of Hunter Water.
Estuary, Hunter River.

The Lower Hunter Water Security Plan reflects community values and priorities while being both robust and adaptable in the long term. It is designed to adapt to the challenges of population and business growth, climate change and technological advancement.

The NSW Government has worked in partnership with Hunter Water to undertake a comprehensive review of the 2014 Lower Hunter Water Plan and to develop the Lower Hunter Water Security Plan.

The scope of the Lower Hunter Water Security Plan covers urban water use in Hunter Water's area of operation.

A collaborative, systems approach has guided the review. A systems approach considers the relationships between the water supply system and the community and external environment.

The process was also guided by integrated water management principles to consider all water across the entire water cycle including how we use water in our homes and businesses, ground and surface water, wastewater, urban stormwater, recycled water and waterway health.

The approach aligns with the circular economy principle of keeping products and materials in use for as long as possible and re-thinking how we manage the complex interconnections between water services, energy, carbon emissions, ecological health and economic productivity.

A fundamental part of this approach is ensuring we are making the best use of the water we have, especially before investing in new infrastructure. By working closely with our customers and community to conserve water and reduce leaks, we have been able to translate the Love Water message into substantive behavioural change and water savings.

Learning with our community about the importance of water conservation and making sure we aren't losing water to leaks forms the foundation of our future planning.

Photography
Image courtesy of iStock.
Aerial view of Dora Creek, Lake Macquarie.

What the Lower Hunter has achieved in water savings and leakage reduction

The National Performance Report for 2020-21 confirmed Lower Hunter household water consumption fell by 14 per cent in real terms, from an average of 175 kilolitres per property across the year down to 151 kilolitres.

Coming two years after the Hunter's water storages reached their lowest levels in more than 40 years, the result showed the Lower Hunter household water consumption is well below the national average for major utilities of 176 kilolitres per property.

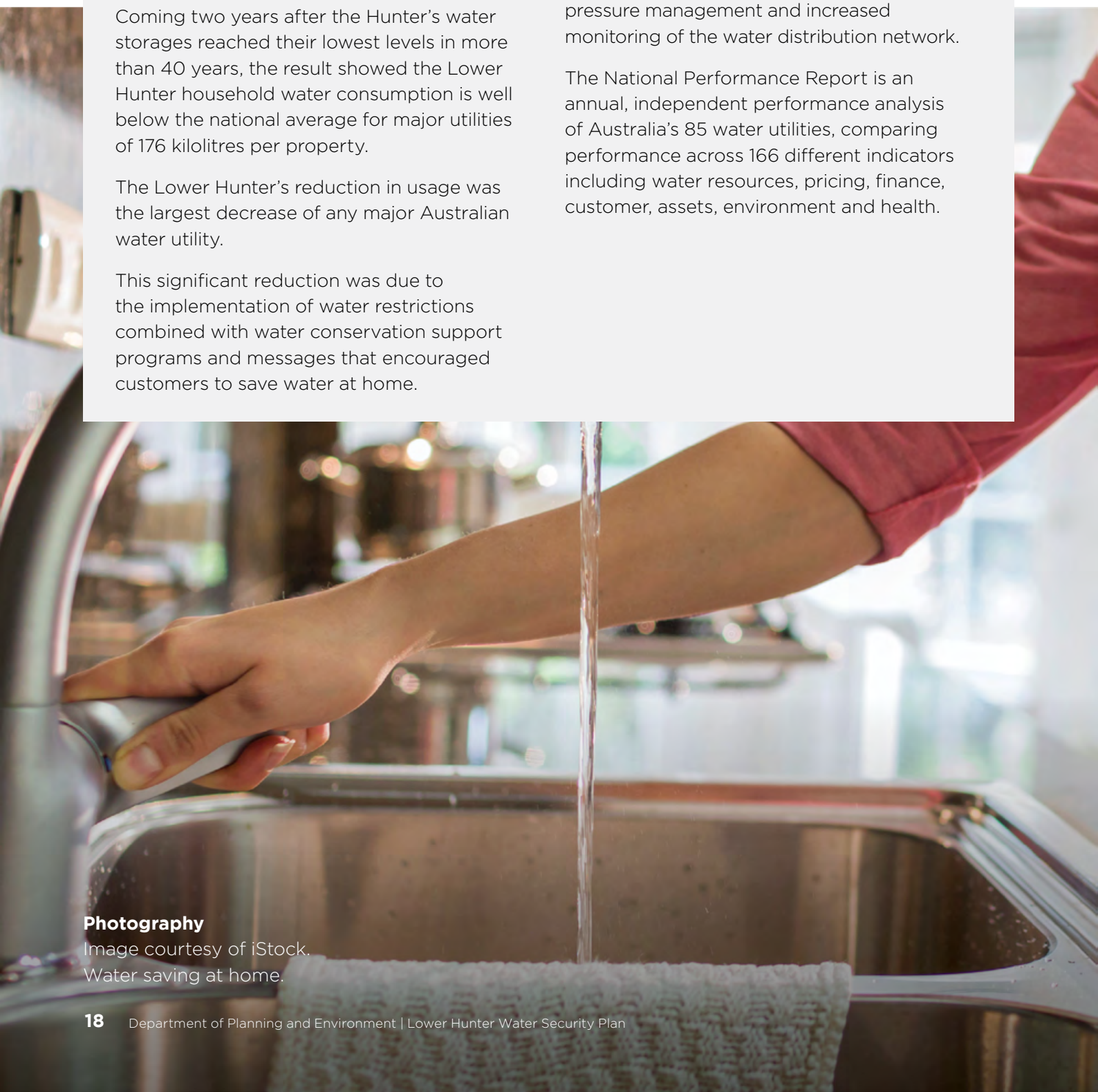
The Lower Hunter's reduction in usage was the largest decrease of any major Australian water utility.

This significant reduction was due to the implementation of water restrictions combined with water conservation support programs and messages that encouraged customers to save water at home.

Hunter Water's leakage reduction result was also significant. Network water leakage dropped a further seven per cent in 2020-21 compared to the previous year, bringing cumulative savings of more than 38 per cent since 2015-16, making Hunter Water one of the nation's top improvers on a year-on-year basis.

This strong performance has been achieved through a program of proactive leak detection, pressure management and increased monitoring of the water distribution network.

The National Performance Report is an annual, independent performance analysis of Australia's 85 water utilities, comparing performance across 166 different indicators including water resources, pricing, finance, customer, assets, environment and health.



Photography
Image courtesy of iStock.
Water saving at home.

Figure 1. Hunter Water average household water usage

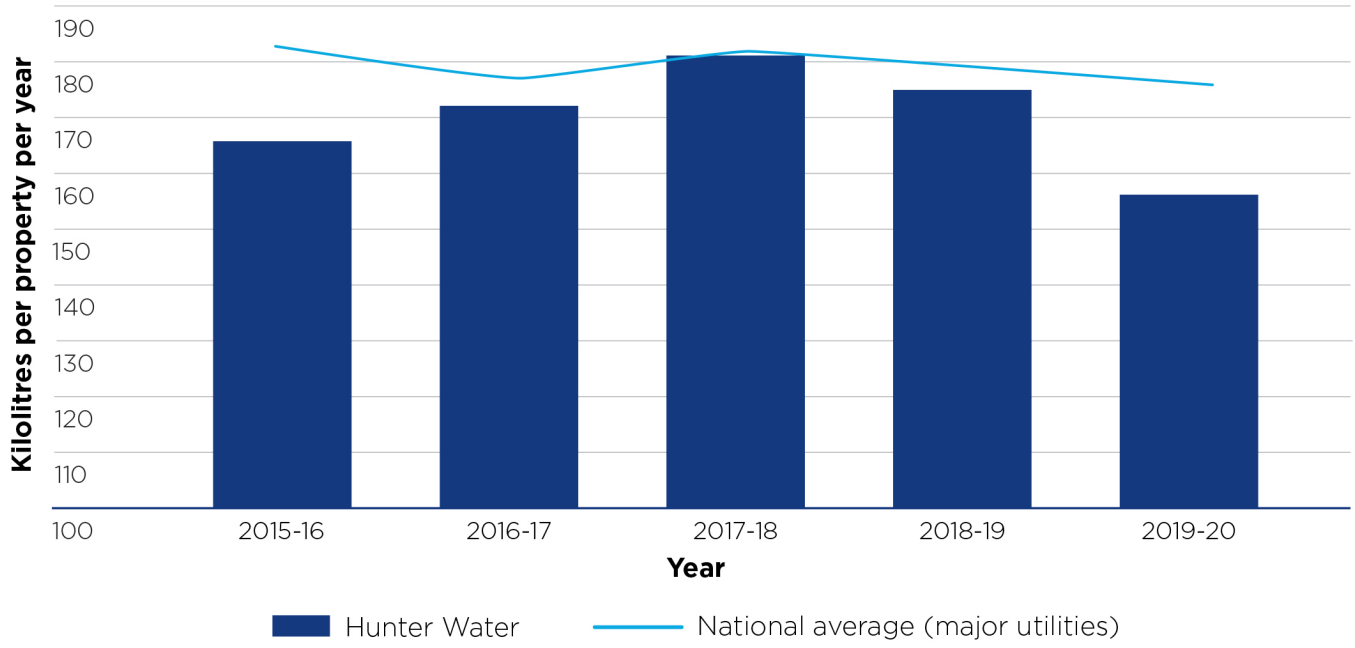


Figure 2. Hunter Water network leakage

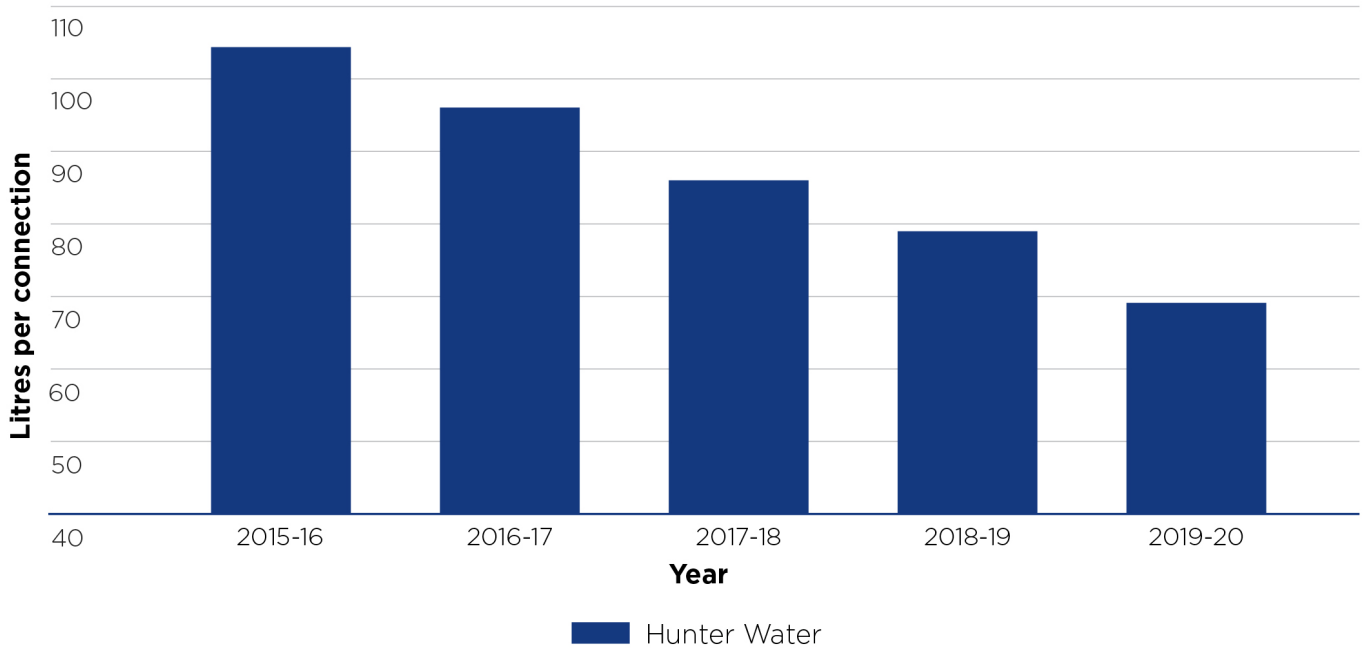
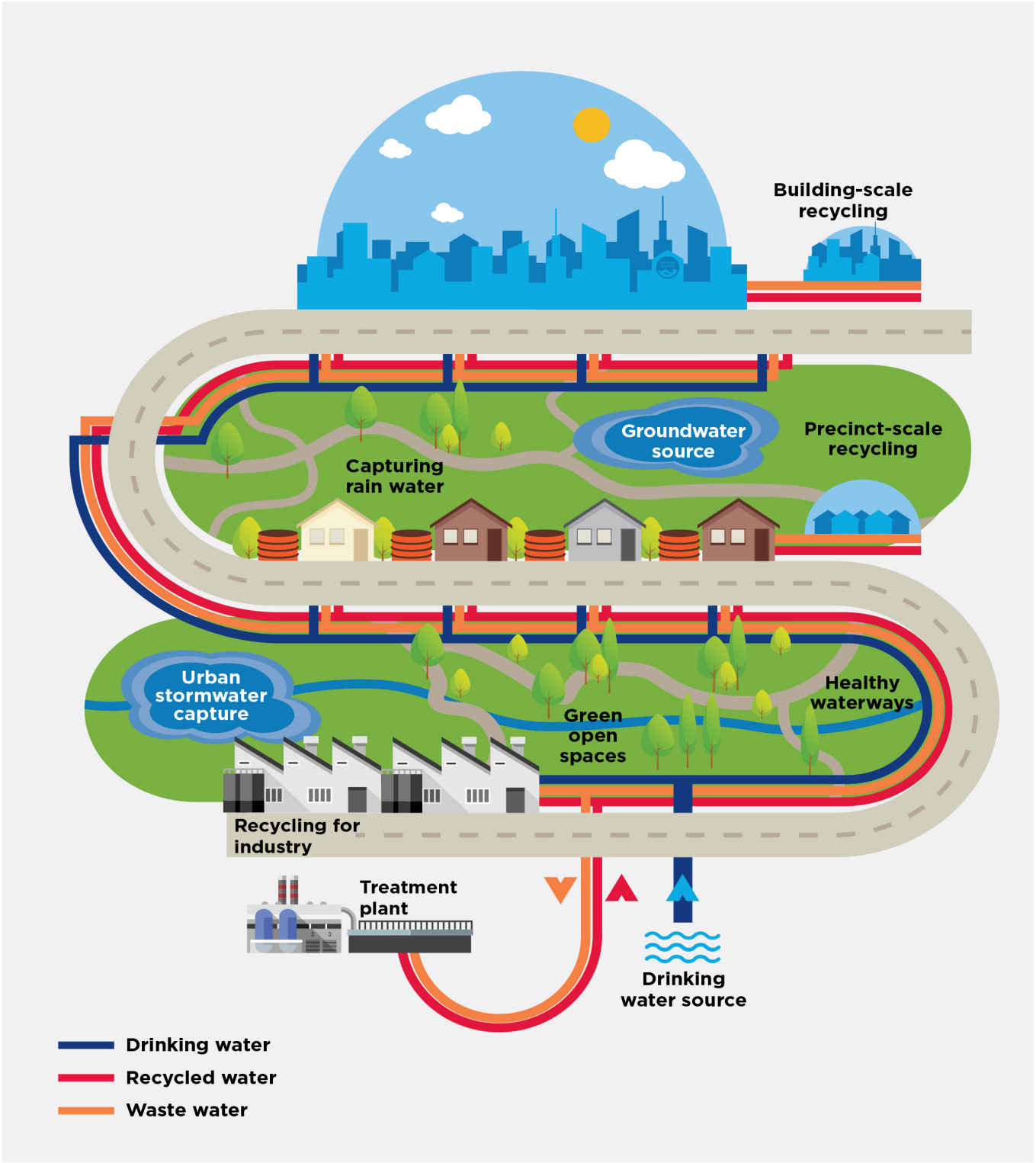
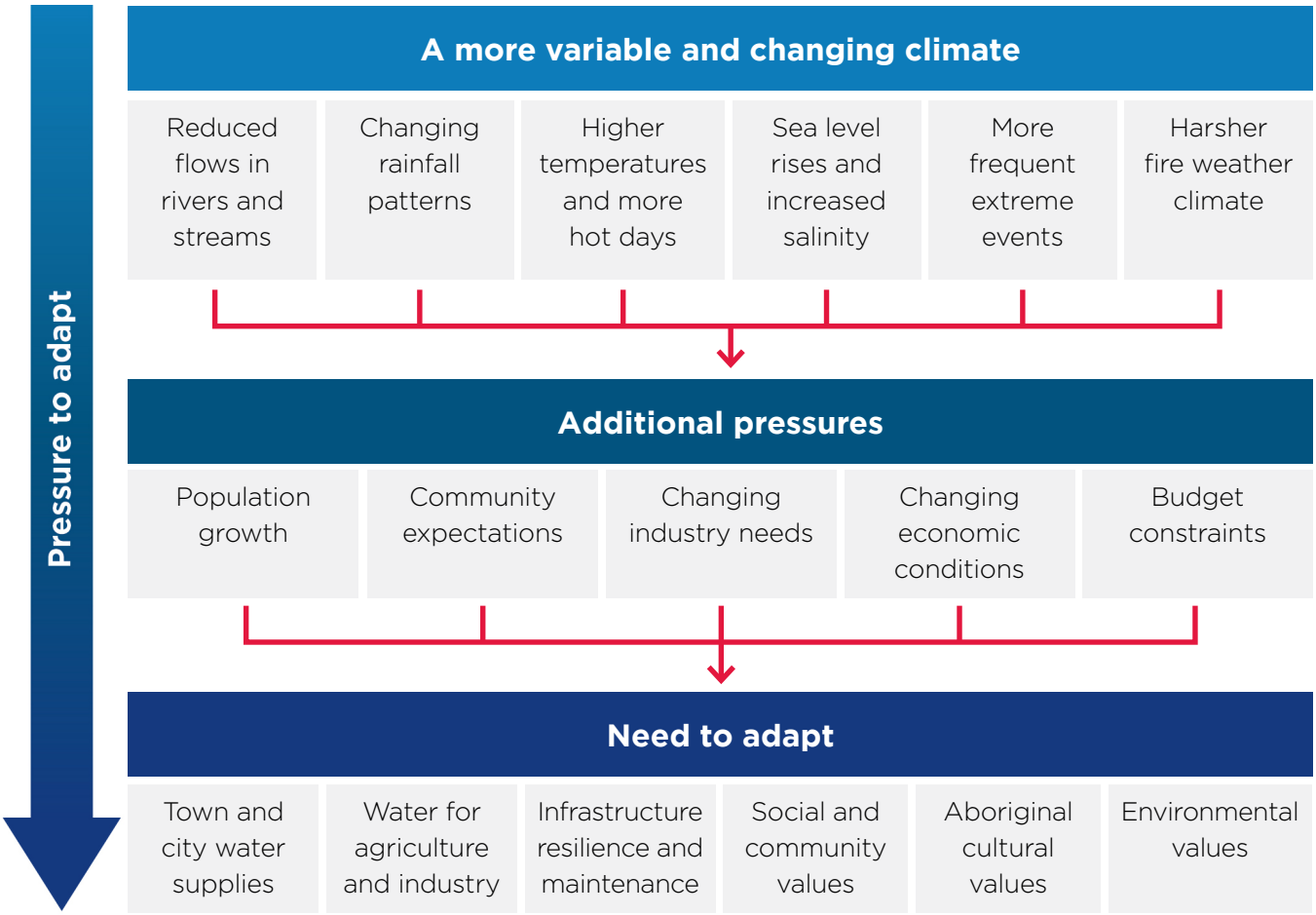


Figure 3. Integrated water cycle management



We have investigated a range of factors that may increase pressure on the ability of the region's water system to meet customers' needs in the future and that will need to be considered in the region's long term water plan. These pressures are summarised in Figure 4.

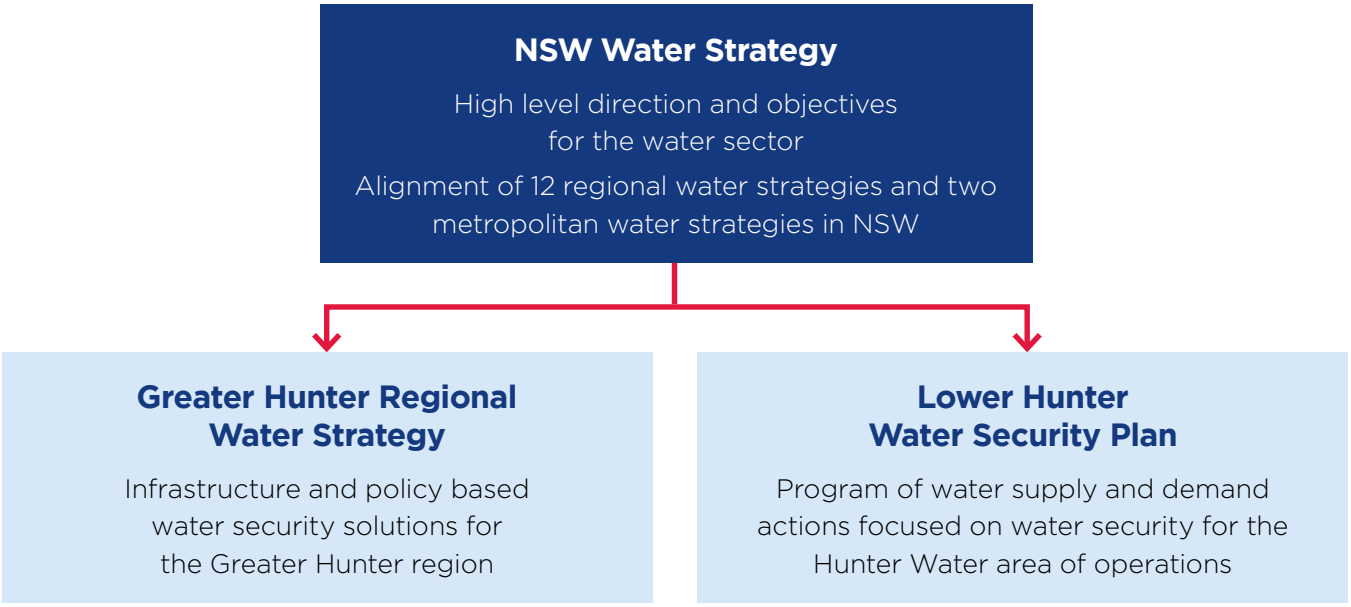
Figure 4. Pressures to adapt in the water sector



1.1 Alignment with other planning processes

The Lower Hunter Water Security Plan is part of a suite of long-term strategies the NSW Government is developing to maintain the resilience of the state's water services and resources over the coming decades.

Figure 5. Interaction with NSW Water Strategy



The NSW Water Strategy is the first 20-year water strategy for all of NSW. It tackles the key challenges and opportunities for water management and service delivery across the whole of the state and sets the strategic direction for water service delivery and resource management in NSW over the long term.

The NSW Water Strategy works in tandem with 12 regional water strategies and two metropolitan water strategies—the Greater Sydney Water Strategy and the Lower Hunter Water Security Plan. The NSW Water Strategy sets overall state objectives, outcomes and priorities, while the regional and metropolitan strategies identify place-based solutions for each region. Together, the suite of strategies will ensure the resilience of the state's water services and resources over the coming decades.

The NSW Water Strategy and the Lower Hunter Water Security Plan have been developed in parallel, enabling:

- alignment between the overall state-level priorities in the NSW Water Strategy
- consistency with the regional priorities set out in the Greater Hunter Regional Water Strategy—Securing the future water needs of the Hunter, Central Coast and Mid-Coast areas (published November 2018)
- development of consistent water security priorities for the Lower Hunter.

The NSW Water Strategy and the regional and metropolitan water strategies do not replace statutory instruments, such as water sharing plans. They set the agenda for water management and service delivery into the future and are designed to contribute to water management outcomes aligned with the objects and principles of the *Water Management Act 2000*.

The Greater Hunter Regional Water Strategy nominates drought security, population growth, future changes to industry in the Upper Hunter and climate change as important drivers for investment to secure the future economy of the region.

The strategy outlines the existing management arrangements for water planning in the Greater Hunter Region and identifies policy, planning and infrastructure options to improve water security.

Recommendations in the strategy include:

- connecting existing water supply infrastructure to improve water access and sharing
- investigating water re-use schemes to boost supply
- better managing water supplies to address the needs of industry and the environment.

The Lower Hunter Water Security Plan aligns with the recommendations of the Greater Hunter Regional Water Strategy.

The Lower Hunter Water Security Plan considers the broader planning framework for the region including the Hunter Regional Plan 2036 and the Greater Newcastle Metropolitan Plan 2036, as well as the Premier's Priorities. This aligns with the NSW Government's commitment to integrating water cycle and land use planning across the state to ensure the coordinated development and management of water resources with land and urban infrastructure.

Hunter Water has also worked closely with Central Coast Council in the development of the Central Coast Water Security Plan. Central Coast Council played a key role in the options assessment process for water sharing between the Lower Hunter and Central Coast, which aims to achieve optimum whole-of-system outcomes for the two regions.

Photography
Image courtesy of iStock.
A bright sunny day at Lake Glenbawn Dam near Scone in country NSW, Australia.

Hunter Regional Plan

The 2036 Hunter Regional Plan's vision is for the Hunter to be the leading regional economy in Australia with a vibrant new metropolitan city at its heart.

To achieve this vision, the NSW Government has acknowledged the growing importance of Greater Newcastle and set four regionally focused goals:

- the leading regional economy in Australia
- a biodiversity-rich natural environment
- thriving communities
- greater housing choice and jobs.

The foundation of these regional goals is having access to a resilient, secure and sustainable water supply.

Premier's Priorities

One of the Premier's Priorities is to improve green public spaces. This aims to increase the proportion of homes in urban areas within 10 minutes' walk of quality green, open and public space by 10% by 2023.

This priority will increase the demand for water. A secure water supply is critical for maintaining these green spaces as attractive, high-quality places where people can meet and connect with each other.

The Lower Hunter Water Security Plan will help ensure we can achieve these outcomes through a mix of traditional supply of treated water, as well as increased use of more innovative options such as more recycling and stormwater harvesting as water sources for irrigation.

Photography
Image courtesy of iStock.
Aerial view of Newcastle residential and commercial areas and the Hunter River, Newcastle.

1.2 Water supply in the Lower Hunter — where we are now

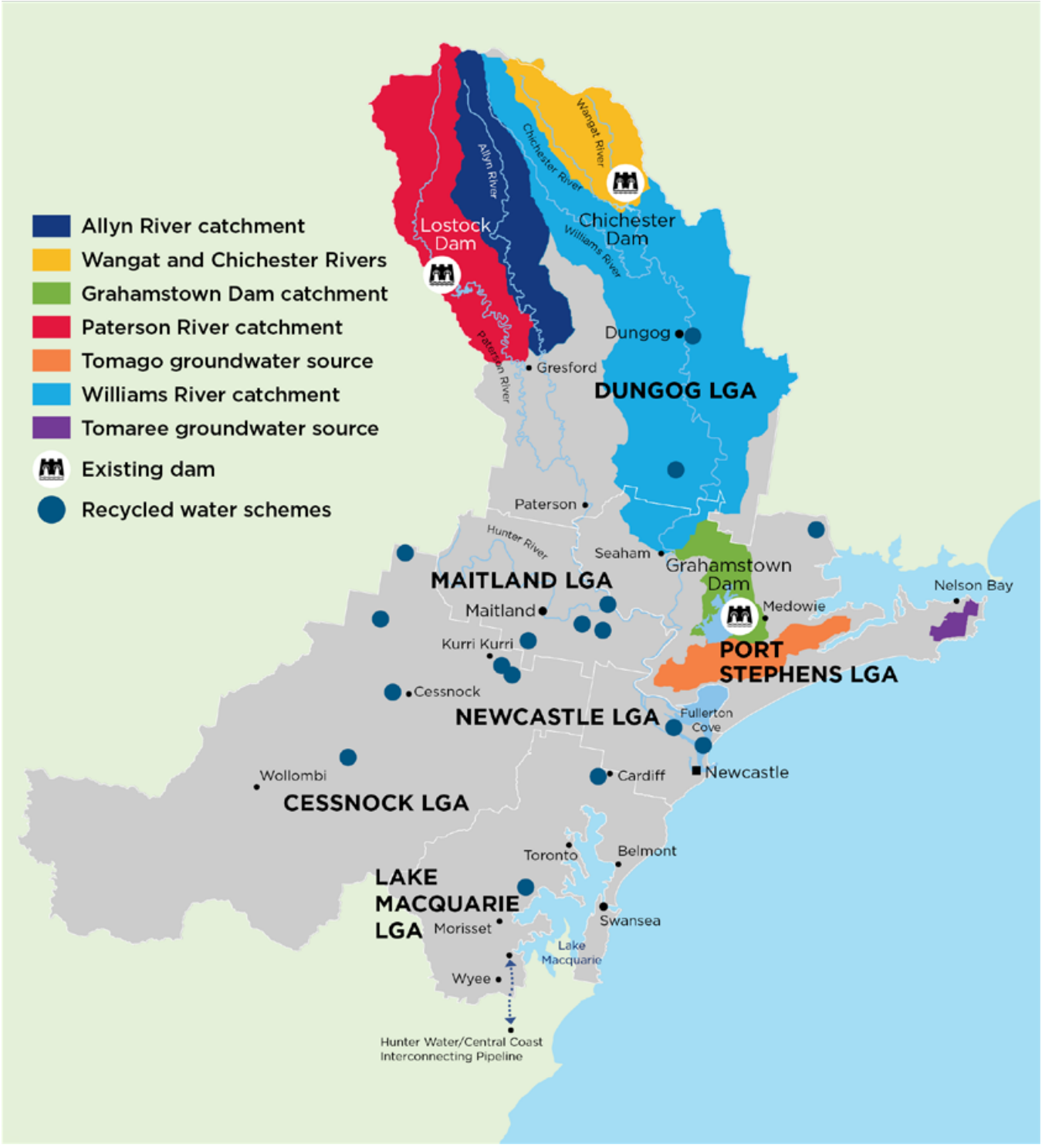
The Lower Hunter region is home to more than 600,000 people. The region supports a vast range of lifestyles, industries and environments, including the beaches and coastal communities of Newcastle, Lake Macquarie and Port Stephens, and the rural townships and large inland rivers around Maitland, Dungog and Cessnock. Water is critical for the region's people, economy and environment to thrive.

Hunter Water is responsible for supplying reliable, high-quality water and wastewater services to homes and businesses across the Lower Hunter region. Hunter Water also provides some stormwater services to about one third of its water and wastewater customers, and provides trade wastewater, recycled water and raw water services.

Hunter Water's area of operations covers 5,366 square kilometres and consists of the local government areas of Cessnock, Dungog, Lake Macquarie, Maitland, Newcastle, Port Stephens and a small part of Singleton.

Photography
Image courtesy of iStock.
View from the top of Tomaree Head, Nelsons Bay.

Figure 6. Hunter Water area of operations and water resources



Note: LGA - local government area.

Water supply system

Most of the water for the Lower Hunter is supplied from two dams:

- **Chichester Dam** is an on-river storage located on the Chichester River, a tributary of the Williams River. It has a total storage volume of 18 billion litres and provides, on average, 28% of the region's current water supply. Chichester Dam was constructed between 1915 and 1926.
- **Grahamstown Dam** is an off-river storage located near Williamtown. Flows are pumped from the Williams River to supplement local runoff to the dam. It has a total storage of 183 billion litres and provides, on average, 51% of the Lower Hunter's current water supply. Grahamstown Dam was constructed between 1955 and 1965.

Both dams rely on source water from the Williams River catchment and together these systems account for approximately 80% of the water supply to the Lower Hunter. The remaining supply comes from:

- Tomago and Tomaree groundwater sources
- several recycled water schemes for non-drinking purposes
- rainwater tanks
- the Paterson and Allyn rivers, which supply the town of Gresford.

Six plants treat the water and then supply it to businesses and households across the Lower Hunter through a vast network of water pipes, reservoirs and pumping stations. The plants treat the water to the high standards set by the Australian Drinking Water Guidelines, which means it is safe to drink straight from the tap.

Hunter Water and Central Coast Council share water via a pipeline connecting the two regions. The pipeline can transfer water in either direction, providing mutual benefits to both systems for drought security. The linked water supply system enables both regions to benefit from variations in broader, regional rainfall and better utilise existing dams in the two systems.

Hunter Water also supplies bulk water to MidCoast Council and three private network operators.

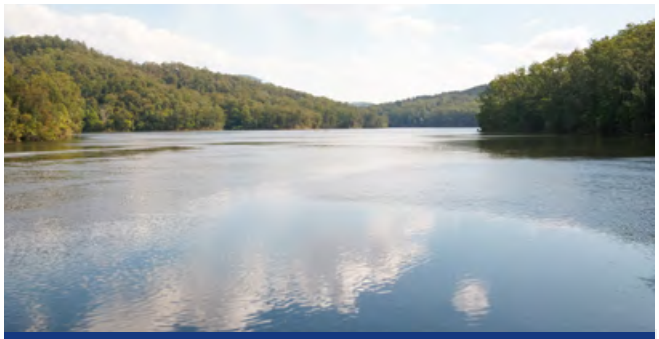
Around 17 per cent of the households serviced by Hunter Water have rainwater tanks installed (approximately 40,000 households). Water from these tanks can be used for toilet flushing, clothes washing and garden irrigation. Assuming adequate rainfall, a well-designed and maintained rainwater tank system can meet around 20% of a household's water demand.

Figure 7. Lower Hunter water system supply sources based on 2015–20 data

Water from dams

28% Chichester + **51%** Grahamstown =

79% Total supply



Water from groundwater sources

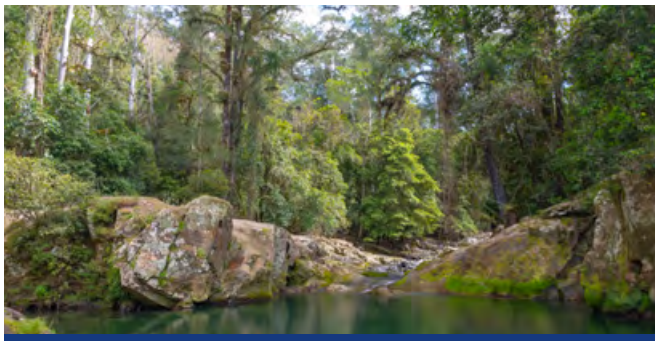
9% Tomago + **2%** Tomaree =

11% Total supply

Water from other sources

8% Recycled water + **2%** Rainwater tanks =

10% Total supply



Water from river offtake and interregional transfers

<1% Paterson and Allyn rivers, Central Coast transfers =

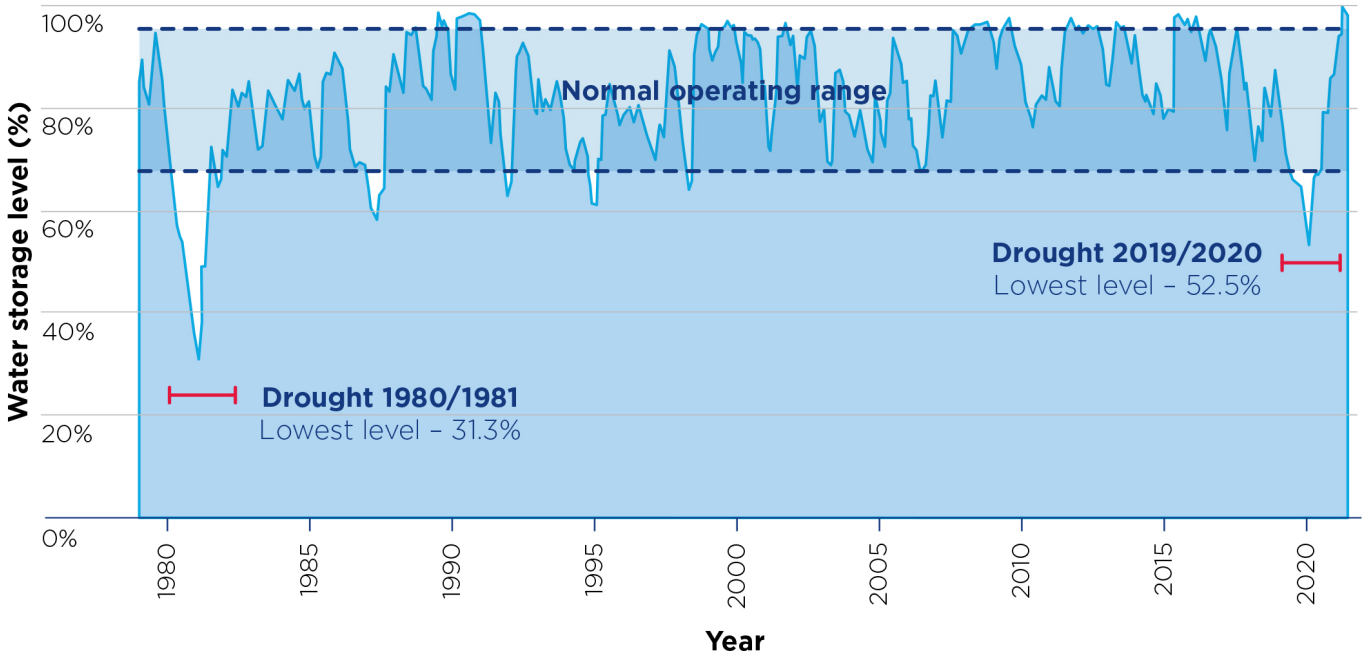
<1% Total supply

Notes:

1. The Tomago sandbeds are typically only used during drought periods.
2. Water transfers between Hunter Water and Central Coast tend to balance each other out in the long term but are important in times of drought.
3. Water supply from rainwater tanks is an estimate based on the number of tanks installed and nominated end uses.

Over 80% of the region's drinking water is sourced from the Williams River catchment. The supply system is highly dependent on rainfall which leaves the region vulnerable to drought. Figure 8 shows how all water storage levels including dams and groundwater sources have fluctuated over the last 40 years. While the system performs well under typical conditions, storages can deplete rapidly during periods of drought. The likelihood and severity of these droughts is expected to increase in the future with climate change.

Figure 8. Historical combined water storage levels from 1980 to 2019



Recycling

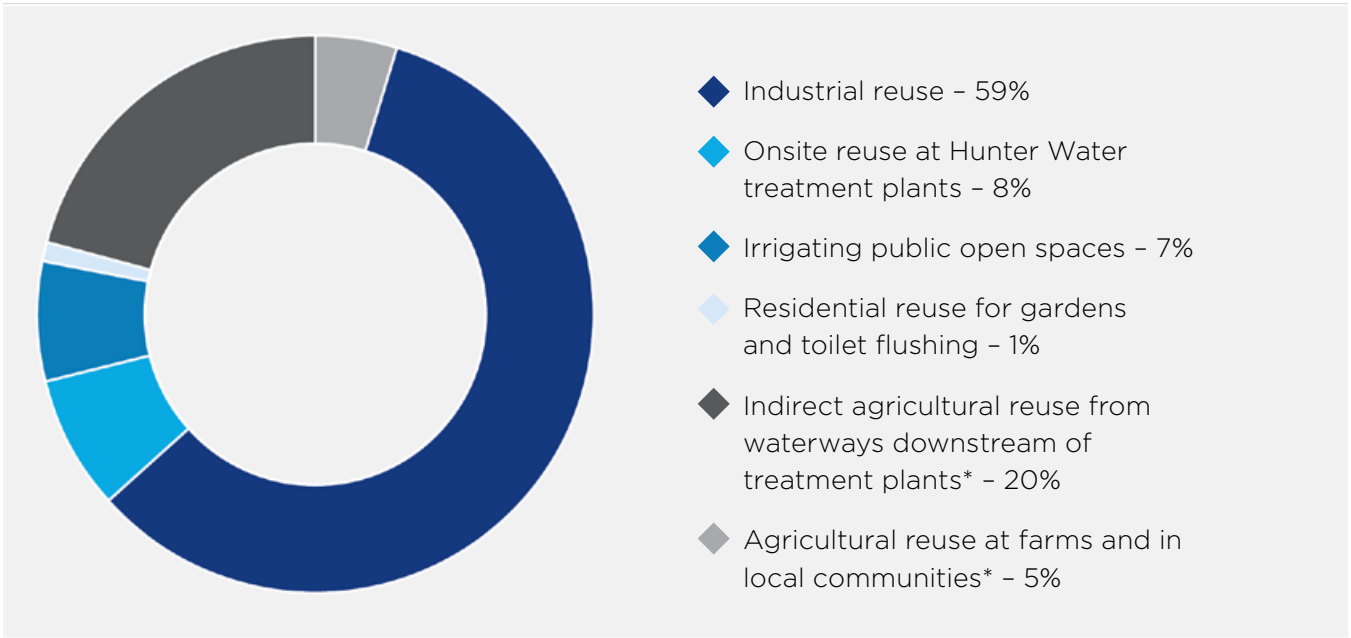
Using recycled water makes our drinking water supply go further. Water recycling involves treating and re-using wastewater and stormwater at home and for industry, irrigation and agriculture.

Recycled water schemes in the Lower Hunter produce around 8 billion litres of recycled water each year, which is the equivalent of around 12% of the total wastewater generated. Of this amount around 6 billion litres per year replaces drinking water. Recycled water is used for a range of activities that do not require water of drinkable quality.

Using recycled water for these purposes conserves precious drinking water supplies and has the added benefit of reducing the amount of treated wastewater released into our waterways. Recycled water use in the Lower Hunter is shown in Figure 9.

There are also several private, localised residential recycled water supply schemes in the Lower Hunter. Water sourced from recycling projects is treated according to the Australian Guidelines for Water Recycling, which means it safe for its intended use, such as watering gardens or flushing toilets.

Figure 9. Recycled water use



*Recycled water use that does not replace drinking water use.

Drought response desalination

The existing Lower Hunter water supply system also includes a proposed drought response desalination plant at Belmont that could produce up to 30 million litres of water a day in the event of a long and severe drought. Construction of the plant would only commence when water storages reach specific trigger levels. Trigger levels are based on ensuring we have enough time to construct the plant prior to our storages depleting to critical levels in a severe drought.

The plant would supply around 15% of average water use and around 25% of restricted water use in times of drought.

Conserving water by finding leaks in the system

Hunter Water undertakes leakage detection across the entire water network. Technicians walk the route of more than 5,000 kilometres of water mains and listen for the sound of leaks using specialised technology.

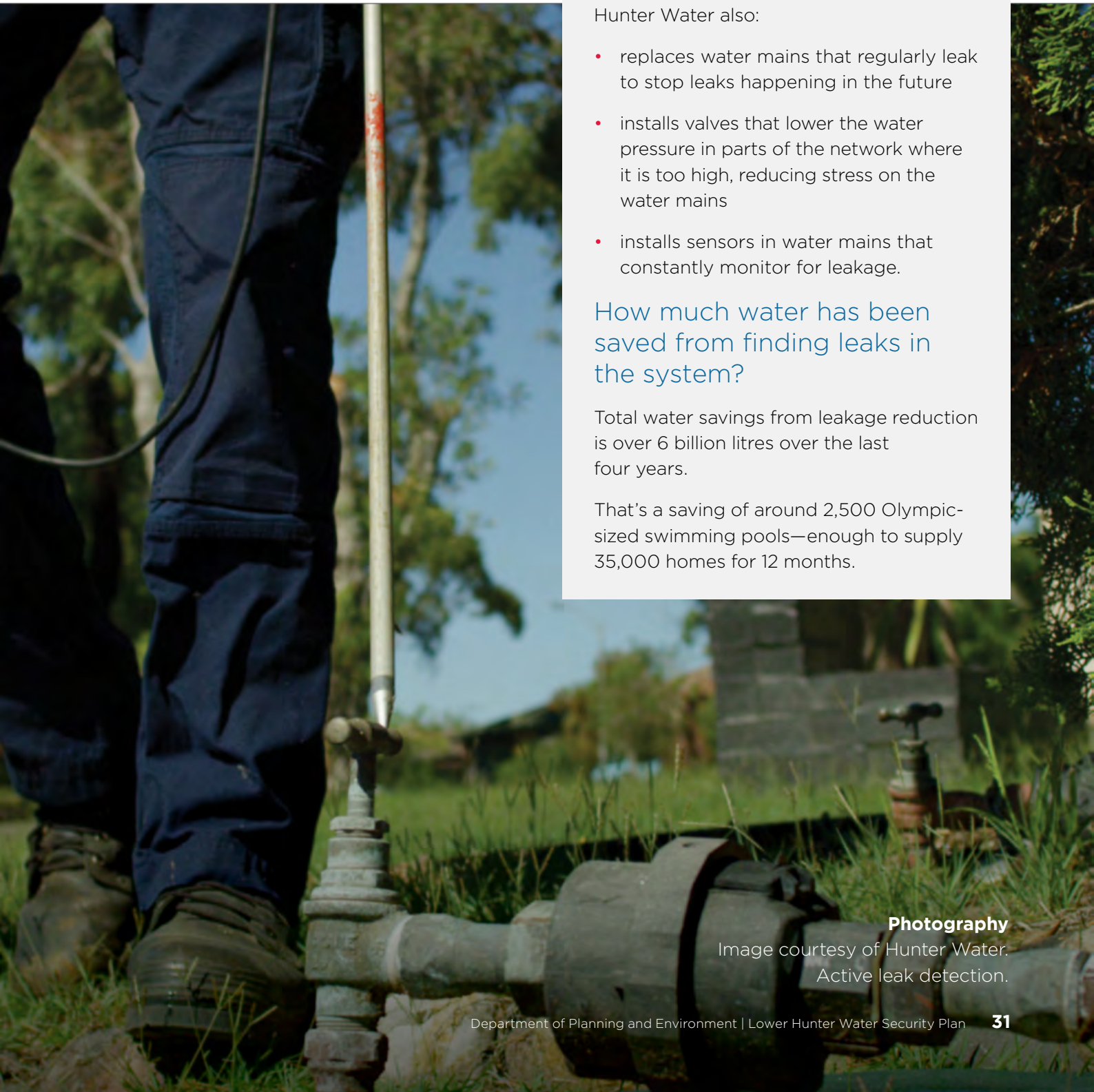
Hunter Water also:

- replaces water mains that regularly leak to stop leaks happening in the future
- installs valves that lower the water pressure in parts of the network where it is too high, reducing stress on the water mains
- installs sensors in water mains that constantly monitor for leakage.

How much water has been saved from finding leaks in the system?

Total water savings from leakage reduction is over 6 billion litres over the last four years.

That's a saving of around 2,500 Olympic-sized swimming pools—enough to supply 35,000 homes for 12 months.



Photography
Image courtesy of Hunter Water.
Active leak detection.

1.3 Current water use in the Lower Hunter

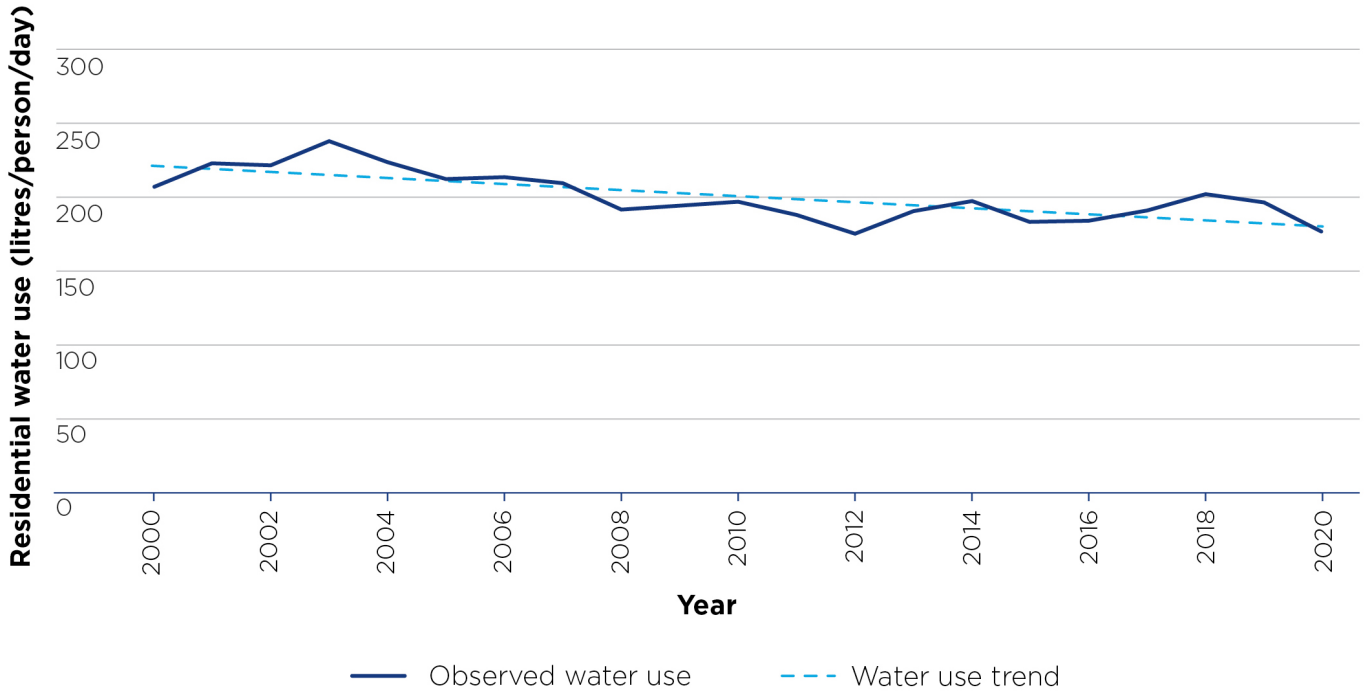
Over the past five years, on average Hunter Water has supplied around 66 billion litres of drinking water a year to people and businesses across the Lower Hunter.

Water use in the Lower Hunter is generally divided into three categories:

- **Residential—**water consumed by Hunter Water customers in their homes and apartments for indoor and outdoor use. Residential use accounts for around 60% of drinking water used each year
- **Non-residential—**water consumed by industrial, business, and municipal customers. Non-residential consumers account for around 30% of drinking water used each year
- **Non-revenue water—**water used in Hunter Water operations and for firefighting, or water lost due to leakage from the distribution system or theft. Non-revenue water also occurs when metering inaccuracies mean the volume of water supplied is not fully accounted for. Non-revenue water accounts for the remaining 10% of drinking water used each year.

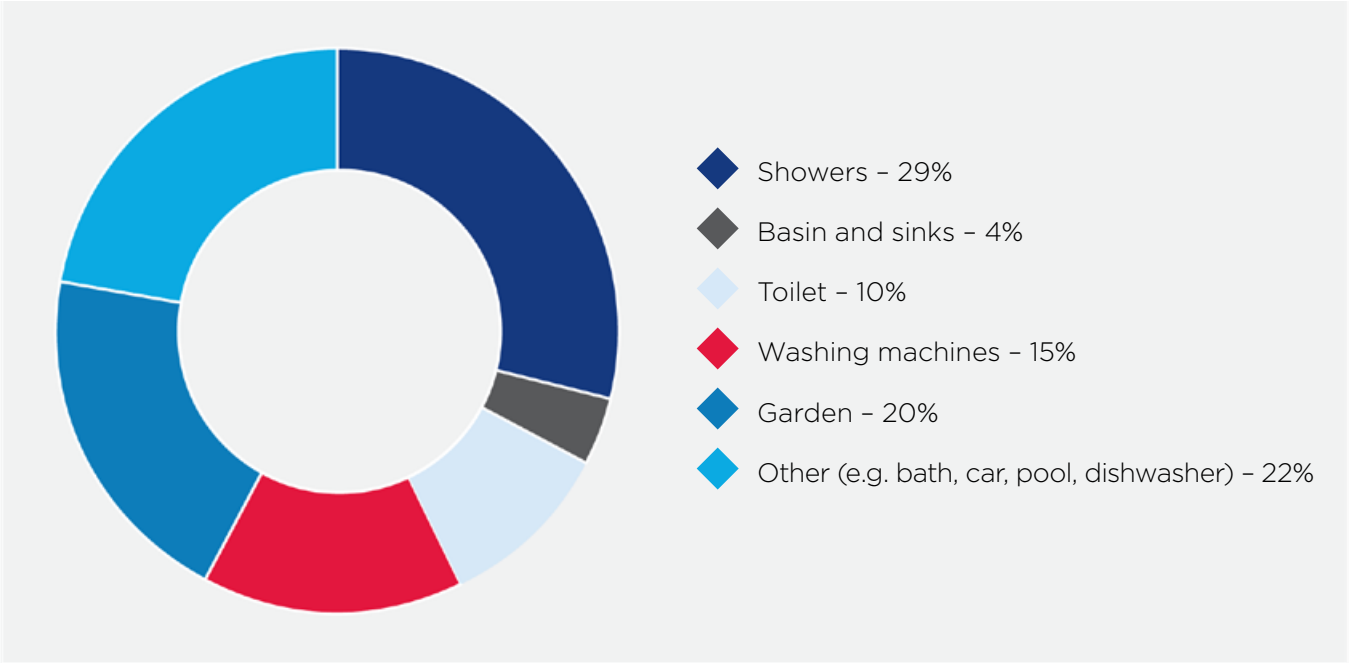
While the population of the region has grown significantly over recent decades, total water use over the same period has decreased. This is due to factors that include changes in the size and type of industrial and commercial water customers, more water-efficient appliances and behaviours, and an increase in higher-density, multi-unit dwellings. Figure 10 shows residential water consumption levels since the year 2000.

Figure 10. Residential water use in the Lower Hunter from 2000 to 2019



On average over the last five years, a typical household in the Lower Hunter used around 190 litres of drinking water per person per day. For comparison, household water use in Sydney and the Central Coast was around 207 and 175 litres of drinking water per person per day respectively. Figure 11 shows how the average household uses water.

Figure 11. How water is used in an average Lower Hunter household



Hunter Water is working to reduce the amount of water used through water conservation programs, such as:

- reducing leaks using leak detection programs, monitoring the system and reducing response times to reported leaks
- working closely with the business community to identify ways to save water together
- programs to help save water in homes and encourage water conservation practices
- community engagement to learn how to save water together.

These programs have reduced leaks by 34% over the last three years. They have also significantly reduced customer water consumption—water efficient practices adopted by the Lower Hunter community prior to the introduction of water restrictions in the recent drought meant that consumption by Hunter Water's customers was already around 4% lower than expected compared to previous years. These savings provided the foundation for a strong community response during drought.

Of the household uses shown in Figure 11, drinking quality water is generally required for showers and baths, basins and sinks, dishwashers and pools. Non-drinking quality water can be used for toilets, washing machines and garden irrigation.

1.4 Supporting growth in the Lower Hunter

A reliable and secure water supply is key to supporting the growth and prosperity of communities across the Lower Hunter, providing a strong foundation for the region's economy and sustaining a healthy natural environment.

The Hunter is Australia's largest regional economy, valued at over $40 billion per year. While the cumulative impacts of recent COVID-19 pandemic-related shocks have affected some sectors such as tourism, the NSW Government has identified opportunities to accelerate the region's recovery through investments in the Williamtown Special Activation Precinct, renewable energy and a range of infrastructure projects. Regional specialisations such as mining and tourism will continue to drive employment and economic growth in the Lower Hunter.

In developing the Lower Hunter Water Security Plan, we have used a range of data to understand likely growth patterns and their impact on water use over time. Birth rates, migration rates and patterns, housing trends, water efficiency improvements and economic indicators are some of the inputs we have considered when forecasting future water needs.

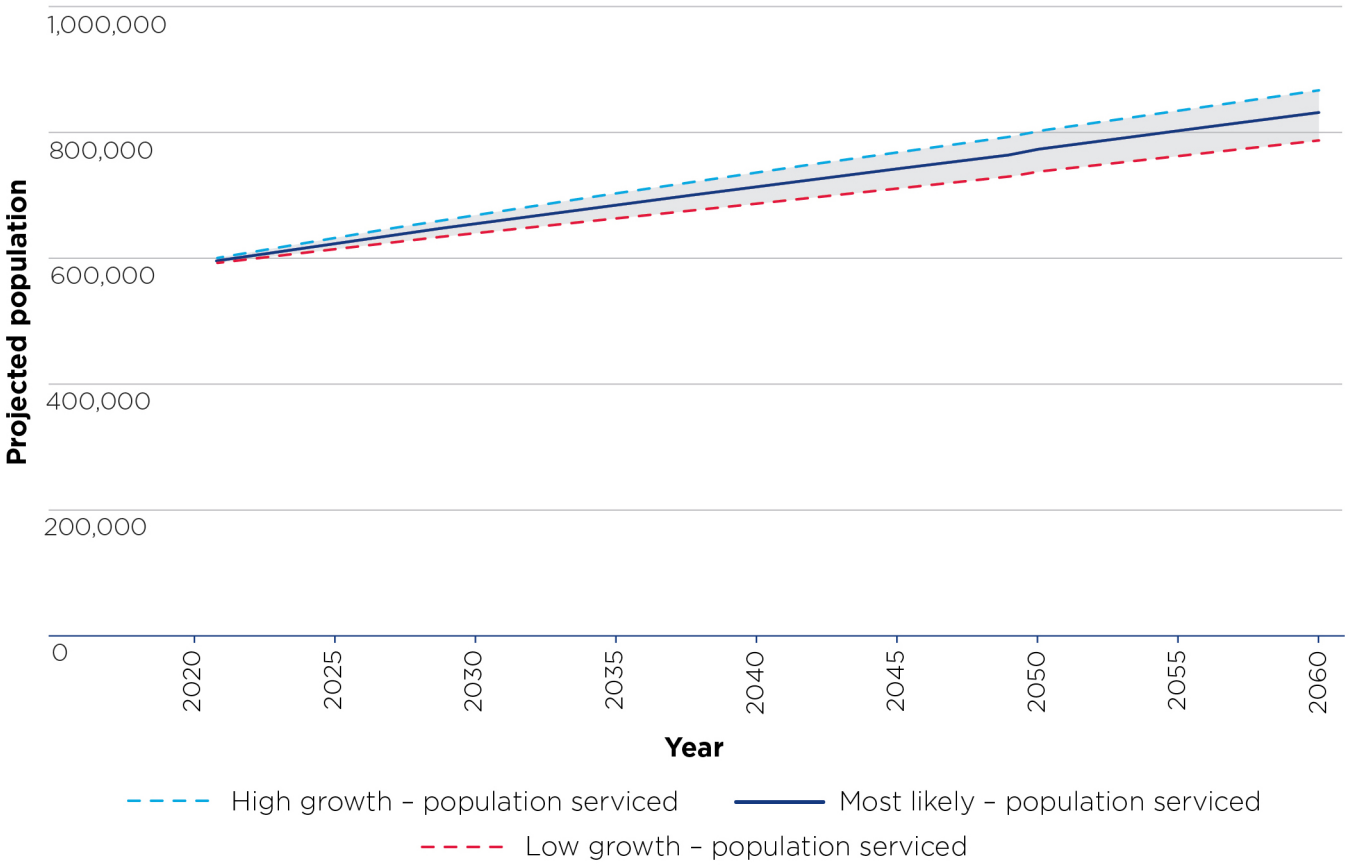
Hunter Water's vision is to be a valued partner in delivering the aspirations for the Lower Hunter region.

Photography
Image courtesy of iStock.
Hunter Valley, NSW.

Current population growth assumptions are based on best available data from the Australian Bureau of Statistics and with reference to the Hunter Regional Plan 2036.

The residential population in the Lower Hunter has grown at a rate of around 1% per year over the last 25 years and is forecast to continue growing at a similar rate.

Figure 12. Projected population growth for 2021 to 2060



We have incorporated these trends and changes into the water use forecast for the Lower Hunter Water Security Plan. Section 3 provides more information about how we used data in our analysis of options for the region.

2.

Why we need a new plan

Photography
Image courtesy of Taryn Manning on Unsplash.
Two people kayaking on the river.

The Lower Hunter's water system can reliably supply around 55 billion litres of drinking water per year. However, given the system's reliance on dams, this is not enough to meet customer and community needs and expectations during drought.

2.1 Our understanding of climate variability is changing

We know our climate is changing, but we are also learning more about underlying climate variability. The NSW Government has invested in new modelling methods and datasets to develop a better understanding of both historical climate variability and likely future climate conditions. This modelling shows our water supplies may be less secure than we previously thought. We now understand that there have been droughts far longer and more severe than those observed during the last 120 years.

Data reconstructed from before instrumental records began, using sources such as tree rings, cave deposits and coral growth (referred to collectively as paleoclimate data), also indicates that we could see higher temperatures and less rainfall in the future.

While the full impacts of a changing climate are somewhat uncertain, we are likely to experience higher temperatures, higher evaporation and more variable rainfall in the future. By testing how our water supply system and the demand for water changes under various climate scenarios we can better understand and assess the magnitude of these impacts. This gives us an understanding of how the Lower Hunter Water Security Plan can adapt to respond to these uncertainties.

The amount of water available in our dams and groundwater aquifers is related to how much runoff occurs in the region's catchments during rainfall events and how much rainfall is available to recharge groundwater aquifers.

We use models that describe the relationship between rainfall and stream flow or recharge to understand how much water can be supplied to water customers in the Lower Hunter under different climate conditions.

Future proofing

What we heard

"Reliability of supply is crucial and the most important consideration."

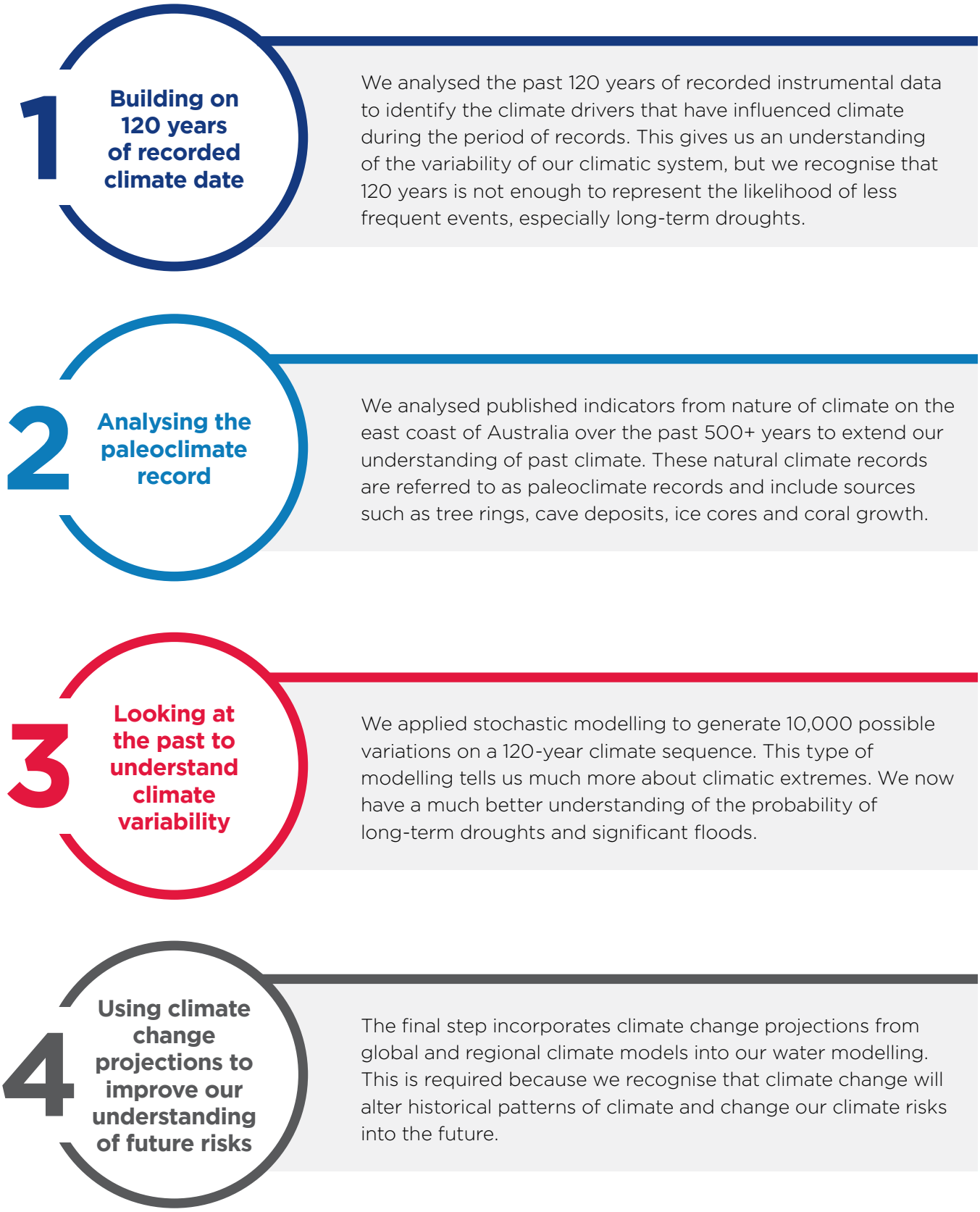
"Definitely investing up-front—we need to be prepared before a drought comes. Doing it early means the cost isn't as high in the long term."

Deliberative forum participants

Future climate projections were sourced from the NSW and ACT Regional Climate Modelling (NARCliM) dataset. The impact of different climate projections (for dry, wet and average scenarios) was tested on customer demand for water and the performance of the water supply system.

We will continue to incorporate new climate data and modelling approaches to improve our understanding of the potential impact of climate change on our future water supply system. Fundamentally, a more diverse and adaptable water supply system will increase our resilience and enable us to better respond to future challenges that may impact the quantity or quality of available water.

Figure 13. Steps in process to understanding climate variability



2.2 We need a new approach to planning for drought

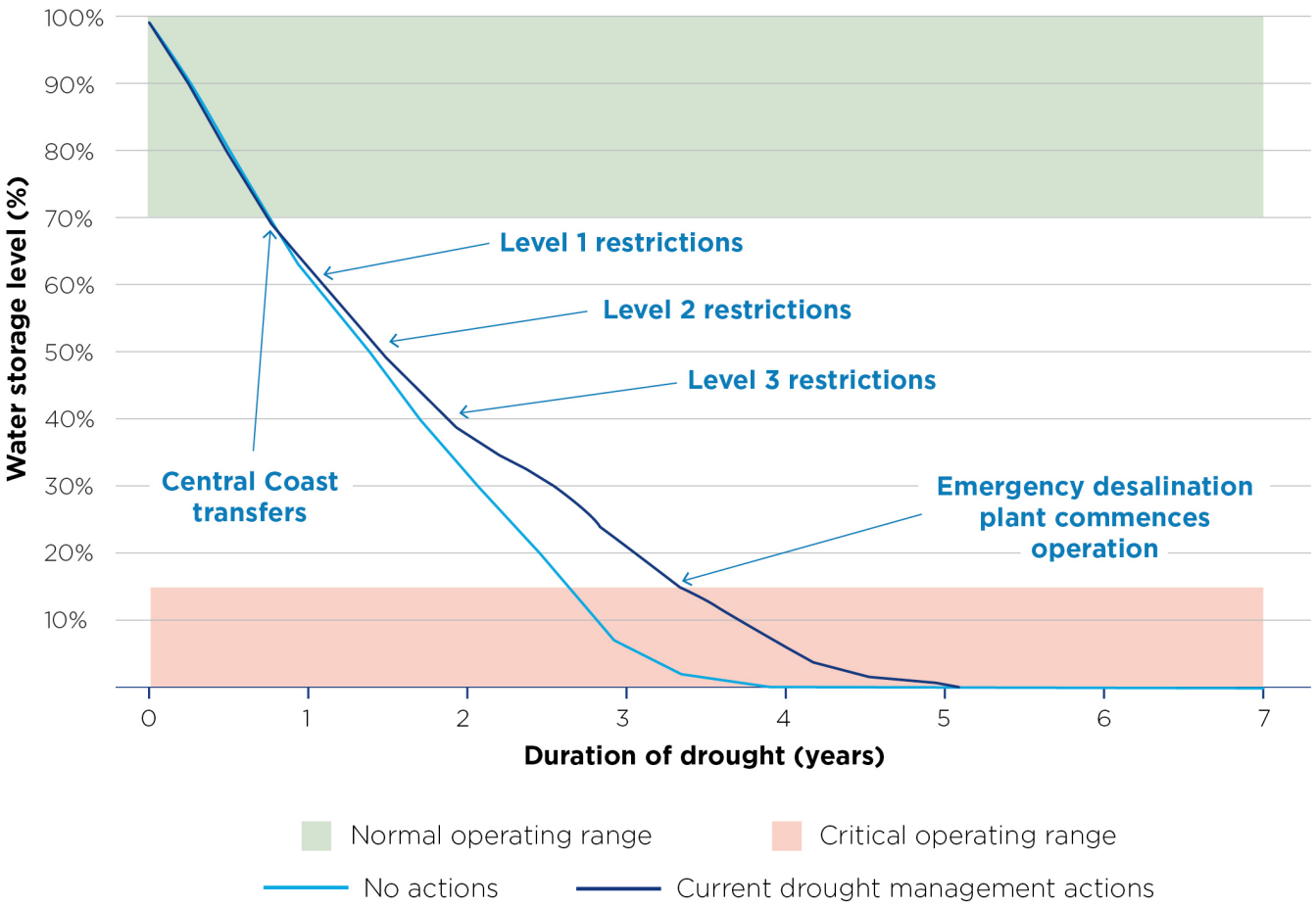
A secure water supply is essential for the health of the community and the prosperity of the region. Households, communities, industries, cities and towns all expect to have access to a water supply that can withstand drought.

While the Lower Hunter's existing water supply system performs well in typical climate conditions, it is vulnerable to drought due to the reliance on rainfall, the relatively small size of its storages and high levels of evaporation in the catchment.

The region's water storages fill up quickly when it rains but can fall from typical operating levels to empty in around three years in a severe drought, even with a range of drought response measures in place to slow the rate of depletion.

If a severe drought was to continue beyond three years, the water supply system could fail and the Lower Hunter could run out of drinking water.

Figure 14. Depletion of Lower Hunter water storages in a severe drought



The traditional approach to planning for drought, and the one adopted for the 2014 Lower Hunter Water Plan, is based on accepting a very low risk of the region running out of water. This risk is calculated by extrapolating from the statistics of observed historical droughts. There are significant uncertainties with this calculation, including the impact of a changing climate, how the system will perform at very low storages and a limited instrumental dataset.

Although the likelihood of the region running out of water is very low, the consequences would be catastrophic.

Throughout the development of the Lower Hunter Water Security Plan, the community and stakeholders told us they expected their minimum demands for water should be met regardless of the severity of a drought. While they supported water restrictions playing an important role in response to drought, running out of water was not acceptable.

In the event of an ongoing drought, the current system (including the Belmont drought response desalination plant) can only guarantee supply of around 50% of the community's restricted water needs.

To ensure we can meet the community's restricted water needs in a drought, the Lower Hunter Water Security Plan adopted a new approach, one which ensures we have time to transition to rainfall-independent sources of water as storage levels fall.

We have considered the planning and delivery of a minimum water supply level to meet the community's expectations during an extended drought.

The Lower Hunter Water Security Plan was developed to meet the following reliability criteria:

- Consistent with many other utilities in Australia, Hunter Water will aim to have restrictions in place for no more than six months every 10 years on average.
- Hunter Water will meet the community's water supply needs under all climatic conditions, including minimum supply requirements during a long and severe drought. Based on feedback from the community, a minimum supply level of 100 litres per person per day has been adopted.
- Adoption of a drought response plan that transitions to rainfall-independent water sources as storage levels fall.

Water supply during drought

What we heard

Community attitudes to running out of water were tested as part of the extensive Lower Hunter Water Security Plan engagement process.

Being able to supply enough water to meet minimum customer demands in a long and severe drought was supported by 84% of participants in the most recent survey. They also said meeting minimum customer demands was the most important value to inform decision-making for the region's future water supplies.

Figure 15. Cities and regions across Australia with permanent desalination shown as a percentage of total supply

Unlike Australia's other major cities, the Lower Hunter does not currently have any supply from desalination.

Current planning relies on drought response desalination, recycled water and a component of inflows in the Chichester catchment as an ongoing source of water in a severe drought. Collectively, these sources would supply only around 50% of the region's restricted demand for water during a severe drought, or around 50 litres per person per day.

What we learned from the drought

In 2019–20 during the statewide drought, water storage levels in the Lower Hunter dropped to 52%, the lowest level in 40 years.

Better water conservation

Using the Love Water initiative, Hunter Water expanded a water saving awareness campaign and enhanced water conservation activities. Hunter Water worked closely with customers to conserve water, develop and implement water efficiency management plans and find and fix leaks in the system.

Working with the community

The community responded positively by adopting water saving measures at home and in their businesses. In 2020, water consumption was 14% less than what would be expected in the hot, dry conditions. Customers took shorter showers and limited outdoor water use, and businesses prepared and implemented water efficiency management plans (WEMPs).

Lessons learned from the drought, including updates to water use projections, have been incorporated into the design of the water conservation programs for the Lower Hunter Water Security Plan. Since the end of the drought, Hunter Water has maintained and strengthened the positive relationships built with local councils and business customers.

Building knowledge in drought preparedness

Another important lesson was better understanding the lead times needed to build new infrastructure to increase water supply in times of drought.

Given the scale and complexity, we now know that it takes around seven years from planning to delivering water into the supply system for major new infrastructure such as a desalination plant. This timing is significant given that the region's storages can drop from full to critical levels in around three years during a severe drought.

We have learned that we need to prepare for future drought before the next drought.

Photography
Image courtesy of Hunter Water.
Grahamstown Dam, NSW.

2.3 Ensuring a reliable water supply to meet the community's needs

A secure water supply means there is enough water to meet community needs through typical conditions and during drought.

Based on our new knowledge about climate variability, and ensuring that we are prepared for drought, the Lower Hunter's current water system can reliably supply around 55 billion litres of drinking water per year on an ongoing basis. This is less that the current average demand for water in the Lower Hunter, which is around 66 billion litres a year. This 'supply deficit' is expected to increase in future as the population grows and climate change influences rainfall and evaporation.

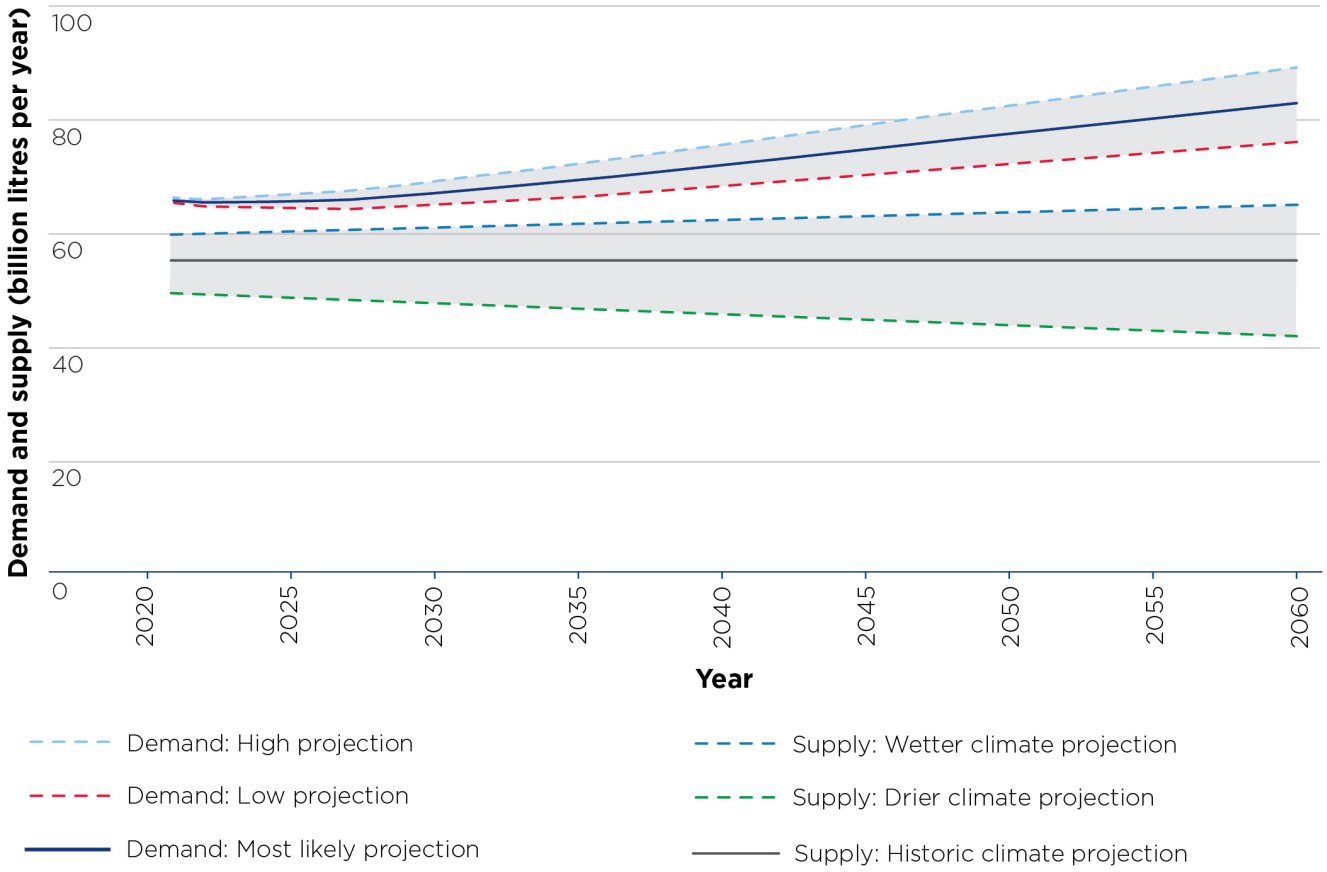
Several factors influence how much water we use. Population growth and demographic changes, variations in the housing mix, our water use behaviour, the water efficiency of household appliances, and changes in business and industry use can all affect water demand. Changes in rainfall patterns also result in fluctuations in water use from year to year. Forecasts for the Lower Hunter consider all these factors to estimate how much water we are likely to use in the future.

We have also considered uncertainty in how much the current water system can reliably supply. To account for future uncertainty and climate change, we have modelled supply under three NARCliM projection scenarios, spanning climates that are both wetter and drier than today.

Understanding the supply and demand balance over time and being able to respond to future uncertainty is important to make the right decisions at the right time. This includes working with the community to reduce demand for drinking water and investing in new water supplies.

Photography
Image courtesy of iStock.
Young girl drinking water from a drinking fountain, NSW.

Figure 16. Projected drinking water demand and supply for 2021 to 2060



The Lower Hunter Water Security Plan has explored a range of ways to reduce demand and increase supply to ensure that we have enough water to meet the community's needs over time. We need to reduce the current supply deficit now and remain adaptive given future uncertainties.

Reliable water supply

What we heard

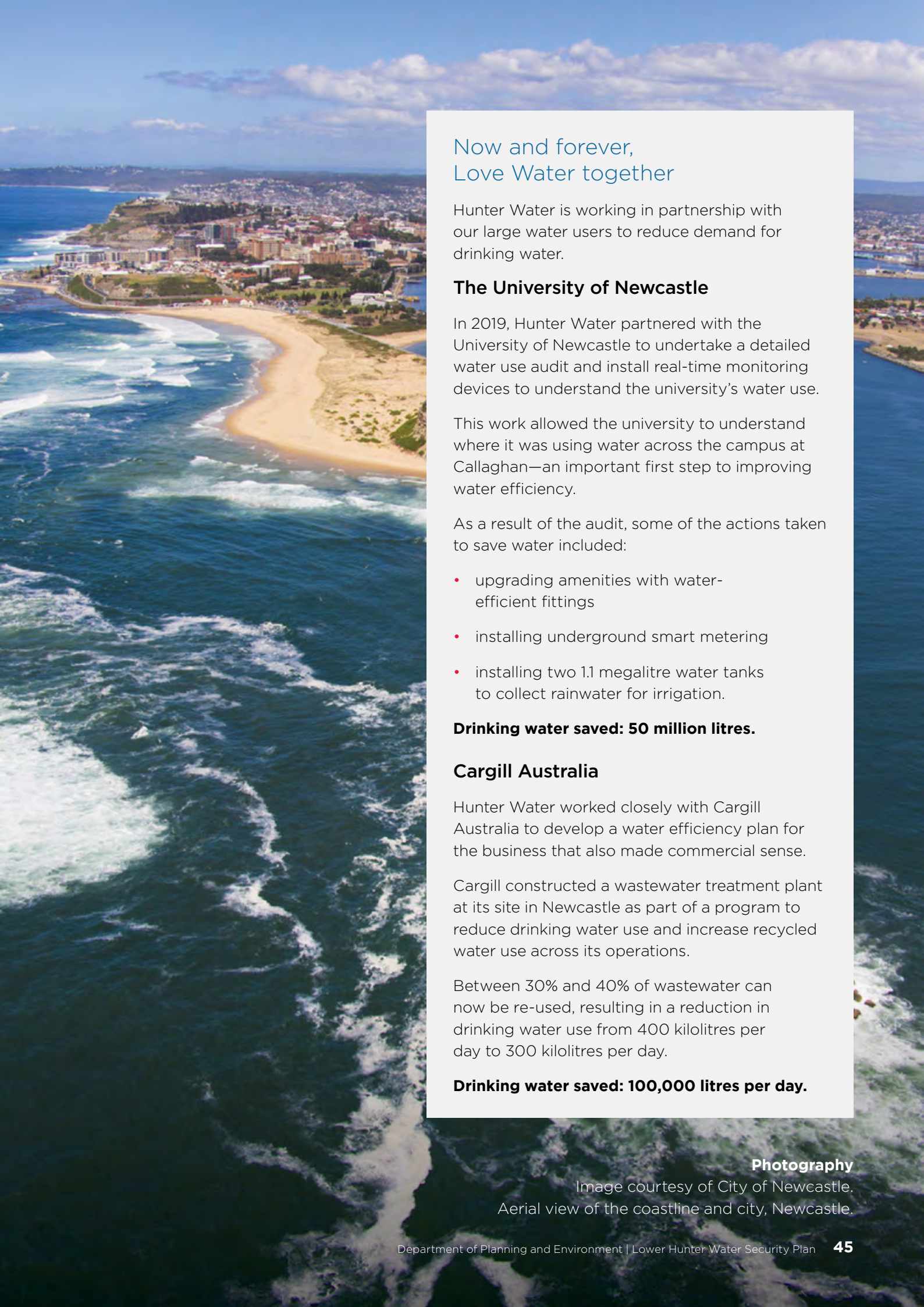
Reliability of supply is highly valued by councils and other non-residential customers. For councils, reliability provides a significant social benefit for residents, associated with the ability to maintain community assets such as parks and sporting fields, particularly in times of drought. For business users, reliability is essential for their businesses to operate.

"Continuity of supply would definitely be a big concern on our front. We have critical systems that rely on that water."

Ensuring there is enough water for people in the Hunter now and in the future was the focus and point of the discussions by participants in deliberative forums conducted for the plan.

"You've got to have enough water—we die if we don't have water!"

"Reliability is important—that's what it's all about."



Now and forever, Love Water together

Hunter Water is working in partnership with our large water users to reduce demand for drinking water.

The University of Newcastle

In 2019, Hunter Water partnered with the University of Newcastle to undertake a detailed water use audit and install real-time monitoring devices to understand the university's water use.

This work allowed the university to understand where it was using water across the campus at Callaghan—an important first step to improving water efficiency.

As a result of the audit, some of the actions taken to save water included:

- upgrading amenities with water-efficient fittings
- installing underground smart metering
- installing two 1.1 megalitre water tanks to collect rainwater for irrigation.

Drinking water saved: 50 million litres.

Cargill Australia

Hunter Water worked closely with Cargill Australia to develop a water efficiency plan for the business that also made commercial sense.

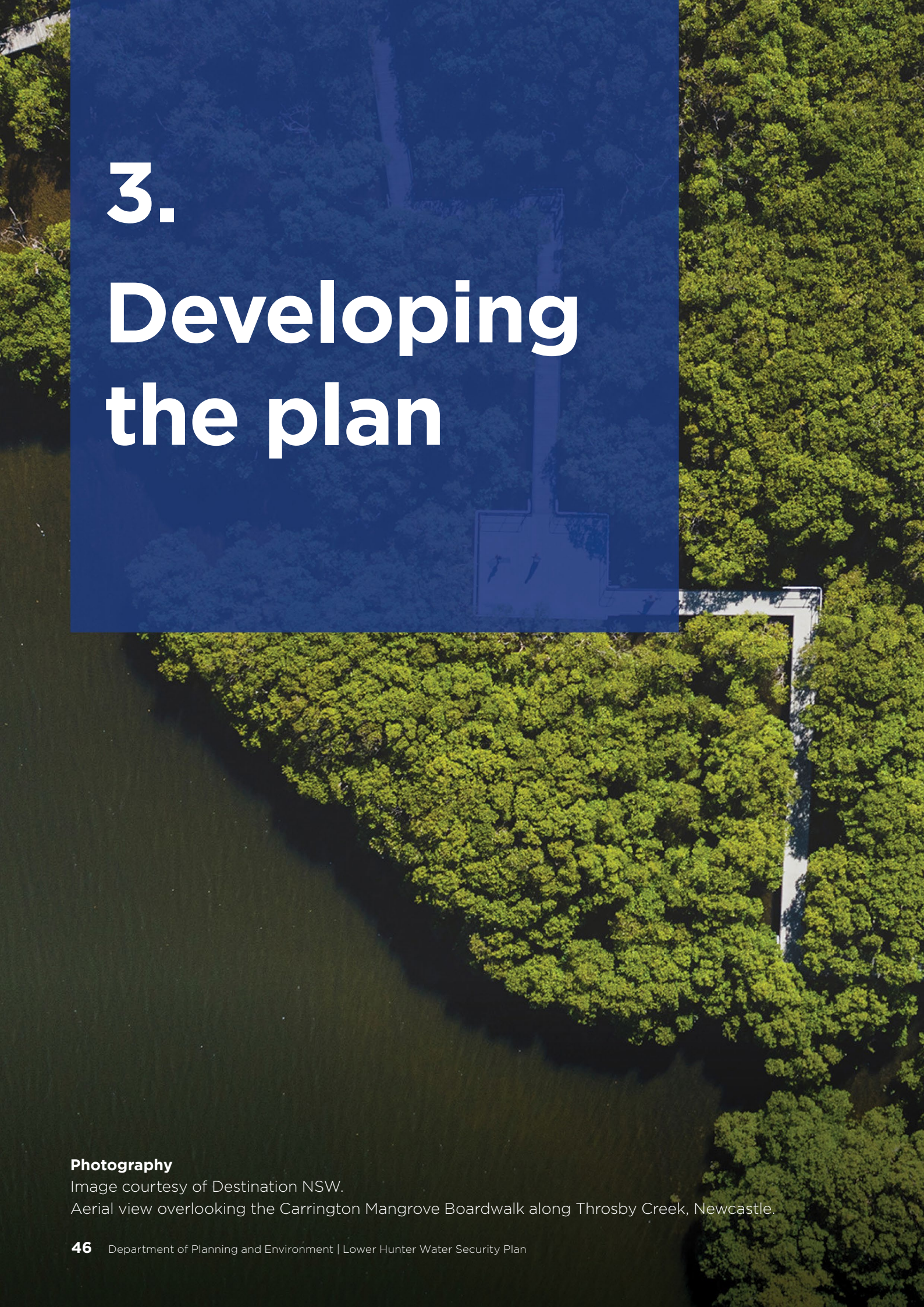
Cargill constructed a wastewater treatment plant at its site in Newcastle as part of a program to reduce drinking water use and increase recycled water use across its operations.

Between 30% and 40% of wastewater can now be re-used, resulting in a reduction in drinking water use from 400 kilolitres per day to 300 kilolitres per day.

Drinking water saved: 100,000 litres per day.

Photography
Image courtesy of City of Newcastle.
Aerial view of the coastline and city, Newcastle.

3.
Developing the plan



Photography
Image courtesy of Destination NSW.
Aerial view overlooking the Carrington Mangrove Boardwalk along Throsby Creek, Newcastle.

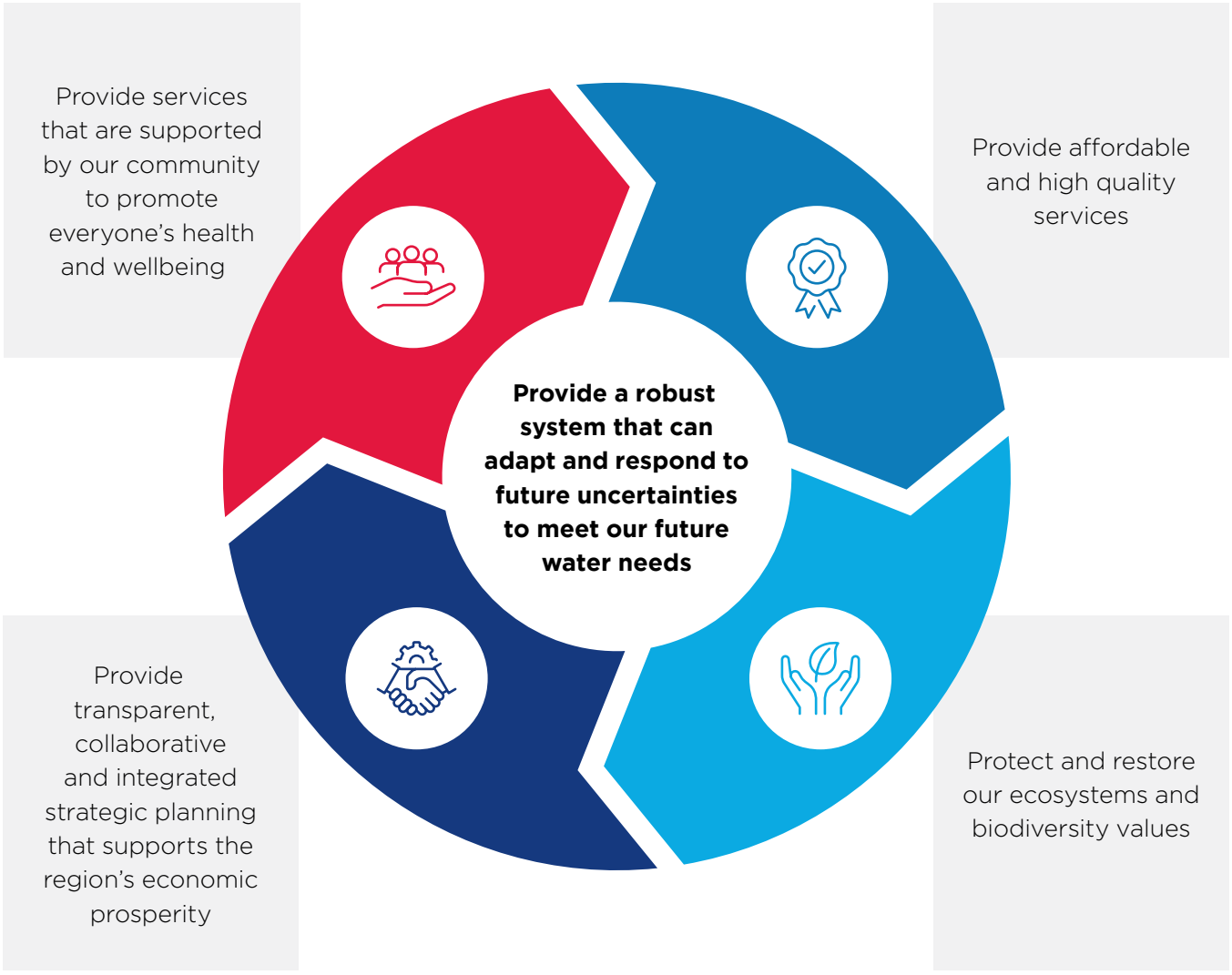
Understanding community values about water, exploring new ways to reduce the amount of water we use and investigating new and innovative sources of water were fundamental to the development of the Lower Hunter Water Security Plan.

Understanding community values and preferences has been a key part of developing the Lower Hunter Water Security Plan. We have considered these values and preferences in the decision-making process alongside robust analysis of a range of policy, planning and infrastructure options.

Figure 17. Process for developing Lower Hunter Water Security Plan

Our goal is to provide a resilient and sustainable water future that contributes to regional health and prosperity and is supported by the community. Figure 18 outlines the plan's objectives in achieving this goal.

Figure 18. Objectives of the Lower Hunter Water Security Plan



3.1 Community engagement program

An extensive engagement program to understand community views, values and preferences has informed decision-making for the Lower Hunter Water Security Plan. Across three phases of engagement, Hunter Water used a wide range of communications and engagement tools and techniques, both qualitative and quantitative, to ensure there was opportunity for the community to provide feedback on the plan.

Photography
Community members participating in a deliberative forum.

Figure 19. How community views informed our decision-making

Phase 1: 2018

What we did

- Deliberative forums
- Online surveys
- Surveys at events
- Stakeholder engagement

What we learned

Community values and aspirations

- Water quality
- Reliability of water supply
- Environmental sustainability

Community stance on restrictions and expected levels of service

- The community strongly supported restrictions during drought and supported Hunter Water's stages of restrictions

How we incorporated

- Community values underpinned the goals and objectives
- Learnings from this stage were key inputs into the decision support framework as well as trade-offs between objectives

Phase 2: 2019-2020

What we did

- Deliberative forums
- Online surveys
- Surveys at events
- Established Community Liaison Group
- Community drop in sessions
- Stakeholder engagement

What we learned

Community views on supply and demand side options

- Community members said they were quite open to us considering all options to secure our water future, but preferred options that reduce reliance on drinking water over options that supplement our water supplies

How we incorporated

- Incorporated into the development of preliminary programs of actions

Phase 3: 2020-2021

What we did

- Online surveys
- Ongoing meetings with LHWSP Community Liaison Group
- Focus groups
- Video presentations for high schools
- Focus group discussions with stakeholder groups

What we learned

- There was generally broad support for all portfolios
- The community were highly supportive of recycled water/ stormwater harvesting and water conservation programs
- How the community trades off objectives
- Views on the level of service the community expects from us

How we incorporated

- Community feedback was considered alongside other ongoing investigations, modelling and analysis to inform the plan

Dedicated website

A dedicated engagement website was established for people to keep up to date as the plan was being developed and to participate in online activities. Due to the COVID-19 pandemic, aspects of the engagement program were redesigned during 2020–21, with some face-to-face consultation replaced with virtual, online and other contactless methods.

Deliberative forums

We provided participants with a range of information and encouraged them to discuss, learn from others, and examine and refine their own views. Hunter Water undertook two phases of deliberative forums in 2018 and 2019. Phase one discussed the water system, values, challenges and opportunities as well as drought restrictions. Phase two explored perceptions and preferences for water supply and demand options.

Surveys at events and on engagement website

A survey was available via the engagement website and face-to-face at community events from May 2018 through to November 2020. The survey focused on the range of supply and demand options for consideration in developing the Lower Hunter Water Security Plan.

Online community survey

Hunter Water conducted a comprehensive online community survey from November 2020 through to January 2021 to understand trade-offs in decision-making, preferences for preliminary programs of actions and willingness to pay for investments to meet minimum customer demand in a long and severe drought.

Focus groups with non-residential customers

The non-residential sector, which includes business and councils, has different experiences, issues and interactions with water supply and demand. Hunter Water conducted seven focus groups in January and February 2021 with representatives from councils in Hunter Water's operating area and representatives of Hunter Water's non-residential customers.

Themes synthesised over the past three years incorporating online, deliberative forum, face-to-face and focus group feedback indicates that the Lower Hunter community seek:

- a safe and reliable water supply that can withstand drought
- consideration of all options
- investments to reduce demand for drinking water
- investments to minimise the environmental impacts of water supply initiatives
- a collaborative approach with stakeholders
- continued use of water restrictions to make the most of our water resources in drought
- up-front investments, as opposed to acting reactively during drought.

Talking to First Nations and Aboriginal people about their water values and knowledge

Hunter Water has been working with The Wollotuka Institute at the University of Newcastle to better understand local Aboriginal and Torres Strait Islander people's water values and knowledge. A literature review collated available historical and current Aboriginal values around water and Wollotuka engaged with representatives of the local Aboriginal community to better understand their viewpoints and values.

The values can be categorised as:

- customary, such as a ceremony or meeting place
- spiritual, like Dreaming Stories or song lines
- ecological, flora and fauna
- economic, such as trade routes and food sources
- recreational, for instance family gatherings.

A common thread to this knowledge sharing was 'water is life'. Water is a critical part of the culture and economy of Aboriginal people. Water is an important element in the creation story of Baiame, and the importance of using water responsibly is the theme of the local story of Tiddalik the Frog.

The rivers, wetlands, estuaries and sea provided a plentiful food source for local Aboriginal groups and harvesting was managed through cultural protocols to ensure the resource was maintained for current and future generations.

The cultural and economic values and perspectives on water are constantly changing as knowledge holders weave traditional knowledge with current values to create new meaning and values. As stewards of water and catchments in the region, there is an inherent need to protect water systems within the context of the whole cultural landscape. Protecting this valuable resource and maintaining the quality of the water and the environment are critical to sustaining the values and ongoing connection of Aboriginal people to water in the Lower Hunter region.

We acknowledge this is just the start of an ongoing conversation and we will continue to engage with local First Nations and Aboriginal peoples to learn from them and work to incorporate their water values and increase their participation in strategic water planning.

Artwork courtesy of Saretta Fielding.
Artwork title Mariin Kaling – All for Water.

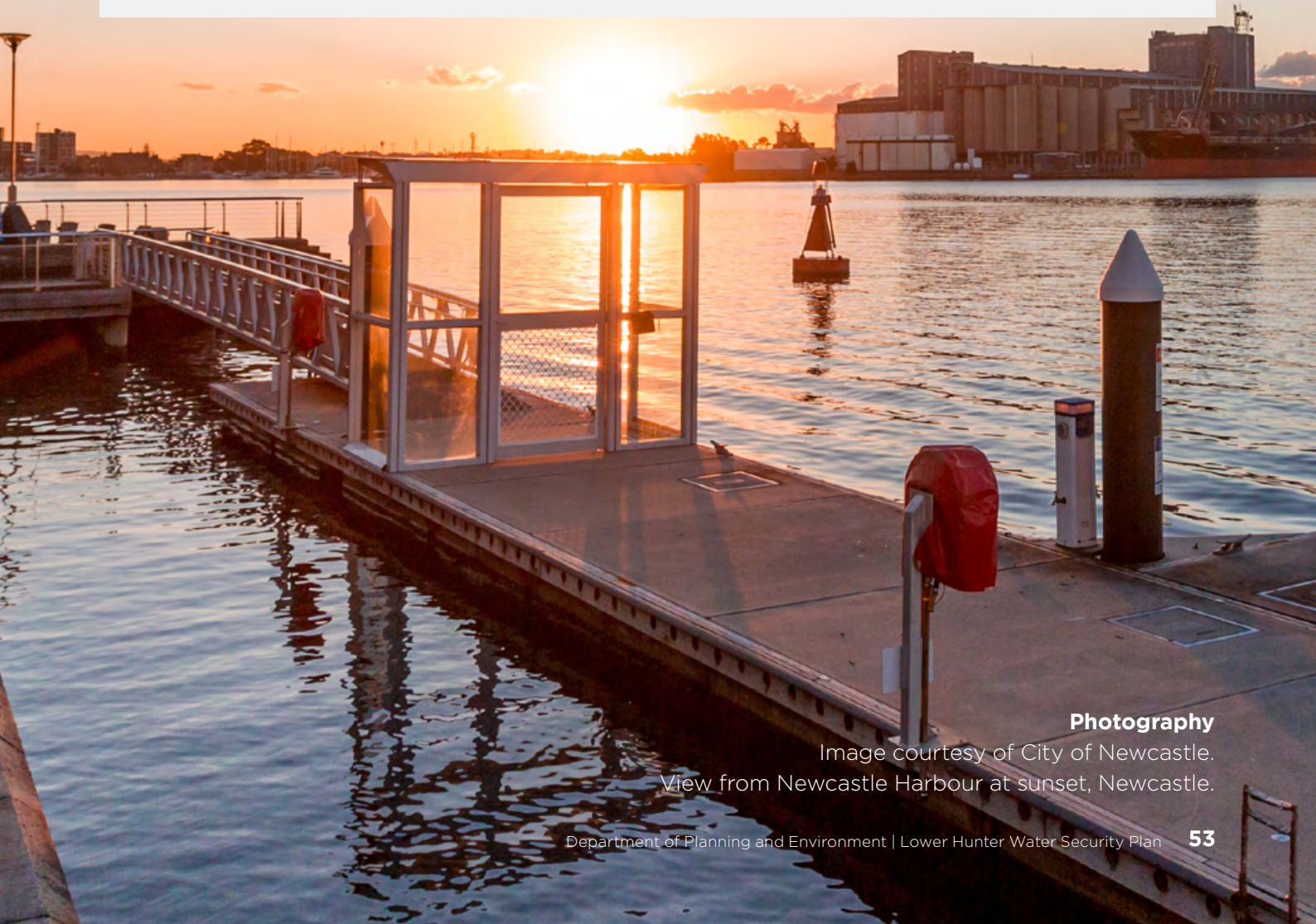
Incorporating community views in decision-making

Community engagement throughout the planning process identified community values and preferences that helped inform:

- the goals and objectives of the Lower Hunter Water Security Plan
- preferences for trade-offs between these goals and objectives
- the design of a range of programs of actions assessed in the plan
- the level of water security for the region's water system
- the preferred program of actions (this plan).

This feedback was incorporated in the decision-making, ensuring that the following community values and aspirations were reflected in the plan:

- providing a reliable water supply that can withstand long and severe droughts
- protecting water quality through active management and protection of drinking water catchments
- making the most of what we've got, particularly before building new infrastructure
- continuing to invest in water conservation and working towards increasing the level of recycled water and alternative water supplies
- proactively partnering with stakeholders to achieve water conservation and liveability outcomes and delivering integrated water management approaches.



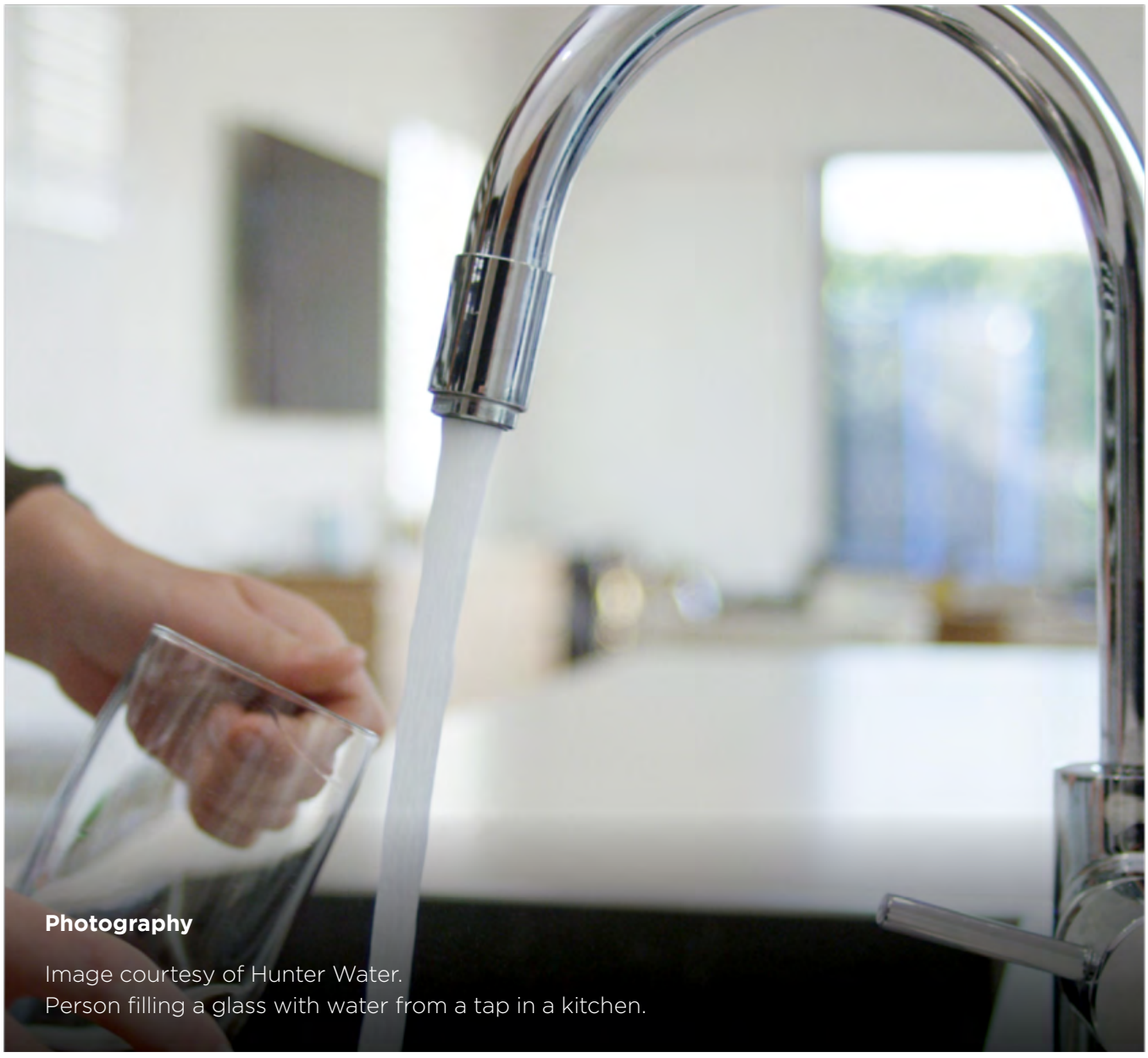
Photography
Image courtesy of City of Newcastle.
View from Newcastle Harbour at sunset, Newcastle.

3.2 Understanding community values

Community values for long-term water planning were explored through community deliberative forums, conversations with the Hunter Water team at community events and online surveys. This feedback informed the development of the goals and objectives of the plan and the options assessment process.

The community told us their water values included:

- **Safe drinking water—**the ongoing supply of safe drinking water by Hunter Water is of primary importance
- **Environmental sustainability—**natural resources should be used sustainably, and environmental impacts are an important consideration in decision-making
- **Reliability—**there should be enough water for the community now and in the future, particularly in light of population growth and climate change, and our supply should be able to withstand drought
- **Affordability—**water is a vital necessity of life and should be affordable for all.



Photography

Image courtesy of Hunter Water.
Person filling a glass with water from a tap in a kitchen.

3.3 Developing and short-listing options

In line with national urban planning principles, we adopted an 'all options on the table' approach. Using the goals and objectives of the Lower Hunter Water Security Plan to guide us, we considered all feasible options to reduce demand for drinking water and increase supply.

These were grouped into option types, which we assessed against environmental, social, technical, and financial criteria.

Figure 20. Process for developing and assessing options and programs of actions

Figure 21. Characteristics of option types

Water conservation (including rainwater tanks)

- reduces demand for drinking water
- low environmental impact
- strong community support
- adaptable
- success depends on ongoing community adoption of water saving behaviours.

Recycled water for non-drinking

- reduces demand for drinking water
- is (largely) rainfall-independent
- strong community support
- reuses treated wastewater, rather than releasing it to the environment
- increases diversity of the system
- cost effectiveness is variable depending on the type (e.g. industrial or dual reticulation), size and location of the scheme.

Purified recycled water

- option is adaptable and can be staged over time to meet growth
- increases diversity of the system
- is (largely) rainfall-independent
- high energy use
- medium to high cost to build and operate
- reuses treated wastewater, rather than releasing it to the environment.

Water sharing between regions

- optimises existing infrastructure and increases diversity of the supply system
- increases resilience across regions
- relies on rainfall
- costs to construct and operate depend on the distances involved.

Stormwater harvesting

- strong community support
- relies on rainfall, supplies can deplete quickly and low reliability in droughts
- high cost to construct and operate relative to the volume of water produced
- reduces urban stormwater pollution released to waterways.

Figure 21. Characteristics of option types (continued)

Dams

- relies on rainfall
- low adaptability for future staging
- environmental impacts on terrestrial and aquatic biodiversity
- low energy use during operation but greenhouse gas emissions associated with dam wall construction
- high social impacts associated with property acquisition and potential Aboriginal or First Nations cultural or heritage impacts.

Groundwater

- relies on rainfall
- low environmental impacts
- low social and cultural impacts
- low cost to construct and operate.

Desalination

- rainfall-independent
- increases diversity of the system
- operation is flexible and adaptable
- high energy use
- medium to high costs to build and operate.

Photography
Image courtesy of iStock.
Lake Macquarie, NSW.

Drawing from literature, technical reviews and community feedback, we developed a long list of demand and supply options based on these option types. These options were screened to produce a list of the most suitable options for the Lower Hunter region.

The shortlisted options to decrease reliance on existing drinking water supplies (or demand options) included:

- water conservation and leakage reduction programs
- recycled water and stormwater harvesting programs for non-drinking purposes.

The shortlisted options to increase water supply to ensure the Lower Hunter is ready to meet future challenges (or supply options) included:

- a new Hunter Water connection to the proposed Lostock Dam – Glennies Creek Dam pipeline scheme (a new water sharing arrangement with the Upper Hunter)
- increasing existing water sharing with the Central Coast including upgrading the existing interconnecting pipeline and increasing the capacity of Mangrove Creek Dam by raising the dam wall
- desalination as either a permanent or drought response source of water, located at either Belmont or Walsh Point, on Kooragang Island
- a new purified recycled water for drinking scheme involving sending highly treated recycled water to Grahamstown Dam for storage and further treatment at the existing Grahamstown Water Treatment Plant
- a new 230 billion litre on-river dam at Upper Chichester, immediately upstream of the existing Chichester Dam
- a new 160 billion litre off-river dam at Limeburners Creek, east of Clarence Town.

The previously proposed Tillegra Dam was ruled out through a planning assessment process in 2010. Better dam investigation areas were identified as part of this review.

Photography
Image courtesy of Hunter Water.
Garden sprinklers watering garden.

We also considered a range of broader policy and planning measures, including:

- improving collaboration with other organisations to deliver recycled water and integrated water management solutions and liveability outcomes
- supporting initiatives for catchment management to ensure we are making the most of our existing water resources and protecting water quality
- changes to water restrictions
- pricing mechanisms to reduce demand, such as increasing the usage price in times of drought
- partnering with universities and other stakeholders on research and development opportunities to reduce demand on our existing supplies and explore new supply sources.

We undertook complex investigations and analysis to understand the environmental, social and cultural heritage impacts, technical feasibility, cost to build and operate, reliability and resilience aspects, and community support for each of the shortlisted options.

The results of technical analysis and community feedback enabled us to compare the shortlisted options and develop several programs of actions to assess against future challenges of drought, population growth and climate change.

The Lower Hunter community told us they were supportive of considering all options but prefer options that reduce the demand for drinking water. The community also supports current restrictions settings as a means of making the most of existing water resources in drought.

What we heard

During Phase 2 of our community engagement program, we asked people how open they were to the shortlisted supply and demand options. The results were relatively consistent over time, with the community showing openness to considering all options. Recycled water, water conservation and stormwater harvesting for non-drinking were the most favoured options. To reflect these views, we included water conservation and recycled water initiatives in all programs of options.

Preliminary programs were presented to the community in late 2020 and early 2021 for feedback. All preliminary programs received between 61% and 73% of support.

3.4 Building and assessing programs of actions

We grouped options into several programs of actions designed to reduce the current supply deficit now and ensure there is enough water supply to meet the projected demand over the 40-year life of the plan.

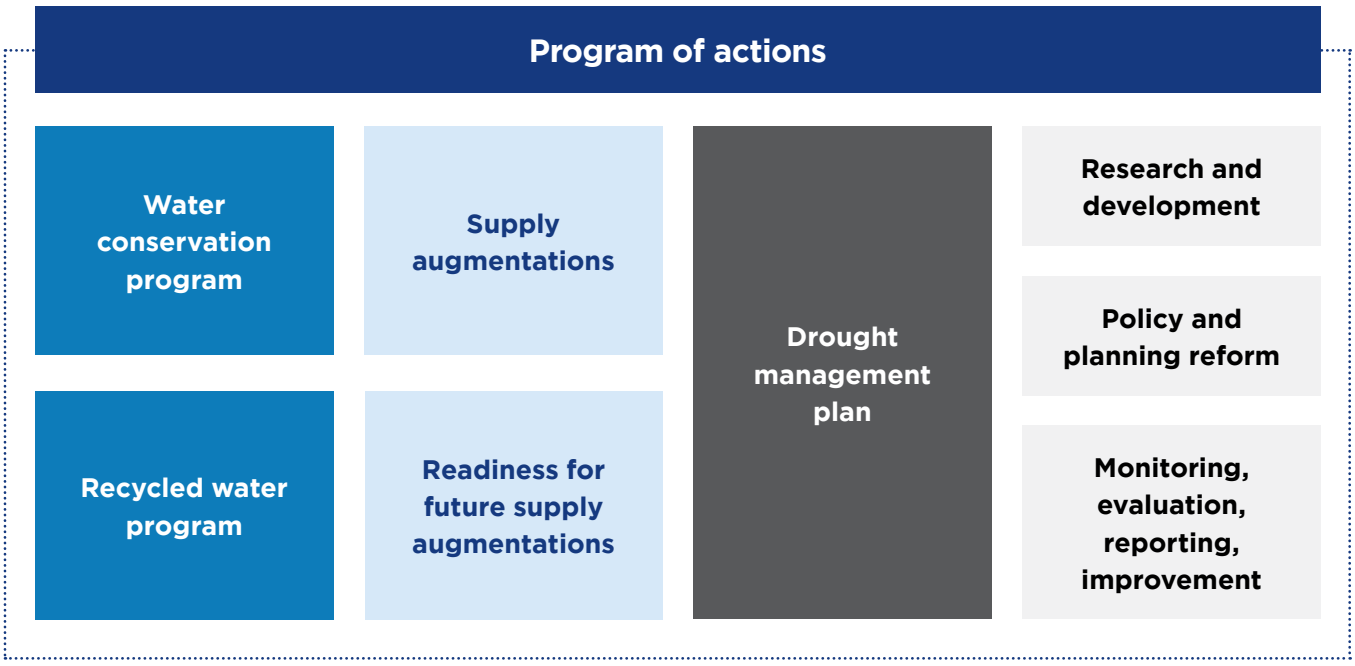
We then assessed these programs using different methods and technical analysis.

Grouping options into programs

Each program was made up of:

1. **Actions to reduce the demand for drinking water—**a range of various levels of investment in water conservation and recycled water for non-drinking programs
2. **Actions to supply additional drinking water—** combinations of shortlisted supply options
3. **A drought management plan—**a combination of further demand reductions measures as well as drought response desalination to meet the needs of the community during drought.

Figure 22. Components of the programs of actions



The design of the programs was informed by the results of technical analysis as well as community feedback.

Assessing the programs of actions

We considered a range of issues in the assessment process:

- social and environmental impacts of water supply options
- broader social costs of water restrictions and inability to meet water demands
- community views on options and alignment with community values
- costs to construct and operate
- implementation timeline
- likelihood and cost of triggering drought response investments
- benefits and potential impacts on neighbouring regions
- reliability and drought performance
- system resilience benefits, including increased diversity of sources
- complexity and risks
- adaptability to future uncertainty.

We assessed the programs using the techniques outlined below. The assessment process was iterative, and we refined programs based on community feedback and the results of ongoing technical analysis.

Understanding the long-term performance of each program under a range of climate conditions

This approach included extensive hydrological, economic and financial analysis. We assessed the costs and benefits of each program of actions.

The cost-benefit analysis helps us to understand which programs perform best to improve water security in the Lower Hunter and maximise social, economic and environmental benefits to the NSW community over the 40-year life of the plan.

We used financial analysis to understand the efficiency of each program from the perspective of the Lower Hunter community. This was based on the funding and pricing principles set out by the Independent Pricing and Regulatory Tribunal (IPART), the body that regulates the prices Hunter Water can charge customers.

We considered social, environmental and resilience measures to ensure a robust assessment of the different programs of actions against the goal and objectives of the plan. These measures covered ecological impacts, greenhouse gas emissions, heritage impacts and alignment with Aboriginal values, community preferences, social impacts, adaptability and operational resilience.

Understanding the performance of each program in light of future uncertainty

Economic and financial analysis involves making assumptions about future conditions, which are often uncertain. We considered this uncertainty by testing the sensitivity of results to key input assumptions and a range of plausible future scenarios for the region.

We considered the ability of each program to respond to future risks and opportunities through adaptive pathways modelling. This included testing programs against a range of possible drivers, including future climate projections, population growth, customer water-use behaviour, technological innovation as well as possible changes in regulatory and governance arrangements.

Understanding the performance of each program in drought

The assessment considered how each program performed in a long and severe drought. This approach tested the system depletion time provided by each program and the associated storage level triggers for drought response investments. Storage level triggers are based on the lead time to deliver a drought response desalination plant. Higher levels of water conservation and recycling and more up-front supply investments provide longer depletion times and reduce the likelihood of expensive drought response investments.

The assessment also considered the balance of up-front and drought response investments in rainfall-independent water sources. Up-front investment in rainfall-independent sources such as desalination reduces the size of drought response desalination needed to meet minimum customer demands in the event of a long and severe drought.

Photography
Image courtesy of iStock.
Close up of water running from basin tap.

Photography
Image courtesy of iStock.
Zenith Beach in Shoal Bay, NSW.

3.5 What we found

Water conservation and recycling are important but not enough to ensure a reliable supply in drought

- There is strong community and stakeholder support for continued investment in water conservation and recycling. These investments make the most of our existing resources and reduce the likelihood of triggering expensive drought investments.
- Water conservation and recycling are not enough to provide a reliable water supply that can withstand drought. To achieve this, we need to continue to invest in water conservation and recycling as well as increase the supply of water.
- New and innovative options for recycled water at the household or precinct level may become available in the future and will continue to be considered.

There is value in an adaptive approach

- The future is uncertain. This means that an incremental investment approach will enable us to remain adaptive to respond to future risks and opportunities, compared to single, large up-front investments that may lock us into less flexible solutions.
- Readiness activities for future options should progress in parallel to ensure they are available if needed in future.

There is value in a balanced and diversified approach

- The current system relies on rainfall and most of the water is sourced from the Williams River catchment. This means the region's system is vulnerable to drought and shocks in the bulk water supply system.
- We need to transition to rainfall-independent supplies as part of a drought management plan to ensure we can meet customer needs through long and severe droughts.
- New supply options that provide an additional water supply source increase the diversity and overall resilience of the system to respond to shocks and changing conditions.

Reliable, flexible and cost-effective supply options are available

- A permanent desalination plant at Belmont and a new connection to the Lostock Dam – Glennies Creek Dam pipeline scheme are the most favourable new supply options.
- Purified recycled water for drinking is a reliable and cost-effective supply option and early community feedback supports exploring this as a future supply option.
- Dams store a large volume of water that extend the system's ability to withstand drought but they can run out in a long and severe drought. Compared to the alternative options considered in the plan:
  - The two dams assessed were not favoured from an economic or financial analysis perspective, or based on their potential environmental, social and cultural heritage impacts.
  - The dams have long lead-times to plan, construct and fill and carry an elevated risk of triggering expensive drought response infrastructure in the interim.

A collaborative approach is needed to deliver water savings and liveable communities

- Businesses and local councils valued the proactive collaborative approach taken by Hunter Water during the recent drought to enable water efficiency programs and integrated water solutions to reduce demands for drinking water.

The community told us that environmental sustainability is important to them. They also supported additional investments to achieve environmental goals for biodiversity and greenhouse gas emissions.

What we heard

We therefore included measures to reduce the carbon footprint for high energy options through the purchase of renewable energy or carbon offsets in the preliminary portfolios presented to the community for feedback. We included additional biodiversity protection and enhancement measures into programs of actions that included new dams.

To achieve the goals and objectives of the plan—and based on community feedback and technical analysis—four strategic priorities were identified.

PRIORITY 1 **Safe drinking water**	Safe drinking water is our highest priority. We will continue to provide high-quality drinking water for the health and wellbeing of our community and the future prosperity of the region.
PRIORITY 2 **Making the most of what we've got**	We will manage our existing water resources wisely, working together with our community and stakeholders to make the most of our existing water resources, particularly before investing in new sources.
PRIORITY 3 **Improving the resilience of the system**	Our climate is changing and the future is uncertain. We will act to improve our resilience to shocks such as drought as well as remaining adaptive to future risks and opportunities.
PRIORITY 4 **Water for life**	Water is an essential part of connection to country for First Nations and Aboriginal people and supports liveable communities. Our plan will work to incorporate the values and participation of First Nations and Aboriginal people. Water supports liveable communities and our plan will seek to protect and restore our environment and ecosystems.

4.

Our plan for the future

Photography
Image courtesy of Destination NSW.
The heritage-listed Morpeth Bridge spanning across the Hunter River, Morpeth.

This is an important time in our water planning. The Lower Hunter has a growing population, our climate is changing and we need a plan that ensures high-quality water is available for the Lower Hunter community in typical conditions and in drought.

The Lower Hunter Water Security Plan is underpinned by what we've heard from the community and is guided by robust technical analysis. The plan adopts a whole-of government approach to achieve its goal of creating a resilient and sustainable water future for the Lower Hunter that contributes to regional health and prosperity and is supported by the community.

The plan prioritises actions to reduce drinking water use. This helps the region's water resources to last longer and reduces the likelihood of triggering expensive drought response investments.

Immediate actions are focused on making the most of what we have by continuing to reduce leakage, working with the community to save water and working with stakeholders to increase the use of recycled water when water of drinking quality is not required. Hunter Water will continue to lead water conservation programs for households, business and industry.

But saving water and recycling more water is not enough to achieve a reliable water supply that can withstand drought. We need to increase the supply of water and be ready to transition to rainfall-independent water supplies in times of drought.

Increasing the supply of water focuses on maximising the efficiency of existing resources and infrastructure by creating connections and sharing water between Lower Hunter, Central Coast and Upper Hunter water storages.

We also need to increase the amount of drinking water supplied from rainfall-independent sources. To achieve this, Hunter Water will construct a permanent desalination plant at Belmont and continue to talk to the community about purified recycled water for drinking as a future water supply option.

The drought management plan included as part of the Lower Hunter Water Security Plan outlines actions to help ensure the community's water needs continue to be met through the next drought. This includes the introduction of staged water restrictions as storage levels fall, and the construction of a second desalination plant at Walsh Point. This plant will only be built if needed in response to a severe drought.

The plan includes actions to continue to engage with First Nations and Aboriginal communities to incorporate cultural values and increase their participation in future water planning and decision-making. It also provides for ongoing work with local councils and stakeholders to integrate land use and water planning to enable more liveable communities.

What we heard

During Phase 1 of the community engagement program, we learned that water quality is the community's most important consideration when it comes to water supply. The community also told us that reliability of water supply is very important, closely followed by environmental sustainability and affordability.

The community wants planning to start now to reduce the risk of needing to resort to emergency drought response measures. There was also strong support for Hunter Water to invest to supply enough water to meet minimum customer demands in a long and severe drought.

Online community surveys and discussions with non-residential customers have reinforced these views, as well as supporting increased levels of investment for water conservation, recycled water and stormwater harvesting initiatives.

PRIORITY 1

4.1 Priority 1: Safe drinking water

Safe drinking water is our highest priority. Hunter Water will continue to provide high-quality drinking water for the health and wellbeing of Lower Hunter communities and the future prosperity of the region.

Protecting drinking water catchments

Managing water quality begins in the drinking water catchment and continues right through to customers turning on their taps. Hunter Water uses a multi-barrier approach to eliminate or reduce water quality risks at multiple points of the process, not just at a single barrier in the supply system.

In partnership with the NSW Government, Hunter Water will continue to invest in catchment management and catchment protection to maintain a robust multiple-barrier approach to drinking water quality and make the most of existing water resources.

In collaboration with local councils Hunter Water will work to balance the development needs of a growing region with the provision of healthy water catchments that will deliver high quality water.

Benefits for the community

- Protects water quality at the source of the water cycle to ensure the ongoing supply of safe drinking water
- Makes the most of existing water resources so we only invest in new water sources when needed
- Healthy catchments and waterways provide benefits for environmental sustainability as well as the health and wellbeing of the community.

Photography
Image courtesy of Hunter Water.
Reflection of the blue sky in the water at Chichester Dam.

4.2 Priority 2: Making the most of what we've got

We will manage existing water resources wisely, working together with water users, communities and stakeholders to make the most of these resources, particularly before investing in new sources.

Continuing to invest in water conservation and reducing leakage

Water conservation is key to managing the current and future supply and demand balance.

This plan's water conservation program is based on maintaining and building on the behaviour change and efficiency gains achieved in the 2019–20 drought and is consistent with the NSW Water Strategy goal of doing more with less. Figure 23 shows the goals and targets of the program.

Figure 23. Goals and targets for water conservation and leakage reduction

Total customer drinking water use

Reduce by 17%*

Household drinking water use

Reduce to 155 litres per person per day

Business and industry drinking water use

Reduce by 2 billion litres per year*

In collaboration with the community and stakeholders, Hunter Water will:

- work towards achieving the above goals over the next ten years
- support the community to adopt water saving behaviours and install water-efficient fittings and appliances
- reduce average residential water consumption in the Lower Hunter from 190 litres per person per day to 155 litres per day
- continue to build on the water savings made during the recent drought.

Leakage

Reduce to 50 litres per connection per day

Hunter Water will:

- reduce leakage from 69 litres per connection per day to 50 litres per connection per day over the next five years
- reduce water loss from leaks and breaks in its distribution network
- consolidate the leakage gains made through the recent drought.

Once achieved, Hunter Water will be a leading water utility in water loss management in Australia.

*Compared to expected water use based on 2016-2018 baseline

Hunter Water will continue to adopt a collaborative approach to achieve these water efficiency goals, acknowledging that they can only be achieved by working together.

Driving change in water use and behaviour is the cornerstone of Hunter Water's Love Water campaign, which is embedded in all areas of operations and incorporated into all community messaging. Love Water is complemented by a comprehensive water conservation program that can be expanded as part of a drought management response and is part of all of the programs of actions that were developed and considered for the Lower Hunter Water Security Plan. This included consideration of potential future changes to the NSW Government's Building Sustainability Index (BASIX) requirements for new developments and the influence of these programs in reducing customer demand for water.

Hunter Water will lead ongoing water conservation efforts by:

- continuing to invest in reducing leaks from the water distribution system
- continuing to use the Love Water program and permanent water conservation measures, Smart Water Choices, to encourage long-term behavioural change
- supporting customers to find and repair leaks
- expanding the schools' program to help students save water at school and at home
- working with major and large water customers, councils and businesses on water efficiency management plans and alternative water supply projects.

Benefits for the community

- Reduces the amount of water extracted from the environment for consumption
- Reduces the amount of water that is treated and pumped around the system.

Recycled water and alternative water supplies

Recycled water

Recycled water involves re-using highly treated wastewater from treatment plants for non-drinking purposes including industrial processes, irrigation of green spaces, residential use (such as for toilet flushing, garden watering and clothes washing), agricultural use and operational use at Hunter Water's treatment plants. Increasing the level of water recycling in the Lower Hunter is an important part of the plan's program of actions as it reduces demand on drinking water supplies.

The plan's approach to increasing the level of recycled water and alternative water supplies includes:

- improving institutional arrangements and removing barriers to delivering recycled water and integrated water management solutions and liveability outcomes
- increasing recycled water use at Hunter Water treatment plants
- working with industrial customers to increase the supply of recycled water for industry schemes, which will use a combination of recycled water, stormwater harvesting and groundwater
- working with local councils to deliver local recycled water schemes for irrigation at local sporting fields and parks—irrigation schemes will use a combination of recycled water, stormwater harvesting and groundwater
- working with local councils and developers to explore viable opportunities for recycling in new residential developments.

The program is estimated to increase the volume of recycled water and alternative water supply by 1.3 billion litres per year. This is an increase of 15% on current levels.

Highlights of existing recycled water schemes

Kooragang Recycled Water Scheme

The Kooragang Recycled Water Scheme transfers up to 12 million litres of treated wastewater each day from the Shortland Wastewater Treatment Works to an advanced water treatment plant that produces up to 9 million litres per day of highly treated recycled water for use by industrial customers on Kooragang Island.

Drinking water saved: up to 3 billion litres per year.

Karuah Recycled Water Scheme

Wastewater from the Karuah Wastewater Treatment Works is treated and stored in a 160 megalitre dam. The recycled water is used to irrigate 36 hectares of pasture, which is sold as feed for livestock.

Recycled water supplied: around 137 million litres in 2019–20.

Photography
Image courtesy of iStock.
Irrigation field at sunset, NSW.

Engaging with the Lower Hunter community about purified recycled water for drinking

All water is recycled through the natural water cycle. A scheme where water is recycled by purifying or treating wastewater to a level that makes it safe and suitable to go back into the drinking water supply is known as purified recycled water. Such schemes are already part of the water supply mix in over 35 cities around the world including Perth, Western Australia.

Informal recycled water schemes are also in place all around the world wherever upstream towns discharge wastewater to rivers that is treated and used by downstream towns for drinking water.

Purified recycled water provides a reliable, rainfall-independent source of water and is often lower in cost and more energy efficient than other rainfall-independent options like desalination. It also decreases the amount of water taken from the environment by re-using wastewater and reduces nutrient discharges to waterways. The Lower Hunter community has indicated an openness to considering purified recycled water for drinking as a future water supply option.

We will continue to explore this option and engage with the community and stakeholders about whether it should be part of the Lower Hunter water supply system in the future. Part of these readiness activities will include planning and delivery of a small demonstration plant in the region to help explain and build confidence in the treatment process. The plant will be accompanied by an education facility to help the community understand the water cycle and purified recycled water.

How open is the community to Hunter Water considering adding purified recycled water to existing water sources?

What we heard

More than three quarters (77%) of 50 respondents to an online survey between April to October 2020 were either quite open to Hunter Water considering this option or think Hunter Water should definitely consider this option.

Of the 38 participants in focus groups and in-depth interviews in August and September 2020, 85% were either quite open to Hunter Water considering this option or think Hunter Water should definitely consider this option.

More than 1,200 people participated in an online community survey about the seven preliminary programs of actions considered for the Lower Hunter Water Security Plan. Three of these programs included purified recycled water. All seven programs were supported by at least six in 10 respondents. However, the three programs that included purified recycled water as a longer-term option received the highest levels of support (73%, 70% and 69% respectively). The survey was open during November and December 2020.

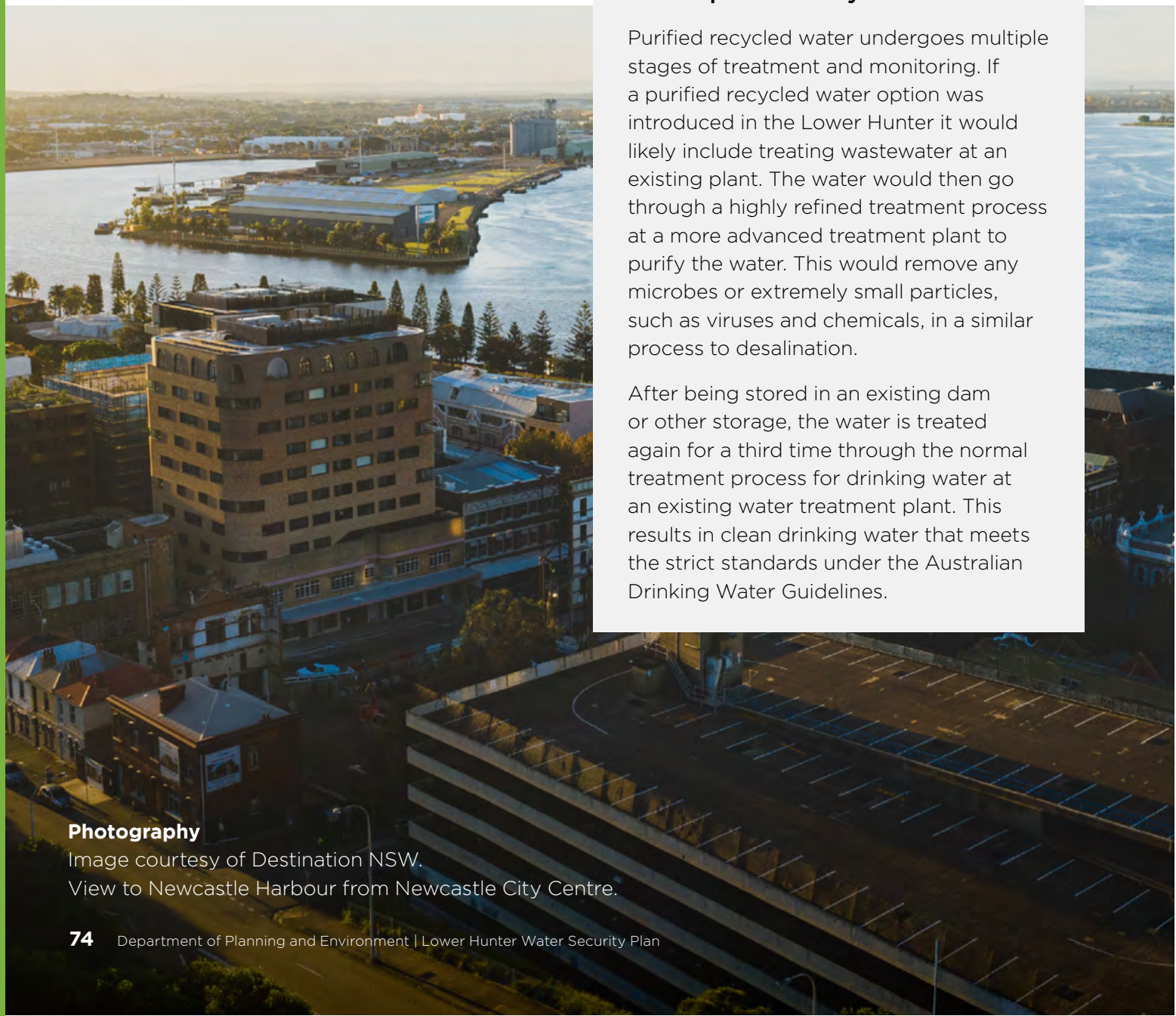
Benefits for the community

- Reduces demand on the region's drinking water supplies
- Provides a rainfall-independent water supply
- Helps to delay the need for major water supply augmentations in the future
- Delivers environmental benefits by reducing the volume of wastewater discharged to waterways
- Supports more liveable communities by providing a rainfall-independent water supply to irrigate parks and sporting fields.

About purified recycled water

Purified recycled water undergoes multiple stages of treatment and monitoring. If a purified recycled water option was introduced in the Lower Hunter it would likely include treating wastewater at an existing plant. The water would then go through a highly refined treatment process at a more advanced treatment plant to purify the water. This would remove any microbes or extremely small particles, such as viruses and chemicals, in a similar process to desalination.

After being stored in an existing dam or other storage, the water is treated again for a third time through the normal treatment process for drinking water at an existing water treatment plant. This results in clean drinking water that meets the strict standards under the Australian Drinking Water Guidelines.



Photography
Image courtesy of Destination NSW.
View to Newcastle Harbour from Newcastle City Centre.

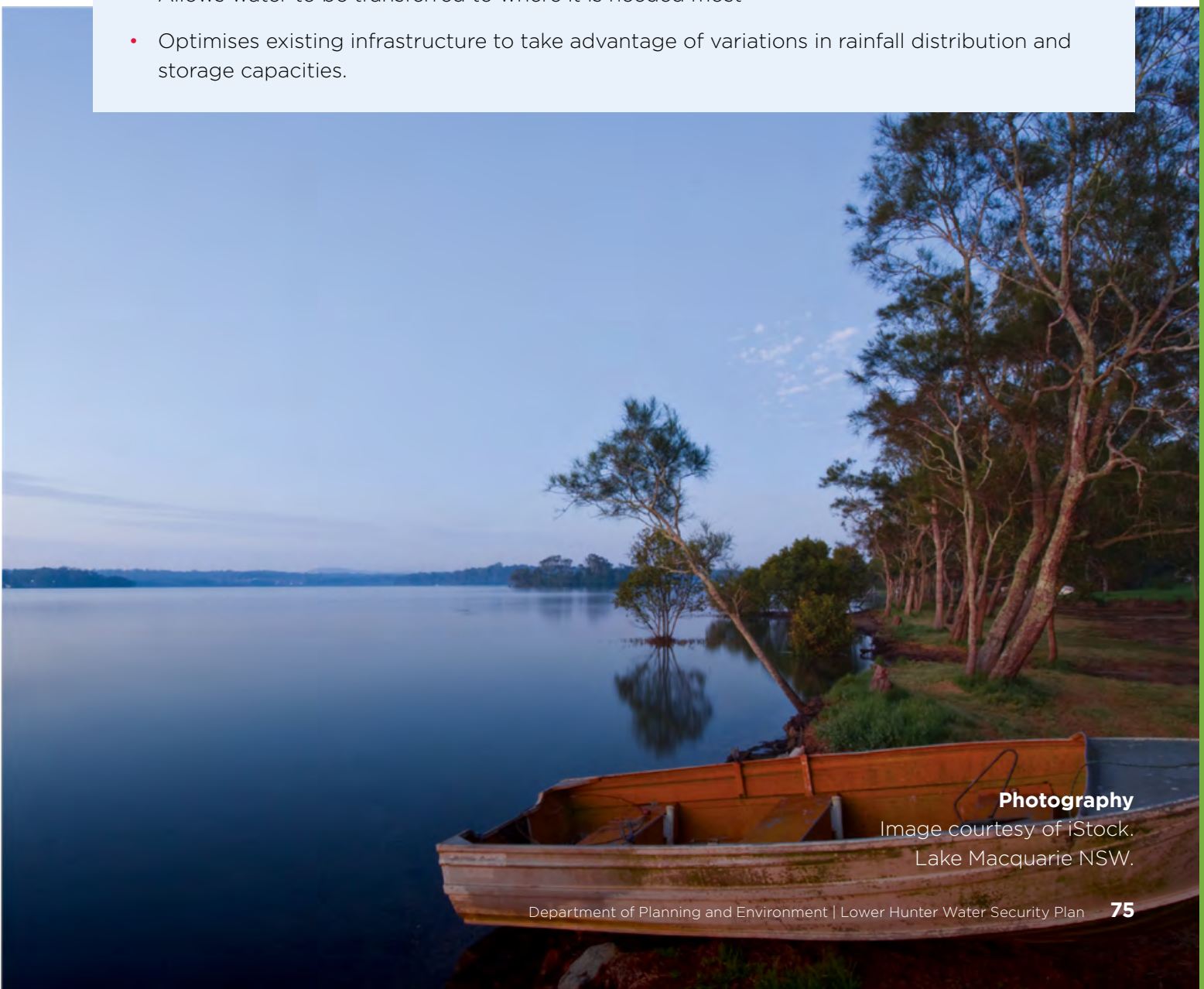
Water sharing with the Central Coast

The existing Hunter Water – Central Coast Council connecting pipeline can transfer water in either direction according to established water sharing rules. The connection offers mutual benefits to both regions and will continue to play an important role in the Lower Hunter's drought security. It also adds diversity to the system by providing an additional water source that is not reliant on the Williams River. This provides operational benefits by increasing resilience to the impacts of any local water issues or incidents.

The existing water sharing arrangements will be continued and no augmentations to the transfer infrastructure are proposed. However, there are opportunities to optimise the rules for water sharing so that we are making the best use of the existing infrastructure and the right amount of flow can be transferred at the right times. This will help to ensure both regions are best placed to respond to drought and operational needs, meet future growth requirements and adapt to climate change.

Benefits for the community

- Allows water to be transferred to where it is needed most
- Optimises existing infrastructure to take advantage of variations in rainfall distribution and storage capacities.



Photography
Image courtesy of iStock.
Lake Macquarie NSW.

PRIORITY 3

4.3 Priority 3: Improving the resilience of the system

Our climate is changing, and the future is uncertain. We will act to improve the Lower Hunter's resilience to drought and to remain adaptive to future risks and opportunities.

Belmont desalination plant

Desalination is an important rainfall-independent water supply option and was originally identified in the 2014 Lower Hunter Water Plan as a drought response measure. As investigations for the Lower Hunter Water Security Plan progressed, a permanent desalination plant emerged as a key action for securing the region's water supply in the future.

A permanent desalination plant at Belmont:

- Will add up to 30 million litres per day of rainfall-independent water supply to the Lower Hunter's water system, which is around 15% of the region's average daily water needs
- Increases the diversity of the region's water supply system, which will improve the resilience of the overall system and help Hunter Water to continue to support customers and communities regardless of climate or system shocks
- Helps to reduce the rate that storages deplete in a long and severe drought by around six months, delaying the need to implement severe drought response measures
- Provides a flexible water supply source that is responsive to water supply needs—the plant would provide a small, continuous supply of water when total storage levels are high, increasing to full supply capacity as storage levels fall in drought
- Greenhouse gas emissions from desalination will be incorporated into Hunter Water's Carbon Strategy, currently under development.

Hunter Water selected the Belmont site following a multi-site analysis that compared the costs of the plant and associated infrastructure, power supply requirements and environmental and community impacts. The site at Belmont proved the best option because the land is already owned by Hunter Water, the construction costs are lower than for other sites and there would be low community disruption and impacts. This site also allows the discharge of brine (the remaining salt water from the desalination process) to the ocean via the existing outfall at the nearby Belmont Wastewater Treatment Works, minimising environmental impacts.

Sizing of the Belmont plant at 30 million litres per day was considered to provide the best value to the Lower Hunter community and materially improve drought security. A plant beyond 30 million litres per day would require costly infrastructure upgrades throughout the water supply and power supply networks.

Water from the plant would be treated to comply with the Australian Drinking Water Guidelines and supplied to customers in the Lake Macquarie area.

Environmental goals

Participants were broadly supportive of additional investments to achieve environmental goals for biodiversity and greenhouse gas emissions.

Phase 3 engagement activities

What we heard

Benefits for the community

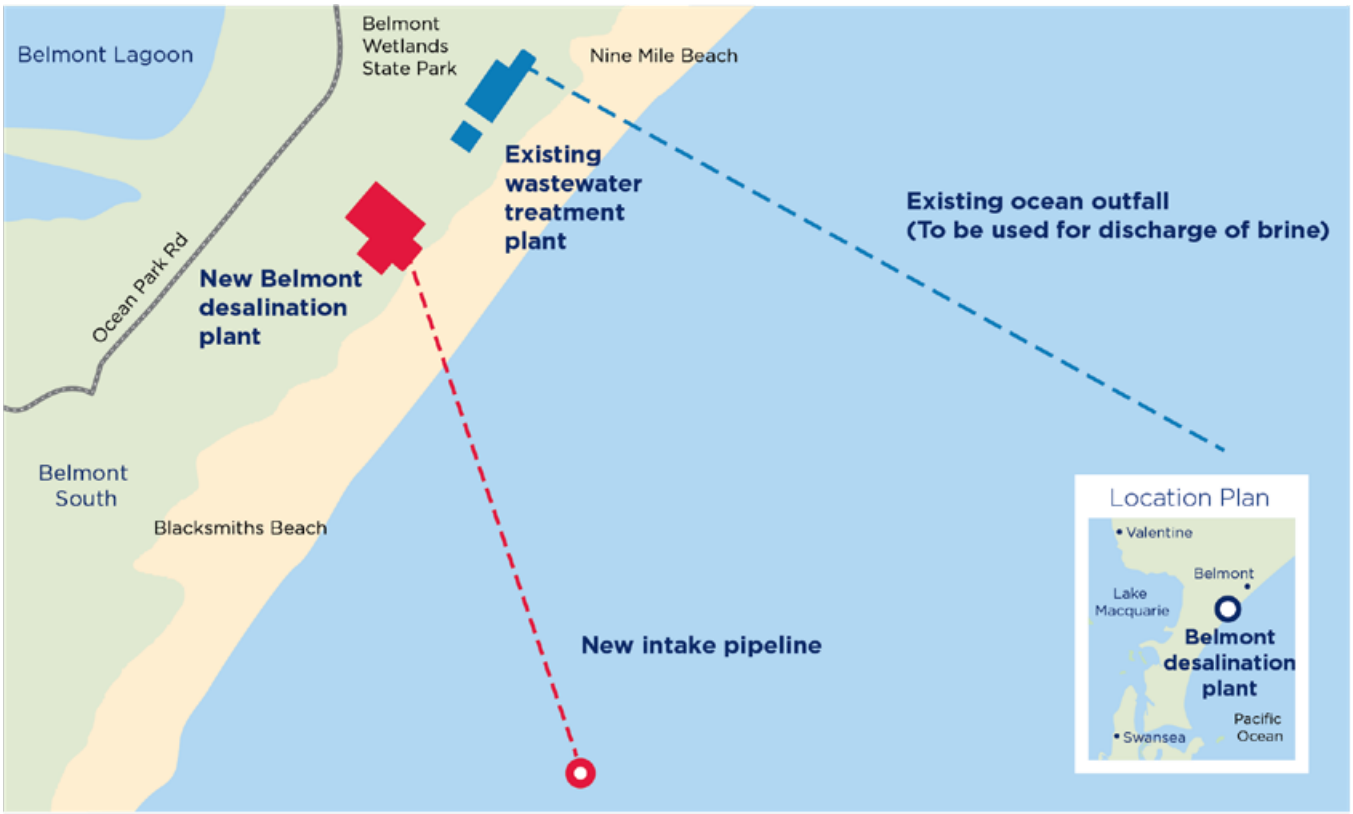
- Adds a permanent, rainfall-independent water source to the Lower Hunter water supply system
- Delays the need to introduce drought response measures
- Supplies water throughout a drought rather than a drought response plant that only supplies water when water storages have reached critical levels.

Readiness activities are complete for a drought response desalination plant at Belmont. These activities were a key action from the 2014 Lower Hunter Water Plan and included investigating a range of sites across the Lower Hunter, selecting a preferred site and then undertaking the necessary technical studies for a planning approval. Approval for the drought response desalination plant has been granted by the Department of Planning and Environment and the desalination plant could be delivered in the event of a drought in the near future.

Given what we have learned during development of the Lower Hunter Water Security Plan, there are benefits in having this desalination plant as part of the region's permanent water supply, not just operated as a drought response option.

Hunter Water will seek approvals to allow the Belmont desalination plant to be built now and operated as part of the region's permanent water supply.

Figure 24. Belmont desalination plant site map



Making better use of existing dams: a Hunter Water connection to the Lostock Dam – Glennies Creek Dam pipeline scheme

The Greater Hunter Regional Water Strategy and NSW State Infrastructure Strategy 2018 both recommended that a Strategic Business Case be completed for a two-way pipeline to connect Glennies Creek Dam with Lostock Dam. By connecting these two storages, water can be moved from the high rainfall catchment in the east to the large storage in the west. The Strategic Business Case completed in 2020 found the project can provide water supply benefits for the agriculture, resources and energy sectors in the Hunter Valley, as well as improve town water security for Singleton.

A Hunter Water connection to the scheme would provide water supply benefits and a higher level of drought resilience to both the Lower Hunter and Central Coast regions.

A new offtake on the Paterson River would be built near Paterson to enable Hunter Water to access additional flows of water in the Paterson River. Water would then be delivered by pipeline to either Grahamstown Dam or pumped to a new water treatment plant and delivered into the drinking water supply network at Maitland.

Releases for Hunter Water would be above current allocations for water users on the Paterson River and existing end of system flow requirements to ensure environmental assets are protected.

Photography
Image courtesy of iStock.
Hilly countryside and Lostock Dam in the Upper Hunter Region of NSW, Australia.

Figure 25. Map of the proposed Lostock Dam – Glennies Creek Dam pipeline scheme and Hunter Water connection

As with the existing connection between the Hunter Water and Central Coast supply systems, linking new systems creates the opportunity to optimise existing infrastructure and take advantage of variations in rainfall distribution and storage capacities across the broader region. Connecting regions can be beneficial and increases resilience of the overall system.

The industries of the Upper Hunter are changing, and work is ongoing to understand their future water needs to ensure a reliable supply for all water users and the environment.

The rules to manage water extraction and use are outlined in water sharing plans for different water systems. These rules ensure an appropriate volume is protected from extraction and reaches the downstream environment, while sharing surplus water across a range of other uses. The Hunter Water connection to the Lostock Dam – Glennies Creek Dam pipeline scheme will ensure requirements for end-of-system flows and existing water access entitlements are maintained.

Water sharing plans are reviewed on a 10-year cycle. This provides certainty to water users about water availability but also ensures the plans are responsive to changing conditions and are making best use of available water for both water users and the environment. The *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* is currently being reviewed and will be replaced in 2022.

The *Water Sharing Plan for the Hunter Regulated River Water Sources 2016* will be reviewed by 2026 and the *Water Sharing Plan for the Paterson River Regulated Water Source 2019* will be reviewed by 2029.

These reviews will consider any new infrastructure and the needs of all water users, including Traditional Owners, domestic and commercial users (including major industries such as mining and energy), and will ensure that environmental flows are appropriate. If required, amendments to these plans could be brought forward to align with the needs of any new infrastructure projects.

The NSW Government, in consultation with Hunter Water, is leading the development of a Final Business Case for the two-way pipeline between Glennies Creek Dam and Lostock Dam and a new offtake from the Paterson River. Further detailed technical investigations and engagement with water users and landholders will be undertaken in the development of the Final Business Case.

The Final Business Case will include:

- comprehensive technical and environmental studies
- options analysis for the water offtake near Paterson and pipeline routes to transfer water to Hunter Water's supply system
- detailed modelling of streamflow and salinity in the Paterson River, and development of operating rules for water extraction
- engagement with stakeholders including water users and landowners.

Progressing a Hunter Water connection to the Lostock Dam – Glennies Creek Dam pipeline scheme will depend on the outcomes of the Final Business Case. In the event that further analysis suggests that the pipeline scheme will not proceed then we will adapt the other actions in the Lower Hunter Water Security Plan, either by upsizing their capacity or bringing them online sooner. This will form part of our ongoing communication with the community on how we are implementing the plan.

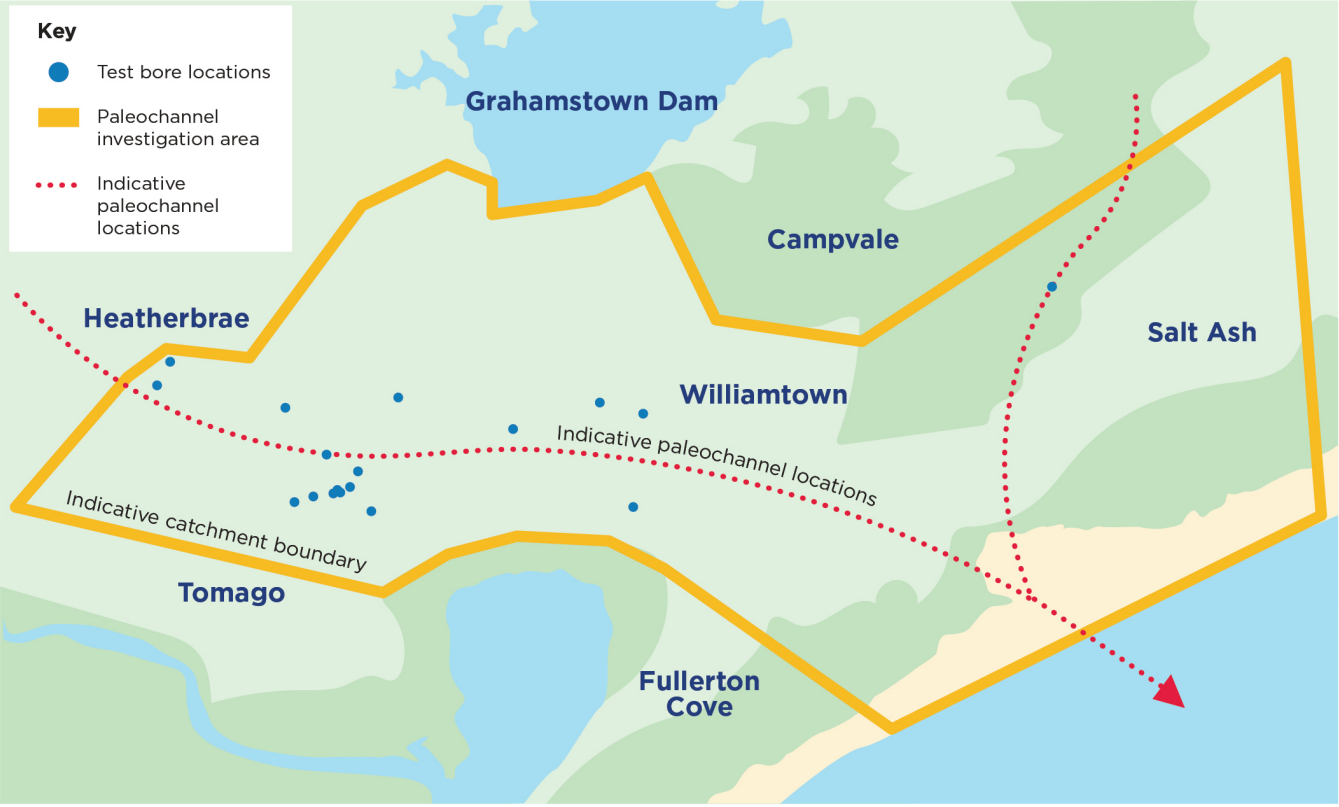
Benefits for the community

- Improved use of existing infrastructure in the region
- Improved regional system resilience, linking the Upper Hunter, Lower Hunter and Central Coast water systems
- Comparatively low ongoing operating costs
- If connected to the Maitland system, increased diversity and resilience of the Lower Hunter's water supply system by providing a new independent water supply source to Hunter Water.

Groundwater investigations

Water-bearing sands and gravels associated with the ancient Hunter River and Karuah River systems (paleochannel) have been identified deep beneath the Tomago Sandbeds.

Figure 26. Map of the paleochannel investigation area



The extent and connections of the water bearing sands and gravels, and any potential pathways from the surface, are unknown. The next phase of investigations will include using several water supply test bores to measure water quality and understand how the aquifer responds to pumping.

If testing shows the resource can successfully be accessed, further investigations will be needed to determine if this water could become a long-term, sustainable source for the region including as a potential managed aquifer recharge scheme, which involves using the aquifer to store treated water from surface sources for later use.

Benefits for the community

- Groundwater is generally a low-cost water supply option in the Lower Hunter with low social and environmental impacts
- The paleochannel may provide an additional underground water source or storage, which could be replenished naturally or filled with water for use during drought.

Drought management plan

The drought management plan for the Lower Hunter is based on ensuring that Hunter Water can continue to support its customers and community through a long and severe drought. Several elements are central to achieving this outcome, including:

- Increasing the level of rainfall-independent water supply to ensure that Hunter Water can meet minimum customer demands as part of the drought management plan
- Completing up-front planning activities before the next drought and delivering a program of actions to reduce the demand for water and increase the supply of water. These actions reduce the likelihood of building expensive infrastructure in drought.

The drought management plan includes a combination of water restrictions, behaviour change, drought readiness activities and infrastructure actions that are introduced progressively according to water storage triggers, as outlined in Table 1 on page 84.

Permanent water conservation measures, known as Smart Water Choices, are in place all the time in the Lower Hunter, regardless of water storage levels. These aim to create long-term behavioural change to save water in households, businesses, schools and industry. Making smarter choices about how we use water helps us make the best use of our existing resources and improves our responsiveness to restrictions during drought.

We will retain current water restrictions settings in the Lower Hunter, including exemption arrangements. Community feedback is supportive of the current restrictions settings and they are in line with best practice. These restrictions may be modified to incorporate the outcomes of a broader statewide review of water restrictions being conducted as part of the NSW Water Strategy. This review will consider the benefits and challenges of harmonising water restrictions across NSW, while also considering local conditions and community preferences.

Water restrictions

The Lower Hunter community supports continued implementation of water restrictions in times of drought and permanent water conservation measures (Smart Water Choices).

Phase 3 community survey

The drought management plan includes a drought response desalination plant at Walsh Point, at the eastern end of Kooragang Island, to further increase the region's supply from rainfall-independent water sources and to ensure minimum customer demands are met in a long and severe drought. Hunter Water would build this plant only if needed in drought.

Following delivery of the Belmont Desalination Plant, there will still be a supply gap of around 65 million litres of water per day to meet minimum community demands in the event of a long and severe drought. This is the nominal current capacity requirement for the Walsh Point drought response desalination plant. Based on population growth projections, the supply gap is expected to reach up to 100 million litres per day in 40 years.

The Walsh Point site was selected following a multi-site analysis that compared the costs of the plant and associated infrastructure, power supply requirements, available land and surrounding land use, and environmental and community impacts.

Undertaking further readiness activities for this drought response plant up-front will ensure this infrastructure can be delivered if and when it is needed. Up-front planning will reduce lead times and delay commencing construction of the plant as far into a drought as possible.

These activities include securing a site for the plant and completing engineering feasibility and environmental assessments, as well as obtaining planning and funding approvals.

Planning activities will include site master planning and assessment of infrastructure delivery. This planning will consider the ultimate capacity of the plant, opportunities for staged delivery and operational rules to ensure we are well placed to adapt to future uncertainties.

Readiness activities for a future desalination plant at Walsh Point also means that we are progressing an alternative permanent water supply source should one be needed in the future if another water supply action does not proceed.

The Lower Hunter Water Security Plan outlines indicative storage level triggers for different levels of water conservation and delivery of a desalination plant. It is important there is flexibility in the implementation of these measures to ensure the right decisions are being made at the right time. The NSW Government and Hunter Water will need to consider the circumstances of the day, including depletion rates, climate projections and the needs of the Lower Hunter community, before implementing important drought policy or infrastructure decisions.

Photography
Image courtesy of Hunter Water.
Aerial view of Swansea bridge and town centre.

Table 1. Drought management plan

Storage trigger	Drought response measures
>70%	**Water restrictions and behaviour change** • Permanent water conservation measures – Smart Water Choices: o only water gardens before 10am or after 4pm o no hosing of hard surfaces o known leaks must be repaired o hoses must have a trigger nozzle and are not to be left running unattended o drinking water used for dust suppression only where there is no alternative water source o ongoing Love Water campaign o regular engagement with large customers and support for water efficiency management plan (WEMP) implementation and leak identification o essential plumbing assistance **Infrastructure actions** • Readiness activities for drought response desalination plant at Walsh Point
70%	**Infrastructure actions** • Draw water from Tomago Sandbeds • Water transfers from Central Coast water system to Lower Hunter system in line with the Hunter Water–Central Coast Council water sharing agreement
60%	**Water restrictions and behaviour change** • Level 1 restrictions – Smart Water Choices plus: o sprinklers and irrigation systems not permitted o major customers (>50 million litres per year) must implement WEMP and large customers (>10 million litres per year) must prepare WEMP o leak repair assistance **Infrastructure actions** • Increase operation of Belmont desalination plant to maximum supply mode
50%	**Water restrictions and behaviour change** • Level 2 restrictions – Smart Water Choices and Level 1 restrictions plus: o hand watering only every second day for 15 minutes o no hosing vehicles, boats or buildings o large customers (>10 million litres per year) must implement WEMP and non-residential customers (<10 million litres per year) must prepare WEMP o filling or topping up of water features, fountains, ponds, dams or non-domestic tanks with drinking water not permitted o 4-minute showers o additional rebates to support customers
Approximately 50%	**Infrastructure actions** • Commence delivery of drought response desalination plant at Walsh Point

Storage trigger	Drought response measures
40%	**Water restrictions and behaviour change** • Level 3 restrictions – Smart Water Choices, Level 1 and 2 restrictions plus: o outdoor use of drinking water banned o all non-residential customers must implement WEMP o 3-minute showers o recycled water made available for critical outdoor use
>15%	**Infrastructure actions** • Commence operation of drought response desalination plant at Walsh Point

Note: The trigger levels are based on continuing to meet community water needs and ensuring protection against system depletion. These triggers will be considered in response to current knowledge on a range of matters including water demand, the rate of system depletion in drought and desalination delivery timelines.

Figure 27. Proposed site for drought response desalination plant at Walsh Point

Benefits for the community

- Supports ongoing community efforts to save water before drought through Hunter Water's Love Water campaign and Smart Water Choices
- Extends the region's ability to withstand drought through water restrictions and increases support for water saving measures through drought
- Up-front planning work for a drought response desalination plant at Walsh Point to ensure that Hunter Water is ready to meet the community's water needs during a severe drought.

4.4 Priority 4: Water for life

Our water system is underpinned by healthy ecosystems and is essential to support liveable communities. The Lower Hunter Water Security Plan works to incorporate the values and participation of First Nations and Aboriginal people. Water supports liveable communities and our plan will seek to protect and restore our environment and ecosystems.

Knowledge, values and participation of First Nations and Aboriginal communities

Water is an essential part of connection to Country for Aboriginal people and the lands and waters of the Lower Hunter region have been managed and cared for by the Awabakal, Birpai, Darkinjung, Wonaruah and Worimi peoples for tens of thousands of years. While engagement with Aboriginal people around water policy and management is improving across NSW, communities continue to have limited access to water for cultural, social and economic purposes.

Increasingly, Aboriginal knowledge and science are recognised as being essential to improving how we manage natural resources in Australia. There is considerable scope to revitalise and learn from Aboriginal custodianship of waterways, teach new skills to young Indigenous people and build respect for Aboriginal culture and heritage.

We have worked towards better understanding Aboriginal people's values in developing the Lower Hunter Water Security Plan but further work is needed to improve knowledge sharing and increase the involvement of Aboriginal people in catchment, land and water management.

As an action of the NSW Water Strategy, the NSW Government will be partnering with First Nations and Aboriginal People to co-design a state-wide Aboriginal Water Strategy.

The Aboriginal Water Strategy will identify a program of measures to deliver on First Nations' water rights and interests in water management.

The Aboriginal Water Strategy will set a foundation for how we work with Aboriginal people, communities and organisations across the state. It will also guide the implementation of the Lower Hunter Water Security Plan and the ongoing management of water resources in the region to support Aboriginal water rights, interests and access.

As a present day steward of water and catchments in the Lower Hunter, Hunter Water will lead engagement with Aboriginal people to incorporate their values in decision-making about the region's water security and increase their participation in strategic planning processes.

Hunter Water is currently finalising the next iteration of its Reconciliation Action Plan (known as an Innovate RAP). The RAP includes actions for stakeholder engagement and strengthening relationships with local Aboriginal and First Nations people, review of procurement and employment practices to increase the involvement of Aboriginal people and organisations in Hunter Water's business operations, and incorporating Indigenous artwork into Hunter Water's assets.

Liveable communities and integrated water management

As the Lower Hunter's population grows and the climate changes, it is important that green spaces and clean and healthy waterways are available for recreation and for urban cooling. We can best achieve these outcomes by integrating land use and water planning and optimising how water resources are managed across the entire water cycle—this is referred to as an integrated water management approach.

Aligned with the direction set out in the NSW Water Strategy, the NSW Government will review current practice, planning mechanisms and development controls to overcome barriers to integrated water cycle management so that opportunities for on-ground solutions can be implemented. This includes establishing governance frameworks that support the delivery of projects and supporting collaboration to improve alignment of land use and water planning.

Hunter Water will work with government agencies, regional stakeholders and customers to implement integrated solutions for land use and water management and also support the efficient and effective use of water resources to contribute to liveable communities, including:

- identifying opportunities where water planning can contribute and align with the integrated water and land use planning initiatives in the Hunter Regional Plan, Greater Newcastle Metropolitan Plan and the local strategic planning statements of each of the Greater Newcastle councils
- reviewing integrated water cycle management opportunities for the Lower Hunter to identify priority projects and place-based solutions
- undertaking social research to understand the community's willingness to pay for improved community and environmental outcomes that are enabled by water investments and the use of alternative water supplies, including recycled water and stormwater harvesting investments, for the irrigation of public open space.

Photography
Image courtesy of iStock.
Lake Macquarie, NSW.

Move towards a circular economy approach in delivering water services

A circular economy values resources by keeping products and materials in use for as long as possible. Underpinned by a transition to renewable energy sources, the circular economy 'closes the loop' by keeping resources in use at their highest value, designing waste out of the system and restoring and enhancing natural capital.

Water consumption requires the use of energy, chemicals and materials, and can alter river flows and generate organic waste that can affect the health of waterways and oceans. Circular economy frameworks provide an opportunity to re-think how we manage the complex interconnections between water services, carbon emissions, ecological health and economic productivity.

Consistent with circular economy principles, the program of actions includes further investment in protecting our existing drinking water catchments, water conservation, and recycling for both drinking and non-drinking purposes. Maintaining and enhancing water sharing arrangements with neighbouring areas also 'closes the loop' by making best use of water sources in the region.

The NSW Government's Circular Economy Policy Statement *Too Good To Waste* sets out principles and actions to help NSW make the shift to a best practice circular economy. The statement includes support for innovative approaches and reducing barriers to the adoption of circular economy principles. Hunter Water will be guided by these principles and will identify opportunities for greater resource recovery in their operations including through the Lower Hunter Water Security Plan.

Greenhouse gas emissions

"Greenhouse gas emissions and their associated impact on climate, society and the environment more broadly are of increasing concern and we recognise our role in reducing emissions".

The NSW Government is committed to achieving net zero emissions by 2050 and to making NSW more resilient to a changing climate.

The **Net Zero Plan Stage 1: 2020–2030** is the foundation for NSW's action on climate change. The Net Zero Plan aims to grow the economy, create jobs and enhance the prosperity and quality of life of the people of NSW while allowing the state to deliver a 50% cut in emissions by 2030 compared to 2005 levels.

All proposed actions in this plan, including desalination, will be incorporated into Hunter Water's Carbon Strategy. The Carbon Strategy, currently under development, will consider the timeframe and associated actions for Hunter Water to reach Net Zero emissions.

Photography
Image courtesy of Hunter Water.
Young family washing car.

4.5 Benefits of the plan

The proposed program of actions included in the Lower Hunter Water Security Plan work together to:

- make the most of what we've got
- ensuring we can reliably meet the water needs of a growing community
- improve drought security
- increase the diversity and resilience of the system
- provide an affordable approach to achieving a sustainable and resilient water supply.

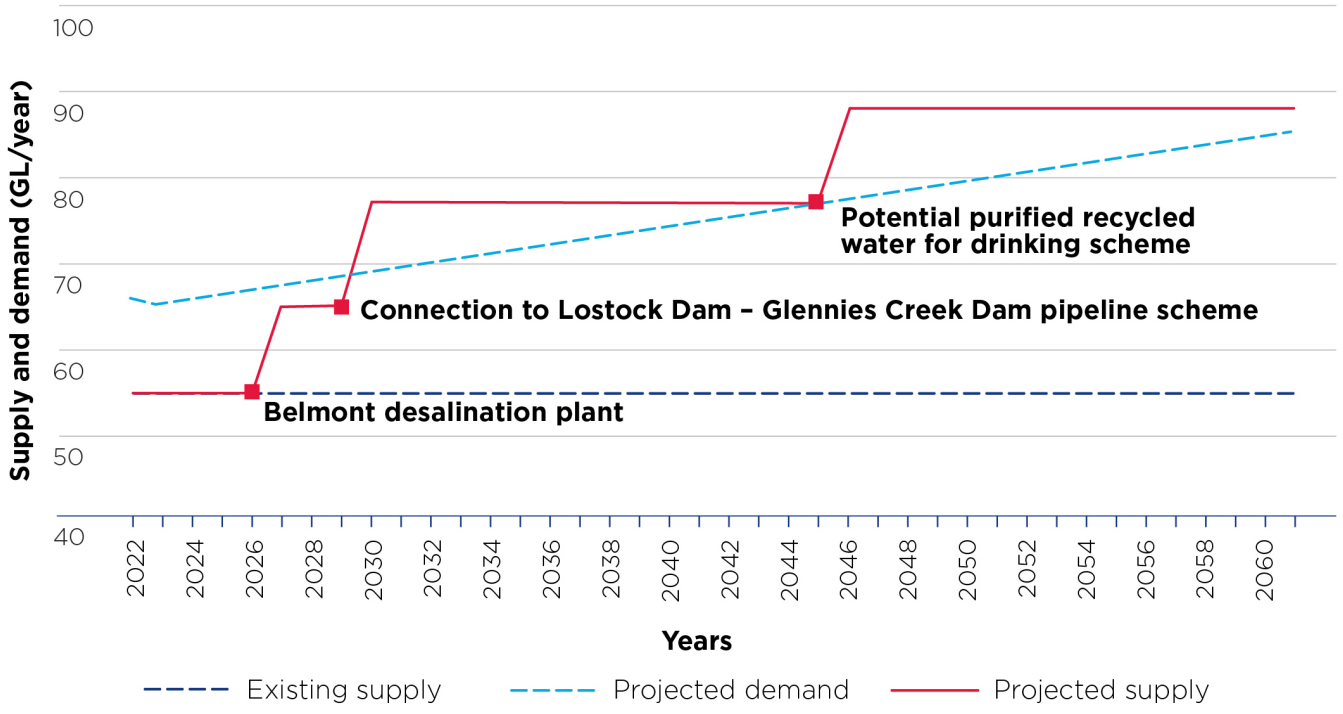
Making the most of what we've got

The plan includes up-front investments in water conservation and recycling to make the most of what we've got, reflecting the strong community and stakeholder support across the Lower Hunter for continued investment in both of these areas. These investments will decrease the likelihood of having to make expensive drought investments.

Ensuring we can reliably meet the water needs of a growing community

The plan recognises that water conservation and recycling will not be enough to secure a reliable water supply that can withstand drought. Up-front investments in new water supplies are included in the plan to ensure there is enough water supply to meet the needs of the Lower Hunter community over time, as well as providing flexibility to make additional investments if needed to service future population growth or changing conditions.

Figure 28. Long-term supply and demand balance*

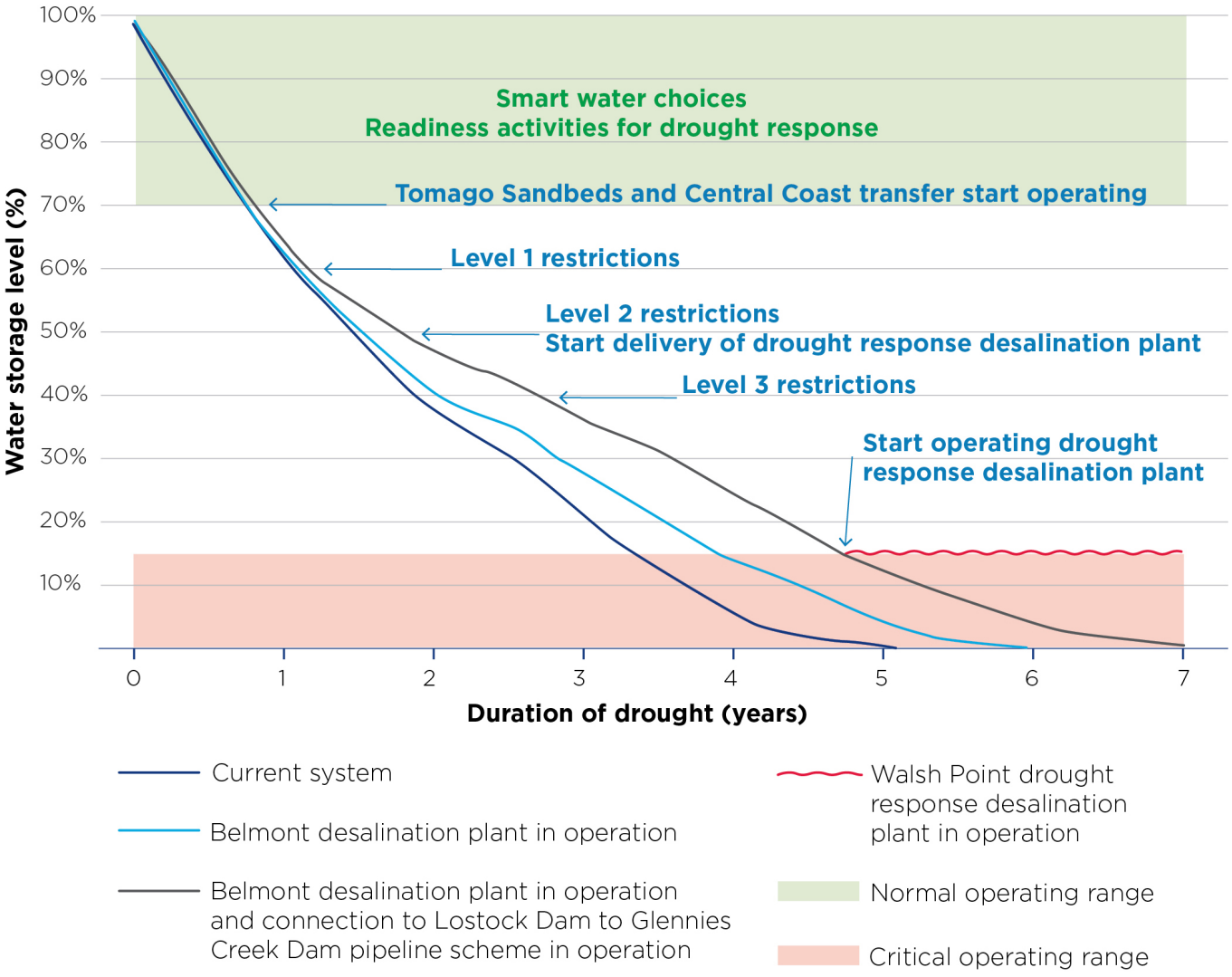


*This figure uses the 'most likely' future projections for water demand and water supply. As shown in Figure 16, we have considered upper and lower bounds on these forecasts to account for future uncertainty.

Improving drought security

The proposed water conservation measures and supply augmentations, which slow the depletion of storages in drought, and the delivery of additional rainfall-independent water supply during drought will safeguard Hunter Water's ability to continue to supply its customers' water needs through a long and severe drought, as shown in Figure 29.

Figure 29. System performance in a severe drought with proposed supply augmentations and drought management plan

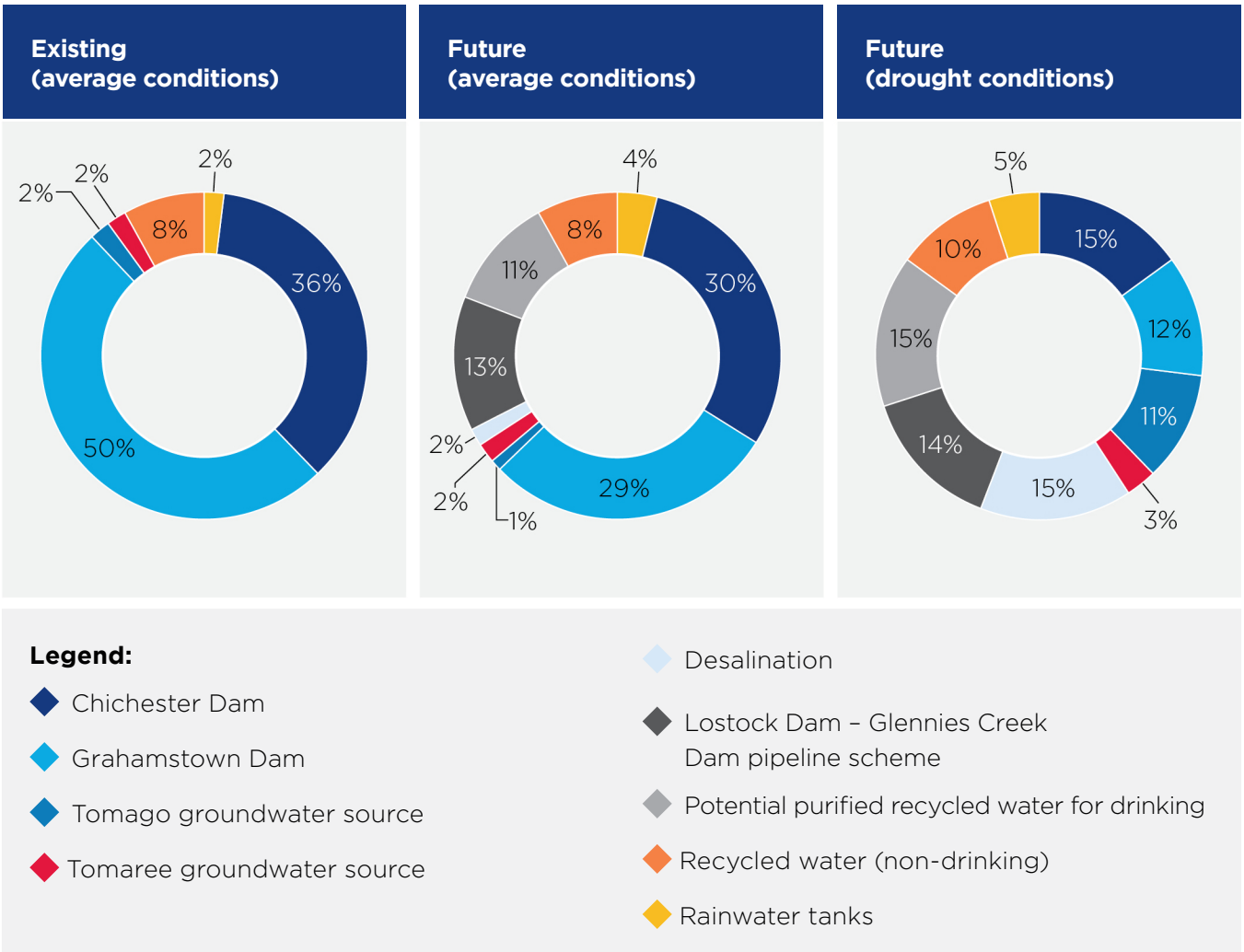


Increasing the diversity and resilience of the system

The plan increases the diversity and capacity of the Lower Hunter's water supply system with two new water sources that will provide an additional supply capacity of 80 megalitres of water per day.

These changes increase the resilience of the system to withstand drought, service growth and respond to operational events and shocks. The increased diversity is highlighted in the charts in Figure 30, which show the average supply from each source at existing and future (2060) water demands, as well as the supply in drought conditions at future demands.

Figure 30. Supply from each water source at existing and future (2060) water demands



Note: The supply from the Tomago groundwater source and desalination in average conditions is small because these sources are assumed to supply minimal water when total storage levels are high, which occurs most of the time. Drought conditions represent the water supplied in a modelled drought sequence with total storage levels between 60% and 15%.

Provide an affordable approach to achieving a sustainable and resilient water supply

Providing affordable and high-quality services is one of the objectives of the plan.

One of the issues explored through the community engagement program was the trade-off between water security and affordability. We heard our community had a preference for up-front investments as opposed to acting reactively during drought, and support to ensure that we can supply enough water to meet minimum customer demands in a long and severe drought.

The community generally accepted that increased water security requires Hunter Water to make investments that result in higher bills.

Developing the plan included extensive economic modelling and financial analysis across a range of programs of actions. The major infrastructure investments included in the plan provide the maximum net benefit (considering social, economic and environmental factors) to the NSW community, as well as comprising the most efficient program of actions from the Lower Hunter community's perspective across the programs assessed. Table 2 shows the estimated costs of the proposed supply augmentations.

Table 2. Estimated capital investment of major infrastructure actions

Infrastructure actions	Estimated capital investment
Belmont desalination plant	$220–250 million
Infrastructure to connect the proposed Lostock Dam-Glennies Creek Dam pipeline scheme to Hunter Water's supply system	$220 million

The prices that Hunter Water can charge customers is regulated by the Independent Pricing and Regulatory Tribunal (IPART). Under IPART's funding and pricing principles, Hunter Water would recover the cost of its investments from its customers.

Based on the estimated costs of proposed water conservation, recycling, supply augmentation, and drought readiness actions, the plan is likely to increase annual residential customer bills by between $75 to $120 on average per year (a one-off increase of between 6 and 9 per cent).

Customer bills will not change (other than being indexed for inflation) before 1 July 2025. Beyond that the investments proposed would be reflected in customer bills and the cost and timing of investments, particularly the delivery of the supply options such as the connection to the Lostock Dam – Glennies Creek Dam pipeline scheme, will affect the size of the increase. If investments are delayed to defer bill increases then a higher level of risk of running out of water is being accepted until the supply augmentations are delivered.

The proposed actions will improve the security of our water system to withstand drought. In the unlikely event we need to construct a drought response desalination plant in addition to these investments, the average annual household bill would increase by around a further $100.

We need to do further analysis to confirm funding arrangements for the proposed investments, including consideration of the reintroduction of developer charges.

The NSW Government will continue to ensure that hardship policies, concessions and other measures are available so that everyone has access to water. Hunter Water will continue to offer support programs to help customers having difficulty managing their water use or paying their water bills.

It is also important to appreciate that an unreliable water supply has economic impacts. Running out of water would be a catastrophic event that would impose very substantial financial costs on Lower Hunter households, businesses and the regional economy.

5. Implementing the plan

Photography
Image courtesy of Destination NSW.
CoastXP tour group off the Newcastle coastline.

The plan includes actions to move towards our goal of providing a resilient and sustainable water future that contributes to regional health and prosperity and is supported by the community. A collaborative and adaptive approach is essential to ensuring we can collectively respond to changing circumstances in the Lower Hunter—addressing risks and taking up opportunities.

5.1 Actions at a glance

Table 3 through to Table 6 summarise the objectives, actions, timing and responsibility for implementation. The timing of each action is described in terms of horizons:

- **Horizon 1—**one to two year delivery timeframe
- **Horizon 2—**three to five year delivery timeframe
- **Horizon 3—**beyond five years delivery timeframe.

Table 3. Priority 1: Safe drinking water

Action	Lead agency	Horizon
Water quality		
Continue to invest in catchment management and catchment protection to ensure we are making the most of our existing water resources and maintaining a robust multiple-barrier approach to drinking water quality	Hunter Water	Ongoing
Work together with relevant agencies to identify opportunities for improvement of key water quality issues	Hunter Water	Ongoing
Support implementation of the NSW Water Strategy action to adopt a more intense, state-wide focus on water quality, including by participating in the monitoring and review of NSW water quality objectives in Lower Hunter catchments	Hunter Water and DPE	1 and 2 (1–5 years)

Table 4. Priority 2: Making the most of what we have got

Action	Lead agency	Horizon
Water conservation		
Implement programs targeting leakage reduction to achieve a target of 50 litres per connection per day	Hunter Water	Ongoing
Implement programs to support Hunter Water's customers to reduce drinking water consumption in their homes and businesses by 17% per person per day	Hunter Water	Ongoing
Participate in the NSW Water Strategy's Water Efficiency Framework and program and implement programs accordingly in the Lower Hunter region	Hunter Water	1 (1-2 years)
Participate in the NSW Government's review of BASIX (the Building Sustainability Index) and improve its effectiveness in driving and sustaining water efficiency	Hunter Water	1 (1-2 years)
Recycled water and alternative water supplies for non-drinking		
Work with local councils to define objectives and priorities for a water-enabled liveable communities program, including irrigation of public open spaces	Hunter Water	1 (1-2 years)
Develop the business case and engage with customers for new or expanding industrial alternative water supply schemes	Hunter Water	2 (3-5 years)
Participate in statewide regulatory and community acceptance campaigns for stormwater harvesting and recycling that support Hunter Water in diversifying sources of supply	Hunter Water	1 and 2 (3-5 years)
Work together with councils, government and developers to continue to explore viable recycling opportunities for new residential developments	Hunter Water	2 (3-5 years)
Community engagement on water literacy and purified recycled water		
Continue to engage with the Lower Hunter community about the natural and urban water cycle	Hunter Water	1 (1–2 years)
In collaboration with Central Coast Council, continue to engage with the Lower Hunter and Central Coast communities about purified recycled water, including by building a demonstration plant and community education facility in the Lower Hunter	Hunter Water and Central Coast Council	2 (3–5 years)
Water sharing with the Central Coast		
Continue to share water with Central Coast Council in accordance with the existing water sharing agreement. Investigate opportunities to optimise water sharing rules where possible	Hunter Water	Ongoing

Table 5. Priority 3: Improving the resilience of the system

Action	Lead agency	Horizon
Belmont desalination plant		
Seek planning and funding approvals to transition plans for the Belmont drought response plant to a permanent desalination plant	Hunter Water	1 (1–2 years)
Construct a permanent desalination plant at Belmont if planning and funding is approved	Hunter Water	2 (3–5 years)
Develop and implement evaluation of operational approaches for Belmont desalination plant	Hunter Water	2 (3–5 years)
Connection to the Lostock Dam – Glennies Creek Dam pipeline scheme		
Develop the Final Business Case for the Lostock Dam – Glennies Creek Dam pipeline scheme and offtake from the Paterson River, including engagement with stakeholders, environmental investigations and planning approvals	DPE and Hunter Water	1 and 2 (1-5 years)
Water restrictions		
Participate in the NSW Water Strategy action to review statewide water restrictions with the aim of improving alignment and harmonisation while considering local Lower Hunter conditions and community feedback	Hunter Water and Central Coast Council	1 (1–2 years)
Readiness activities for a future desalination plant at Walsh Point		
Undertake a review of desalination delivery and good practice approaches to readiness and procurement, and integrate learnings from the last drought	Hunter Water	2 (3–5 years)
Start readiness activities for a future desalination plant at Walsh Point including land acquisition, concept design and planning and funding approvals	Hunter Water	2 (3–5 years)

DPE: Department of Planning and Environment

Action	Lead agency	Horizon
Groundwater		
Complete additional readiness activities for groundwater access such as further investigations, approvals and amendments to water sharing plans (if required) for the Tomago secondary aquifer (paleochannel) including as a potential managed aquifer recharge scheme	Hunter Water	2 (3–5 years)
Evaluate information from Hunter Water's monitoring programs and assess opportunities to improve understanding of the impact of water extraction on groundwater-dependent ecosystems at Tomago	Hunter Water and DPE	1 (1–2 years)
Implement the NSW Groundwater Strategy and Action Plan to inform sustainable groundwater management in the Lower Hunter	DPE	1 and 2 (1-5 years)
Integrated water system modelling		
Investigate improvements to integrated system modelling to support coordinated long-term water planning for the Upper Hunter, Lower Hunter and Central Coast	DPE	1 (1–2 years)
Climate change modelling		
Continue to integrate paleoclimate data into the supply system model and apply the latest future climate projections to build understanding of the influence of climate on demand, supply and asset planning	Hunter Water and DPE	Ongoing
Reducing evaporation		
Pilot new technology to assess the costs, benefits and risks of options to reduce evaporation from water storages	Hunter Water	2 (3–5 years)

DPE: Department of Planning and Environment

Table 6. Priority 4: Water for life

Action	Lead agency	Horizon
Knowledge, values and participation of First Nations and Aboriginal people		
Continue to engage with First Nations and Aboriginal communities to incorporate their knowledge and values in decision-making and increase their participation in strategic planning processes	Hunter Water	1 (1–2 years)
Implement the NSW Aboriginal Water Strategy to deliver programs that increase access, ownership and stewardship of water for First Nations and Aboriginal peoples.	DPE	2 (3-5 years)
Integrate land use and water management and improve liveability		
Undertake social research to understand the community's willingness to pay for improved community and environmental outcomes that are enabled by water investments and the use of alternative water supplies, including recycled water and stormwater harvesting investments, for the irrigation of public open space	Hunter Water	2 (3–5 years)
Identify opportunities where water planning can contribute to and align with the integrated water and land use planning initiatives in the Hunter Regional Plan, Greater Newcastle Metropolitan Plan and the local planning statements of Greater Newcastle councils	Hunter Water	2 (3–5 years)
Enable more broad scale implementation of Integrated Water Cycle Management (IWCM) in the Lower Hunter by: • Using the outcomes of the Lower Hunter Water Security Plan to inform the review of the Hunter Regional Plan and related strategic planning documents to ensure consideration of future integrated land and water use • Reviewing current practice, planning mechanisms and development controls to overcome barriers to IWCM and maximise opportunities • Coordinating government, Hunter Water and local council collaboration to improve alignment of land use and water planning • Introducing governance frameworks that support the delivery of IWCM	DPE	1 and 2 (1-5 years)
Undertake a review of IWCM opportunities for the Lower Hunter to identify priority projects and place-based solutions	Hunter Water	2 (3–5 years)
Circular economy		
Develop a Hunter Water circular economy framework to identify opportunities for greater resource recovery	Hunter Water	2 (3-5 years)
Carbon strategy		
Develop a Hunter Water Carbon Strategy, considering the greenhouse gas emissions from all proposed actions in this plan	Hunter Water	1 (1-2 years)

DPE: Department of Planning and Environment

5.2 Ongoing monitoring and adaptation

In developing the Lower Hunter Water Security Plan, we have considered a wide range of future scenarios and the options to ensure that we have enough water to meet the needs of the Lower Hunter community.

We have used data and information to anticipate a range of future scenarios and to understand how the measures in the plan will deal with shocks and stresses. However, applying an adaptable approach is critical to ensuring that the plan can respond to changing circumstances.

Monitoring and evaluation are an essential part of an adaptable planning approach. This includes ongoing review of the key assumptions of the plan, such as population growth, customer behaviour and water use. Assessment of the future is also important so that we can understand if the plan needs to adapt or respond to changes in climate, technology or economic conditions.

We will establish a framework for reviewing and reporting against the Lower Hunter Water Security Plan that aligns with the NSW Water Strategy, the 12 regional water strategies and the two metropolitan water strategies.

With clear actions, responsibilities and timeframes for delivery of the Lower Hunter Water Security Plan, we will be able to monitor progress, assess the effectiveness of the program of actions and identify areas where we need to adapt.

The Lower Hunter Water Security Plan and the associated program of actions has a 40-year life span. We will review and evaluate key aspects of the plan annually and in response to changing circumstances such as drought events.

Photography
Image courtesy of iStock.
Plant sprouts in field.

Photography
Image courtesy of iStock.
Dawn over the Hunter River, Maitland.

Glossary

Term	Definition
Aquifer	A geological structure or formation that can hold water underground
Australian Drinking Water Guidelines	Australian reference document for water regulators and suppliers on monitoring and managing drinking water quality in Australia
Catchment	A natural drainage area, bounded by sloping ground, hills or mountains from which water flows to a low point Flows within the catchment contribute to surface water sources as well as to groundwater sources
Climate variability	The way key climatic elements, such as temperature, rainfall, evaporation and humidity, differ from the average over time Variability can be caused by natural or man-made processes
Evaporation	The process by which water or another liquid becomes a gas Water from land areas, bodies of water and all other moist surfaces is absorbed into the atmosphere as a vapour
Groundwater	Water located beneath the surface of the ground in the spaces between sediments and in the fractures of rock formations
Independent Pricing and Regulatory Tribunal (IPART)	The independent pricing regulator for water, energy, public transport and local government in NSW. IPART administers Hunter Water's Operating Licence and determines the prices that Hunter Water can charge its customers
Integrated water cycle management	Water management within an urban environment that considers all elements of the water cycle: natural aspects (such as waterways), built aspects (such as drainage systems, roads and urban developments) and service aspects (such as drinking water supply and sewerage services)
Local water utilities	Generally, council owned and operated utilities that provide water supply and sewerage services to local communities
Lower Hunter region	A subset of the broader Hunter region of NSW which covers the five local government areas of Newcastle, Lake Macquarie, Port Stephens, Maitland and Cessnock
Love Water	Hunter Water's public education campaign promoting the value of water and water conservation behaviour change
Managed aquifer recharge	Purposeful recharge of an aquifer using a source of water (including recycled water) under controlled conditions, in order to store for later use or for environmental benefit while protecting human health and the environment
NARCliM	The NSW and ACT Regional Climate Modelling (NARCliM) climate change projections

Term	Definition
Paleochannel	Underground water-bearing sands and gravels associated with ancient rivers when the sea level was lower than it is today. Hunter Water is investigating the ancient paleochannel of the Hunter River and Karuah River systems deep beneath the Tomago Sandbeds
Paleoclimate data	Climate records prior to instrumental records Various environmental indicators can be used to reconstruct paleoclimate variability extending back hundreds to thousands of years in time. These indicators include marine and terrestrial deposits, tree rings and ice cores
Purified recycled water	Water recycled by purifying or treating wastewater to an advanced level that makes it safe and suitable to go back into the drinking water supply
Rainfall-independent water source	A source of water that does not depend on rainfall or stream flows for replenishment Includes seawater desalination and recycled water
Recycled water	Water that has been treated to a 'fit for purpose' standard for a specific application
Resilient water resources	Water sources that can withstand extreme events, such as drought and flood, and/or adapt and respond to changes caused by extreme events
Smart Water Choices	Hunter Water's permanent water conservation measures to save water in households, businesses, schools and industry
Stochastic climate datasets	Extended climate sequence data that are generated using statistical methods applied to observed data of rainfall and evapotranspiration and can include paleoclimatic data These extended sequences include a more complete sample of climate variability, part of which describes more severe drought sequences than what is captured in the instrumental record
Stormwater	Flow generated from rainfall falling on hard (impervious) surfaces
Surface water	All water that occurs naturally above ground including rivers, lakes, reservoirs, creeks, wetlands and estuaries
Wastewater	Water that is an output of or discharged from a particular activity, for example, from domestic, commercial, industrial or agricultural activities
Water Efficiency Management Plan (WEMP)	A plan of actions prepared by a business and registered with Hunter Water, to improve their water efficiency, particularly during drought
Water sharing plan	A plan made under the *NSW Water Management Act 2000* that sets out the rules for sharing water between the environment and water users, and between different water users, within whole or part of a water management area or water source

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