Regional Water Strategy

Namoi

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Cover image Image courtesy of Tim Haeusler, Department of Planning and Environment. Gulligal Lagoon, Namoi.

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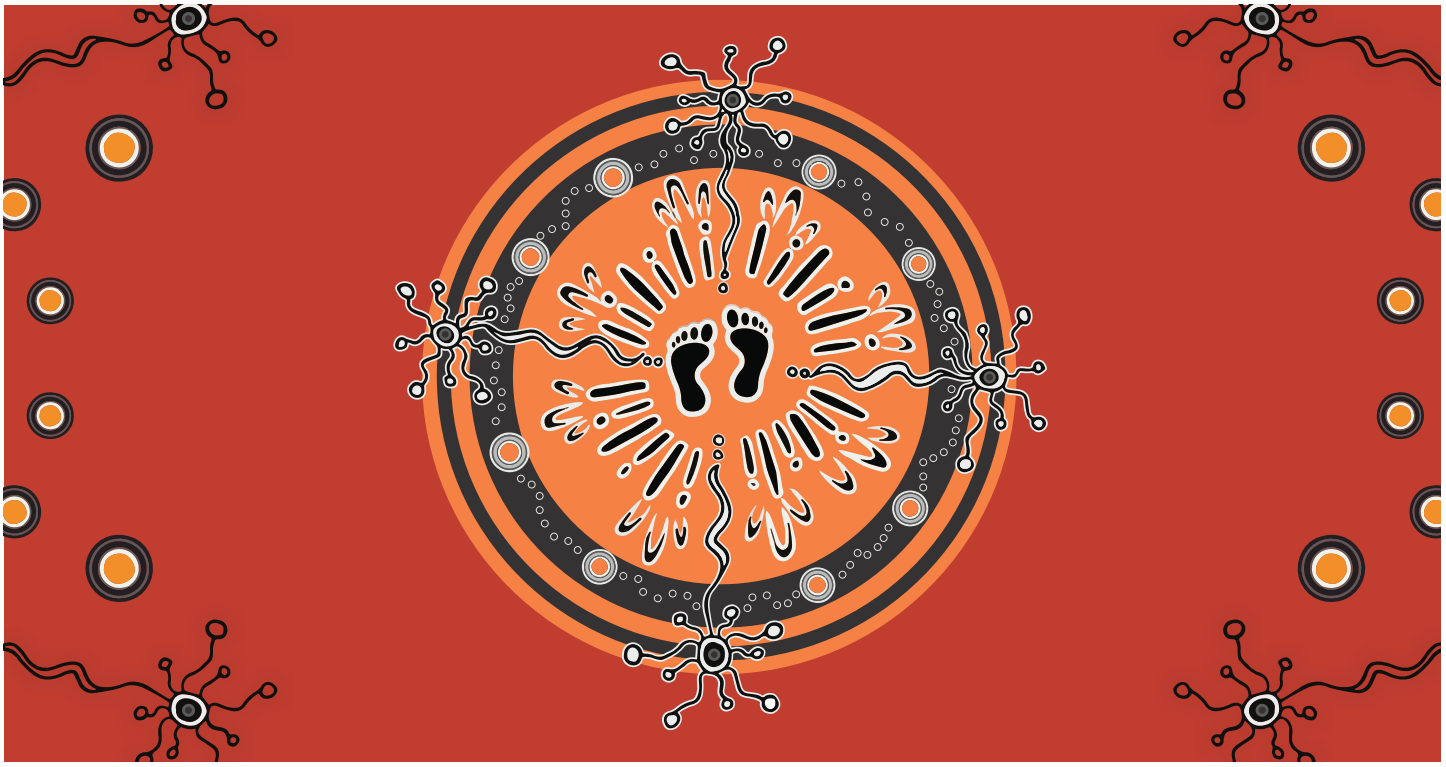

Acknowledging First Nations people

The NSW Government acknowledges First Nations people as the first Australian people and the traditional owners and custodians of the country's lands and water. First Nations people have lived in NSW for over 60,000 years and have formed significant spiritual, cultural, and economic connections with its lands and waters.

Today, they practise the oldest living culture on earth.

The NSW Government acknowledges the Gomeroi, Kamilaroi, Gamilaroi and Gamilaraay people as having an intrinsic connection with the lands and waters of the Namoi Regional Water Strategy area. The landscape and its waters provide the First Nations people with essential links to their history and help them maintain and practise their traditional culture and lifestyle.

We recognise Traditional Owners as the first managers of Country. Incorporating their culture and knowledge into management of water in the region is a significant step towards closing the gap.

Under this regional water strategy, we seek to establish meaningful and collaborative relationships with First Nations people. We seek to shift our focus to a Country-centred approach; respecting, recognising and empowering cultural and traditional Aboriginal knowledge in water management processes at a strategic level.

We show our respect for Elders past and present through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places where First Nations people are included socially, culturally and economically.

As we refine and implement the regional water strategy, we commit to helping support the health and wellbeing of waterways and Country by valuing, respecting and being guided by First Nations people, who know that if we care for Country, it will care for us.

We acknowledge that further work is required under this regional water strategy to inform how we care for Country and ensure First Nations people hold a strong voice in shaping the future for all communities.

Artwork by Nikita Ridgeway.

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Image courtesy of Destination NSW. Farmer herding sheep on a farm in Barraba, NSW.

About the Namoi Regional Water Strategy

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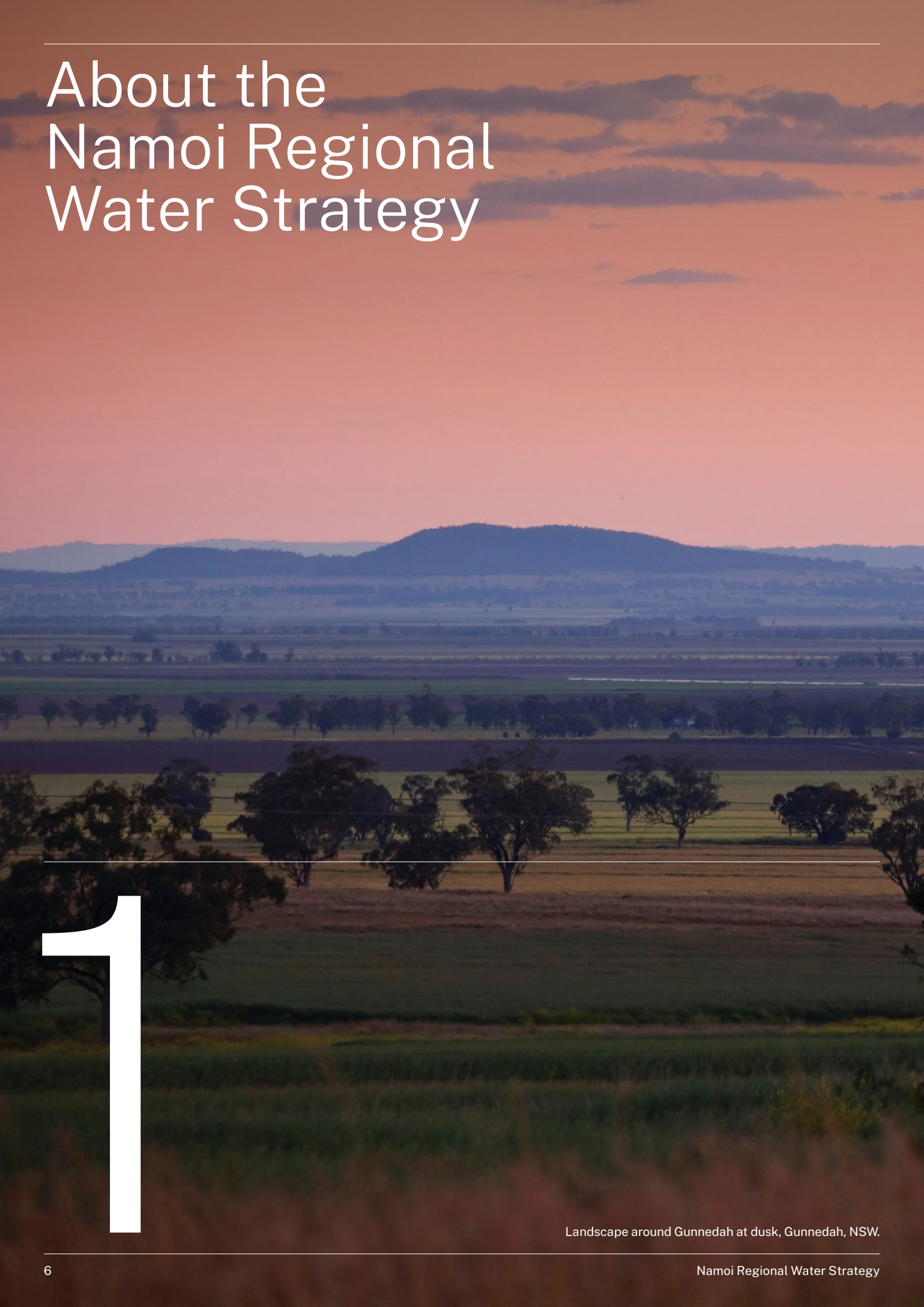


Landscape around Gunnedah at dusk, Gunnedah, NSW.

Secure, reliable and resilient water supplies are critical to regional communities in NSW. They contribute to the appeal and prosperity of rural areas, regional towns and cities. Rivers, creeks and wetlands create cultural connections to Country and support community well-being. Water in the right places at the right times is vital for healthy regional landscapes and sustainable ecosystems.

Changing water demand, increased climate variability and shifting community expectations mean we need to plan and invest in improved long-term regional water security.

The Namoi Regional Water Strategy identifies the key regional challenges that we need to tackle over the coming decades and outlines the actions that we will undertake to respond to those challenges. The best and latest climate evidence, along with a wide range of tools and solutions, has been used to chart a progressive journey for our water needs for the next 20 years and beyond.

Image courtesy of Destination NSW. Oxley Scenic Lookout, Tamworth.

The regional water strategies

Across NSW precious water resources are under pressure. A more variable climate, as well as changing industries and populations, mean we face difficult decisions and choices about how to balance the different needs for this essential resource and manage water efficiently and sustainably into the future.

The Namoi Regional Water Strategy is one of a suite of catchment based strategies across the state (Figure 1). The strategies identify critical challenges that we need to tackle over the coming decades and outline the priorities and actions that we will undertake to respond to those challenges.

Figure 1. Map of NSW regional water strategy regions

Objectives of regional water strategies

Regional water strategies set out a long-term 'roadmap' of actions to deliver 5 key objectives (Figure 2). Each regional water strategy describes the key challenges that impact our ability to achieve the objectives and identifies priority actions that address the challenges and works towards meeting at least one regional water strategy objective.

Figure 2. Regional water strategy objectives

Deliver and manage water for local communities

Improve water security, water quality and flood management for regional towns and communities.

Enable economic prosperity

Improve water access reliability for regional industries.

Recognise and protect Aboriginal water rights, interests and access to water

Including Aboriginal heritage assets.

Protect and enhance the environment

Improve the health and integrity of environmental systems and assets, including by improving water quality.

Affordability

Identify most cost-effective policy and infrastructure options.

Our aim is for each strategy to have a comprehensive, balanced package of options that delivers on all the regional water strategy objectives and aligns with the priority actions of the NSW Water Strategy.

When formulating plans to share water, the NSW Government must take all reasonable steps to prioritise the protection of water sources and their dependent ecosystems.[1]

During extreme events such as drought, our focus is on securing water for critical human needs. At these times, under section 60 of the *Water Management Act 2000*, critical human needs are the first priority, and the environment is the second priority. Outside of these extreme events, we have greater flexibility to deliver across all the objectives.

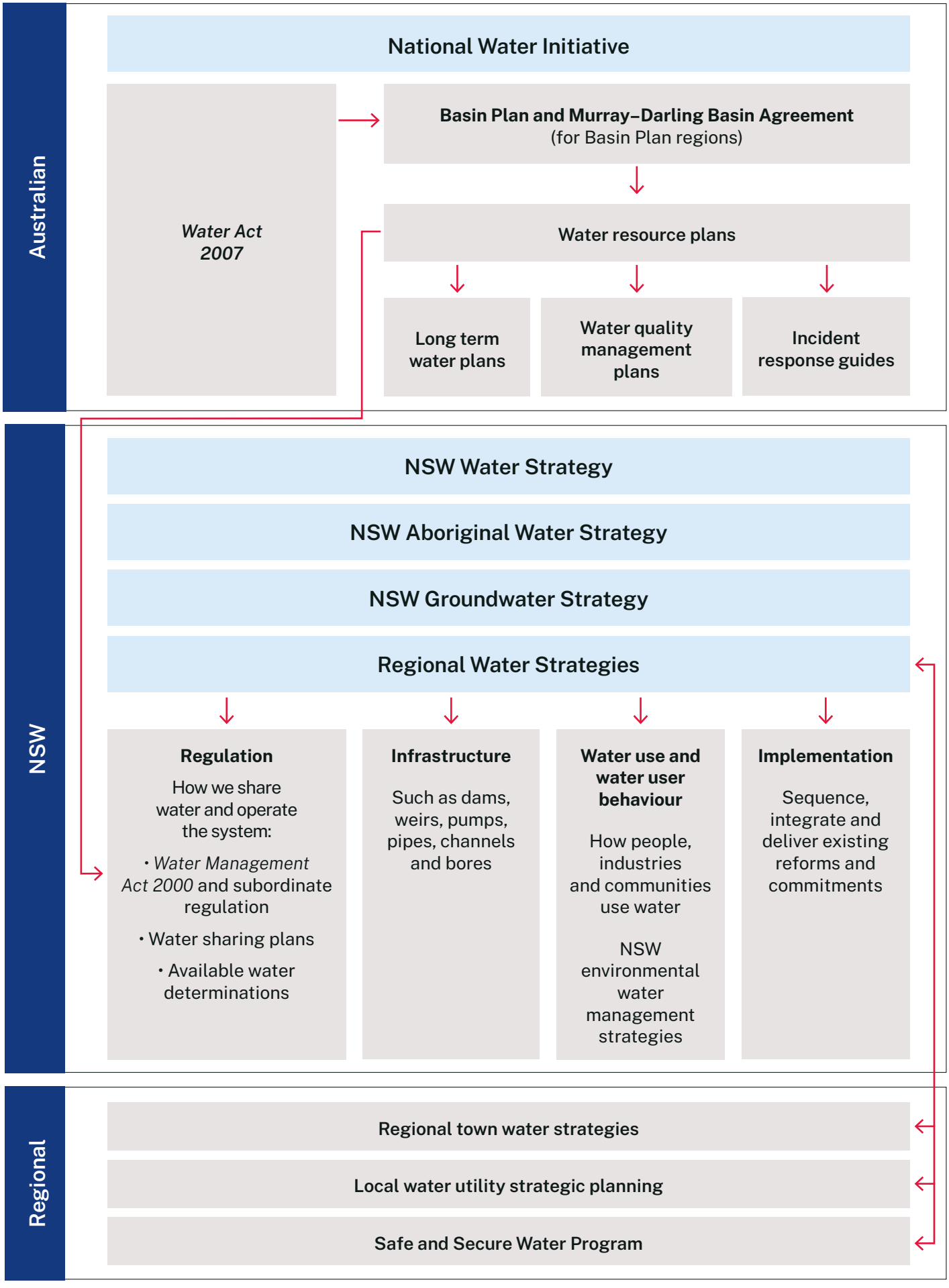
1. Subsections 9(1)(b), 5(3)(a) and 5(3)(b) of the *NSW Water Management Act 2000*

Fitting regional water strategies with other water plans and policies

Each regional water strategy across the state sits within a broader policy and planning context, including a range of policies and plans that guide the management of water resources in NSW (Figure 3).

Image courtesy of Destination NSW. Streetscapes, Tamworth, NSW.

Figure 3. NSW water policy and planning context



The strategic planning framework for water management in NSW includes the NSW Water Strategy, which aligns with a range of catchment based regional, metropolitan and statewide water strategies. The NSW Water Strategy was developed in parallel with these strategies and guides the strategic, state-level actions that we need to take. The regional water strategies prioritise how those statewide actions, as well as other region specific, place-based solutions, are to be staged and implemented in each region.

As part of delivering the NSW Water Strategy, the NSW Government is delivering other statewide strategies including:

- the NSW Aboriginal Water Strategy – co-designed with Aboriginal people to identify a program of measures to deliver on First Nation's water rights and interests in water management
- the NSW Groundwater Strategy – to ensure sustainable groundwater management across NSW
- the Town Water Risk Reduction Program – to identify long-term solutions to challenges and risks to providing water supply and sewerage services to regional towns in collaboration with local councils
- a statewide Water Efficiency Framework and Program – to reinvigorate water use efficiency programs in our cities, towns and regional centres.

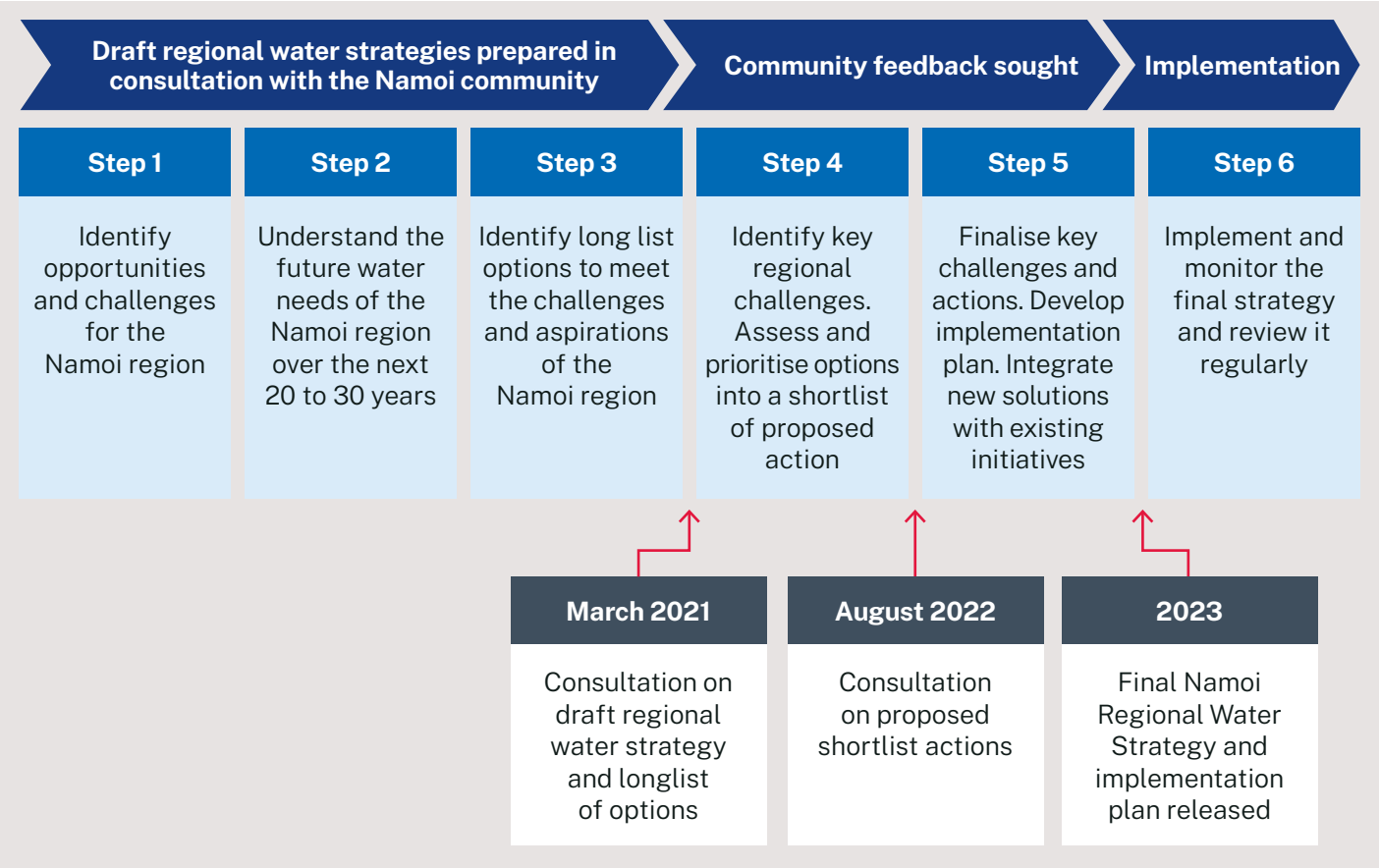
The NSW Water Strategy and the Namoi Regional Water Strategy also complement other whole-of-government strategies, including the government commitments to Net Zero, the State Infrastructure Strategy and the New England North West Regional Plan 2041.

Image courtesy of Destination NSW. Oxley Scenic Lookout, Tamworth.

Development of the Namoi Regional Water Strategy

The strategy has been developed using an evidence-based and risk-based approach informed by extensive community consultation at each step of the process. A 6-step approach has been used to prepare and implement regional water strategies as shown in Figure 4.

Figure 4. Process for developing regional water strategies



What informed the Namoi Regional Water Strategy

We have used feedback from community, and the most recent data taken from a wide range of sources, to inform the regional water strategies and ensure they are based on a robust evidence base. This information has been used to help identify the challenges that need to be tackled first, and the measures that will best support the region over the next 20 years.

Information used to develop the strategy included:

- new climate data
- extensive community consultation across a broad range of interests[2]
- economic, ecological and hydrological analyses[3]
- a range of existing studies
- existing commitments and reforms.

2. water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies/what-we-heard/namoi-regional-water-strategy
3. See Attachment 2 of the *Draft Regional Water Strategy Namoi: Shortlisted Actions – Consultation Paper*, www.dpie.nsw.gov.au/namoi-regional-water-strategy

Climate data in the regional water strategies

The regional water strategies are underpinned by ground-breaking new climate data. Our new climate datasets and modelling gives us a more sophisticated understanding of past and future climatic conditions. These improved datasets integrate recorded historical data with paleoclimate data[4] to give a modelling tool that generates 10,000 years of synthetic climate data. This information provides a much better understanding of the natural climate variability under current climate conditions. When combined with climate change projections, we can better understand how this natural climate variability will be influenced by human induced climate change. We used both of these scenarios to assess risks to future water availability in each region.

This updated climate information has been used in developing the regional water strategy and comparing the effectiveness of the actions. It will also support all water users in making more informed decisions and better plan and prepare for climate risks.[5]

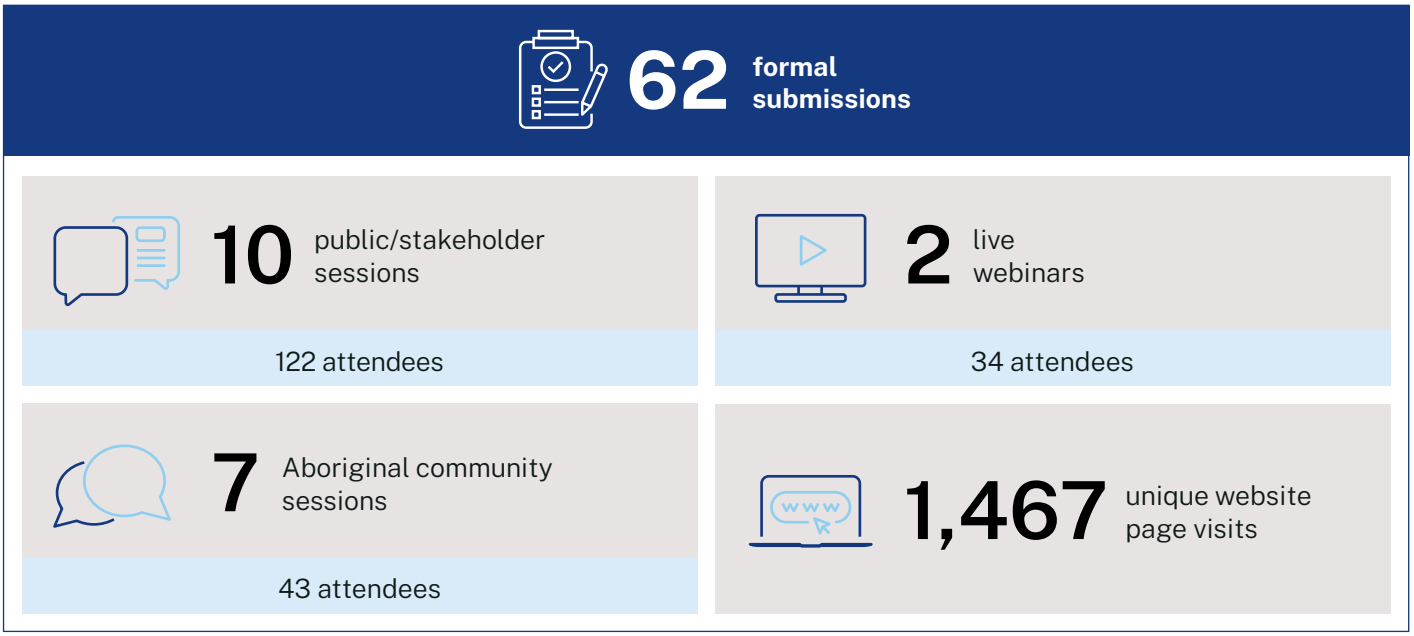
The section *What the future climate could look like in the Namoi region* sets out the results from the analysis of the new climate data for the region. We will continue to use the best and latest evidence about the future climate to help develop solutions for water challenges in the region.

Extensive community consultation

Developing an effective and lasting regional water strategy requires input from Aboriginal people, landholders, community members, local councils, and industry and environmental groups. We would like to acknowledge and thank all of these groups and individuals for the time and effort they have given to providing input into the strategy.

We sought feedback on the Draft Namoi Regional Water Strategy through 2 public exhibition periods, as well as a range of targeted engagement sessions (Figure 5). Community feedback was critical in shaping the final regional water strategy and implementation plan.[6]

Figure 5. Stakeholder engagement during the public exhibition processes for the Namoi Regional Water Strategy



4. Data reconstructed from before instrumental records began, using sources such as tree rings, cave deposits and coral growth.
5. More information about these new climate datasets and how they are being used in our river system models is in the *Regional Water Strategies Guide,* www.industry.nsw.gov.au/water/plans-programs/regional-water-strategies
6. water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies/what-we-heard/namoi-regional-water-strategy

The key insights we heard are provided in Figure 6 below.

Figure 6. Summary of community feedback received during consultation of the Draft Namoi Regional Water Strategy and consultation paper

Feedback theme	Feedback summary
Water for Aboriginal people	• We heard during consultation that access to waterways is critical to providing a purpose and pathway for young people to connect to culture and provide a space for healing, as well as for food, medicine and teaching. In addition, access water entitlements now require Gomeroi and Kamilaroi people to buy it from the fully or overallocated market. • We know from consultation undertaken regionally and for the NSW Water Strategy, that there is strong community support for Aboriginal water rights and access, with the small amount of water in Aboriginal ownership frequently identified as a key area for improvement. Gomeroi statement – (full statement is available in Attachment 1) 'We can't sing our song no more, we can't live on the river no more to look after her, for you all.' (Gomeroi) 'Yaama Nginda Gomeroi Wunnungulda. We are Gomeroi, we have our way of doing business. You have to be invited to sit around our fire. We share language and we engage together. You are asked to identify who you are and what you represent and be clear in your intent. Then, and only then can we do business together.'
Ecological and environmental resilience	• Support for protecting and sustaining the health of ecosystems and biodiversity. • Mixed feedback about actions relating to floodplains, with general support for removing unapproved floodplain structures, but differing views about fully implementing the NSW Floodplain Harvesting Program.
Water security for towns	• Mixed feedback about the proposed new Dungowan Dam and pipeline project with strong support as well as strong opposition for this action. Some stakeholders raised concerns about including the proposed new Dungowan Dam in the strategy's base case analysis, given the uncertainty around funding for the project at the time of public consultation. The Dungowan Dam has not been carried through to the final strategy. • General support for the sustainable growth of regional centres, but caution about growth being at the expense of smaller communities and impacts to other water users or the environment. • Investigating water efficiency and demand management measures was widely supported. • Strong support for water recycling and reuse of storm and wastewater and calls for state government to fast-track community engagement programs.
Knowledge and data	• Stakeholders raised concerns about the reliability and accuracy of river gauges. There was concern that some gauges only provide updates on a 24-hour basis which is not frequent enough during high flow and flood periods. Gauges need to be updated more than once a day to assist in decision making. • Public access to reliable data, information and modelling about groundwater and surface water was generally supported. • Some people expressed a lack of confidence in current groundwater modelling, with requests for a better understanding of the relationship between surface water and groundwater.

Economic, environmental and hydrological analyses

Robust assessments have been used to prioritise the actions in the regional water strategy, including:

- hydrologic analysis of options that had the potential to change the supply, demand or allocation of water
- cost-benefit and cost-effectiveness economic analyses through rapid and detailed assessments
- assessment of environmental impacts based on expert opinion, and detailed environmental watering requirement assessments based on hydrologic modelling
- qualitative assessments based on feedback from experts, Aboriginal people and the community.

The various analyses in the regional water strategies are based on the best available information at the time. As with all types of analyses, a range of assumptions are made. Significant changes to the critical assumptions used in the strategy may trigger the need to review or amend the strategy.

Critical assumptions adopted within the analysis include:

- **Town water supply risks** focused on surface water availability and do not include any consideration of existing alternative supply sources such as groundwater or desalination plants.
- **Population changes** have been included in accordance with the median population growth forecasts in the NSW Government's Common Planning Assumptions. For Tamworth population growth estimates vary significantly from 10–50% over the coming decades. The strategy has adopted a conservative growth rate for Tamworth by adopting a hybrid approach, assuming an annual growth rate of 1.02% between 2036 and 2041 and 0.5% from 2041 onwards. This aligns with existing NSW common planning policy documents.
- **Water use and industry mix in the region** were assumed to be constant over the 40 years examined. Significant changes in the nature of the crops produced, or the industry mix in the Namoi region will change the amount of water used and may require a review of the strategy.

Climate variability outside the bounds of the variability of the climate data sets used to inform this strategy may also necessitate future review of the Namoi Regional Water Strategy.

Glossy Black Cockatoos in wattle tree.

Existing studies

A significant amount of work has been undertaken to understand the risks affecting water resource management in regional NSW.[7]

In the Namoi, this has included catchment studies, water security reports and existing water allocation and drought planning, as well as regional development, infrastructure and environmental strategies prepared by NSW Government departments and agencies. The following studies were critical for informing the Namoi Regional Water Strategy:

- WaterNSW's 20 Year Infrastructure Options Study for Rural Valleys
- the Dungowan Dam final business case[8]
- the Independent Review of the Northern Basin First Flush Assessment[9]
- the *Independent Assessment of Social and Economic Conditions in the Murray–Darling Basin*, commissioned by the Australian Government[10]
- the Department of Planning and Environment's Long-Term Water Plan for the Namoi region
- the Australian Competition and Consumer Commission's inquiry into markets for tradeable water rights in the Murray–Darling Basin.[11]

The strategy has also been guided by NSW's commitments under the Murray–Darling Basin Plan.

Building on existing commitments and reforms

The NSW Government has made significant commitments to address the risks associated with water in regional NSW and to prepare our regions for the future.

Some of the statewide water reforms include:

- improving water and sewerage services for Aboriginal communities
- improving compliance and transparency around water use and access
- implementing robust metering laws to ensure the vast majority of water taken in NSW is accurately measured and monitored.[12]

In 2020, the department commenced implementation of all of the environmental water reforms that arose from the Water Reform Taskforce, which was set up following the *Independent Investigation into NSW Water Management and Compliance* report.

During the 2017–2020 drought, state government assisted the Namoi region's local councils to undertake emergency works to address water security issues and funding projects for the towns of Walcha, Tamworth and the Liverpool Plains under the Critical Drought Initiative and Emergency Relief for Regional Town Water Supplies programs.

In 2023 the NSW Government has also been providing support to Walgett Shire Council to help move from groundwater back to river water and improve water quality.

The Aboriginal Communities Water and Sewerage Program funds water supply operation and maintenance for Aboriginal communities in Walhallow and Walgett.

Regional water strategies build on the foundation provided by existing actions being taken by governments to improve water security and reliability in our regions.

7. More information is in the *Regional Water Strategies Guide,* www.industry.nsw.gov.au/water/plans-programs/regional-water-strategies
8. Dungowan Dam business case summary available at: water.dpie.nsw.gov.au/water-infrastructure-nsw/dam-projects/dungowan-dam
9. Available at: www.industry.nsw.gov.au/water/allocations-availability/northern-basin-first-flush-assessment#:~:text=The%20Independent%20Panel's%20final%20report%2C%20which%20assesses%20management%20of%20the,Northern%20Basin%20First%20Flush%20event
10. Available at: www.mdba.gov.au/publications/independent-reports/independent-assessment-social-economic-conditions-basin
11. Available at: www.accc.gov.au/focus-areas/inquiries-finalised/murray-darling-basin-water-markets-inquiry-0#:~:text=On%207%20August%202019%20the,in%20the%20Murray%2DDarling%20Basin
12. The NSW and Australian governments have committed $23.6 million and $12.5 million respectively to the metering program to ensure that meters are upgraded effectively. This includes rebates for water users who switch to telemetry-based systems.

The Namoi region

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Kangaroos grazing near new housing estate, Tamworth.

Figure 7. Snapshot of the Namoi region

94,700
population

43,000
km^2 area

Aboriginal nations:
Gomeroi/Kamilaroi

Regional centres include:
Tamworth, Gunnedah and Narrabri

Smaller towns and localities include:
Barraba, Manilla, Nundle, Quirindi, Caroona, Breeza, Tambar Springs, Walgett, Wee Waa and Werris Creek

Main rivers:
Two main river systems. The Peel River and the Namoi River

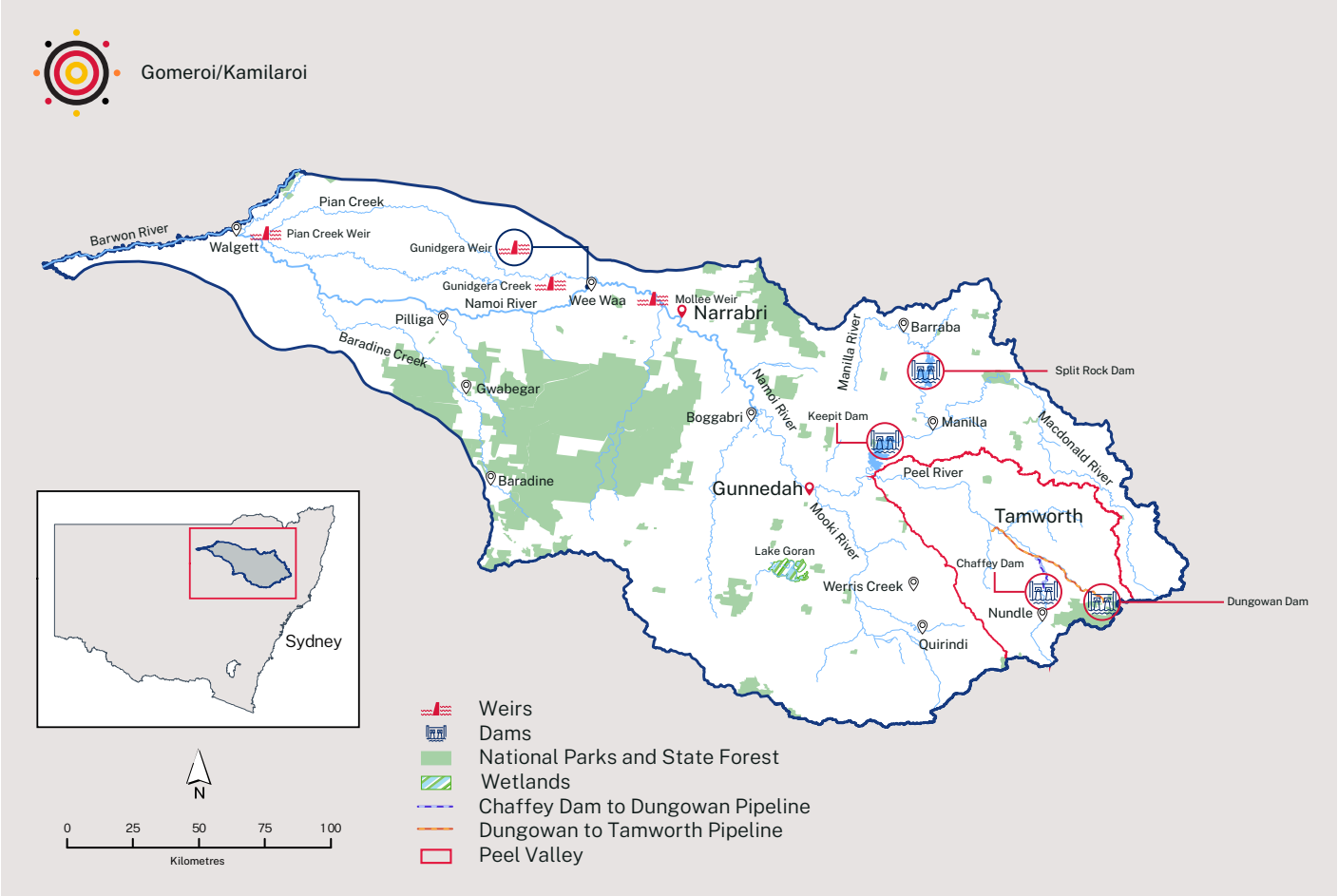
Major water storages:
Keepit Dam, Chaffey Dam, Split Rock Dam, Dungowan Dam and Quipolly Dam

Groundwater sources:
Upper Namoi Tributary Alluvium (Currabubula Alluvial, Quipolly Alluvial, Quirindi Alluvial), Peel Alluvium, Manilla Alluvial, Upper Namoi (Zones 1–12), Lower Namoi, Great Artesian Basin Surat Shallow, Surat, Southern Recharge, Gunnedah–Oxley Basin Murray–Darling Basin, Peel Fractured Rock and New England Fold Belt Murray–Darling Basin

Key environmental assets:
A range of significant ecosystems include Lake Goran and various billabongs, lagoons and floodplains. Some threatened or key species that are flow dependent or heavily reliant on water include the Murray Cod, Bell's Turtle, Sloane's Froglet, many water birds, rakali and platypus

Gross Regional Product: **$6.36 billion**

Figure 8. Map of the Namoi region



The Namoi region is located within the traditional lands of the Gomeroi/Kamilaroi nation who have lived in the region for over 60,000 years. Water is the lifeblood of Aboriginal people. It allows kinship, connection, stories, songlines, healing through medicine and food. Healthy waterways and groundwater systems are critical to Aboriginal communities for culture, health and wellbeing. The lands and water of the Namoi catchment contain places of deep significance to Aboriginal people that are central to their spiritual and religious belief systems.

The Namoi region is a relatively large catchment, covering 43,000 km^2 and stretching over 350 km from the Great Dividing Range near Tamworth to the low-lying alluvial floodplains that connect to the Barwon–Darling River near Walgett in the west. This region includes:

- the Peel Valley, including the city of Tamworth
- the Upper Namoi catchment: covering Barraba and Manilla
- the Lower Namoi catchment: extending from approximately Gunnedah to Walgett.

The Namoi region has a diverse climate and landscape, ranging from cool, high rainfall areas in the rugged terrain in the east to semi-arid, low rainfall areas on extensive riverine plains in the west.

The area is home to a range of locally and nationally significant ecological communities which support a high diversity of flora and fauna species. These important ecological sites include remnant forests in the Kaputar National Park, Warrabah National Park, the Pilliga Forest and Pilliga Nature Reserve as well as significant wetlands including Lake Goran, Barbers Lagoon and Gulligal Lagoon. These areas host a range of unique and threatened native flora and fauna species and are key to migration and life cycles of many bird and fish species that occupy the area.

Environmental assets in the Namoi contribute to the wellbeing of the community and liveability of the region, as well as providing recreational opportunities and attracting tourism. The natural environment also supports the economy by providing resources and raw materials, as well as ecosystem services such as carbon sequestration, water purification, managing flood risks and nutrient cycling.

The Namoi region is home to around 95,000 people who live predominantly in and around the regional centres of Tamworth, Gunnedah and Narrabri. For these communities and smaller communities spread across the region access to reliable good quality water is essential to their long-term liveability. For many towns across the Namoi region surface water is not a reliable source. Due to this, the Namoi is one of the most groundwater dependant regions in the Murray–Darling Basin.

The Namoi region is a highly fertile and productive region and has been one of NSW's prime agricultural regions since the late 1820s. It hosts some of the largest livestock processing facilities in Australia which support national and international markets. In addition, the Gunnedah Coalfield is one of the 5 major coalfields in NSW, with a number of coal and coal seam gas mines currently operating or proposed for development in the future.

Mining and agriculture are the key economic drivers for the region. Together these industries employ over 10,000 people and account for over 20% of the region's economic output. The success of these industries is closely linked to the availability of water to support operations. In dry times a reduction in output from these industries can have flow on effects to the broader economy.

Environmental significance of the Namoi region

Water is a significant feature of the Namoi region's landscape and environment, with its interconnected systems of rivers, creeks, aquifers and wetlands. The Lower Namoi River in particular is characterised by a network of anabranches, small tributaries, lagoons and wetlands across the floodplain, which need periodic flooding to maintain good condition. Connectivity plays a key role in supporting the environmental needs of the region as well as downstream sites. On average the Namoi region contributes 24% of the flows into the Barwon–Darling River and is a key contributor to water in the Menindee Lakes system.

Across the Namoi and Peel catchment systems, high value river reaches such as instream pools and low-flow channel refuges provide vital habitat supporting local and migratory species and threatened native fish such as the Eel-tailed Catfish and Southern Purple Spotted Gudgeon. Due to the natural wet dry cycles in the region, groundwater also plays an important role in sustaining plant and animal life by recharging waterholes, wetlands and streamflow, during long dry periods.

For communities across the Namoi region, environmental assets play a crucial role in the liveability of the region, as well as providing recreational opportunities and attracting tourism.

Addressing the environmental challenges facing the Namoi region

Changes in water use and land use across the region have impacted the health of native populations and their ecosystems. The changes to flow patterns and the construction of instream barriers have put many native fish species under pressure by reducing water quality and limiting their ability to carry out lifecycle migration.

The potential for longer and more severe droughts will increase the risk of ecosystem damage and decline in connectivity. Managing these risks will need coordinated and cooperative action across all parts of the community, as well as a better understanding of how potential future climate scenarios may impact on different parts of the environment.

A range of water reforms, including the dedication of water to the environment and connectivity improvement measures, have sought to stop further decline and improve the condition and resilience of these environmental assets. However, parts of the catchment are still in poor condition and climate change will increase the risk for many species and ecosystems.

Through strategic planning, the NSW Government aims to further build on these reforms and enhance the natural environment by:

- improving knowledge of the region's environment and its water needs
- introducing measures to support flows and water quality at a catchment level
- supporting better cultural involvement in water
- improving the long-term outcomes of water for the environment.

The Namoi Regional Water Strategy outlines a suite of actions that will be delivered by the NSW Government to advance water for the environment in the Namoi region.

More information and analysis of the Namoi region's ecological assets and challenges is available in the Namoi Regional Water Strategy Consultation Paper, which is available at www.dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/public-exhibition/namoi-regional-water-strategy

Water use in the Namoi region

The major dams in the Namoi region are:

- Chaffey Dam (100 GL state-owned dam) and Dungowan Dam (6 GL council owned dam) in the Peel Valley
- Keepit Dam (425 GL) and Split Rock Dam (397 GL) both are state-owned dams in the Namoi Valley
- Quipolly Dam (5 GL) is a council owned dam in the Namoi Valley near Quirindi.

These dams provide water to support towns, industry, irrigators, livestock, domestic users and environmental flows.

The region's largest water user is agriculture, with most of the surface water and groundwater licences held by agricultural enterprises (Table 1).

Approximately 1% of the licences are managed by state and commonwealth environmental water holders.

Table 1. Regulated and unregulated river licences in the Namoi catchment

Regulated Namoi River			Unregulated Namoi and Peel River water sources		
Entitlement	Proportion of shares compared to total share pool (%)		Entitlement	Proportion of shares compared to total share pool (%)	
	Upper Namoi	**Lower Namoi**		**Namoi**	**Peel**
Domestic and stock	0.5	0.5	**Domestic and stock**	0.5	1.2
Local water utility	1.5	0.6	**Local water utility**	1.7	31.6
High security	0.8	0.9	**Unregulated (general)**	97.3	67.2
General security	97.2	67	**Unregulated (special additional high flow)**	0.5	N/A
Supplementary	N/A	31			

Source: Water Sharing Plan for the Upper and Lower Namoi Regulated River Water Source 2016, and Water Sharing Plan for the Namoi and Peel Unregulated River Water Sources 2012

The Namoi Valley is one of the most groundwater dependent regions in the Murray–Darling Basin. This dependency on groundwater increases as surface water declines during the regular dry periods in the region.

In the Peel Valley, there is less access to reliable good quality groundwater. Due to this, towns rely heavily on water from Chaffey and Dungowan dams, with irrigation needs often relying on both surface and groundwater.

Table 2. Groundwater licences in the Namoi catchment

Groundwater			
Entitlement	Proportion of shares compared to total share (%)		
	Lower Namoi	**Upper Namoi**	**Peel Valley**
Basic landholder rights	2.6	1.1	0.5
Domestic and stock	0.0	0.0	0.4
Local water utility	5.0	5.2	1.2
Aquifer access	92.5	93.7	35.7
Aquifer (general security) access	0.0	0.0	62.2

Source: Water Sharing Plan for the Namoi Alluvial Groundwater Sources Order 2020
Notes:

- while most extraction occurs from the alluvial aquifers, they overlie porous and fractured rock groundwater sources that have additional shares which are not included in this table
- for the purposes of this table, Upper Namoi includes Zones 1-12, Quipolly, Quirindi and Currabubula Groundwater Sources
- for the purposes of this table, Peel Valley includes Peel and Manilla Groundwater Sources.

Image courtesy of Gerhard Koertner, Department of Planning and Environment. Rock cliff next to creek, Warrabah National Park.

What the future climate could look like in the Namoi region

3

Machine harvesting cotton, Namoi Valley.

Climate data and modelling used to develop the strategy

We have used 3 climate data sets to understand the key regional challenges and to assess the effectiveness of actions under different climate change scenarios.

- **Historical data:** about 130 years of observed rainfall, temperature and evaporation records collected by the Australian Bureau of Meteorology.
- **Long-term climate variability risk data (stochastic data):** 10,000 years of stochastically-generated climate data developed using paleoclimatic information by the University of Adelaide, Australia.
- **Dry climate change scenario:** modified version of the long-term climate variability data, scaled up or down using the NSW and Australian Regional Climate Modelling (NARCliM) climate projections. These scaling factors compare the baseline period of 1990–2009 with climate projections for the periods 2020–2039 and 2060–2079. We apply these scaling factors to every climate timeseries used in the modelling.

Combined, these 3 datasets provide us with a range of plausible climate futures, that cover a range of wet and dry sequences.[13]

Why we have used the dry 'worst-case' future climate scenario?

The regional water strategies planned for climate change by using a dry 'worst-case' climate change scenario. The dry future climate change scenario[14] is the SRES A2 which represents a high carbon emissions scenario, and therefore results in higher projected climate change impacts on the region.[15] This is not a forecast of how climate change is expected to eventuate, but it is one possible future outcome.

This scenario assumes that governments around the world will not take any action to reduce carbon emissions. This scenario may not occur because many governments around the world are already taking action on climate change. However, using this 'worst-case' scenario helps us to plan strategically and to focus on the key challenges facing a region. It also helps us understand how different options might work in a very dry climate in the future.

Considering the worst-case climate scenario together with current climatic conditions is appropriate for this type of strategic-level assessment. It allows us to assess the full range of risks to the water system. We will need to complete more refined assessment of climate change risk when we implement many of the regional water strategy actions. These additional assessments will be based on both the action's planning horizon and the latest climate science.

This recognises that policy and operational decisions with short-term planning horizons should be based on shorter-term climate scenarios and risk management. When making long-term infrastructure and investment decisions, we will need to consider how the climate may change decades into the future. These longer-term climate scenarios may be more extreme than the shorter-term climate scenario.

Our climate science is continuously improving. The regional water strategies are an important first step to better understand the region's climate and the potential vulnerability of our towns, communities, industries and the environment to a more variable and changing climate. We know that the future climate is uncertain, and work is progressing to further enhance our understanding of the region's climate and how it affects our vital water resources, including groundwater.

13. For further details about the new climate data and modelling, please refer to, www.dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/climate-data-and-modelling
14. The scenario uses the regionally downscaled factors from the NARCliM 1.0 Project to adjust the long-term past climate scenario rainfall and evapotranspiration data. Further information on NARCliM 1.0 Project is available on the NSW Government, AdaptNSW website: www.climatechange.environment.nsw.gov.au/climate-projections-used-adaptnsw
15. The SRES A2 assumes a 2°C warming over the regional water strategy planning horizon.

Climate snapshot

The Namoi region has a naturally variable climate

Like many other inland catchments across northern NSW, the Namoi region cycles between wet and dry periods. Over the past 130 years of observed rainfall data, the region has undergone several transitions between wet and dry:

- the 1890s to 1940s the region was dominated by dry periods with most longer decadal droughts (10 years or more) occurring in this period
- the 1950s to 1990s was a comparatively wet period
- since the Millennium Drought, the observed record suggests a return to a dry period with multiple years of low inflows including the driest period on record. The 2017 to 2020 drought was the worst on record with the lowest 12, 24 and 36 months of inflows all occurring during this time.

The observed historic record also shows that within these dry and wet cycles, there are short intervals of wet or dry cycles that oppose the general climate cycle trend (Figures 9–10).

Pelicans, Lake Keepit.

Figure 9a. Lowest 3-year average rainfall in the Peel Valley

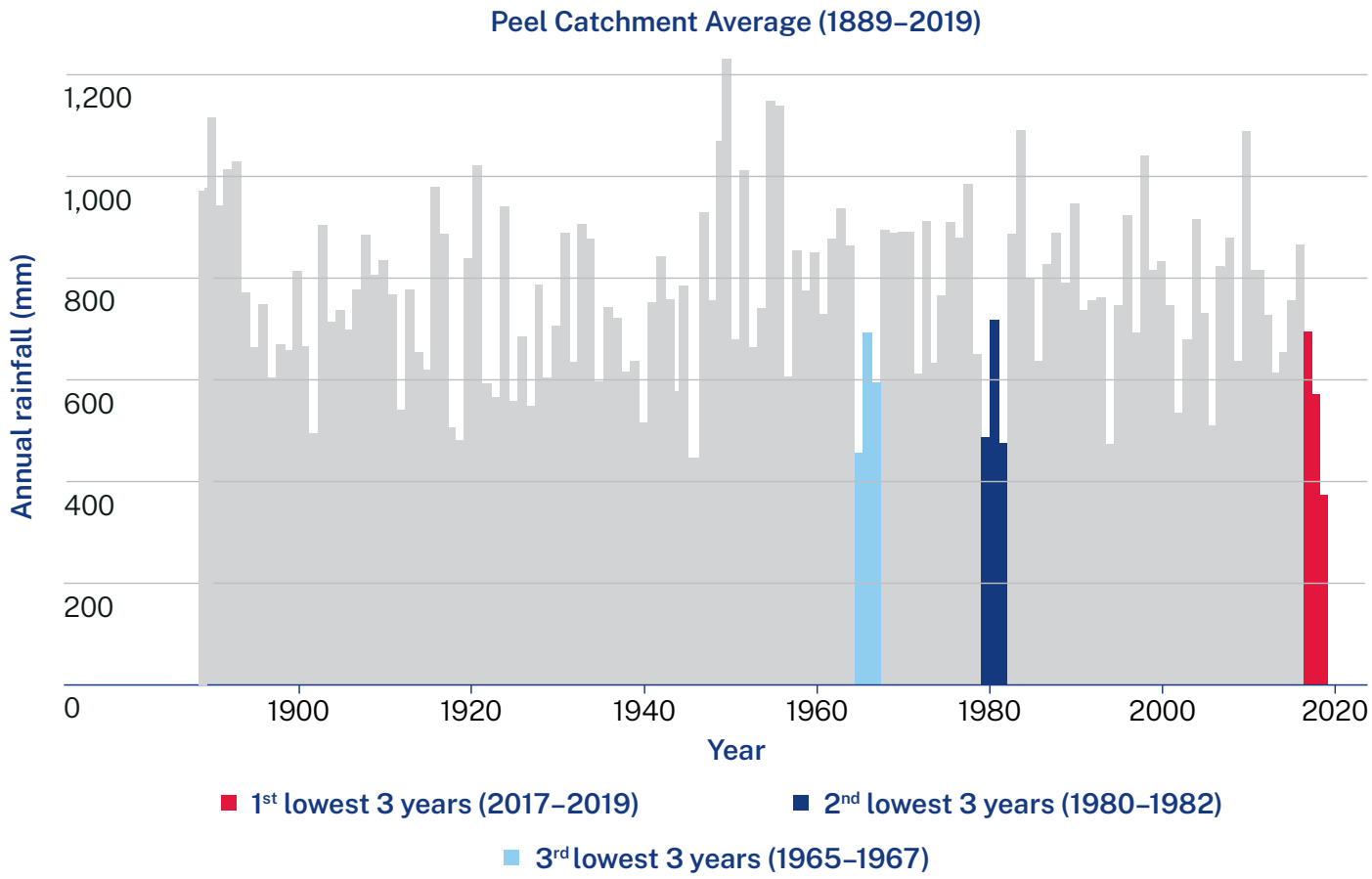


Figure 9b. Lowest 10-year average rainfall in the Peel Valley

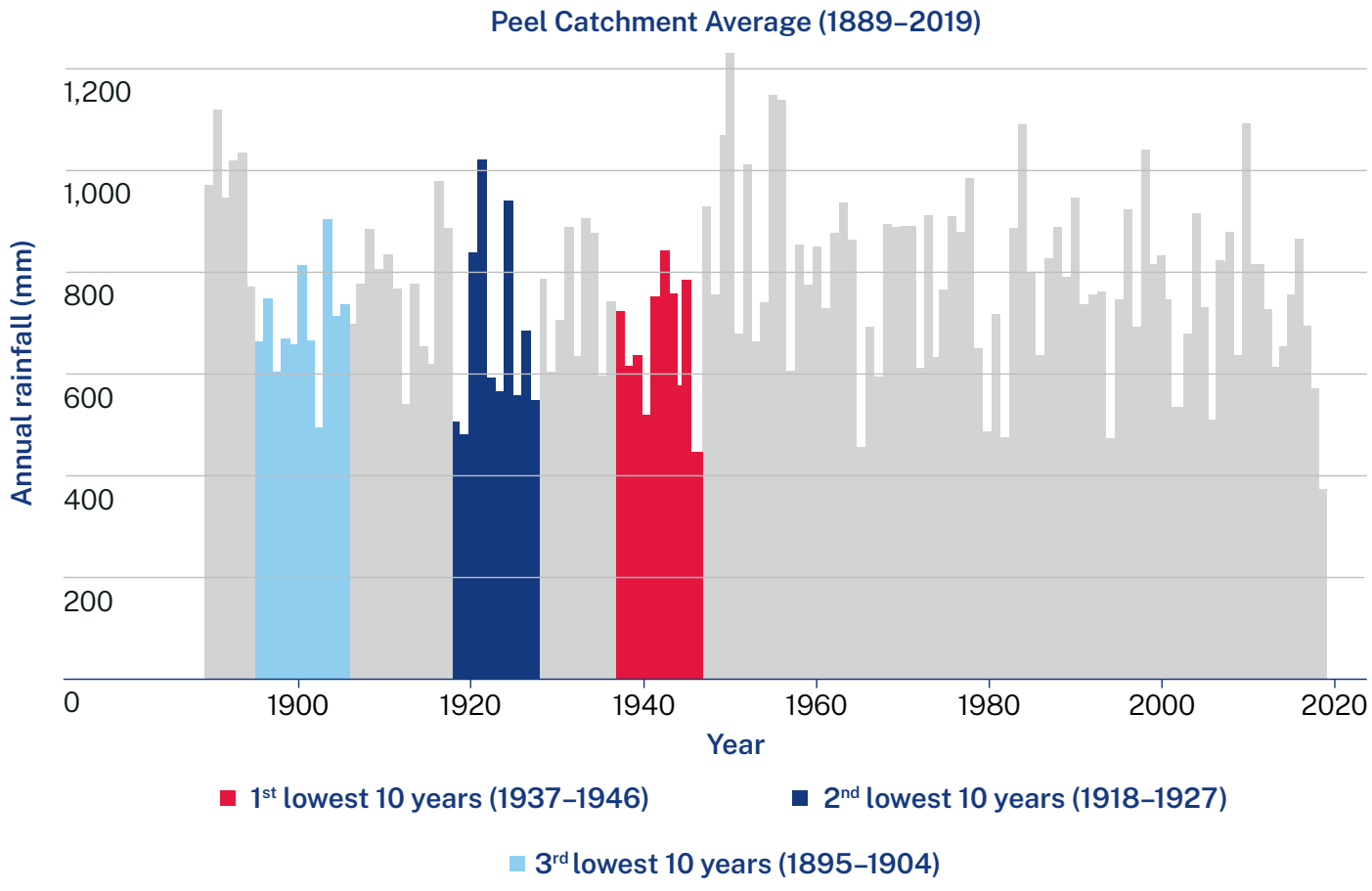


Figure 10a. Lowest 3-year average rainfall in the Namoi Valley

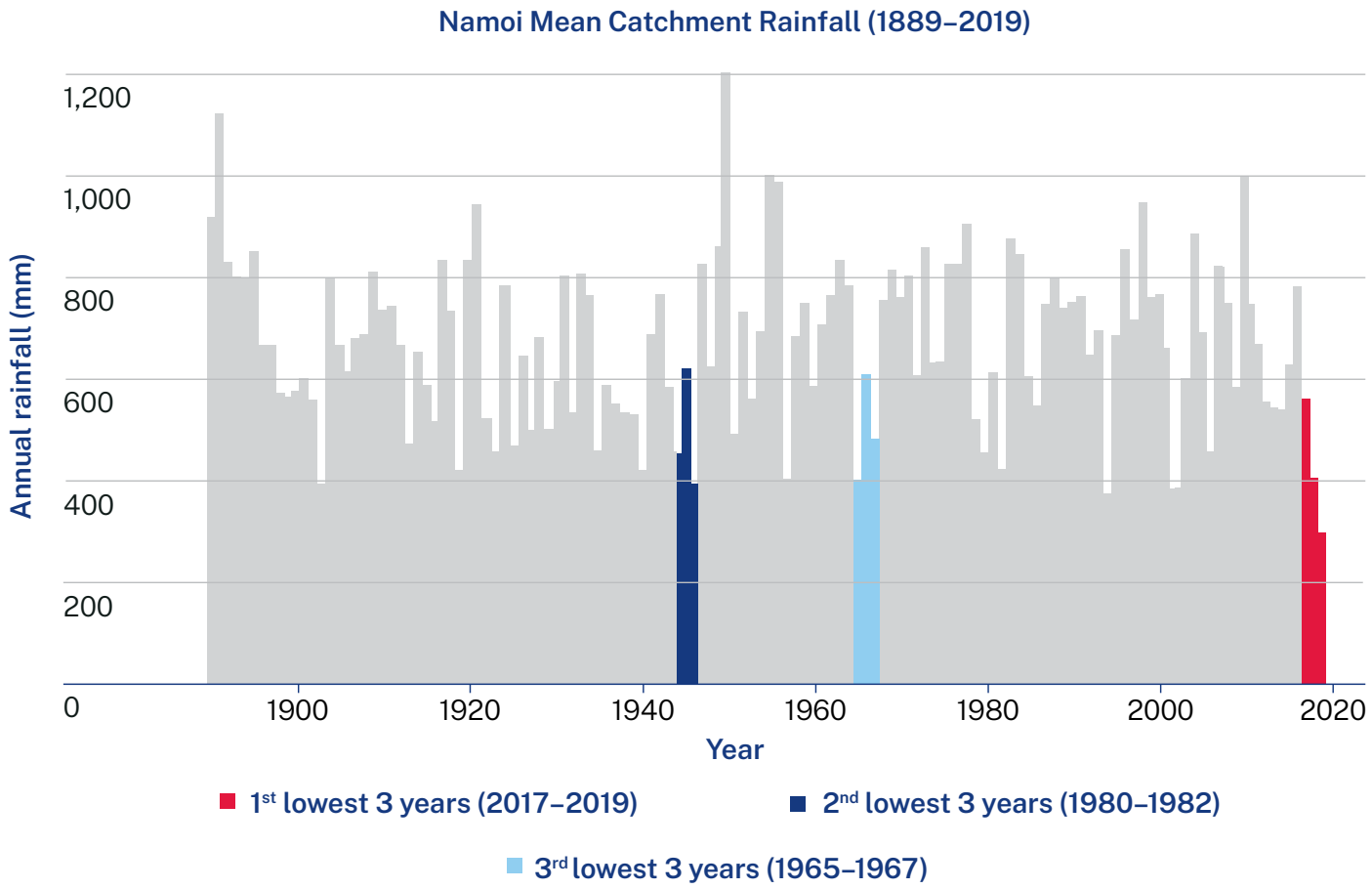


Figure 10b. Lowest 10-year average rainfall in the Namoi Valley

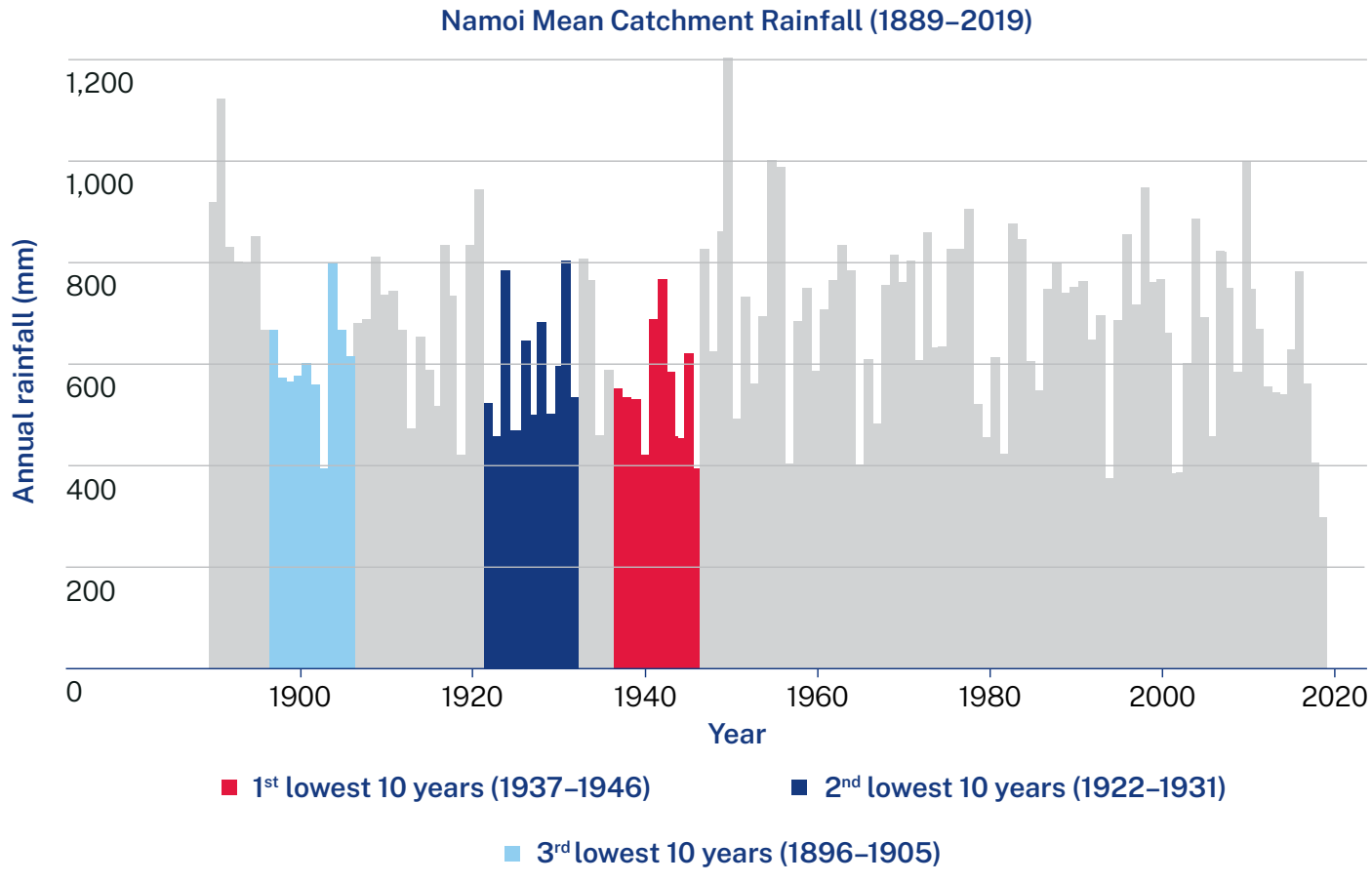


Image courtesy of Destination NSW.
Goonoo Goonoo Station, Tamworth.

Our latest data suggests that a future climate could be even more variable

We don't know for sure what the future climate will be like. It may be similar to what we have experienced in the past, or it might be drier than we have seen in our lifetimes.

The NSW Government has invested in new climate datasets. This new data has improved our hydrological modelling and gives us a better understanding of the natural variability of the climate, beyond the observed historical records.

Our analysis of different climate projections for the Namoi region tells us there could be more extreme wet and dry periods than what we have observed in our lifetimes. There is a potential for:

- changing rainfall patterns with reduction in average annual rainfall. Shifts in seasonal patterns are expected to cause a decrease in winter and spring rainfall by around 35% by 2079, and an increase in summer and autumn rainfall by 35% (Figure 11)
- increased evapotranspiration particularly in winter and spring
- higher on average minimum and maximum temperatures across the region which will include more hot days over 35°C
- more prolonged droughts and more frequent, shorter periods of drought
- extreme events could become more extreme – both at the wet and dry ends of the spectrum. Under a dry climate change scenario, the median volume of water flowing in the Namoi region each year could reduce, impacting all parts of the flow regime and while dams are unlikely to be empty, they could sit at critically low levels for longer periods
- increased risk of cease-to-flow periods in different parts of the river under a worst-case dry climate change scenario (Figure 12).

These impacts may not necessarily occur. They include results based on a deliberately conservative dry climate change scenario. But they can help us to begin planning for extreme events.

We need to plan for this uncertainty and fully understand the future risks we face.

Figure 11. Average monthly changes in rainfall for the Namoi region from climate change (NARCliM) projections

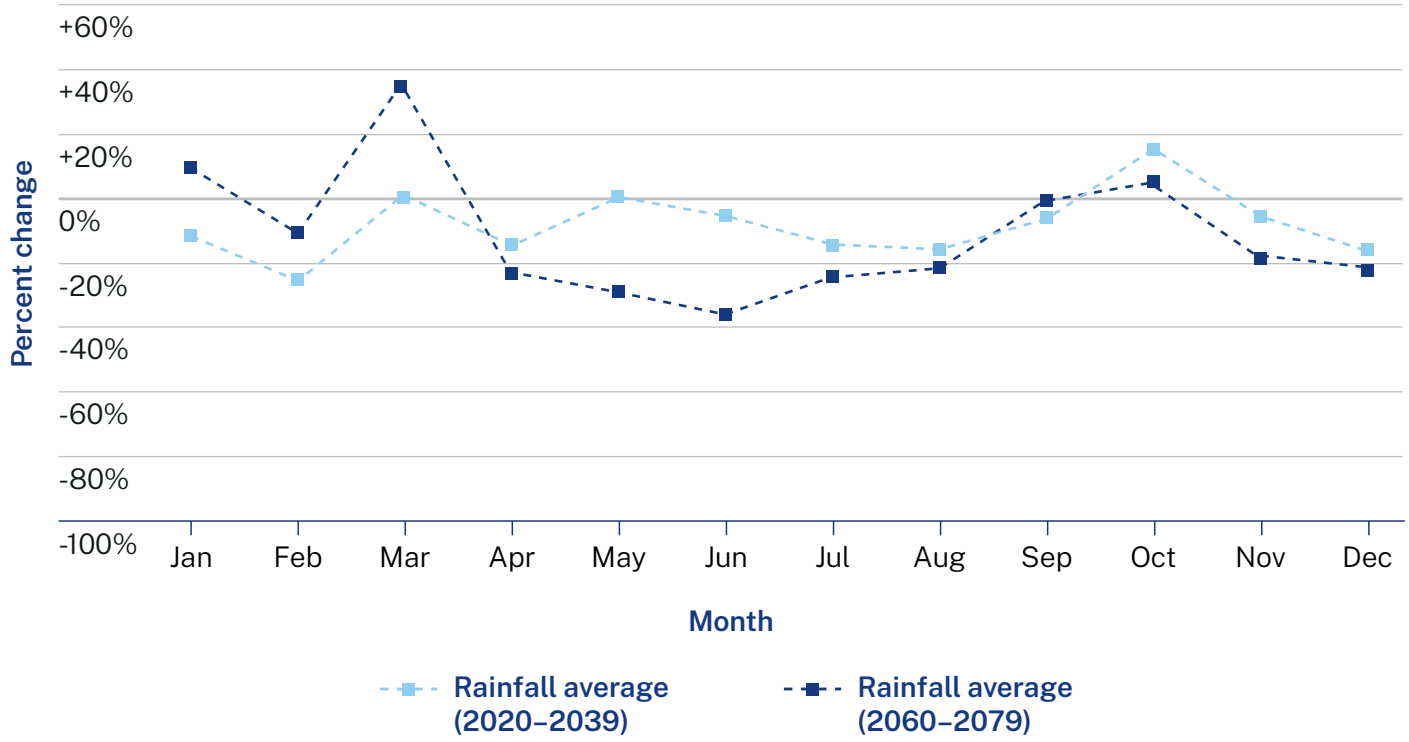


Figure 12. Impact of climate risk on cease-to-flow events in the Namoi and Peel rivers

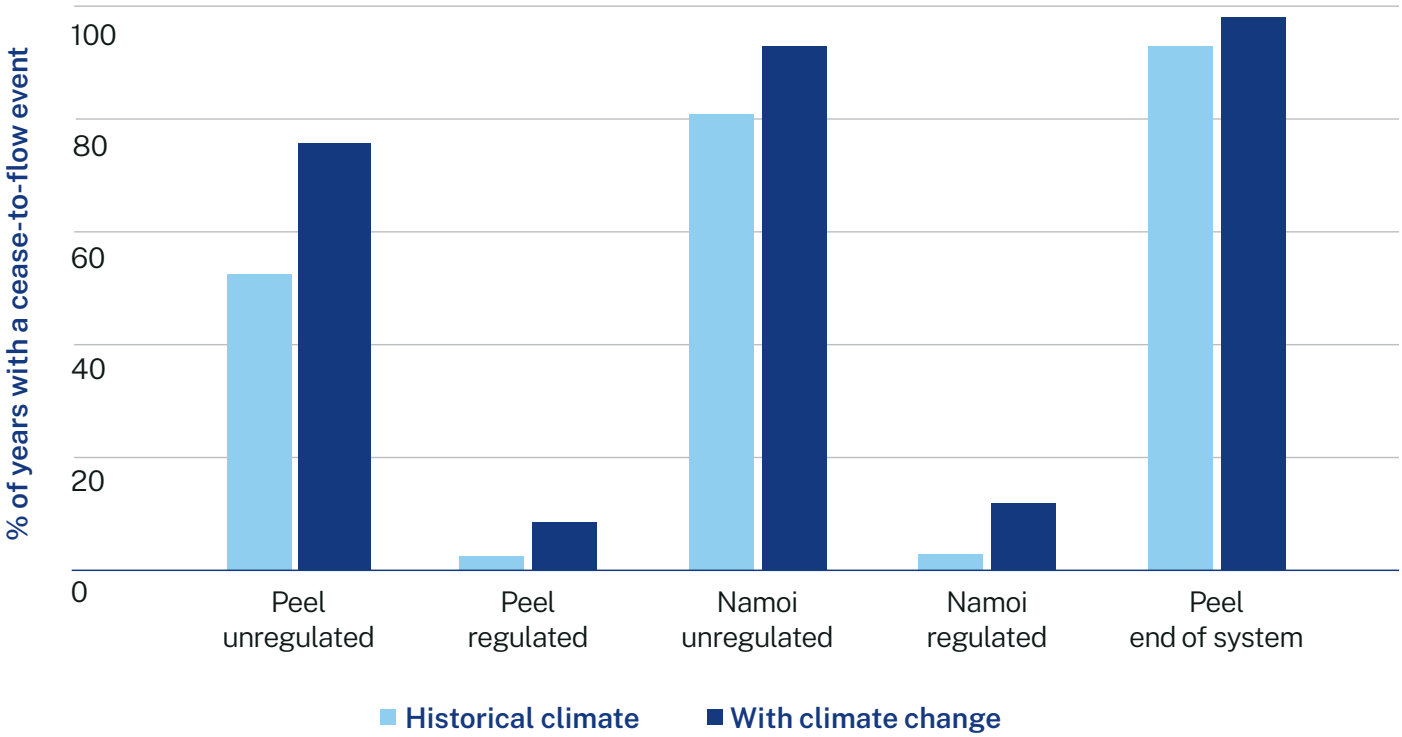


Image courtesy of Nicola Brookhouse, Department of Planning and Environment. Salt Caves Tower and visitor area, Timmallallie National Park.

The challenges facing the Namoi

4

Chaffey Dam in the Peel Valley.

Like all regions across Australia, the Namoi faces a warmer and more variable climate. We need to transition to a scenario where we do more with less water, make smarter decisions about our water use and management – armed with better knowledge and information – and protect our most critical water needs.

We have identified 5 key challenges that are immediate priorities for the region.

- Addressing Tamworth's long term water security risks
- Addressing water security risks of regional towns across the Namoi Valley
- Improving the health and resilience of the region's aquatic and floodplain ecosystems
- Addressing barriers to Aboriginal water rights
- Supporting a growing regional economy in a future of potentially reduced water availability

Addressing these challenges will help us meet the vision and objectives we have set for the Namoi Regional Water Strategy.

Image courtesy of Destination NSW. Paradise Fresh, Tamworth.

Challenge: Addressing Tamworth's long term water security risks

Tamworth is an important regional centre

Tamworth is the largest regional centre in north-west NSW and an important hub for services and employment for the region. Currently, around 63,000 people – 65% of the Namoi region's population – live in Tamworth and towns across the greater Peel region. The city of Tamworth provides key services in manufacturing, transport, health care, entertainment, retail and education. Tamworth's gross regional product is currently $4.2 billion per year[16] and is growing at an average of 3.8% each year.

In addition to supporting social services for much of the inland north, Tamworth is of statewide significance to the agricultural and manufacturing industries. The area hosts some of the largest livestock processing facilities in Australia as well as distribution facilities that drive employment and help to link farmers in the region with national and international consumers. Because of this, Tamworth has:

- the largest number of agricultural employees for a local government area in NSW
- the highest number of food manufacturing employees outside metropolitan Sydney.

Tamworth is growing

Tamworth is expected to grow significantly in population, housing and employment over the next 20 years. Much of this growth will be stimulated by local, state and national investment in schemes such as the New England Renewable Energy Zone. These schemes will drive business and population growth across the north-east of NSW.[17] Population growth projections range from a 10% increase to a 50% increase over the next 20 years.[18] The economic growth of Tamworth is fundamental to the success of the Namoi region and surrounding regions.

A key challenge for all levels of government is to ensure that Tamworth's growth is sustainable. This includes ensuring access to reliable and secure water supplies, while retaining and enhancing the character of the environment, the town and surrounding regions.

16. REMPLAN gross regional product of Tamworth Regional Council, based on 2011 and 2020 data from the Australian Bureau of Statistics.
17. Tamworth Regional Council 2020, *Local Strategic Planning Statement 2020*
18. Department of Planning, Industry and Environment 2019, *Common Planning Assumptions*

There is a real risk that Tamworth could run out of water

For Tamworth to continue to grow, communities and businesses require confidence that water sources are reliable and able to support future demand. Currently, even without growth, there is a real risk that Tamworth could run out of water in a severe and prolonged drought. There could be extended periods when Tamworth residents are on high or persistent water restrictions.

Tamworth's water supply relies heavily on rainfall, making it vulnerable to droughts and climate change. The majority of Tamworth's water supply comes from Chaffey and Dungowan dams, and only a very small proportion comes from groundwater. The local groundwater source – the Peel Alluvium – is relatively small and unreliable during extended dry periods. The Peel Alluvium relies on rain or water from the Peel River and its tributaries to recharge the groundwater source.

When there is no rain and low river flows, groundwater levels drop quickly. This means that during severe drought, groundwater cannot sustain the needs of Tamworth for extended periods of time.

Without action to reduce demand or improve supply, Tamworth could go from full dams to running out of water within 6 years. The risk of Tamworth being in water restrictions for extended periods of time or running out of water will become more acute as the population grows (Table 3) or if climate change impacts involve drier conditions. Although these scenarios may not occur, analysis undertaken for the regional water strategies tells us that we need to have plans ready for this as a future possibility.

These risks demonstrate that doing nothing is not an option. All levels of government need to invest in multiple actions to address Tamworth's long-term water security risks and ensure that the city remains resilient to climate change impacts as its population grows. This includes both water efficiency and demand management, as well as options to increase supply for Tamworth Regional Council.

Table 3. Probability of Tamworth water supply being restricted under different climate and water demand scenarios if there are no changes to policy, infrastructure, or demand management

TWS* unrestricted water demand (ML/year)	TWS* water mean diversions (ML/year)	Nominal population	% of time under any restrictions	% of time under level 5 restrictions	Frequency of any shortfalls**
Tamworth water security under historical climate projections (paleo-stochastic climate dataset)					
9,200	8,900	50,000	17.7%	3.5%	1 in 1,400 years
11,000	10,500	60,000	21.3%	5.4%	1 in 516 years
Worst case dry climate change scenario (NARCliM)					
11,000	9,700	60,000	58.6%	30.3%	1 in 20 years
12,900	10,900	70,000	62.9%	36.1%	1 in 12 years

*TWS' as town water supply

**A 'shortfall' event is where Tamworth's water demands under level 5 restrictions cannot be met from the existing supply system because the dams are empty for 2 weeks or more. A 'major shortfall' is where the dams are empty for 3 months or more.

The townships of Manilla and Barraba are also within the Tamworth local government area but source water from the Upper Namoi catchment. Manilla relies on surface water from the unregulated Upper Namoi River, supplemented by supply from Split Rock Dam in dry years. Barraba relies on supply directly from Split Rock Dam but has some bores that can be used when needed.

Our analysis suggests that surface water is likely to be less reliable than previously thought for these towns. There could be a higher risk of Split Rock Dam being at critically low levels or empty for longer, increasing the water security risks for Manilla and Barraba (see Table 4).

Table 4. Probability of Split Rock Dam being at critically low levels

Split Rock Dam capacity	Historical climate projections (paleo-stochastic climate dataset)	Worst case dry climate change scenario (NARCliM)	Implications
3% capacity	0.5% (1 in 200 years)	5% (1 in 20 years)	Water is preserved for Manilla and Barraba only
Dead storage	0.2% (1 in 500 years)	2% (1 in 50 years)	Manilla will run out of surface water. Barraba can access dead storage

Challenge: Addressing water security risks of regional towns across the Namoi Valley

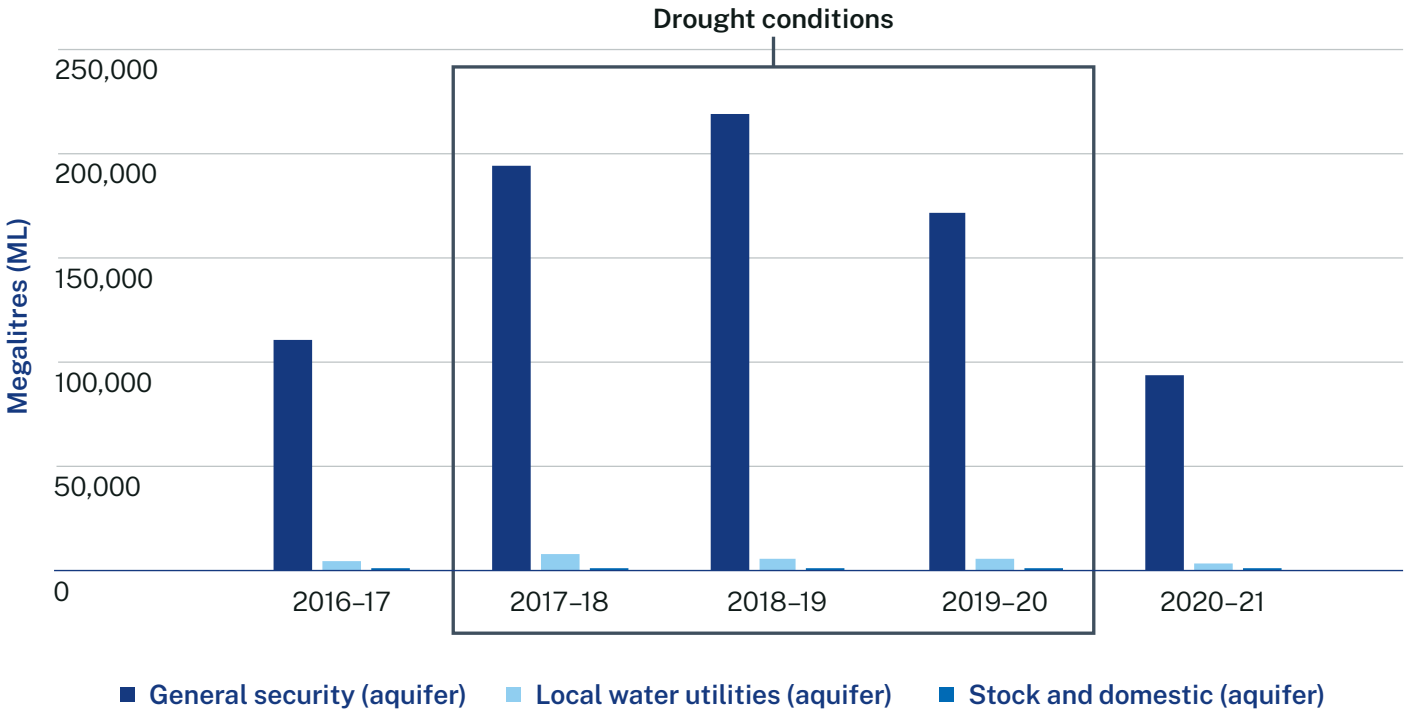
Gunnedah and Narrabri are important regional centres in the Namoi Valley. These large regional towns have a combined population of around 16,000 and provide a hub for important services to the surrounding rural areas. The population and economies of both centres are projected to grow in coming years, stimulated by major schemes and projects that are planned for the region. These include:

- Narrabri Gas Project
- expansion of Gunnedah coal mining industry
- Inland Rail project, which will connect Narrabri directly with ports and processing facilities in Queensland and Victoria.

Narrabri and Gunnedah rely on groundwater for their water supply. Many small towns in the region with populations below 3,000 also rely on groundwater, including Boggabri, Quirindi and Wee Waa. For most towns in the Namoi region, groundwater is their main or only source of water.

Most of the groundwater in the region is used for irrigation purposes. During extended dry periods many water users increase their use of groundwater compared to average years (Figure 13), and the amount of water recharging aquifers from rivers and rainfall is diminished. Combined, these conditions can result in severe localised water level drawdowns and create difficulties in accessing water for town water use until the drought breaks and the groundwater levels recover.

Figure 13. Licensed groundwater use in the Namoi and Peel valleys 2016–2021



During the recent drought (2017–20), there were declines in groundwater levels – for example, in Zone 4 of the Upper Namoi Groundwater Source, which supplies Gunnedah and Curlewis.

Groundwater-dependent towns in the region were able to maintain town water supplies during this period. However, had the drought continued for longer, local water level declines may have impacted the ability of some towns to maintain the same pumping rate from groundwater.

There is uncertainty in several locations about the implications of local short-term drawdowns in groundwater levels if future droughts are worse than what we have experienced in the past. The NSW Government collects data on groundwater levels at a regional scale; however, this information is often not sufficient to show local impacts on groundwater nor support council decision making. Because of the complexity of the aquifer systems, our knowledge of how these aquifers will react in future extended dry conditions is still developing. To better understand the short-term localised behaviour of aquifers, we need further data, modelling and investigations.

Some locations are also experiencing long-term declining trends in groundwater levels which are exacerbated during droughts. From 2006 until 2021, groundwater levels declined by between 2 and 5 m in the area south of Breeza (Upper Namoi Zone 8), where Caroona draws water. Over this period, groundwater levels declined by between 5 and 10 m in the area north of Wee Waa. In the longer term, a drying climate may increase long-term drawdowns.

During dry periods surface water is not reliable for towns like Walgett

Walgett, with a population of approximately 2,100, is largely dependent on water from Keepit Dam, which flows down the full length of the Namoi River. Bore water has been used to supplement water in Walgett during dry periods as well as in recent years. However, the groundwater can be saline and there is a strong community preference for surface water. Attracting and retaining skilled staff to operate treatment plants and manage water quality is a significant challenge.

Due to Walgett's distance from Keepit Dam (approximately 350 km) the township cannot rely on accessing water from the dam during drought periods. During the most recent drought the river was cut off for extended periods of times. At points only 1 ML out of every 20 ML released from the dam would make it to Walgett due to increased water seeping into surface soils and evaporation. A more variable future climate will mean that surface water is likely to become less reliable, increasing the probability of surface water supplies for Walgett failing (Table 5). Walgett may therefore need to rely more heavily on groundwater sources in future.

Table 5. Percentage of time when surface water supplies from the Namoi catchment to Walgett could fail under different climate scenarios

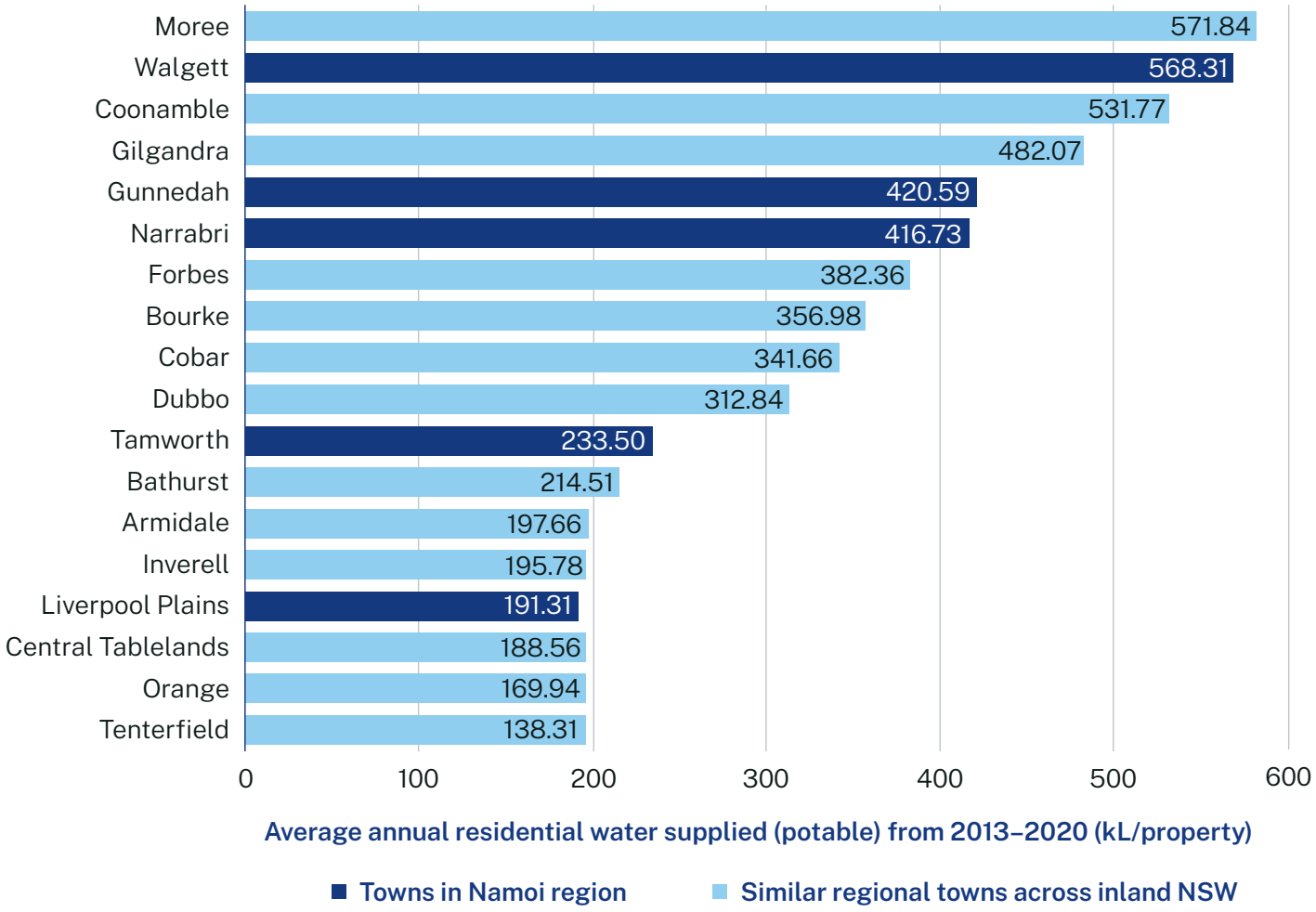
	Repeat of historic climate 1889–2021	Long-term 10,000-year climate projection	Long-term 10,000-year worst-case dry climate change scenario
Walgett	0.50% 1 in 200 years	2.0% 1 in 50 years	10.0% 1 in 10 years

Demand management and water-use efficiency can improve town water security

Programs to improve water-use efficiency, reduce leakage and reduce demand can help improve water security for these towns. Some towns have implemented rebates for more efficient appliances and community education programs to manage demand over multiple years.

Water demand per capita in the Namoi region is expected to be higher than the average for NSW, given the semi-arid and hot conditions. Between 2013 and 2020, some groundwater-dependent towns in the region were among the largest per capita residential water users in the state (Figure 14). During drought, water use in these towns remained similar to demand before the drought, whereas other similar towns that rely heavily on surface water reduced residential water use significantly. Tamworth reduced domestic water use by up to 52% – 286 kL per property in 2013 versus 140 kL per property in 2020.

Figure 14. Annual residential water (potable) supplied to regional towns in inland NSW (2013–20)



Source: www.industry.nsw.gov.au/water/water-utilities/lwu-performance-monitoring-data

Challenge: Improving the health and resilience of the region's aquatic and floodplain ecosystems

The Namoi region supports a rich and diverse range of water-dependent plants, animals and ecosystems. Platypus are abundant in the Peel Valley. The Namoi Valley is home to more than 40 waterbird species and 20 native fish species (including 5 threatened species), as well as floodplains, wetlands and endangered ecological communities.

The region is also home to a range of groundwater-dependent ecosystems, such as river red gums, which have been in decline in the Murray–Darling Basin and the wetlands surrounding Lake Goran.

These ecosystems provide habitat for migratory birds that are protected under international migratory bird agreements.

Flows in the river at different times of the year help support the life cycles of fish, animals and plants – providing cues for movement, growth and reproduction. Recharge of groundwater sources supports groundwater-dependent ecosystems.

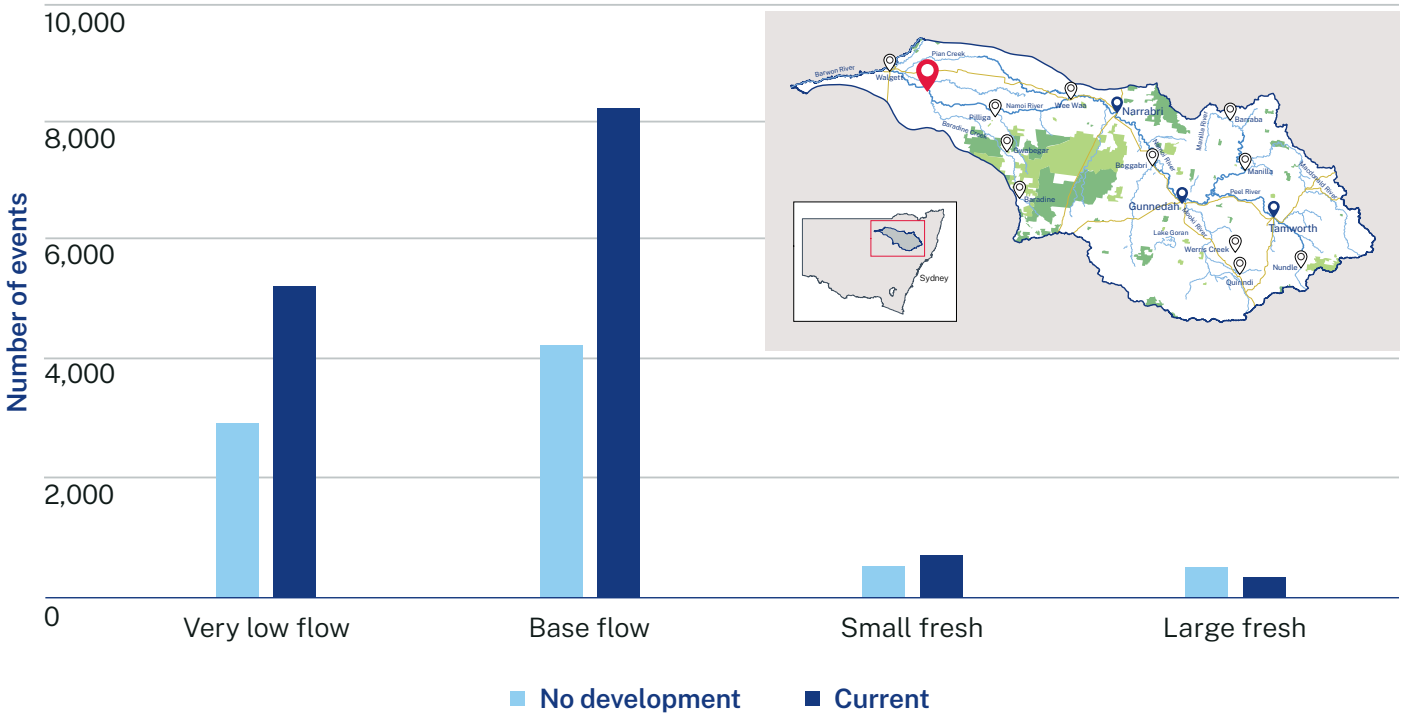
Water flows to the end of the system are declining

During the past 60 years, river flows across the Namoi catchment have changed significantly in response to the construction of 3 major dams – Keepit Dam (1960), Chaffey Dam (1979) and Split Rock Dam (1987) – as well as weirs, floodplain infrastructure, and industry and town development.

Modelling analysis has shown that there has been an increase in the number of base flows and small freshes in the lower end of the Namoi (Figure 15), supporting the critical needs of the environment during average and wet periods. However, the frequency of large freshes has decreased (Figure 15).

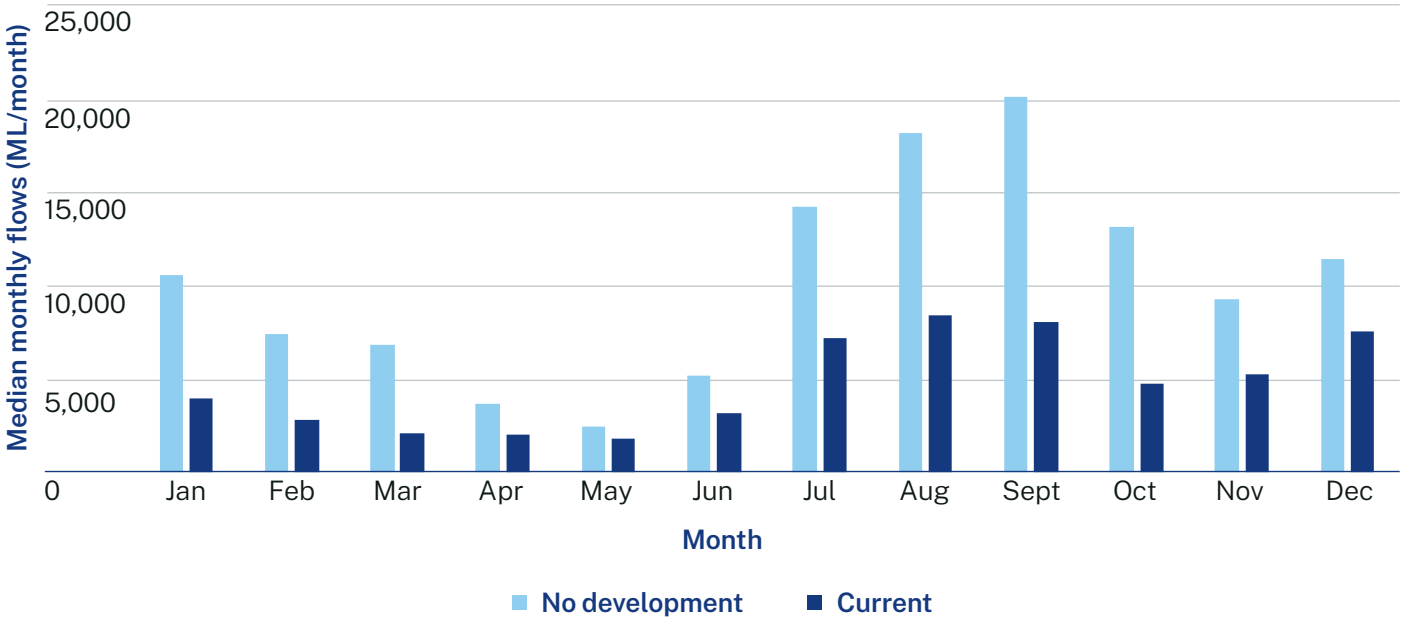
On average there is less water flowing to the end of the system (Figure 16) and cease-to-flow periods have increased in the mid and end of the system (Figure 17 and Figure 18).

Figure 15. Modelled frequency of flow events in the Namoi region at Goangra (end of system stream gauge 419026) with and without development for the period 1892–2020



Replenishment flows from dams that provide for essential supplies and consumptive water orders also support the needs of the environment; however, during dry periods replenishment flows cannot always be delivered especially to the river reaches in the Lower Namoi, because of very high seepage and evaporation in the river channel and the need to preserve water in dams for essential needs. For the same reasons, end of system flow rules are currently not designed to operate during dry conditions[19] when the need for water is greatest. This impacts on the ability to sustain critical human and environmental needs, especially in dry years, when the need is highest.

Figure 16. Modelled median monthly flow at the end of the Namoi catchment at Goangra with and without development for the period 1892–2020



19. During the 2017–20 drought, the end-of-system flow rule was not triggered 8 out of 9 months that it could have been triggered because of low storage levels.

Figure 17. Modelled cease-to-flow periods (<5 ML/day) at the end of the Namoi catchment at Goangra (stream gauge 419026) with and without development for the period 1892–2020

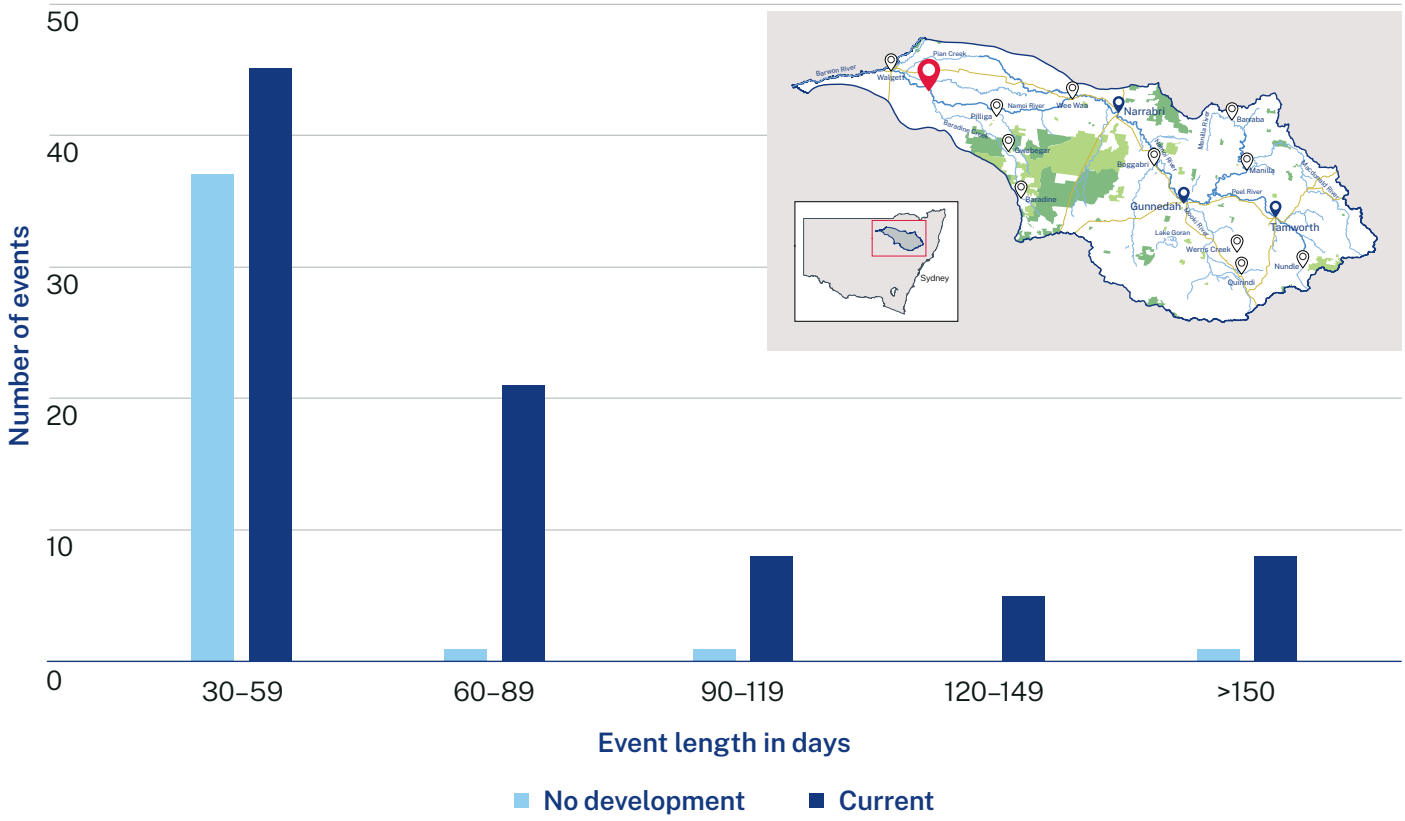
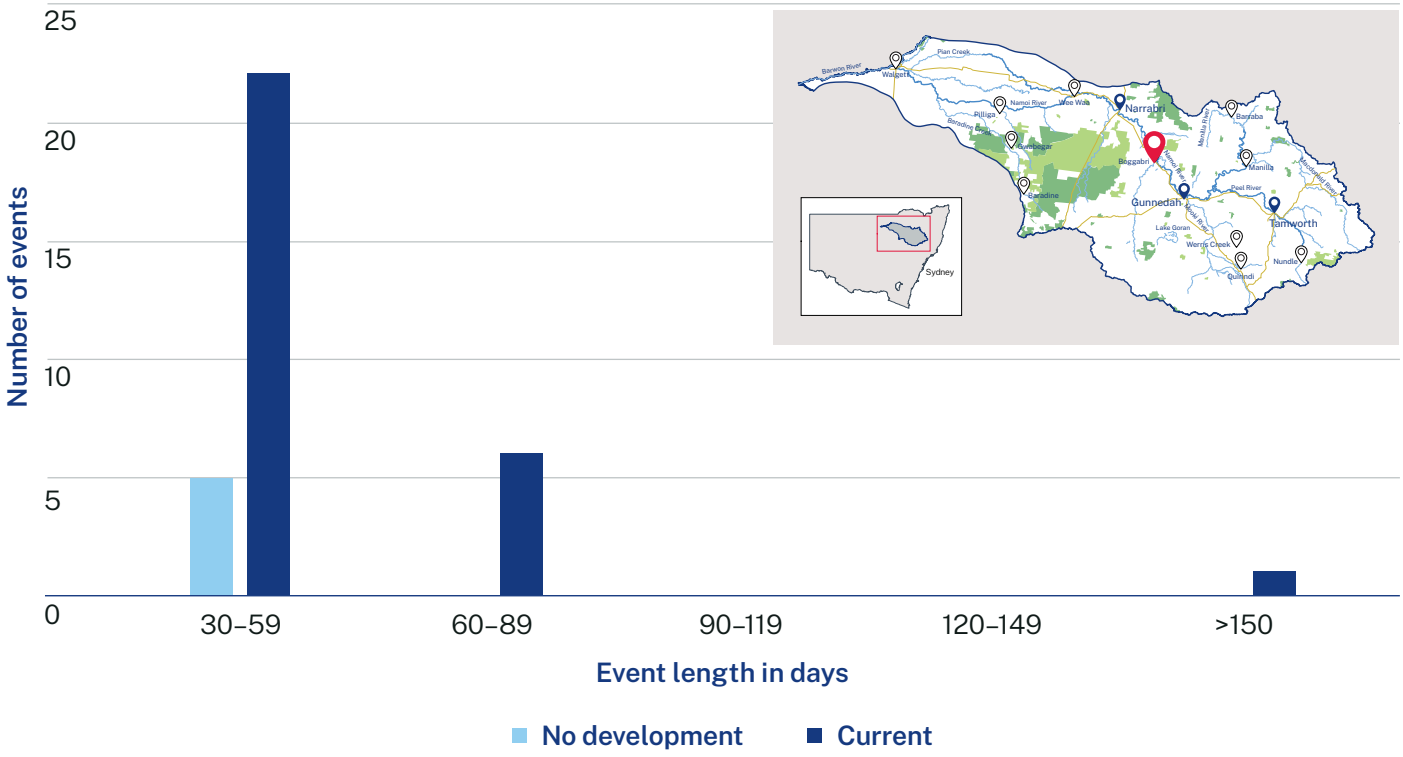


Figure 18. Modelled cease to flow periods (<5 ML/day) in the Namoi River in the mid system at Boggabri (stream gauge 419012) with and without development for the period 1892–2020



The past 20 years have been a dry period in our climate. If our future climate is similar to our long-term historical climate, end-of-system flows between the Namoi and Barwon catchments are unlikely to change significantly. If the dry climate change scenario from our modelling eventuates, in 40–80 years we could see:

- an overall decline in flows to the Barwon River – median flows into the Barwon–Darling River system may decrease by 60%, and there may be no flows at Walgett for 40% of the time
- a change in the seasonality of flows to the Barwon River, with a significant reduction in flows in winter, and a delay in peak flows from summer to autumn.

These changes could lead to longer periods when it is more difficult to meet critical human and environmental needs at the end of the system.

The timing and variability of flows are changing

Towards the middle of the Namoi catchment where there are large irrigation demands, modelling analysis shows there has been an increase in median flows during the summer months irrigation season (Figure 19), but a decrease in median flows during the winter months and less water flowing to the Lower Namoi overall. The lower overall flows to the Lower Namoi (Figure 16) have resulted in less surface water across the year and groundwater being relied on to support different water demands.

Aquatic populations need all types of flows at certain frequencies, duration and timing to maintain their health and resilience. Changes in flow patterns and seasons can impact on food resources from the riparian zone and disrupt natural cues of fish and aquatic plants and animal populations.

The gap between large freshes has increased, particularly at the end of the system. Figure 20 shows that when compared to a no development scenario, small freshes have increased in frequency, but the time between large freshes and overbank flows has increased.

Image courtesy of Nicola Brookhouse, Department of Planning and Environment. Pilliga National Park.

Figure 19. Modelled median monthly flow in the Namoi River at Boggabri for the period 1892–2020

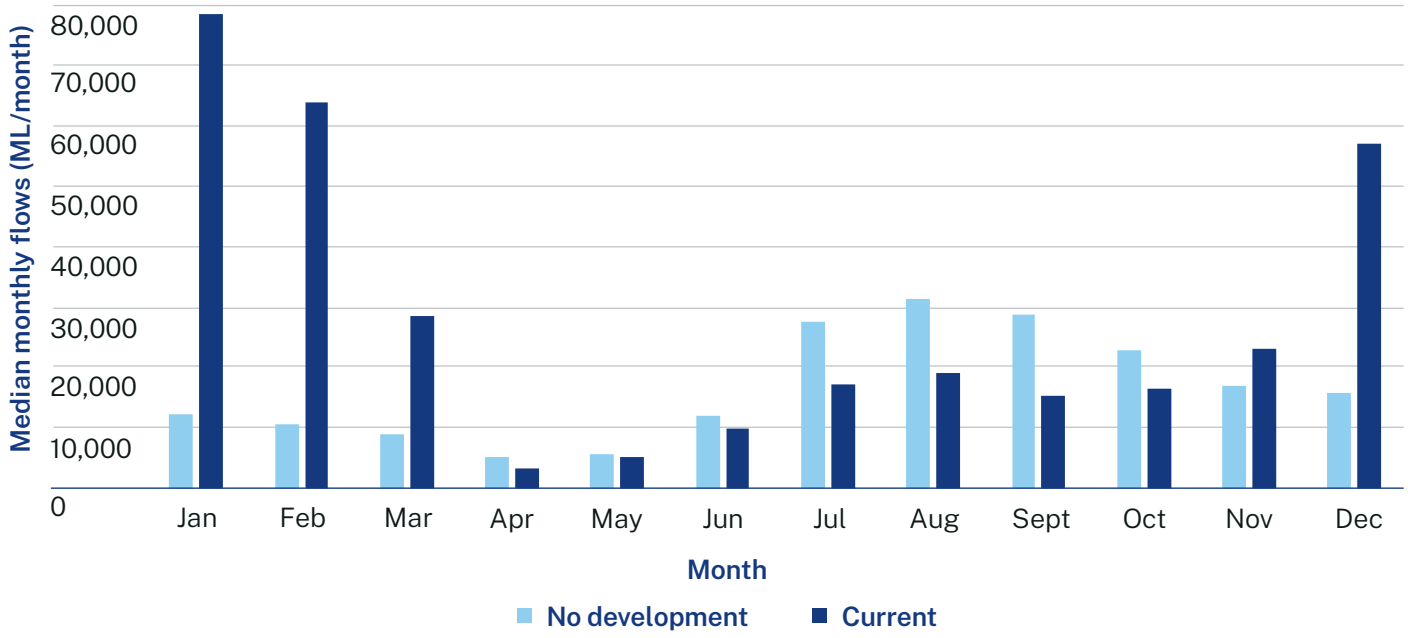
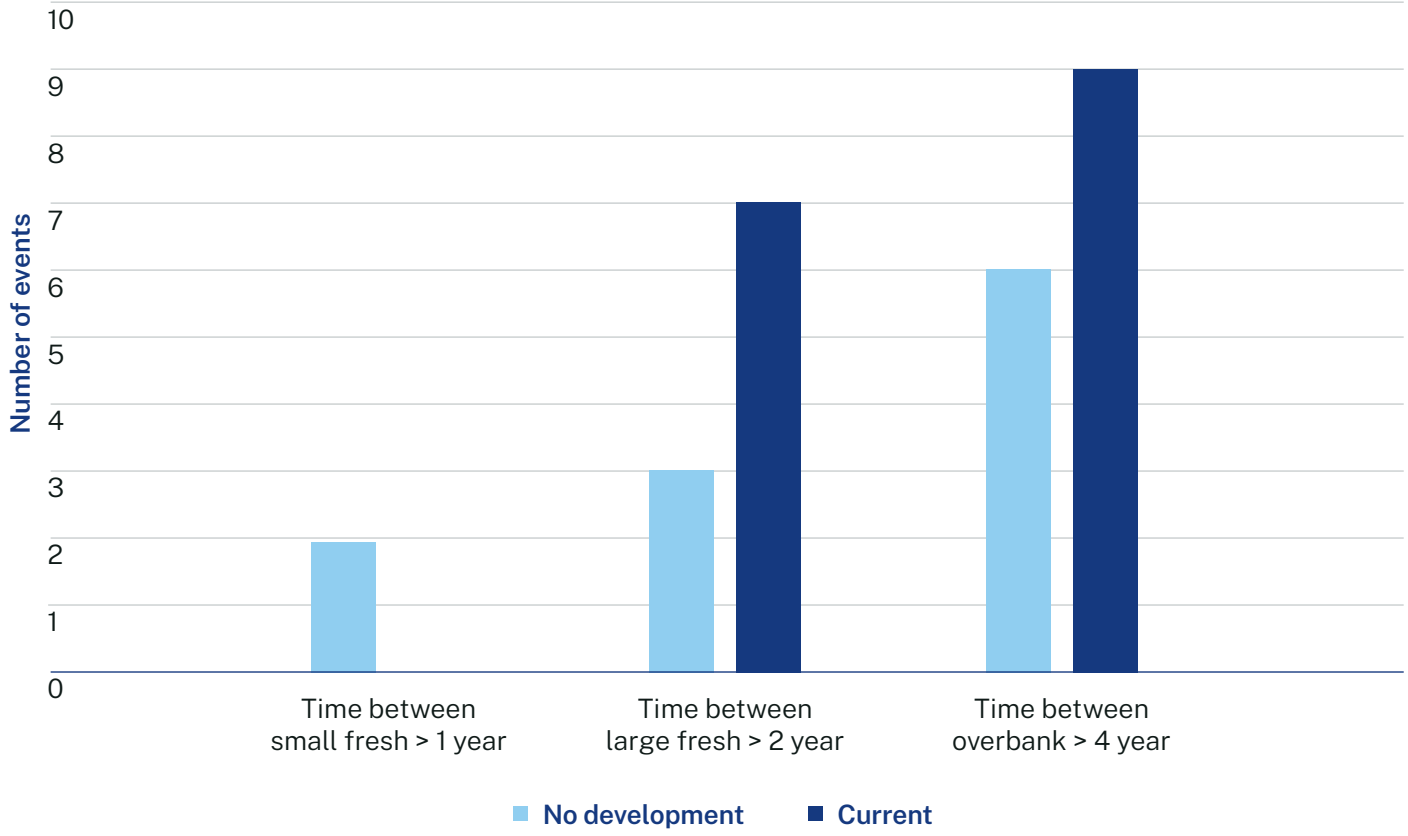


Figure 20. Modelled frequency of large time gaps between freshes at the end of the Namoi catchment at Goangra for the period 1892



Aquatic species are under stress from degraded habitat and declining water quality

Water quality and habitats have been changed and impacted by modified flows, land use changes, modification of riparian vegetation, river channelisation and bank erosion in parts of the Namoi system.

More than 60% of the riparian vegetation in the Namoi Valley has been substantially modified from its natural condition, and 21% has significantly less vegetation (severely impaired). The most impacted areas are the Peel River, Mooki River and Coxs Creek catchments and the upper Manilla River near Barraba, which have extensive reaches with less than 20% native woody riparian vegetation.

Water quality is an important driver of ecological processes. Changes in water quality have resulted from a combination of factors including introduced species, loss of riparian vegetation, changes in river flows, river regulation infrastructure and change in land use. High flow from rainfall and run-off can result in more soil and nutrients being washed into waterways. This can make water less clear and prone to excessive algal growth when flows reduce, impacting on the quality and quantity of refugia during dry times. Dams and weirs in the Namoi catchment often have algal bloom events.

During the recent drought, fish deaths were reported in the Namoi and Peel rivers. These deaths were attributed to very low water availability and an associated decline in water quality. Fish deaths were also triggered by short sharp increases in river flow that flushed organic material and deoxygenated water (hypoxic blackwater) from pools along the waterway, leading to larger scale 'blackwater' events.

Dams can also cause cold water pollution downstream, as well as impeding the movement of fish, altering habitats, and affecting spawning, recruitment and riverine productivity. Keepit Dam can cause cold water pollution for over 100 km downstream of the dam.

This impacts the quality of the water for town and household use, as well as affecting on the amenity of the rivers and increasing the stress on aquatic species.

Increased groundwater demand, particularly during drought periods, is causing a decline in groundwater levels in some areas, making it difficult for groundwater-dependent ecosystems such as river red gums to access their water needs.[20] Reduced recharge from surface water and rainfall in the Upper Namoi tributaries, Peel Alluvium and Manilla water sources exacerbates these impacts.

The combination of these factors has resulted in:

- very poor condition of fish communities[21]
- poor condition of riverine vegetation communities[22]
- declining health and abundance of groundwater – dependent ecosystems[23]
- decline in some waterbirds; for example, between 1983 and 2016, duck numbers declined by 23%, herbivore numbers by 61% and large wader numbers[24] by 71%.

20. Thurtell, L., Wettin, P.D., *Barma Water Resources Consulting, Commonwealth Environmental Water (Australia) 2012, Environmental water delivery: Namoi River*, Commonwealth Environmental Water Office, Canberra.
21. NSW Environment Protection Authority 2021, *NSW state of the environment 2021*, Environment Protection Authority, Sydney.
22. Murray–Darling Basin Authority 2012, *Sustainable Rivers Audit 2: the ecological health of rivers in the Murray–Darling Basin at the end of the Millennium Drought (2008–2010)*, Summary, MDBA, Canberra.
23. Department of Primary Industries–Water 2013, *Water Sharing Plan Namoi Unregulated and Alluvial Water Sources 2012: background document,* Sydney.
24. Department of Planning, Industry and Environment 2020, *Namoi Long-Term Water Plan 2020: Part A*, Sydney.

There is limited ability for environmental water holdings to mitigate these impacts

Water sharing plan rules set aside water to protect the basic health of the environment, and water reform processes over the last few decades have recovered water entitlements for the environment.

The water sharing plan for the Namoi Regulated River helps to ensure that approximately 73% of the long-term average annual flow in the water sources remains in the river to help maintain the basic health of the ecosystem. Provisions in the Peel catchment water sharing plans include similar rules that set extraction limits and require the remaining inflows to be left in rivers for the health of the environment.

The water not subject to these protection provisions is allocated to licences. Approximately 3.5% of water entitlements[25] in the Peel Valley and Namoi catchment are held by the Commonwealth Environmental Water Holder in the form of general security licences. An additional 5 GL environmental water allowance in the Peel Valley is provided through the water sharing plan, which accrues water when general security allocations are made.

There is restricted flexibility at times in the Namoi and Peel catchments, which can lead to challenges in meeting the needs of the environment using the environmental water holdings. Environmental water managers have limited capacity to intervene and provide flows to support environmental water needs at critical times, such as during extended drought periods and when unregulated inflows are not available.

Additionally, there is no ability for water held under general security licences and the environmental water allowance in the Peel River to be carried over as unused water allocations from one year to the next so that it can be used when most needed.[26] The environmental water allowance is subject to extraction once the Peel River reaches a flow threshold,[27] and any held environmental water from the Peel River that makes it into the Namoi River can be reallocated for extraction.

Climate change could exacerbate these challenges

Our new climate modelling shows that climate patterns in the region could change, with consequences for rainfall patterns and associated water flows. Climate change impacts are uncertain. We have analysed a worst-case dry climate change scenario. While the scenario may not occur, if it does occur in 40 years' time, we could expect more extreme wet events and more extreme dry events. Our modelling of this scenario indicates that the total volume of water flowing each year, on average, could decrease in the long term by 44% in the Peel River and 47% in the Namoi River, with fewer high-flow events and more cease-to-flow events.

This would place stress on platypus populations, result in fewer events that trigger fish movement and spawning, and waterbird breeding, and dry up key habitats. While these scenarios may not occur, analysing these data sets can help us understand how we may need to prepare.

Measures to support the resilience of ecosystems and improve overall waterway health include adjusting operations to better support environmental flows, increasing the flexibility for use of environmental water holdings, rehabilitating habitats, mitigating cold water pollution and remediating fish passage.

25. Percentage compared with all regulated licences in the Namoi and Peel valleys.
26. The Water Sharing Plan for the Peel Regulated Water Sources 2010 may be amended to allow for carry-over of environmental water allowance before 1 July 2024.
27. Clause 41(4) of the Water Sharing Plan for the Peel Regulated River Water Source 2022.

Challenge: Addressing barriers to Aboriginal water rights

‘We can’t sing our song no more, we can’t live on the river no more to look after her, for you all.’ (Gomeroi)

‘Yaama Nginda Gomeroi Wunnungulda. We are Gomeroi, we have our way of doing business. You have to be invited to sit around our fire. We share language and we engage together. You are asked to identify who you are and what you represent and be clear in your intent. Then, and only then can we do business together.’

Aboriginal people have lost access to water and Country

Gomeroi/Kamilaroi people have occupied the Namoi Valley for at least 60,000 years. They have always been closely linked to rivers, groundwater, billabongs and wetlands, and this relationship is essential to culture, community and connection to Country.

The historical dispossession of land continues to impact Aboriginal people’s rights and access to water. Fences and locked gates on public land such as Crown land, travelling stock reserves and state conservation areas prevent Aboriginal people from accessing Country. Carrying out cultural practices and using traditional knowledge to care for and manage waterways is critical in providing a purpose and pathway for young people to connect to culture and provide a space for healing, as well as for food, medicine and teaching.

There are already steps being taken by governments to address this. For example, the National Parks and Wildlife Services is developing a new model for Aboriginal joint management of the NSW national parks estate. It is anticipated the new model will provide for the potential handback of title to all NSW national parks – covering nearly 10% of the state – over a 15–20-year period, subject to the land being leased back (long-term and for nominal rent) to the NSW Government for its continued use and management as a national park.

In addition, accessing water entitlements now requires Gomeroi/Kamilaroi people to seek water from often highly competitive water markets. We know from consultation undertaken regionally and for the NSW Water Strategy that there is strong community support for Aboriginal water rights and access. The small amount of water under Aboriginal ownership is frequently identified as a key area for improvement.

Aboriginal water values are not well-supported by water management

Current water legislation and water management frameworks have evolved over the last 130 years but do not fully reflect Gomeroi and Kamilaroi water values. This is exacerbated by the limited involvement of Gomeroi and Kamilaroi people in water policy and planning processes, which is the result of:

- changes to Aboriginal water programs
- consultation timeframes and processes around water policy changes not allowing the time needed for Gomeroi/Kamilaroi cultural governance processes, leading to erosion of trust
- Gomeroi/Kamilaroi people not being informed or having a say in when and where environmental and cultural water is delivered
- the complex set of state and national laws and systems around water management, which is often not explained in plain English or in a visual manner
- inadequate resources and support for Gomeroi/Kamilaroi people to engage in water management
- Gomeroi/Kamilaroi people now having to buy rights to water that they once had from a fully allocated market
- structures around water management not providing for Gomeroi/Kamilaroi people's cultural governance structures or shared management.

Changing this system and empowering Aboriginal communities to make decisions on water requires the NSW Government to 'flip the model on its head' and develop an approach for engagement that works for Gomeroi/Kamilaroi people. We need an innovative approach that allows Gomeroi/Kamilaroi people in their nation area to get the right people involved or appointed to seats at the table where decisions about water are being made.

Gomeroi/Kamilaroi people would like to have a direct line of contact with regional water managers, compliance officers and decision makers, and have their knowledge and science actively sought, respected and heeded. To do this, water policy makers, planners and managers need to 'sit around the fire', listen to the knowledge holders and develop a cultural governance structure that is familiar to Gomeroi/Kamilaroi people, supported by the time that is needed to engage, consult and listen genuinely.

The NSW Government is addressing these challenges by investing $15 million over 3 years to 2025 to develop an Aboriginal Water Strategy that will identify a program of measures to deliver on First Nations' water rights and interests in water management. It is being informed by direct engagement and co-design with Aboriginal people and communities.

Image courtesy of Destination NSW. Len Waters Aboriginal Cultural Tours, Tamworth.

Challenge: Supporting a growing regional economy in a future of potentially reduced water availability

Agriculture and mining provide employment for more than 16% of all workers in the region, and account for around 29% of the region's economic output.

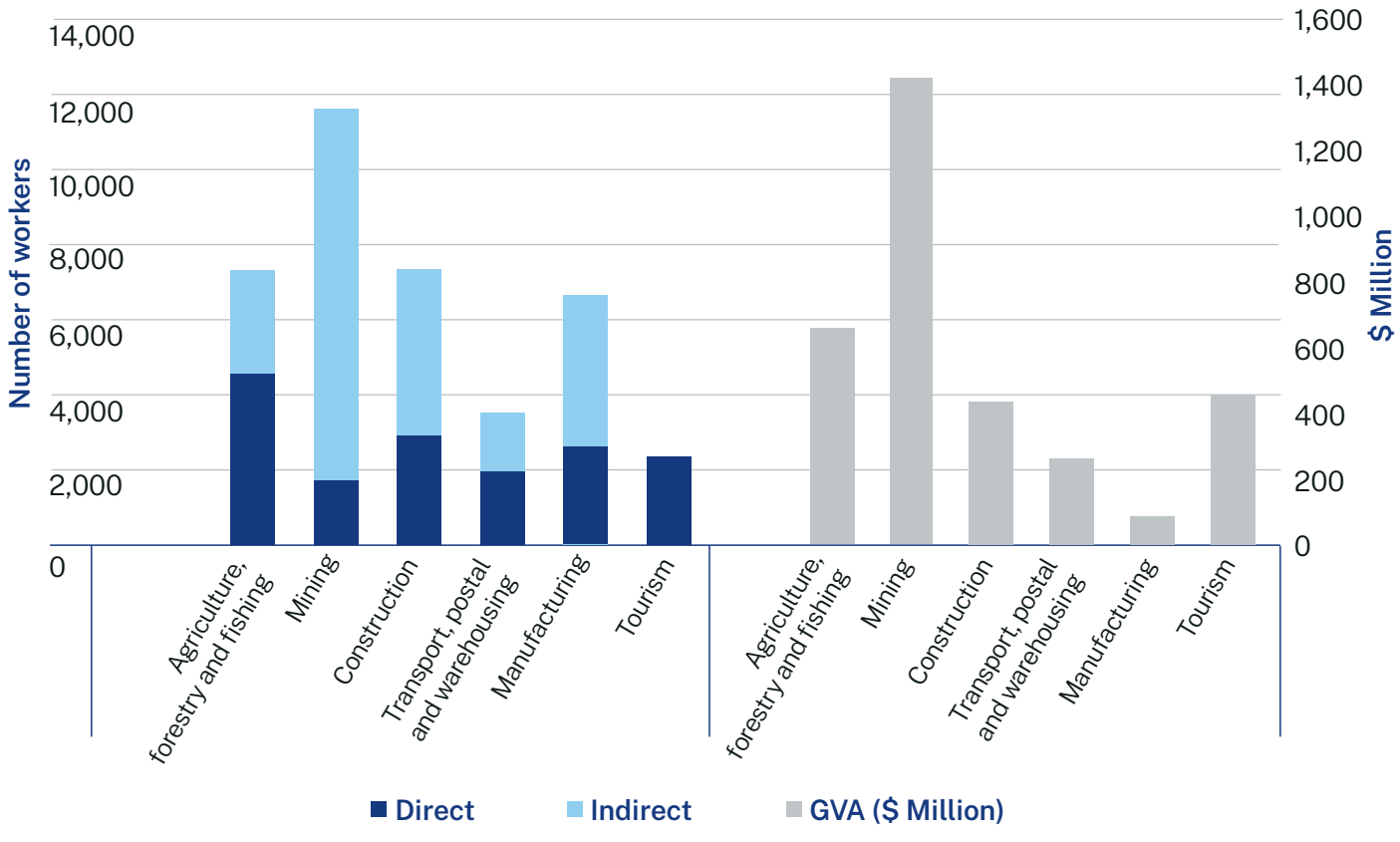
Agriculture is the dominant land use in the region, including extensive livestock, dryland and irrigated cropping operations, and an agribusiness cluster for chicken, meat and eggs around Tamworth.

Each year, the Namoi region produces approximately $1.8 billion in agricultural products. The highest-value areas are the Liverpool Plains and Gunnedah local government areas, with highly fertile black earth, and access to both surface water and groundwater.

These areas have the highest agricultural yields per hectare, with production more than 40% higher than state averages.

The Namoi region is also one of NSW's most important mining districts, with mining adding more than $1.4 billion of economic value to the region annually. It is estimated that Narrabri Shire alone contains more than 12% of NSW's remaining coal reserves. The mining sector in the region is growing in the short term with proposals for several new gas and coal mining operations. This includes the Narrabri Gas Project. However, over the longer term there is likely to be a transition away from coal based industries.

Figure 21. Employment and economic outputs of key industries in the Namoi region

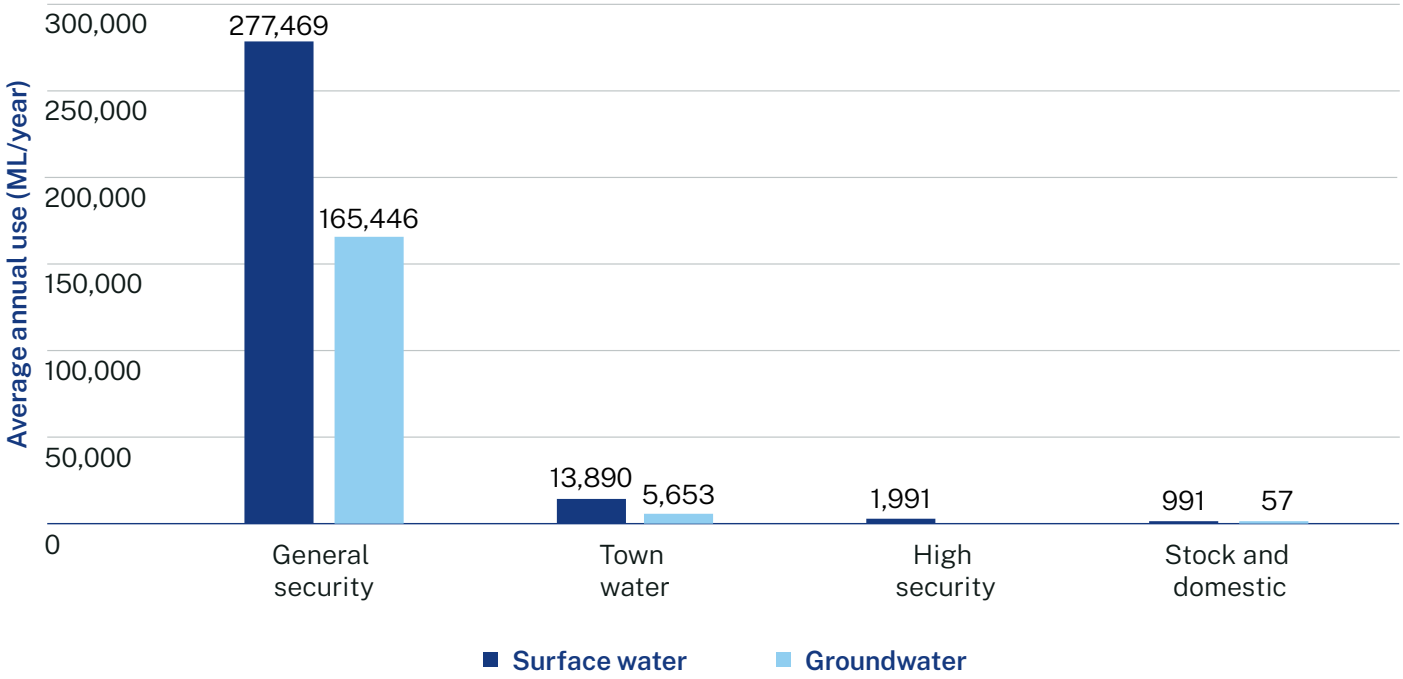


Agriculture and mining rely heavily on water as inputs and at times compete for water with each other and with other users. Surface water and most groundwater sources in the region are fully allocated with new water users needing to secure allocations through trade with existing users. Water use each year varies, depending on water availability. On average, agriculture accounts for 94% of all licensed surface water and groundwater use in the region, almost all of which is used to irrigate cotton and grains. Mining accounts for approximately 2%, on average, of the region's licensed water use (see Figure 22).

Table 6. How different water access licences are generally used in the Namoi region

Water access licence type	Primary users
General security	Primarily used for irrigation
High security	Typically used by mines, towns and other industries that need highly reliable water, like intensive livestock or permanent plantings
Town water	Used to support towns and connected industries
Stock and domestic	Used to support livestock and domestic water users

Figure 22. Average yearly surface and groundwater use across licence categories, averaged over 2016–21



Because of the high reliance of the region's economy on water, many industries are vulnerable to shocks from droughts. As water availability decreases, so does production and employment. During the most recent drought, there was a decline in productivity across the New England-North West region. Gross domestic product in the period 2018–20 fell almost 15% below average. This resulted in reduced employment, reduced investment and lower productivity across the broader economy.[28]

28. Wittwer G 2020, *Estimating the regional economic impacts of the 2017 to 2019 drought on NSW and the rest of Australia (CoPS Working Paper No. G297)*, *Centre of Policy Studies*, available at: www.copsmodels.com/ftp/workpapr/g-297.pdf

There is significant potential for growth in high value industries in the region

Agriculture and mining will remain essential industries for the region for years to come.

We have also heard that we need to begin planning for the transition of mining industries. In the Liverpool Plains Shire Council small coal mines will be closing in the coming years. In the Gunnedah Shire Council coal mines are likely to continue operating for the coming decades, however, there will be a stage where the region will need to transition economically, and we need to begin planning for this.

There is also potential for new high value industries, which could help grow and diversify the regional economy. This growth could be driven by:

- growth of the intensive agricultural industry – chicken and cattle livestock production is becoming one of the fastest-growing industries in the region as a result of growing demand from domestic and export consumers
- industries based around natural gas – the Narrabri Gas Project has been approved to produce natural gas from coal seams near Narrabri
- the New England Renewable Energy Zone – this will coordinate investment in electricity transmission, generation, storage and infrastructure
- the Inland Rail project – a new 1,700 km freight rail line connecting Melbourne and Brisbane via regional NSW will include a stop at Narrabri, connecting it with important supply networks.

Reliable water is essential to support these new and future industries. There may also be an overlap in the timing of when water is required for new industries and transitioning industries. Only a small proportion of licences in the region are of the high reliability needed for these industries, and these licences are difficult to buy and redeploy.

Surface water and groundwater sources are finite, and water for new industries will need to be purchased or traded from existing water entitlement holders, or sourced from the reuse of treated wastewater.

We need to identify ways to support new industries entering the region so they can operate in times of reduced water availability.

A long-term reduction in surface water could impact the regional economy

Mining and agricultural businesses in the Namoi region anticipate wet and dry cycles, and plan for their businesses to withstand several years of low or no surface water flows.

Irrigators have adapted to the region's variable climate by producing annual or seasonal crops, investing in on-farm storages to capture water during wet periods for use later, and setting aside funds for years when cropping is not possible or greatly reduced. They have also invested in technology and improved management practices to maximise benefits from the available water. For example, the cotton industry has improved whole-farm irrigation efficiency, so producers now achieve almost twice as much cotton from the same amount of water as 25 years ago.

Some agricultural businesses use groundwater, or a combination of surface water and groundwater, to allow production to continue during the frequent times when surface water is scarce.

Mines typically have multiple water sources. They maximise use of local runoff and wastewater and can use water of lower quality than many other industries.

During dry periods, mines and agricultural processing facilities often look to the water market to secure additional water for their operations. We have heard from some parts of the community that this can sometimes drive-up prices, making it harder for other water users to buy water on the market.

Despite this adaptability, during recent record droughts, many of these businesses were placed under significant stress due to unanticipated low inflows for 3 consecutive years. Historically, general security water licences in the Upper Namoi Regulated River have had very high reliability compared with general security licences in the Peel Valley and Lower Namoi catchment. Users of these licences have had to adapt accordingly.

However, during the 2017–20 drought, even these licences received zero water allocation, with access to carried-over water allocations suspended. This was a severe shock to local businesses.

During our community consultation we heard that consistent zero or low general security water availability for 4 or 5 years will impact the viability of many of the region's irrigated agricultural operations and will start to have flow-on impacts on regional towns placing the regional economy and jobs at risk. It will also impact the ability of new high value or diversified industries to enter the region.

Recent improvements in our understanding of the region's climate suggest there is a possibility of multiple consecutive years of low or no water availability for general security licences even without a dry climate change scenario. This risk is lowest in the Upper Namoi catchment and highest in the Peel catchment (Table 7).

Table 7. Probability of general security licences being below 20% allocation for 4 consecutive years

	Peel Valley general security		Lower Namoi general security		Upper Namoi general security	
	Long term historical climate projections (Stochastic)	Worst case dry climate change scenario (Stochastic + NARCliM)	Long term historical climate projections (Stochastic)	Worst case dry climate change scenario (Stochastic + NARCliM)	Long term historical climate projections (Stochastic)	Worst case dry climate change scenario (Stochastic + NARCliM)
Probability of 4 consecutive years below 20% allocation	1 in 62 years 1.6%	1 in 22 years 4.5%	1 in 131 years 0.8%	1 in 32 years 3%	1 in 2,450 years <0.1%	1 in 272 years 0.4%
Probability of 4 consecutive years of 0% allocation	1 in 109 years 0.9%	1 in 24 years 4.2%	1 in 891 years 0.1%	1 in 110 years 0.9%	1 in 2,450 years <0.1%	1 in 272 years 0.4%

Note: NARCliM = NSW and Australian Regional Climate Modelling.

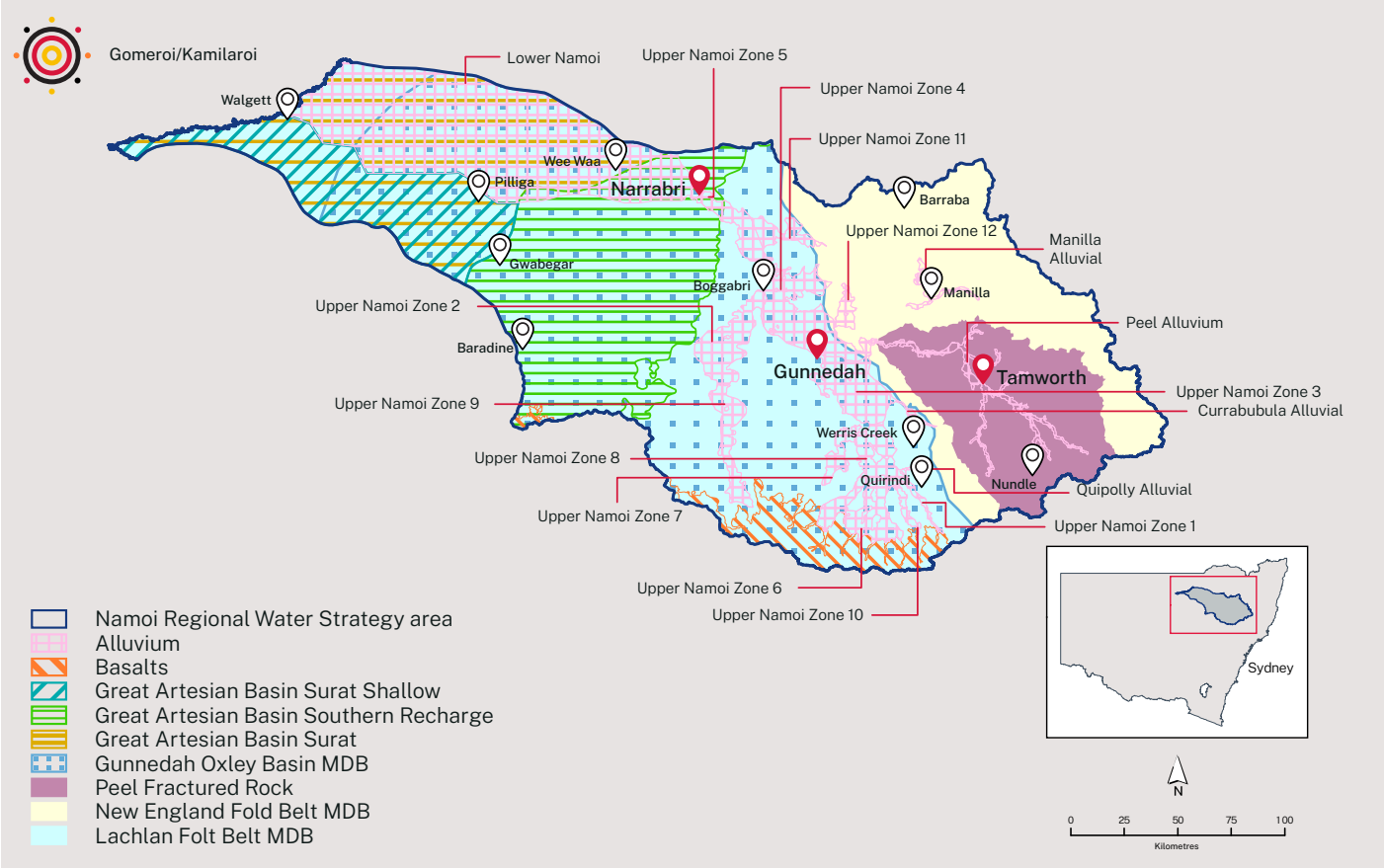
While these scenarios may not occur, and the probability of some of these scenarios is very small, we will need to identify innovative ways to provide water to support existing and future industries that enter the region and ensure that they can operate at times when water is scarce.

What we heard

During the development of the Namoi Regional Water Strategy, irrigators in the Lower Namoi told us the risk of 4 consecutive years of below 20% allocation is small enough that they can continue to make risk-based decisions in their planning processes. In the Peel Valley however, irrigators suggested that the risks to them are very high in comparison and their businesses would be unsustainable with 4 years of no water allocations.

Groundwater levels are declining in some areas, putting economic production at risk

Figure 23. Groundwater resources in the Namoi region



Groundwater extraction from the alluvium in the Namoi region is one of the highest in the Murray–Darling Basin. Groundwater sources support stock and domestic uses and town water supplies. They are also critical in supporting some of the state's highest levels of agricultural productivity, particularly in the Gunnedah and Liverpool Plains local government areas. The mining industry also uses groundwater from the Upper Namoi Zones 4, 5 and 11 (see Figure 23).

The amount that can be taken in the long-term from these groundwater sources is closely linked to the rate at which they are recharged. Yearly recharge is a very small proportion of the total volume that is in storage in a large alluvial ground water sources like the Lower Namoi. The large volume in storage in many major alluvial aquifers provides a buffer for years of drought and low recharge, making these aquifers very reliable water sources. However, if the average extraction continues to exceed the average recharge over many years, it can lead to extensive and long-term declines in water levels which can reduce groundwater supplies and potentially cause land subsidence. Groundwater declines also occur where extraction is concentrated spatially.

We are seeing long-term declines in some parts of the Upper and Lower Namoi Groundwater Sources. From pre-1990 until 2021, groundwater levels declined by:

- 2–5 m across most of the Upper Namoi
- up to 10 m north-east of Gunnedah (Upper Namoi Groundwater Source Zone 4 and Zone 12)
- up to 10 m near Breeza (Upper Namoi Groundwater Source Zone 3 and Zone 8)
- more than 10 m in the Upper Namoi Groundwater Source Zone 12 and east of Caroona in the Upper Namoi Groundwater Source Zone 8
- between 5 and 10 m in the area north of Wee Waa in the Lower Namoi Groundwater Source.

More recently (from 2006 to 2021), water levels have improved north of Breeza (Upper Namoi Groundwater Source Zone 3) and near Mullaley and Boggabri (Upper Namoi Groundwater Source Zone 2). However, the water levels have continued to decline across most of the Upper Namoi by around 2 m, with the Upper Namoi Groundwater Source Zone 12 (north-east of Gunnedah) and the area near Caroona (Upper Namoi Groundwater Source Zone 8) showing up to a 10 m decline.

If these declines continue, restraints on water extraction are likely to be introduced in these areas to provide ongoing viability of the resource for all uses. If the climate becomes drier in the longer term, this problem will become worse.

A plan to secure water for the Namoi

5

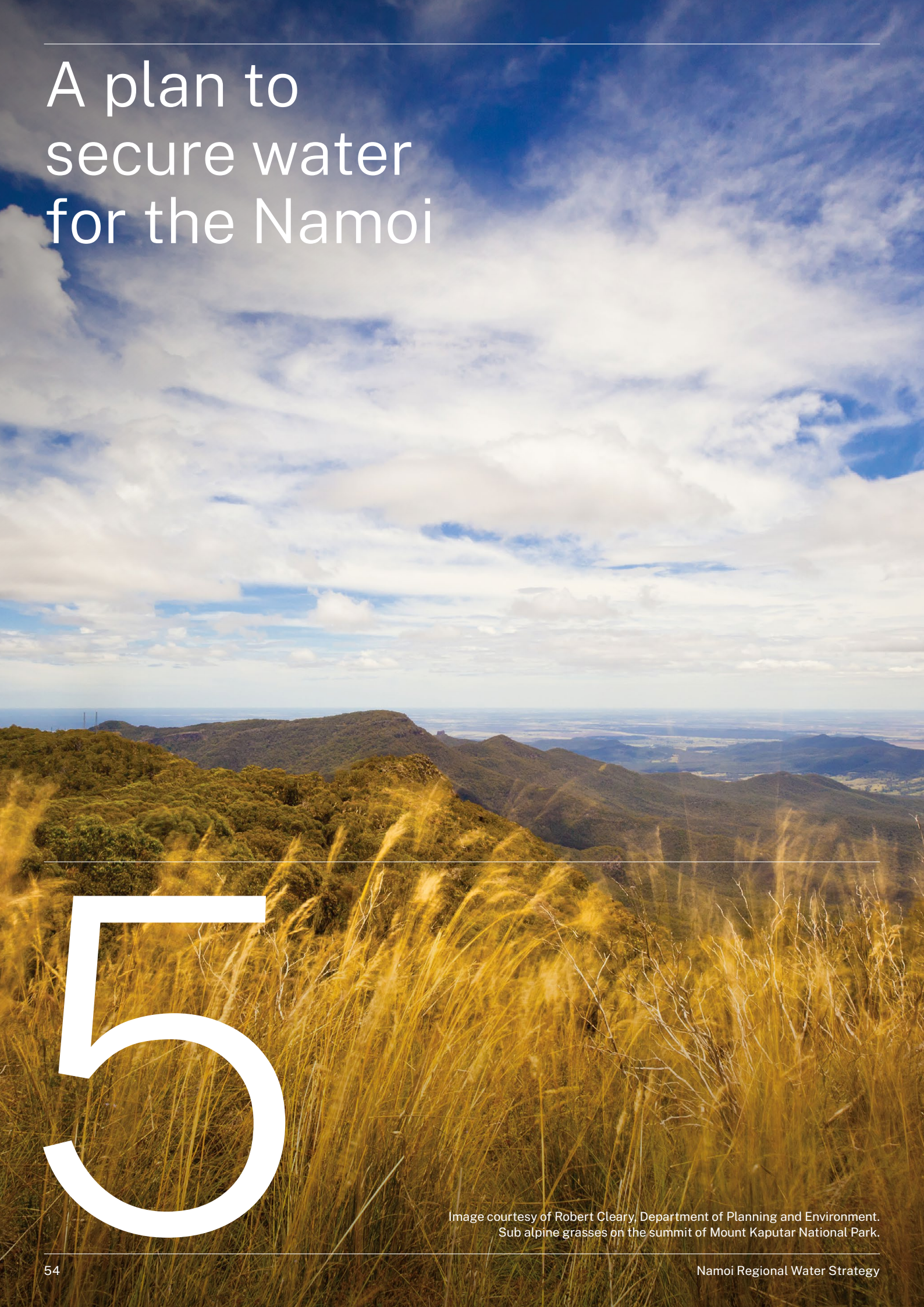


Image courtesy of Robert Cleary, Department of Planning and Environment.
Sub alpine grasses on the summit of Mount Kaputar National Park.

The vision for the Namoi region is to support the delivery of healthy, reliable and resilient water resources for a liveable and prosperous region. To achieve this, we need to position the region so there is the right amount of water of the right quality delivered in the right way for people, Aboriginal communities, towns, industries and the environment.

We have prioritised a range of actions which aim to address the challenges in the Namoi region by:

- supporting the long-term water needs of towns across the region
- supporting regional communities under a more variable and uncertain future climate
- improving the health and resilience of water dependent ecosystems.

Together, the actions can improve the Namoi region's readiness to adapt to a more variable climate and support the difficult decisions we need to make to deliver healthy, reliable and resilient water resources for the region's future.

The regional priorities do not override the priorities around water sharing set out in the *Water Management Act 2000*. The priorities help identify the range of actions that need to be progressed in the region over the coming decades. Each priority contributes to all of the objectives of the regional water strategies. The actions are not listed in any priority order.

Image courtesy of Destination NSW. Manager Brendon North at his Paradise Fresh farm, Tamworth.

Figure 24. Namoi Regional Water Strategy: overview of strategy vision, objectives, water security challenges and priorities

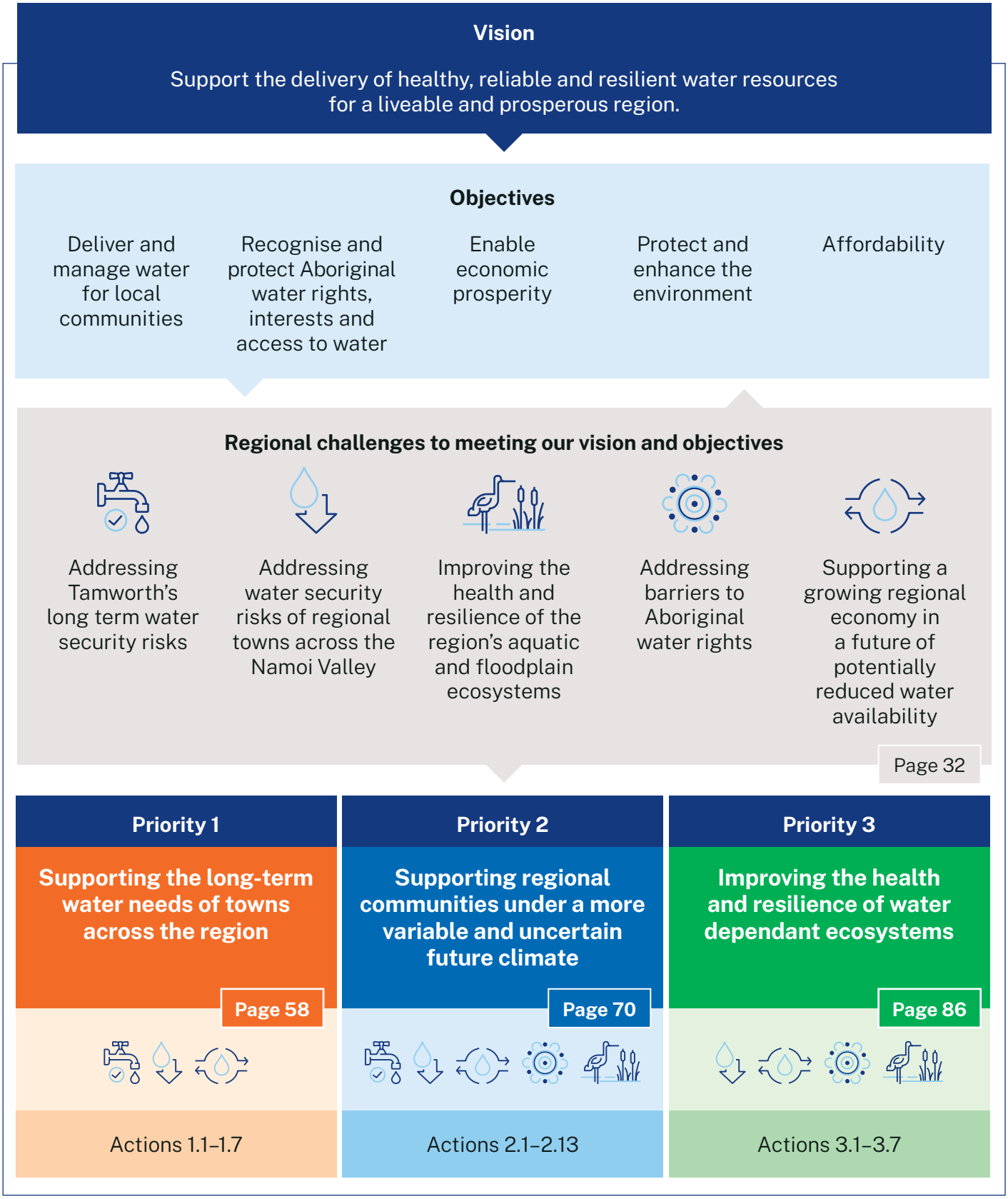


Image courtesy of Destination NSW. Scenic drive, Tamworth.

Priority 1

Supporting the long-term water needs of towns across the region

Over the coming decades, towns across the Namoi region will face increasing risks to the security of their water supply. This is particularly the case for towns that are growing.

For Tamworth, as its population and water demand grows, water security will deteriorate if we do nothing to manage demand or safeguard its supply. For most other towns across the Namoi region, groundwater is essential. Having reliable and sustainable access to groundwater allows communities to endure extreme climates.

This priority focuses on doing more with less water and supporting sustainable growth and resilience of towns and regional communities in a future with a more variable or potentially drier climate. The actions in this priority will reduce the risk of severe restrictions and costly emergency water supply measures, make the best use of available water and better respond to the needs of a growing population and the risks associated with climate change.

Image courtesy of Destination NSW. Countryside, Tamworth.

Our starting point

Over recent years investments have been made to help secure water supplies for towns across the Namoi region, and to support critical needs during drought periods. In 2023 the NSW Government will continue to support Walgett Council transition from groundwater to surface water in order to improve the aesthetic quality of water provided to its residents. The NSW Government will continue to support Walgett Council and other councils across the state to improve the treatment of water and improve water quality.

Supporting town water security

Every local water utility faces unique challenges and risks. In the Namoi region, the costs associated with implementing water security infrastructure solutions across a small and dispersed ratepayer base, attracting and retaining skilled staff, and working through regulatory requirements can make it challenging for local water utilities to operate.

During the 2017–2020 drought funding assistance was provided to local water utilities through critical drought initiative and emergency relief programs to ensure critical human needs continued to be met, whilst also improving future drought resilience.

The NSW Government is providing ongoing funding support to local water utilities to resolve priority water security, water quality and environment (sewerage) risks through the Safe and Secure Water Program.

The NSW Government in partnership with local water utilities and the wider water sector has also collaborated on the Town Water Risk Reduction Program[29] to develop and implement a new approach of working together that enables local water utilities to manage risks and priorities in town water systems more strategically and effectively.

The program, is based on a new partnership approach, which recognises and leverages the wealth of expertise within councils and local water utilities and provides opportunities for these stakeholders to design and refine better solutions in collaboration with the department.

The NSW Government will continue to support local water utilities to reduce risks to water security.

Groundwater resources

The NSW Groundwater Strategy aims to guide sustainable groundwater management across NSW. In addition, the NSW Government has published a report on how groundwater levels have been changing since monitoring began in the 1970s–80s across 29 alluvial groundwater systems.

NSW Water Strategy

The NSW Water Strategy includes a commitment to reviewing water allocation frameworks and water sharing plan provisions in response to the last drought. This review will need to determine the most appropriate dataset to use in assessing whether essential needs reserves in dams need to be amended through a risk framework. Analysis undertaken for the Namoi Regional Water Strategy will be considered in this review.

29. Department of Planning and Environment, *Town Water Risk Reduction Program*, available at: www.dpie.nsw.gov.au/water/plans-and-programs/town-water-risk-reduction-program

Figure 25. Actions for Priority 1: Supporting the long-term water needs of towns across the region

Legend				
Addressing Tamworth's long term water security risks	Addressing water security risks of regional towns across the Namoi Valley	Improving the health and resilience of the region's aquatic and floodplain ecosystems	Addressing barriers to Aboriginal water rights	Supporting a growing regional economy in a future of potentially reduced water availability

Action number	Action name	Challenges addressed
Action 1.1	Move towards an enduring level of supply to support water security for regional cities and large towns	
Action 1.2	Improve drought management planning for towns	
Action 1.3	Adopt a stronger focus on water efficiency and demand management for towns	
Action 1.4	Progress advanced water treatment facilities for industries reliant on town water supplies	
Action 1.5	Reduce uncertainty in groundwater security for regional towns	
Action 1.6	Plan for long term water supply augmentation as Tamworth grows	
Action 1.7	Addressing water related skills shortages in small councils	

Action 1.1: Move towards an enduring level of supply to support water security for regional cities and large towns

Our current approach to managing water security for towns relies on defining an 'acceptable risk' of running out of water. Existing NSW Government guidelines suggest town water supplies should meet a minimum service level. This roughly correlates to town water supplies being able to withstand a drought that has the probability of occurring one in 1,000 years. This level of risk may not be appropriate for large towns where there are no last resort options, such as water carting, in extreme droughts.

Metropolitan water utilities such as Sydney Water and the Hunter Water have shifted their focus away from an 'acceptable level of risk', recognising that running out of water is a risk that neither the communities they supply nor government will tolerate, regardless of the probability of it happening. Instead, they have moved to the concept of 'enduring supply' to inform their long-term water supply planning.

The enduring supply concept involves determining the amount of water needed to meet the minimum needs of the community during periods of prolonged and extreme drought, irrespective of how long the drought lasts.

Determining this level of supply is informed by:

- the minimum amount of water needed for the cities or large towns to keep running
- how long residents and businesses are willing to endure severe water restrictions
- the willingness of communities to pay for increased water security.

During public consultation on this strategy, it was suggested that determining the 'enduring level of supply' needs to be on an individual community basis.

This action will develop guidance for local water utilities to use the enduring supply approach for large regional centres where last resort options such as water carting, are not realistic.

Action 1.2: Improve drought management planning for towns

Climate change could result in droughts occurring more often. Local and state governments have invested in a raft of emergency drought measures that helped to stretch out water reserves during the last drought. These measures include investment in bores, pipelines and water treatment facilities. Additional longer-term measures are also being investigated and implemented to support the long-term water security of towns across the region. However, there is still a real risk that a drought worse than the 2017–20 drought could occur at any time, and the additional measures being investigated may not be implemented before the next drought occurs. Robust emergency drought measures are likely to still be required for may towns.

It is critical that these measures are thoroughly planned for and costed, even if they are not needed in our lifetimes, because there is a chance they will be needed at any time. These emergency measures are typically very expensive and appropriate for use over short periods, rather than ongoing, so we delay implementing them as long as possible.

To manage these risks, town water managers need to develop plans now that identity the best drought management measures for the towns across the region. Planning and approvals processes need to be completed so that the measures are ready to be implemented when drought occurs again. The NSW Government will continue to work with local water utilities to provide technical advice for drought planning and emergency response.

Action 1.3: Adopt a stronger focus on water efficiency and demand management for towns

We will need to do more with less water under a more variable future climate. Water managers use a range of water efficiency and demand measures to help reduce their demand on water sources and make existing water supplies go further. For large regional centres like Tamworth and Narrabri, these measures can be vital for sustaining water supplies through the region's regular dry periods and droughts and can support population and industry growth without increasing risks to water security.

During the public consultation on the Namoi Regional Water Strategy, we heard strong support for water conservation by communities and businesses, and across government. There was a desire to push the envelope and invest more heavily in measures to do more with available water. These measures included:

- water restrictions to limit town water use during dry periods and prolong water supplies
- community water conservation schemes, such as installation of rainwater tanks and greywater systems, and encouraging the use of water-efficient appliances
- reducing leakage from pipes
- 'smart' metering and pricing
- improved reuse and recycling of wastewater and stormwater
- requiring large industrial water users to make investments to reduce water demand
- using price as a signal to reduce water demand for industrial use
- designing and implementing water-use practices that minimise the amount of groundwater extracted.

We also heard there was a need for culturally appropriate education about water usage and restrictions.

Many councils in the region, particularly those reliant on surface water, have invested significantly in demand management measures that have helped to improve the resilience of water for towns. For example, over the last 10 years Tamworth's population has grown every year but water demand has remained constant. This action would continue collaborative actions between state and local governments to continue to invest in demand management and water efficiency measures.

NSW Water Efficiency Program

The Water Efficiency Program seeks new ways and approaches to working with the community to ensure we have secure, reliable water sources and build future resilience to climate change and droughts. It includes commitments for the department to provide a clear statement of government policy; collaborate across the water sector; to focus on building water efficiency capacity, gaining a greater understanding of water use, improving the evaluation of water efficiency initiatives and increasing private sector involvement.

Key aspects of the Water Efficiency Program to date have been:

- development of the NSW Water Efficiency Framework – a best practice guide for water efficiency planning
- establishment of the Regional Leakage Reduction Program to address network leakage and water loss. In November 2022 the NSW Government announced $12.5 million to continue with stage 2 of the Regional Leakage Reduction Program
- rolling out a washing machine replacement trial
- partnering with the National Australian Built Environment Rating System to help buildings achieve a first-time water rating.

The NSW Government is also working with Tamworth Regional Council and Liverpool Plains Council to implement pilot projects that align to their non-revenue water management maturity. Pilot projects will reduce water supply system leakage and improve water efficiency in the areas of capacity building, active leak control, pressure management and bulk metering.

Action 1.4: Progress advanced water treatment facilities for industries reliant on town water supplies

A large proportion of Tamworth's town water supply is used to support agricultural and food processing and manufacturing facilities. Half of Tamworth Regional Council's demand is used by industrial use and major meat processing industries alone currently use around 25% of Tamworth's total water supply. These industries are an important part of the region's supply chain and are significant regional employers. They are expected to grow, with corresponding growth in their water demand.

For example, the Baiada chicken abattoir, which is one of the largest livestock processing facilities in Australia, processes more than 700,000 birds per week. This facility is the town's biggest water user, requiring around 2 ML per day to operate. Plans are currently in place to grow the facility so that it can process 3 million birds per week. The increase in production will significantly increase the demand on town water supplies, reducing the overall water security for Tamworth.

Over the coming decades Narrabri and Gunnedah Shire councils may have increased commercial demand on their town water supplies due to forecast growth and stimulus projects planned for the towns. To address this potential growth in demand alternative water supplies such as advanced water treatment facilities for commercial and industrial water users currently connected to town water supplies could help meet increased water demand.

The NSW Government will seek to support Tamworth Regional Council investigate opportunities to develop an advanced water treatment facility to recycle wastewater from large commercial and industrial users and is estimated to be the equivalent volume of 25% of the towns current drinking water supply per annum. This recycled water could help to support industries and their growth without putting additional pressure on town water supplies. Our initial analysis suggests this action could result in a net reduction in Tamworth's current raw water demand of around 5% as industrial water demand grows, postponing the need for additional water supply infrastructure as Tamworth grows.

The NSW Government will work with local water utilities to identify, promote and provide incentives for water reuse and recycling for commercial and industrial water needs.

Image courtesy of Destination NSW. Oxley Scenic Lookout, Tamworth.

Action 1.5: Reduce uncertainty in groundwater security for regional towns

Many towns in the Namoi catchment rely solely on groundwater for water supply. We have heard from councils that there is uncertainty about how long the town water bores will be able to sustain the towns during droughts.

Where there is a high density of irrigation bores, the local groundwater level can decline during the pumping season. This decline makes it harder to extract the same amount of water from nearby bores, including those used for town water. The problem is exacerbated during severe droughts because more water is extracted during the pumping season. Uncertainties about groundwater recharge rates can also make it difficult to make decisions around when to lift water restrictions. In addition, strategic regulatory and policy actions are needed to improve groundwater certainty for towns, along with investigations at the local level.

At the local level, the critical factor in supporting groundwater-dependent towns in the region is to understand whether local town water bore infrastructure is sufficient to sustain town water supply during droughts. This includes ensuring:

- there are an appropriate number of bores that are sufficiently deep and well-constructed so that bore yield is not affected by declines in the groundwater level during drought
- the bores are constructed to a quality that can sustain the needs of the local water utility over an extended period
- there are suitable water treatment facilities to support the long-term treatment and use of groundwater sources for towns.

The site-specific nature of this issue means that investigations at the local level are the best way to understand risks to water supply. This work is already progressing in the Namoi region. With support from the NSW Government, Namoi Unlimited, a joint organisation of councils, commissioned a detailed investigation of current and future water supply vulnerabilities for 17 towns. This investigation included detailed assessment of groundwater supply risks at town bores. The work will inform long-term water security plans for these towns. Narrabri Shire Council is also undertaking similar investigations. For many councils, groundwater planning and management involves using many assumptions due to limited data collection points to measure the volume and quality of groundwater sources.

Many councils have highlighted the need for improved science and understanding of groundwater resources and recharge rates to reduce the level of assumptions and remove uncertainty (see Action 3.7: Continue investment in groundwater science in the Namoi region).

The Walgett Shire Council area is reliant on groundwater as either a primary water source or as an essential back up. For the township of Walgett surface water will continue to be unreliable and so access to a reliable back up supply of groundwater will likely be required into the future.

During the 2017–2020 drought, a portable reverse osmosis groundwater treatment facility was installed in Walgett as a temporary measure to help treat saline groundwater for domestic use.

In 2023, Walgett Council commenced a shift back to surface water with the support of the NSW Government. Groundwater is used as an alternate supply during dry times but could be used in combination with surface water in the future.

At the strategic level, the NSW Government can provide clear guidance around how high priority groundwater needs such as town water supply will be managed in the Namoi region. This includes:

- determining how to ensure critical needs and high priority uses such as local water utility licences are prioritised when considering impacts on the aquifers and other users
- exploring the option of granting temporary licences to access groundwater during drought
- reviewing the regulation of basic landholder rights including stock and domestic rights – to assess whether new rules are required to better manage this type of water take when water restrictions are in force.

The NSW Government will continue to support councils in the Namoi region to plan and implement long-term water security measures through current funding programs, and by providing access to the latest water resource and climate data and modelling information.

Action 1.6: Plan for long term water supply augmentation as Tamworth grows

As Tamworth grows over the coming decades, so will demand on its water sources. Demand reduction can push back when the next augmentation needs to occur. But even with water efficiency, recycling and demand management these combined measures are unlikely to be enough to prevent Tamworth's water system from running out of water in a severe drought.

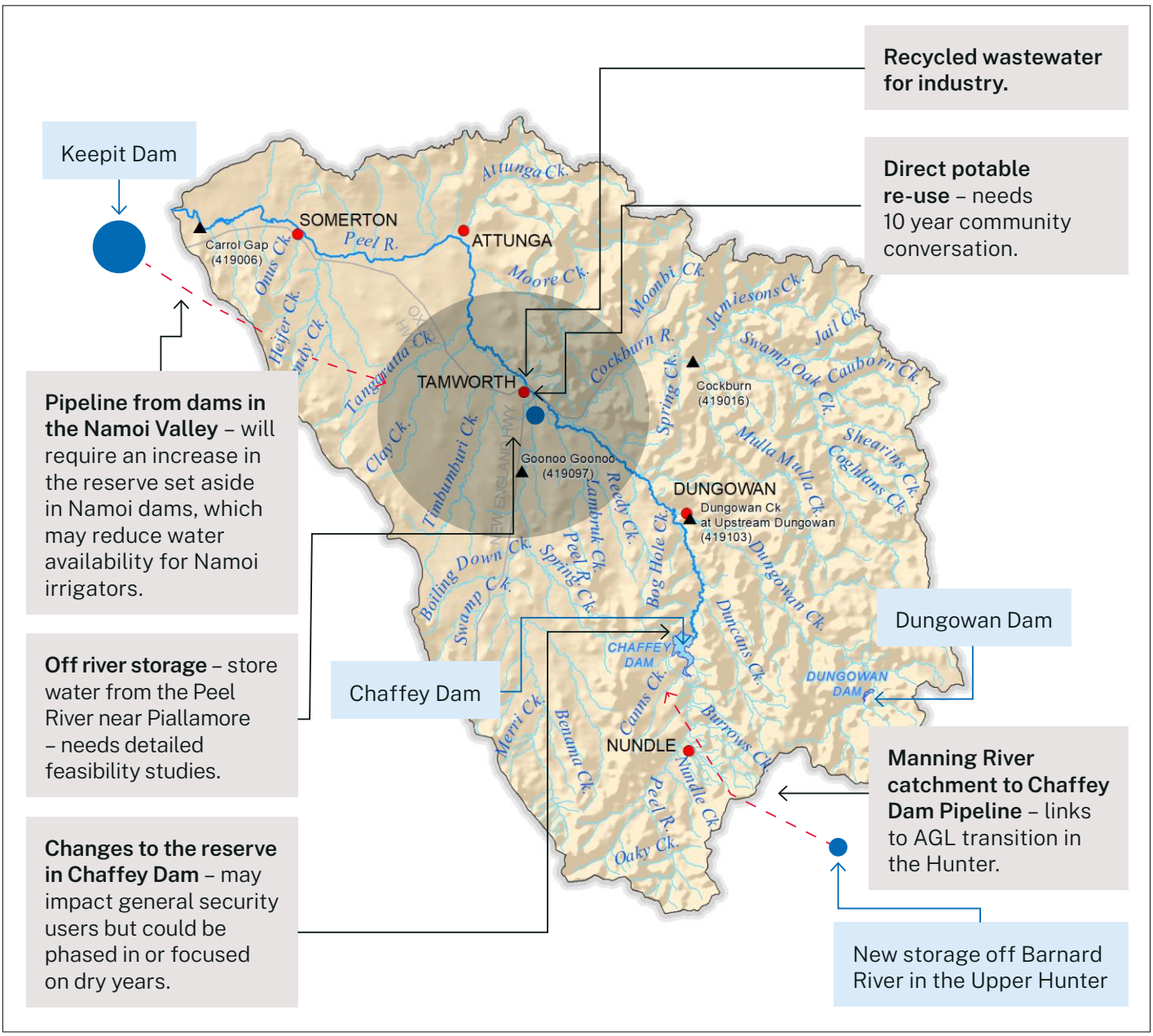
To support longer-term growth, additional investment will be needed to maintain security of the water supply and provide confidence for people and businesses to live and work in the region.

The Namoi Regional Water Strategy needs to remain adaptive as the region's circumstances, climate and the population all change over the next 20–30 years.

Adaptive strategies typically do not rely on a single solution; rather, they identify a range of feasible solutions. This will allow decision makers over the coming decades to choose the most appropriate options to implement, based on the information, technology and conditions at the time.

The strategy has analysed a range of alternative options that could support Tamworth's water security through a strategic assessment. Strategic assessments help compare the relative benefits and costs of various options. We will need to undertake further detailed analysis, design and planning with updated river system models to confirm the best and most cost effective combination of options for Tamworth. The proposed new Dungowan Dam that was presented in the draft strategy has not been carried through the final strategy. While a new dam in the region may be needed as part of a combination of options over the long-term, it is unlikely to be the most cost effective option in the short-to-medium-term.

Figure 26. Options to support Tamworth's water security



Instead, this strategy has identified a range of alternative shortlisted options that merit further investigation. These include:

- **Working towards purified recycled water facilities**

  Investing in advanced water treatment can help to reduce Tamworth's reliance on potable water in dams and rivers and enable Tamworth to diversify its water sources. This could allow Tamworth to expand its water demand without increasing take from dams.

  There are a number of barriers to the implementation of these facilities including stringent regulatory processes and standards, costs and the need to achieve community confidence and acceptance. During consultation we heard a strong desire for government to fast track community engagement programs on purified recycled water. No decision on purified recycled water will be taken without extensive community consultation and stringent government approvals.

  During consultation there were calls for government to fast track community engagement and educational programs on purified recycled water.

- **Pipeline from Namoi Valley dams to Tamworth with an increased storage reserve**

  This option included investigating a pipeline from Keepit Dam or Split Rock Dam in the Namoi Valley. The pipeline would enable Tamworth's water supply to be topped up during drought from an extra reserve of water set aside in Keepit and Split Rock dams. Analysis shows if the pipeline is only used when there are significant risks to Tamworth's town water supply, it will likely only be required for 4 years in 100 years. This option also has the dual benefit of having the potential to secure water supplies for towns in the Upper Namoi such as Manilla but could reduce supplies to general security agricultural water users in the Namoi Valley, as well as have ecological implications. There are opportunities to mitigate the impacts on licence holders by purchasing licences and converting or retiring the licences so the water can remain in the dam to support Tamworth's water needs. While this option helps improve water security for Tamworth, it continues to rely on surface water, which could become less reliable under climate change risks.

  Stakeholders had mixed views on transferring water from the Namoi catchment to the Peel catchment. Concerns were raised due to the potential impacts on Namoi general security licence holders, reduced water availability for Namoi communities, that transferring water from the Namoi to the Peel Valley may result in declining populations and economic activity in smaller regional towns in the Namoi. Support for this action stemmed from its ability to increase water security for Manilla and Tamworth.

- **Pipeline from Manning Valley to Peel Valley**

  This option involved transferring water from the Manning Valley on the mid north coast of NSW into the Peel Valley – an inland diversion scheme. This option would increase the water supply in the Namoi and could significantly reduce the risk of Tamworth running out of water but may reduce water available to users and the environment in the Hunter or Manning systems. The benefits, impacts, costs and ecological implications would require further analysis, and would need to compare the benefits, impacts and costs of:

  – ongoing use of the water in the Upper Hunter to support regional diversification as the mining and power generation industries transition

  – transferring water to the Peel to improve reliability for Tamworth town water security

  – leaving entitlements in the Manning system for town water security, industry benefits and environmental outcomes.

  There were mixed views on this option with stakeholders suggesting that the economic and environmental costs and benefits of regional and inter-regional pipelines need careful evaluation and the potential impacts on surface and groundwater systems would require a thorough assessment. Many stakeholders supported this option as it could help address water security challenges in the Peel Valley without impacting the broader Namoi. Concerns focused on potential adverse impacts on the environment and local ecosystems and whether this action may result in water being diverted from existing water users.

- **Increase the water reserved for Tamworth in Chaffey Dam**

  Additional water set aside in Chaffey Dam could help reduce Tamworth's water security risk. It could be implemented relatively quickly to improve short term water security. Progressing this option would provide the time needed to progress a longer-term option.

  Currently, water is set aside in Chaffey Dam over a 2-year rolling period for essential needs before water is allocated to general security licences. Each year 70% (11.5 GL) of Tamworth's 16.4 GL water entitlement is set aside in Chaffey Dam. If there is enough water, the remaining 30% (4.9 GL) of Tamworth's water entitlement is then set aside before water is allocated to general security licence holders. This means that council is provided with 100% allocation in all but the worst drought years. Over the last 5 years Tamworth Regional Council has been allocated 100% of its entitlement by the end of the water year (30 June). While Tamworth has received its total water entitlement, in most years it uses well under half of that entitlement.

  There are opportunities to increase the amount of water set aside to provide greater drought security and accommodate future growth in water demand including by:

  – allowing for 100% of Tamworth's water entitlement to be set aside automatically each year – which will not change water availability in wet years for Tamworth or irrigators in the region, but will provide a greater buffer for Tamworth in dry years. It may also reduce reliability of water for irrigators in dry years
  – increasing the town water reserve in Chaffey Dam by 14 GL/year or more.

  An additional 14 GL of water set aside in Chaffey Dam could provide the same water security benefits as the previously proposed Dungowan Dam, reducing the risk of running out of water from a one in 1400 year risk to a one in 2450 year risk. However, changing reserves is likely to reduce average end of year allocation to Peel Valley general security licences from 64 to 50%. Peel Valley licence holders have noted that this will have a significant impact on the local irrigation industry.

  This option could be pursued in conjunction with demand management actions – for example, by increasing the reserve set aside in Chaffey Dam based on reductions in town water consumption achieved by Tamworth through demand management and water efficiency actions.

  There are opportunities to explore smaller or larger changes in the reserve set aside in Chaffey Dam. There are also opportunities to mitigate the impacts on licence holders by purchasing licences and converting or retiring the licences so the water can remain in the dam to support Tamworth's water needs. Over the long term, as Tamworth grows, additional action will be needed to support Tamworth's future water security risks – storing more water in the dam or progressing an additional water supply option.

  Some stakeholders opposed this action, in part due to concerns that this may result in a reduction of general security allocations and negatively impact water users in the region. Water users suggested that reduced water from general security allocations would not be able to be offset by additional water from off-allocation licences. Additional water during high flows will require larger on-farm storages which may not be physically feasible in the Peel catchment. Some stakeholders also raised concern about impacts to environmental water holders and planned environmental water that need to be carefully considered.

- **Off river storage for town water supply**

  Construction of a new 10 GL off-river storage and bulk transfer system near Tamworth could help improve water security for Tamworth. This option alone would not solve Tamworth's water security but could pursued in conjunction with other options to assist in improving Tamworth's future supply such as water efficiency measures and purified water recycling facilities.

  The benefits, impacts, costs and ecological implications of this option would require further analysis.

  All of these options require further investigation and consultation with stakeholders to understand the best long-term package of actions to support Tamworth's water security. It is important to recognise that a more variable future climate limits how much water can be taken from rivers and groundwater systems meaning that the next long-term water security option for Tamworth is likely to be costly and may have impacts on water used by other parts of the community or the environment.

  These difficult choices will require thorough and more detailed investigations, community consultation to identify the optimum package of long term options, and ways to mitigate and offset impacts. Additional options could be identified as information and evidence evolves over time, and as we work through this analysis in consultation with the community and stakeholders.

Action 1.7: Addressing water related skills shortages in small councils

Attracting and retaining skilled staff to operate water and wastewater treatment plants is a significant challenge for many local water utilities across the Namoi region and NSW more broadly. Councils in the Namoi region have identified this as an ongoing and widespread issue that can impact on their ability as local water utilities to maintain water and sewerage treatment operations and maintenance.

Over the next 4 years there is an expected deficit of 1,476 water operators' qualifications in NSW and a shortfall of up to 21 trainers and assessors to deliver training in regional NSW. This limits the capability of local water utilities to operate and maintain water infrastructure.

This is a statewide priority and work has already begun to help address this through the department's Town Water Risk Reduction Program. Working with Training Services NSW, 200 fully funded training places for new trainees each year were made available from December 2021, with 158 places filled between December 2021 and December 2022. Under this action, the NSW Government will continue to work across the training and water sector to help address the skills and training gaps. The NSW Government is investing $32.8 million into a suite of new initiatives to provide greater support for local councils and local water utilities under phase 2 of the Town Water Risk Reduction Program.

Image courtesy of Destination NSW. Hydroponically grown red coral lettuce at Paradise Fresh, Tamworth.

Image courtesy of Gerhard Koertner, Department of Planning and Environment.
Rocky creek, Warrabah National Park.

Priority 2

Supporting regional communities under a more variable and uncertain future climate

The Namoi region is one of the most productive agricultural and mining regions in Australia. Agriculture and mining will continue to underpin the regional economy in coming decades; however, declining water availability could reduce productivity and have flow-on impacts on the regional economy. There will also need to be preparation for a transition to an economy less dependent on coal mining in the decades beyond the timeframe of this regional water strategy.

The NSW Government is taking steps to help diversify the Namoi region's economy and reduce the vulnerability of communities to changing economic and climate conditions. Investments to help diversify the economy focus on leveraging and value-adding to the region's agricultural base, as well as encouraging investment in industries less dependent on water such as the New England Renewable Energy Zone, Inland Rail and the visitor economy.

These investments have the potential to provide more stable employment, attract investment and maintain liveability, particularly in the face of more extended droughts.

The actions shortlisted under this priority focus on strengthening the resilience of the region's economy by making sure communities, industry and environmental managers are better placed to make water related decisions.

Image courtesy of Jessica Stokes, Department of Planning and Environment. Yellow flower branch, Salt Caves Dam walking track.

Our starting point

A range of existing government strategies and programs have been developed to help support the resilience of regions, communities and industries to climate change. These include:

- **The Future Ready Regions Strategy and Future Ready Communities Pilot Program** which includes a commitment to upgrade the Enhanced Drought Information System to provide farms with world-leading weather and climate data so they can make better business decisions and develop drought resilience plans.
- **Aboriginal water rights:** jurisdictions across Australia have finalised a target of 3% for ownership of water entitlements by Aboriginal people and organisations under the National Closing the Gap Agreement. This will be a priority program for all governments over the coming years. The NSW Government will partner with First Nations/Aboriginal people to co-design a statewide Aboriginal Water Strategy that will identify a program of measures to deliver on First Nations' water rights and interests in water management and help address the statewide systemic issues to better enable the exercise of First Nations/Aboriginal people's rights and access to water.
- The NSW Government **Climate Change Research Strategy** is supporting projects that help primary industry sectors adapt to climate change. As part of this the Department of Primary Industries is analysing the risks and opportunities of a changing climate to support resilience and adaptation for broadacre cropping, horticulture, intensive livestock and forestry.
- The Australian Government's **Off-farm Efficiency Program**, which will provide over $1 billion for on and off-farm measures that improve the efficiency of water delivery infrastructure and increase the volume of water available for irrigators and communities.
- **Regional Plans** across NSW are being updated. The regional plans set a 20-year framework, vision and direction for strategic planning and land use to ensure regions have the housing, jobs, infrastructure, a healthy environment, access to green spaces and connected communities, green spaces and connected communities.
- **Regional Economic Development Strategies (REDS)** help provide a clear economic development strategy for each functional economic region across the state.
- The NSW Government's **Royalties for Rejuvenation Fund** will support sustainable economic diversification for coal mining communities. A Regional Expert Panel has been established to represent the North West region.

Figure 27. Actions for Priority 2: Supporting regional communities under a more variable and uncertain future climate

Legend				
 Addressing Tamworth's long term water security risks	 Addressing water security risks of regional towns across the Namoi Valley	 Improving the health and resilience of the region's aquatic and floodplain ecosystems	 Addressing barriers to Aboriginal water rights	 Supporting a growing regional economy in a future of potentially reduced water availability

Action number	Action name	Challenges addressed
Action 2.1	Invest in continuous improvement to surface water system modelling in the Namoi region	
Action 2.2	Accelerate investment in groundwater modelling in the Namoi region	
Action 2.3	Improve the participation of Aboriginal people in water management in the Namoi region	
Action 2.4	Improve public access to climate information and water availability forecasts	
Action 2.5	Undertake research to inform reviews of groundwater extraction and condition limits	
Action 2.6	Investigate the level of connectivity between the Peel Alluvium and Peel River to inform allocation and access rules	
Action 2.7	Support the development of new water-related Aboriginal business opportunities in the Namoi region	
Action 2.8	Improve outcomes for Aboriginal people through place-based initiatives	
Action 2.9	Support increased investment and research into industry climate adaptation	

Figure 27. Actions for Priority 2: Supporting regional communities under a more variable and uncertain future climate (continued)

Action number	Action name	Challenges addressed
Action 2.10	Increase transparency in the management of groundwater resources in the Namoi region	
Action 2.11	Investigate managed aquifer recharge in the Namoi region	
Action 2.12	Ensure the water management framework can support sustainable economic diversification and transitioning economies	
Action 2.13	Fully implement the NSW Floodplain Harvesting Program	

Mount Kaputar National Park.

Action 2.1: Invest in continuous improvement to surface water system modelling to the Namoi region

The NSW Government uses river system models to inform decisions around infrastructure investment, water sharing rules and policy changes. The models also provide information to support local water utilities in planning for future water supply and to inform water users generally about the risks and reliability of water entitlements.

We have heard there needs to be greater transparency around the development of models to help improve community confidence in them.

Continuing to improve and expand the capabilities of these models as new data and information becomes available will be particularly important for managing and sharing limited water resources and predicting and mitigating the impacts of increasingly variable and extreme conditions. This could include:

- publishing reports on how models have been built and peer reviewed
- investigating ways to represent how we change river operations as we go into and recover from drought. Being able to simulate drought contingency measures and better represent evaporation and groundwater seepage can help us to better assess the impacts and benefits of different actions during droughts
- investing in updated data and improved river system models for the region's unregulated river catchments
- reducing model uncertainty to better account for different components of water take once sufficient floodplain harvesting and unregulated river non-urban water take measurement data is available
- combining our models with analysis from hydraulic models and remote sensing to better estimate floodplain inundation extent and duration and consequent environmental outcomes, as well as improving our representation of floodplain return flows under different floodplain harvesting rules
- collaborating across different disciplines to explore how hydrologic models could be linked or combined with other models, such as economic and ecological models, to better understand ecological vulnerability to future conditions including climatic variation.

Improved modelling will give stakeholders and the broader community greater confidence that water-sharing and management decisions are made using the latest scientific knowledge and a strong and credible evidence base.

Horses at sunset.

Action 2.2: Accelerate investment in groundwater modelling in the Namoi region

The Namoi region is one of the most groundwater-dependent catchments in inland NSW. The ability to understand and forecast how groundwater sources will respond to changes in use, rainfall and recharge is critical to ensure that water management decisions are based on the best available information.

Groundwater levels fall and recover seasonally with annual pumping cycles and over multi-year periods where they decline in dry years and recover in wet years. Groundwater models are the only way we can assess the long-term (decadal and multidecadal) trends in aquifer behaviour in the highly used aquifers, such as the Lower Namoi Groundwater Source, taking account of the impact of water extraction. The models simulate the behaviour of aquifers over time including recharge, the movement of water and the take of water through bores and are critical for defining long-term sustainable levels of extraction for future reviews of water sharing plans.

Groundwater models can also:

- provide regional information to support local water utilities in planning for future water supply
- provide a better understanding of the impacts of groundwater extraction on other users of a groundwater source to improve the assessment of licence applications
- help to understand the potential risks to groundwater-dependent ecosystems and to water quality
- take into account the potential impacts of climate change and how that will influence the behaviour of groundwater resources into the future.

Continuing to update groundwater system models will need to be a priority. This action will fast-track the development and expansion of these models by:

- ensuring there are up to date, calibrated and peer reviewed numerical models of the Upper Namoi, Lower Namoi and Peel Alluvium – the most used aquifers in the region
- upgrading and expanding the monitoring bore network to fill in data gaps that are essential for improving our models. Additional and replacement monitoring bores are critical to ensure there is sufficient data to build and calibrate models
- incorporating shifts in demand and changes to rainfall patterns that are likely driven by climate variability
- incorporating new understanding on interconnectivity between surface water and groundwater. This is underway as part of the development of the Peel Alluvium groundwater model which will be used to inform future management decisions about this highly used groundwater source
- developing multi-disciplinary models incorporating socio-economic and physical data, as well as groundwater volume, level, and quality data
- developing approaches to help use the models to inform future water level and quality management practices.

By investing in improved groundwater modelling, we will have better tools to identify and manage risks to one of the most highly used and valuable groundwater sources in NSW.

Action 2.3: Improve the participation of Aboriginal people in water management in the Namoi region

We heard from Aboriginal people that consultation with their communities on water issues has been sporadic and poorly executed. Community sentiment is that government agencies often come out to 'tick a box'. During consultation in the Namoi region, Aboriginal groups told us that government had to earn the trust of the community as the first step in building a strong lasting relationship with them.

To address this now and over the next 20 years, we need an approach that allows Aboriginal people in each local area and region to involve the right people or have them appointed to roles where decisions about water are being made. Aboriginal people need to have a direct line of contact with regional water managers, compliance officers and decision makers. Aboriginal knowledge and science should be actively sought out, respected and listened to.

An effective governance, engagement and knowledge sharing arrangement is the first step in fundamentally improving Aboriginal people's involvement in water management. For it to be successful, the makeup and function of groups need to be led by local communities – experience has shown that government dictated governance models for Aboriginal communities do not work.

The NSW Government is setting up an Aboriginal Water Program led by an all Aboriginal team of staff. The team will develop an Aboriginal Water Strategy. The program will work with and fund existing or new Aboriginal groups to develop a governance approach for involvement in water management processes. The success of this action will be driven by the extent to which it enables self-determination and provides an adequate level of support for these groups.

This action supports Priority Reform 1 in the National Agreement on Closing the Gap – to enter formal partnerships and decision-making arrangements and develop place-based partnerships to respond to local priorities.

Local Aboriginal groups in the Namoi could be involved in:

- developing programs and initiatives to improve cultural competency within the water sector
- developing culturally appropriate water knowledge programs
- outlining a process that the NSW Government can follow to ensure water decisions have been appropriately considered by the community
- progressing on-ground initiatives.

Image courtesy of Destination NSW. Farming Barraba, farmer looking back at mountains.

Action 2.4: Improve public access to climate information and water availability forecasts

All parts of the community and government need access to reliable and timely information to make informed decisions and participate effectively in water planning.

An incomplete understanding of the risks relating to future water availability can lead to poor investments, poor business decisions, poor drought security planning and loss of opportunities to invest in alternative water supplies. For example, towns and communities may be unaware of the higher risk not just to their essential water supplies, but also to their local economies when a significant proportion of the economy is based around irrigated and rainfed agriculture – both of which suffer heavy impacts during extended severe droughts.

Having an incomplete picture of how, when and where water is used also has implications for water quality and water-dependent habitats. Longer and more severe droughts increase the risk of debilitating ecosystem damage, fish deaths and severe blue-green algae outbreaks. Better understanding of potential future climate scenarios will improve our ability to plan for, and mitigate, ecosystem risks.

In unregulated systems it is often difficult for users to gauge the level of water in different parts of the river to help guide when they can or cannot pump water in accordance with water sharing plan rules. In some areas such as around Manilla users manually notify each other on river levels and on whether commence to pump thresholds have been met in the system. For many users more sophisticated notification methods, and monitoring facilities could support better decisions in the unregulated reaches of the system.

The NSW Government will consult with stakeholders on their information needs and the best ways to communicate with them. We will design and deliver suitable training and information products and platforms that communicate information such as:

- 12-month climate outlooks and how these could influence water allocation decisions and other operational water sharing decisions, which could help water users make informed decisions on managing their allocations using carryover or trading water on the market
- indications of water allocations ahead of the 1 July start of the water year, where possible, to support business planning
- potential implications of long-term climate data for:
  - surface water availability and water quality
  - the likelihood of consecutive years of low or no water availability
  - periods when access to water allocations may be restricted by delivery problems in the regulated river system
  - groundwater availability.
- improvements over time in flow forecasting capabilities and investment in science and analytics to better understand rates of return of flows from floodplains into rivers
- how future use may affect the condition of groundwater resources
- a decision framework for how available water determinations are made based on use, compliance triggers, and carryover
- information about groundwater resources and how they are managed to assist councils and other water users to make more informed decisions about their water supply security.

We will do this by:

- increasing the frequency of surface water data collected – specifically during high-flow and flood periods, including updating the reliability and accuracy of gauging stations
- taking a proactive approach to understanding the water quality and quantity requirements of emerging industries in order to inform policy development and planning decisions
- delivering upfront education and clarity to new industries and government on potential water sources, given that the surface water sources and some groundwater sources are already fully allocated and there is potential for reduced water availability in the future
- encouraging new industries to have comprehensive drought management plans as they set up in the region
- modernising communication around commence-pumping and cease-to-pump targets being met in real time.

The work will build on or complement existing state and national information platforms and products, including the WaterInsights and Water Information dashboards.

Increasing the amount of publicly available climate-related information, including short-term and long-term water availability forecasts, will help the region's businesses plan with greater certainty. It will also support farm-level climate adaptation decisions.

Action 2.5: Undertake research to inform reviews of groundwater extraction and condition limits

Groundwater use in the Namoi region is one of the highest in NSW. The region has experienced long-term water level declines in some sections of its groundwater sources. For example, the area south of Breeza has experienced a decline between 2 and 5 m in water levels over multiple decades. Further declines may lead to a reduction in use by irrigators and a subsequent impact on economic activity in the region. It would also impact on First Nations and the environment.

The 2005 Achieving Sustainable Groundwater Entitlements program aimed to address long term water level declines in alluvial sources such as the Upper and Lower Namoi Groundwater Sources by reducing entitlements. The NSW Government needs to analyse the effect of these reductions in combination with new information to provide evidence for the review of the sustainable diversion limit for the Murray–Darling Basin Plan in 2026. This is a complex process because of seasonal and longer-term wet/dry fluctuations in groundwater levels.

Also important is reviewing the resource conditions limits – that is, what is considered acceptable water levels and quality parameters. This is becoming more of a concern in the alluvial aquifers of the Lower Namoi Groundwater Source and Upper Namoi Groundwater Source Zones 3, 4, 8 and 12. In these areas, the concentration of groundwater extraction is causing water level declines or creating interference effects between users. For such areas, we need to look at not only the larger-scale extraction limits but also the smaller-scale resource condition limits.

This action will:

- undertake field investigations and desktop analyses to provide up-to-date information on current and predicted long term trends in water levels, recharge rates and connectivity (with surface water and between groundwater systems)
- consider the impacts of climate variability and climate change using new climate information and updated modelling
- establish what groundwater extraction limits will need to be set in the future to ensure sustainable access to groundwater by consumptive users and the environment, considering the sustainable diversion limit review for the Murray–Darling Basin Plan in 2026
- establish the groundwater condition limits we need to ensure fair and ongoing access to groundwater for towns, industries and the environment.

Action 2.6: Investigate the level of connectivity between the Peel Alluvium and Peel River to inform allocation and access rules

The Peel Alluvium Groundwater Sources is connected to the Peel River, meaning that much of the water from the riverbed seeps into the groundwater source at various points.

The level of connectivity is contested. Some community stakeholders have raised concerns that with a high level of connectivity between the surface and groundwater sources, during severe droughts groundwater users near the Peel River can still access water even though surface water users cannot, arguing that the groundwater they are drawing is from the river.

Other stakeholders have told us that the level of connectivity with surface water across the groundwater source varies and the level of connectivity needs to be investigated before water allocation or access rules are amended.

Under current water allocation rules, aquifer licences in the Peel Alluvium near the Peel Regulated River receive an allocation each year where 51% of their licence linked to the groundwater allocation and 49% of their licence linked to the allocation to general security licences on the regulated river. If the groundwater allocation is 100% (as it is mostly) and the regulated river general security allocation is 0%, these licences still receive a 51% allocation. This rule was based on a modelled long-term pumping scenario at a rate equivalent to that permitted by the long-term average annual extraction limit, which showed that 49% of water pumped could be traced to the Peel Regulated River.[30]

The NSW Government is developing an enhanced model of the Peel Alluvium that includes a much better representation of the interchange of water between the alluvium and the river. This will be used to support a review of the water allocation rules for licences in the Peel Alluvium. If changes are recommended, they will be implemented through the review of the Namoi Alluvial Groundwater Sources water sharing plan in 2030.

30. www.industry.nsw.gov.au/__data/assets/pdf_file/0006/166875/peel-valley-background.pdf

Action 2.7: Support the development of new water-related Aboriginal business opportunities in the Namoi region

During our consultation on the Draft Namoi Regional Water Strategy, we heard about the need for economic development and business opportunities in the region that are led by Aboriginal communities and allow for local Aboriginal people to be employed.

Investing in regional Aboriginal run businesses and initiatives can help diversify incomes in the region, create employment for local Aboriginal youth and deliver social and economic outcomes for Aboriginal people.

The NSW Government is supporting Aboriginal business development opportunities in the Namoi region through a range of programs including the Aboriginal Partnership Program led by the Department of Regional NSW. The program will support a range of government agencies and communities in progressing economic development opportunities. A dedicated Aboriginal Partnership Manager will work with Aboriginal organisations, businesses, and individuals to identify and develop new business opportunities or better manage existing ones and access support or grant funding.

Other support is also available through the NSW Department of Aboriginal Affairs, the NSW Aboriginal Land Council and the National Indigenous Australians Agency.

Action 2.8: Improve outcomes for Aboriginal people through place-based initiatives

The Draft Namoi Regional Water Strategy identified options to improve Aboriginal people's access to water and water rights. While there was a significant amount of support for these options, preferences on how they should be prioritised or implemented varied across communities. The needs and priorities of Aboriginal communities in different parts of the region are different.

The Australian Government's Closing the Gap report and Local and Regional Voice program have highlighted that Aboriginal people have expressed the desire for strong and inclusive partnerships, in which local communities set their own priorities and tailor services and projects to their unique situations.

Programs with demonstrated successful initiatives are typically those that are tailored to local circumstances, place-based, well resourced, locally driven and often cannot be scaled up.

This action would provide NSW Government support for Aboriginal organisations and communities to develop tailored projects for their communities. It would aim to move away from central decision-making and develop a flexible program that is driven by the principle of self-determination – local communities 'speaking with their voice' to make decisions about which programs are needed for their community and their region.

In the Namoi region, this could include:

- developing a cultural watering program that supports cultural, economic, social and recreational outcomes for Aboriginal Communities and people across the Namoi region. This could involve working with the Department of Planning and Environment–Water, WaterNSW and environmental water holders to identify whether cultural water access licences or water for the environment could help deliver water to these locations
- improving access to Country, including locations that have local significance. This would include opening up local parcels of public land that have access to waterways that are otherwise gated or locked – such as travelling stock reserves or Crown roads
- a restoration reach, which would use cultural knowledge and science to rehabilitate riparian land, through planting of native species and caring for Country
- programs that engage Aboriginal youth in water and landscape management, with the aim to build cultural awareness and give a sense of ownership and cultural connectivity
- locally run programs that identify and record significant water dependent sites in the Peel and Namoi valleys. Information would be stored in a culturally appropriate way.

To receive government support, these initiatives would need to have local champions, effective local governance arrangements and a strong capacity building component.

Action 2.9: Support increased investment and research into industry climate adaptation

Farm businesses in the Namoi region are considered early adopters of best practice management and new technology.[31] The cotton industry has significantly improved whole farm irrigation efficiency and producers now achieve twice as much cotton from the same amount of water as 20 years ago.[32]

Continuing critical research and development will set industry up for the future and may go a significant way to mitigating future climate risks and adapting to climate change. There are opportunities to fast-track research and development into new practices and enterprises that are best suited to the warmer and drier conditions projected for regional NSW. This research would build on the climate vulnerability assessment being undertaken by the Department of Primary Industries and help agricultural businesses to diversify their incomes and ensure their long-term sustainability.

Through this action, the NSW Government will build on behaviour change and efficiency gains by continuing to support research, trials and demonstration projects for:

- evaporation mitigation technology, particularly suspended and floating covers, building on the significant amount of research already undertaken by the cotton industry, the Cotton Research and Development Corporation and the Department of Primary Industries
- smart sensors and automated irrigation systems
- reconfiguration of on-farm storages to reduce the surface area-to-volume ratio
- limiting deep drainage by increasing the soil's water holding capacity using novel compounds such as hydrophilic polymers.

This work could be progressed through:

- the NSW Government's $48 million expanded Farms of the Future program, which will support on-farm connectivity and encourage farmers to adopt agricultural technology (AgTech) to boost productivity including water efficiency and drought preparedness. In 2023, a grants program will be delivered to help farmers purchase AgTech devices and applications
- research programs of the Department of Primary Industries–Agriculture, which will lead efforts to translate world-leading research into practical improvements, including drawing on research to develop and coordinate local pilots, and information and training programs
- the One Basin Cooperative Research Centre program, a collaboration between government, research institutions and industry that will develop policy, technical and financial solutions to support and reduce exposure to climate, water and environmental threats in the Murray–Darling Basin.

Action 2.10: Increase transparency in the management of groundwater resources in the Namoi region

Groundwater users in the Namoi region have raised concerns about the transparency of government decisions about the risks associated with activation of inactive licences and responses to ongoing groundwater level declines. Improving the transparency of the types of actions government water managers may take to manage groundwater declines and other risks will give users more certainty to help plan for business decisions and confidence in decision-making processes.

This action will:

- look at ways to proactively manage groundwater systems where the entitlements plus basic landholder rights exceed the extraction limit. Risks associated with inactive licences will be investigated with the view to providing clarity to water users about how fully committed groundwater systems will be managed if licence activation and use further increases over the next 30 years
- prepare a guideline with a series of escalating management actions corresponding to stages of groundwater level decline. This will provide certainty to all water users about what actions the NSW Government will take and when in areas where groundwater extraction is causing declines in water levels and help towns, stock and domestic and industry users plan for more extreme droughts when groundwater may not be a viable backup.

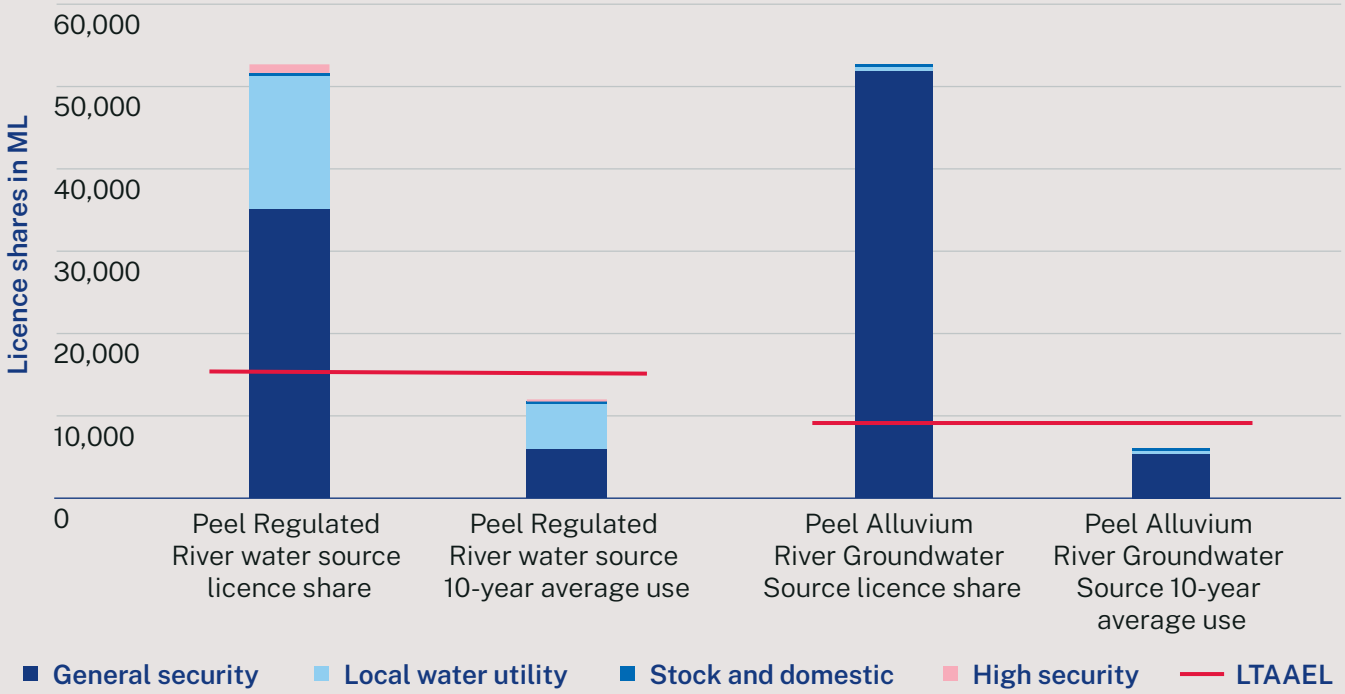
31. Roth, G., Harris, G., Gillies, M., Montgomery, J. and Wigginton, D, 2013, *Water-use efficiency and productivity trends in Australian irrigated cotton: a review, Crop and Pasture Science*, 64(12), pp. 1033-1048.
32. Australian Cotton Sustainability Report 2019.

Risks associated with potential future activation of underused licences in the Peel

In the Peel Regulated River system and the Peel Alluvium Groundwater Source, the number of shares is significantly higher than the megalitres set in the long- term average annual extraction limit – approximately 5 times higher in the Peel Regulated River and approximately 6 times higher in the Peel Alluvium.

However, average use remains below the extraction limit. As a result active irrigators in the Peel can presently access 1 ML per share in a large proportion of years because there are currently many licences that are underused or not used at all (Figure 28).

Figure 28. Water use by licence holders in the Peel Valley



Note: LTAAEL = long-term average annual extraction limit.

Some stakeholders were concerned about the financial risks that activation of unused licences represent to established irrigation enterprises. If the unused licences become activated and average water use goes beyond the long-term extraction limit, irrigators could have their water allocations reduced to maintain extraction within the long-term extraction limit.

We undertook a survey of licence holders in the Peel Valley and desktop market analysis to understand the risks of unused licences being activated to understand this risk.

Approximately 35% of the licence holders surveyed were concerned that the overallocation of licences presented a risk to their business operations. However, our analysis suggests that the risk of inactive licences actually being activated in the short-to-medium-term is small in the Peel Valley. This is because:

- Water availability and water allocations are seen as significant barriers to licence activation. Many water users hold large entitlements as a way to manage the risk of low or variable regulated surface water allocations.
- Farmers holding a larger number of licences were unable to activate licences when they wished due to the volume of water allocated to their licences. Climate risks suggests that water availability will become more variable, which may continue to act as a barrier to activated un-used licences.
- Groundwater is seen to be a more reliable water source than surface water, with farmers using groundwater to maintain crops during times when regulated surface water irrigation allocations is unavailable. However, even at the height of the 2017–2020 drought and during the millennium drought, groundwater extraction did not go above the extraction limit.

- Water demand by Tamworth is perceived to be a significant threat to water supply to irrigators.
- Activation of sleeper licences may occur if new commodities were able to be commercially produced, or if growth in demand and commodity prices significantly drives production. Half of the respondents to the survey stated had plans to expand the areas irrigated in the next 12 months with the majority considering purchasing water from the market to support this.

These insights suggest that there are barriers to activating un-used licences, and those that wish to expand land-use and use more water are more likely to use existing market mechanisms to access water.

As populations and affluence grow across key markets, or as alternative crops become commercial, demand for agricultural products from the Peel Valley may grow. This growth may drive the increased use of underused licences across the Peel Valley, impacting on the amount of water shared between general security licence holders.

As this risk is not expected to occur in the short-to-medium-term, there is no overriding need for government intervention at this stage. As a result, the Namoi Regional Water Strategy has not progressed a specific action to address unused licences. The risk of inactive licences being activated should be revisited in the review of the Namoi Regional Water Strategy.

Further information on the analysis used to inform this review is available at www.dpie.nsw.gov.au/namoi-regional-water-strategy.

Image courtesy of John Spencer, Department of Planning and Environment. Freshwater and reeds, Werrikimbe National Park.

Action 2.11: Investigate managed aquifer recharge in the Namoi region

Managed aquifer recharge – also known as groundwater replenishment, water banking or artificial recharge – is the purposeful recharge of water into aquifers for environmental benefit or future use, including during drought. A range of water sources can be used in aquifer recharge, including stormwater, treated wastewater, river or dam water, or industrial water.

Water can be artificially injected into the aquifer with pumps or infiltrated naturally through ponds or purpose-designed wetlands.

Progressing managed aquifer recharge is a NSW Government priority. Potential benefits from managed aquifer recharge include:

- minimising evaporation, compared to storing water aboveground
- providing additional recharge to groundwater sources to increase water reliability for groundwater dependent users, including ecosystems
- reducing pressure on surface water supplies during drought, which could improve environmental outcomes for riverine environments.

Our initial assessment has suggested that there is potential for managed aquifer recharge to be undertaken in several locations in the region, particularly by using an injection method to store water in the deep sandy and gravelly aquifers beneath the Namoi River. This action will investigate managed aquifer recharges and other subsurface storage options and their potential for implementation in the region.

The NSW Government is currently developing the regulatory framework for managed aquifer recharge. As it is a new alternative way of managing and storing water in NSW, extensive stakeholder consultation will be needed, especially because existing users could be affected.

To progress this action the NSW Government will, among other things:

- explore the feasibility potential of managed aquifer recharge, including its cost effectiveness and how efficiently the stored water can be accessed
- understand biosecurity and water quality risks associated with transferring water from surface water – especially stormwater or recycled water – to groundwater
- determine public acceptance, particularly the impacts on and benefits for Aboriginal cultural heritage and environmental flows – including specific pilot schemes
- create the water licensing and accounting framework for surface water temporarily stored as groundwater, and develop the necessary policy and legislative changes
- consider the distribution of benefits – additional water because of reduced evaporation – among consumptive water users and the environment.

Action 2.12: Ensure the water management framework can support sustainable economic diversification and transitioning economies

The NSW Government is making significant place- based investments in the region and surrounding areas to build strong communities and support industry development and diversification.

The NSW Government is committed to Net Zero which is the foundation for NSW's action on climate change and goal to reach Net Zero emissions by 2050. We need to ensure the Namoi region is set up to help attract new industries whilst helping to reduce emissions over the coming decades.

Many of the new industries that grow in the Namoi region will require access to water, which will need to come from trading of existing water entitlements, groundwater sources that are not fully allocated, or recycled and re-used water sources. We need to make sure our water entitlement and access framework can cater to these new industries by supporting sustainable access to water.

Coal mining will continue to be a significant contributor to the local economy in the coming decades. However, over the long-term it is an industry that will be directly affected by the global transition to lower carbon sources of energy. This is an immediate issue in some local government areas where small mines are closing down in the coming years, and a longer-term strategy for areas in the region where coal mining is expanding in the short term. We need to begin work now to prepare for the transition, particularly in places like Gunnedah where the economy has been reliant on coal mining industries for many decades. Transition will be a long -term process and may involve an overlap in the water needs of new industries entering the region while existing industries are transitioning.

This action will:

- begin investigations and preparation for the long-term transition away from coal dependent economies including how water will be needed to support the transition
- address water-related policy and regulatory barriers around supporting new and diverse industries setting up in the region
- encourage new industries to have comprehensive drought management plans
- use evidence from this regional water strategy when informing future industrial and land use planning strategies, to ensure there are sustainable water sources available to support new industries.

Converting general security licences to high security licences

The Namoi Regional Water Strategy: Shortlisted Actions – Consultation Paper included a proposed action around converting a small amount of general security licences to high security licences to enable more higher reliability products to be secured by businesses needing higher water security. During the public exhibition of the Draft Namoi Regional Water Strategy, significant concerns were raised about the impact this would have on the reliability of the remaining licences, particularly during dry periods, and the impact on the environment. In the Peel Valley, we heard that conversion factors would need to be very high in order to maintain the reliability of existing licences.

As a result, the strategy is not proposing to progress this in the short-term or medium-term.

Progressing this in the long term would need further modelling and consultation, as well as an impact assessment to confirm conversion factors and any rules needed to mitigate impacts on other licences, basic landholder rights and environmental outcomes.

Action 2.13: Fully implement the NSW Floodplain Harvesting Program

Floodplain harvesting happens when water is collected from floodplains during a flood or after a major or significant rain event (overland flows). It is a form of water take that has not been fully transitioned into the licensing framework provided by the *Water Management Act 2000*.

Floodplain harvesting is a significant farm management practice in the Namoi region. A large portion of all surface water used in the Namoi (up to one quarter) is water that is diverted from floodplains. This water is intercepted before it enters rivers and creeks.

Floodplain harvesting is accounted for in the legal limits on surface water extractions that are set out in the Murray–Darling Basin Agreement (the Cap), NSW water sharing plans (long-term average annual extraction limits) and the Basin Plan (sustainable diversion limits).

There has been growth in floodplain harvesting across the NSW northern Basin. Where this growth has resulted in total diversions in as water resource exceeding the legal limits, the floodplain harvesting reform will reduce take so that total diversions within each valley will not exceed legal limits. The reforms will also look to implement restrictions to make sure water is not taken by floodplain harvesting licences when there are downstream critical needs.

This action will ensure a regulatory framework is in place to regulate, measure and enforce floodplain harvesting water taken in the Namoi catchment.

Namoi River, NSW.

Priority 3

Improving the health and resilience of water dependent ecosystems

Changes to rivers flows and land use have impacted the health and resilience of water-dependent ecosystems across the Namoi region. The potential for longer and more severe droughts will increase the risk of ecosystem damage and the decline in connectivity.

This priority focuses on improving the resilience and health of the Namoi regions water dependent ecosystems through improved flow regimes, landscape rehabilitation and planning.

Our starting point

The strategy builds on the existing evidence base and programs being implemented across government that can guide how to achieve multiple outcomes with the water we have. These include:

- The Namoi Long-Term Water Plan which has been developed to describe the flow regimes that are required to maintain or improve environmental outcomes in the region.
- Water Quality Management Plans developed for the Namoi surface water resource plan and the Namoi Alluvial water resource plan which aim to provide a framework to protect, enhance and restore water quality for the region.
- The department has also prepared the NSW Extreme Events Policy and valley specific incident response guides that help manage extreme events in each of major water source in the NSW Murray–Darling Basin. The Extreme Events Policy is currently being reviewed given the severe drought conditions in 2017–2020 across NSW.
- The NSW Government responded in a range of ways to manage limited water supplies, support rural communities and minimise ecological impacts during the last drought (2017–2020). Individual valley 'drought snapshots' have been prepared that include sections on 'lesson learnt' and changes that are being implemented from the last drought (2017–2020).
- The NSW Government restricted commercial access to water to protect the first flow after the extended drought in 2020 (Northern Basin first flush event).

Flooding, Tamworth.

Figure 29. Actions for Priority 3: Improving the health and resilience of water dependent ecosystems

Legend				
Addressing Tamworth's long term water security risks	Addressing water security risks of regional towns across the Namoi Valley	Improving the health and resilience of the region's aquatic and floodplain ecosystems	Addressing barriers to Aboriginal water rights	Supporting a growing regional economy in a future of potentially reduced water availability

Action number	Action name	Challenges addressed
Action 3.1	Assess gaps in the flow regime and identify cooperative actions to improve ecological outcomes	
Action 3.2	Identify regionally significant riparian, wetland and floodplain areas to protect or rehabilitate	
Action 3.3	Mitigate the impact of water infrastructure on native fish	
Action 3.4	Remediate unapproved floodplain structures	
Action 3.5	Improve understanding of water use and water quality at priority locations in the Namoi region	
Action 3.6	Investigate ways to improve connectivity with the Barwon–Darling River on a multi-valley scale	
Action 3.7	Continue investment in groundwater science in the Namoi region	

Action 3.1: Assess gaps in the flow regime and identify cooperative actions to improve ecological outcomes

All water, including water from natural events and consumptive (irrigation and town) water, has the potential to contribute to the ecological condition of rivers, wetlands, and floodplains. The way the river is operated to deliver consumptive water can either enhance environmental outcomes or worsen environmental impacts.

The water sharing plan for the Namoi Regulated River helps to ensure that approximately 73% of the long-term average annual flow in the water sources remains in the river to help maintain the basic health of ecosystems.[33] Provisions in the Peel catchment water sharing plans include similar rules that set extraction limits and require the remaining inflows to be left in rivers for the health of the environment.

The water not subject to these protection provisions is allocated to licences. Of the water entitlements issued to licence holders in the Peel and Namoi catchments, 3.5%[34] are held by the Commonwealth environmental water holder as general security licences. There is also up to 5 GL of an environmental water allowance in the Peel catchment depending on general security allocations. A further 9.5 GL still needs to be recovered for the environment in the Namoi catchment under the Basin Plan.

Environmental water provisions do not always allow environmental water holders to use this water to meet some of the flows needed to support ecosystem needs.

As a result, we need to rely on how water is released from the dams for irrigation use to maximise environmental watering benefits and minimise water quality impacts.

There may be fewer opportunities to use environmental water licences to support environmental outcomes in the region under a more variable or changing future climate, particularly if the reliability of general security licences declines under climate change scenarios. We need to make sure mechanisms are in place to allow water for the environment to go as far as possible.

This proposed action would investigate opportunities to provide flexibility to manage environmental flows in changing climate conditions, better coordinate the management of consumptive flows and water for the environment and achieve more natural flow patterns without impacts on water users. This could include:

- reviewing relevant water sharing plan rules around carryover of the environmental water allowance in the Peel Valley and protection of environmental water to improve flexibility and certainty of environmental water
- coordinating dam releases with unregulated tributary flows to promote higher flow events, within system constraints
- assessing system constraints and developing a program to address them, where possible
- refining water releases from dams and weir pools to mimic more natural rates of rise and fall and minimise water quality impacts. This could include developing procedures to manage block releases and other operational measures and identifying critical triggers and potential actions in relation to water quality events
- planning water releases from water storages to better consider environmental impacts, damage to riverbanks, risks to public safety and operational efficiency
- protecting critical drought refuge areas such as wetlands, billabongs and lagoons by defining triggers for protecting natural flows to these areas
- improving transparency and certainty about how water will be managed during drought by updating the Incident Response Guide[35] and developing a drought management plan for the Namoi region
- developing guidance on how to ‘restart’ the river after dry times or cease-to-flow events to minimise the risk of fish deaths occurring from hypoxic blackwater events or the destratification of pools
- investigating the impact of drought management responses on alluvial groundwater sources and designing responses to account for this influence.

Workable solutions could be included in guidance developed by the Department of Planning and Environment for the coordinated management of water for the environment and consumptive (irrigation) flows.

33. Clause 13 of the Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016
34. 14805 environmental shares – percentage compared with all regulated licences in the Namoi and Peel valleys
35. www.mdba.gov.au/publications/mdba-reports/namoi-alluvium-water-resource-plan

Action 3.2: Identify regionally significant riparian, wetland and floodplain areas to protect or rehabilitate

The Namoi region includes wetlands and lagoons of national, state and regional significance including Lake Goran, Gulligal Lagoon and Barbers Lagoon as well as a series of lagoons that stretch between Boggabri and Narrabri along former channels of the Namoi River. When inundated, these water bodies provide important habitat for migratory birds and a range of flora and fauna. They are also important drought refuges.[36]

Land use changes for urban and agricultural development have had adverse impacts on the health of the rivers and water bodies throughout the region. Water now moves more quickly and with more energy through the catchment, eroding land and waterways, reducing water quality and leading to less water being stored in the landscape. The degradation of native riparian vegetation along water courses is recognised as a key threatening process under the *NSW Fisheries Management Act 1994.*

This action would deliver targeted, on-ground activities at high priority locations to restore, conserve and protect critical riparian, wetland and floodplain habitat and species, or areas of high cultural value in the Namoi region. The action could build on existing land management programs and other local initiatives to coordinate a whole-of-catchment program of works to improve river health, connectivity and ecosystem resilience. Works could include instream structures – for example, appropriately designed and approved large woody habitat structures – as well as improved instream vegetation to slow and filter water flow. These works improve water quality by removing sediments and nutrients. Improved riparian management, including controlling stock access, could provide bank stability, protecting banks from erosion and reducing sediment loss during floods.

Delivering this more focused and prioritised approach would require:

- mapping existing programs and potential overlaps
- developing a system to prioritise areas to protect or rehabilitate – for example, based on detailed habitat mapping data, native fish conditions, threatened species distribution, the River Styles Framework, severity of land degradation and environmental management outcomes
- establishing a program of management measures
- identifying funding models, including landholder incentives
- developing a clear governance framework for decision making and program delivery
- understanding and integrating local Aboriginal knowledge and expertise in delivering river improvement works – for example, through a River Rangers program
- developing a monitoring and evaluation framework based on the outcomes and targets identified through the Namoi Long-Term Water Plan.

36. Eco Logical Australia 2008, *Namoi Wetland Assessment and Prioritisation Project*. (Project No. 125-005). Draft report prepared for Namoi Catchment Management Authority, Gunnedah.

Action 3.3: Mitigate the impact of water infrastructure on native fish

Many native fish species in the Namoi region require unimpeded access through waterways to move upstream and downstream daily to access food, avoid predators and find shelter, and seasonally to spawn, migrate and recruit. Enabling native fish to move across the region will improve the resilience of fish species in a changing climate and also help to maintain and replenish native fish stocks across the northern Murray–Darling Basin.

Improve fish passage at priority sites in the Namoi region guided by the *NSW Fish Passage Strategy*

Physical barriers to fish passage such as weirs and dams can limit fish movement, leading to a decline in the health and viability of native fish populations. Removing barriers to fish movement and allowing fish to breed and find food and ideal habitat are critical to supporting native fish populations in the Namoi region.

Good progress has been made in remediating 2 priority fish barriers in the Namoi region. The temporary town weir on the Lower Namoi River has been removed as a requirement of the 1 m raising of Walgett Weir on the Barwon River. A fishway at Gunidgera Weir is included in the WaterNSW Dam Safety Upgrade Fishway Offset program and is funded for delivery over the next 5 years. Remediation of the priority barriers will restore catchment-wide connectivity from the Barwon River junction to Keepit Dam. This will improve fish access to habitat across an additional 561 km of the Namoi River and sections of the Peel River.

An additional 6 fish barriers with medium to high priority across the Namoi and Peel rivers and Halls Creek could be considered for remediation in the future.

Implement fish diversion screens at priority sites in the Namoi region

Large numbers of native fish are sucked into pumps and diverted into irrigation channels along with debris such as sticks and leaves. This impacts the sustainability of native fish populations because these fish are taken out of the system. It also causes significant damage to irrigation infrastructure.

Approximately 2,300 pumps are distributed across the Namoi and Peel river systems. The highest concentrations of pumps are found on sections of the Macdonald, Peel and Mooki rivers, Coxs Creek, the mid-Namoi River; and below Narrabri.[37]

Modern screens are available to solve these problems, by stopping fish and debris entering pumps and diversions. Modern screens can reduce fish losses at water diversions by over 90% and protect native fish during upstream and downstream migrations, helping more fish survive to maturity and boosting native fish populations. The protection extends to other aquatic species such as crayfish and turtles. Screening infrastructure also improves pump operation, water delivery and extraction efficiency for asset owners through fewer blockages caused by debris.[38]

This action could identify priority reaches in the Namoi region to install diversion screens and seek funding for their installation.

Progress cold water pollution measures

Cold water pollution has damaging impacts on riverine ecological function, particularly in summer when biological cues such as fish spawning are disrupted. The water released from dams is typically 5°C colder than the ambient river temperature, and the cold water pollution can affect the river for more than 100 km downstream of the dam.

Chaffey and Split Rock dams have variable-level offtakes to mitigate cold water pollution, Keepit Dam has no mitigation infrastructure. While variable-level offtakes can be operated to reduce cold water pollution risks, in warmer months, the presence of potentially toxic surface algae often means that it is not possible to use the variable-level offtake to take warmer surface water. As it is not currently possible to remove the risk of algal blooms in these dams, additional actions to manage cold water pollution need to be taken.

Through this action, WaterNSW and the Department of Primary Industries–Fisheries would:

- improve understanding of the improvements in fish populations that can be achieved by addressing cold water pollution
- progress investigations into infrastructure improvements, new technologies and operational changes to find a preferred solution for the Namoi region.

37. Department of Primary Industries 2007, *The effects of selected irrigation practices on fish of the Murray–Darling Basin Fisheries*, Sydney.
38. Boys, C., Baumgartner, L., Rampano, B., Robinson, W., Alexander, T., Roswell, M., Fowler, T. and Lowry, M. 2012, *Development of fish screening criteria for water diversions in the Murray–Darling Basin*, Fisheries Final Report Series No. 134, Department of Primary Industries, Sydney.

Action 3.4: Remediate unapproved floodplain structures

Extensive floodplain development exists on the Namoi Valley floodplain, including levee banks, earthworks, on-farm storages, raised roads and water supply channels. Flows that extend to the floodplain can be constrained by these structures, which are referred to as flood works. Flood works can significantly alter the flow of waters across the floodplain and impact on the flood connectivity that is essential for sustaining ecological and cultural assets and allow water to move unimpeded through the valley.

The Improving Floodplain Connections program (which commenced in January 2022), has identified 5 hotspot areas in the Upper Namoi Valley floodplain and 11 in the Lower Namoi Valley floodplain for the remediation or removal of works. These works are altering the flow of floodwaters in the region and potentially impeding the delivery of water to floodplain areas and to the end of the system. These hotspot areas relate to an area that may involve more than one work.

A large proportion of wetland and floodplain ecosystems in the Namoi region would benefit from this action. The program also has the potential to enhance cultural sites and values held by local Aboriginal people.

Pilligia Cave, Pilligia Nature Reserve.

Action 3.5: Improve understanding of water use and water quality at priority locations in the Namoi region

Currently, water management across regional NSW is impaired by gaps in real-time and long-term information on streamflow, water extraction and water quality. Telemetered river gauges are limited in the region because of operational costs, and water taken from many unregulated rivers is poorly metered.

Under the NSW Non-Urban Water Metering Policy, the extraction of water will be accurately measured and reported on all unregulated rivers, giving a better understanding of water use over the next few years.

Water quality is important for ecological processes, recreation, amenity and industry use. Changes in water quality are due to a combination of factors, including changes in river flows and land use. For example, high flows from rainfall and runoff often result in higher turbidity, whereas low-flow and cease-to-flow events increase the risk of algal blooms in reservoirs and weirs. Rainfall following extended dry periods can also increase the risk of blackwater events, which can result in fish deaths.

Improved information about water quality and water use at priority locations could be used to inform future planning and management for these systems, such as developing environmental watering requirements, developing access and trade rules, identifying flow components for protection, and preventing environmental harm.

This action will review existing monitoring programs and data to identify key information gaps and investigate how they could be addressed. Areas that have already been identified include:

- improving understanding of water use in unregulated water sources, particularly in the Lower Namoi and near Lake Goran, which is an important site for migratory birds
- improving telemetered monitoring of water quality parameters such as dissolved oxygen, turbidity and conductivity on regulated and unregulated systems to inform management of water quality during regulated releases and extreme events such as droughts, floods and bushfires.

Once identified, information gaps could be addressed through investment in technologies and monitoring that can provide additional information about water quality, flows and use.

Action 3.6: Investigate ways to improve connectivity with the Barwon–Darling River on a multi-valley scale

The Namoi catchment is one of several NSW and Queensland catchments that play a critical role in providing water to the Barwon–Darling River system.

We have heard that many stakeholders outside the Namoi region expect additional actions in the Namoi Valley to help meet needs downstream and improve connectivity. We have also heard that it may not be possible to improve connectivity when the river dries up naturally from time to time.

The NSW Government is taking action to improve connectivity and strengthen downstream protections for the environment and high priority needs. This includes taking action to:

- reduce water usage in the Namoi valley, so that it returns back to the extraction limits set in NSW water sharing plans
- ensure that there are adequate statutory protections in place to ensure 'first flush flows' are prioritised for downstream critical human needs before floodplain harvesting licences are issued
- accelerate an independent expert panel review into the adequacy of the protections in water sharing plans across the northern Basin to meet downstream needs following critical dry periods, improve water quality and allow native fish to move.

This work is being covered through a more coordinated, system-scale approach as part of the Western Regional Water Strategy.

Rule changes that significantly affect the amount of water available to water licence holders may trigger compensation under the *Water Management Act 2000 (NSW)*.

Action 3.7: Continue investment in groundwater science in the Namoi region

The NSW Government has invested in understanding groundwater systems over many decades.[39] However, these systems change over time in response to changes in groundwater use and the climate. There are also emerging threats to these systems and the ecosystems they support, such as pollution from different land uses. We need to better understand these changes and threats to protect and manage the resource for the future. Continuing to invest in groundwater science and increasing our knowledge of groundwater sources and their dependent ecosystems, water quality and changes to aquifers is critical to future management of this important resource.

Priority areas of research include:

- **Groundwater-dependent ecosystems:** The Namoi region is home to many important groundwater-dependent ecosystems such as river red gum, coolibah, black box, river cooba and lignum communities. They support a range of species and important ecosystem services, supplying drought refuge for fish, waterbirds and foraging species during dry periods. Degradation of habitats, a decline in groundwater levels due to water extraction, land clearing and changes in land use have had severe impacts on the health of these systems. Our current knowledge of the locations and water requirements of these ecosystems is very limited.
- **Groundwater quality:** Groundwater quality information in the Namoi is generally out of date and has many gaps. Quality can change over time; for example, due to declining groundwater levels that can draw in saline groundwater from surrounding aquifers. Improving groundwater quality monitoring through auditing the current bore network (and expanding the network if required), implementing regular sampling programs and collating groundwater quality data from industry and government sources into one database can help to identify groundwater quality risks early.
- **Sediment compaction risks:** Declining groundwater levels in some areas of the Lower and Upper Namoi means there is a risk of sediment compaction. This can lead to land subsidence, reduction in groundwater storage capacity and water quality degradation over time. Appropriate scientific and modelling work can help to clarify these risks.
- **Groundwater recharge rates:** Understanding recharge rates is essential to sustainable use and management of groundwater and supports evidence based decision making by councils on town water security matters. We have heard that a greater understanding of groundwater recharge rates is needed to inform water decisions made by multiple levels of government.

Filling these gaps in our knowledge of groundwater systems would provide important information for our groundwater system models and inform reviews of water sharing plans, water licensing and approval decisions, and land management.

39. Read more about groundwater science undertaken by the NSW Government at, water.dpie.nsw.gov.au/science-data-and-modelling/groundwater-management-and-science

Implementing the strategy

6

Image courtesy of Jessica Stokes, Department of Planning and Environment.
Rocky hills, Mount Kaputar summit.

Getting our timing right

A critical feature of developing the strategy has been deciding which actions and investments are needed now, and which ones will be needed further into the future. The strategy has a 20-year timeframe. The timing of various actions is aimed to meet existing challenges, identify and prepare for foreseeable coming challenges, and lay the groundwork for adapting to future uncertainties and changed circumstances.

The water security actions in this strategy have a strong focus on drought security following the experience of the 2017–2020 drought. However, this drought has been closely followed by major flood events from 2020–2022.

Some of the actions in this strategy may have the capability to mitigate low to moderate flooding events. Analysing the flood management benefits of many of the actions in this strategy will require enhanced investment by governments in flood modelling and mitigation works.

The floodplain management plans being developed for northern NSW valleys are the cornerstone for whole-of-catchment floodplain management in western NSW and will be extended into the southern NSW valleys over the coming years. Local councils, the Office of Local Government and the Department of Planning and Environment–Environment and Heritage take specific lead roles in flood risk management for towns and regional centres across the state.

The strategy has a separate implementation plan that prioritises the delivery of actions. The implementation plan also outlines responsibilities and timeframes for delivery, so that we can monitor the progress of the actions, assess the effectiveness of the strategy and identify areas where we need to adapt.

Not all actions will be commenced at once, and funding will be a key consideration in planning when and how the actions will be implemented. The regional water strategies will be a key tool in seeking funding as future opportunities arise.

The implementation plan sets out priorities over the next 3 years and is located at www.dpie.nsw.gov.au/namoi-regional-water-strategy

The implementation plan also identifies the key partners who will be involved in the implementation plan.

- NSW Government agencies will lead implementation of actions that will develop and review policies and regulatory arrangements in consultation with the community undertake research; deliver regional programs and take action where there is a market failure or other need for government intervention. The NSW Government will also support local water utilities when needed.
- Local councils will be involved in actions that influence town water supply at the local level and lead actions directly related to local level strategic planning.
- State owned corporations, such as WaterNSW will be involved in actions that result changes to design, operation and management of major infrastructure and the way water is delivered in regulated rivers.
- Community and industry groups and research organisations will be engaged in the implementation process for actions and may partner with different levels of government to progress or deliver certain actions.

Figure 30. Regional water strategy process

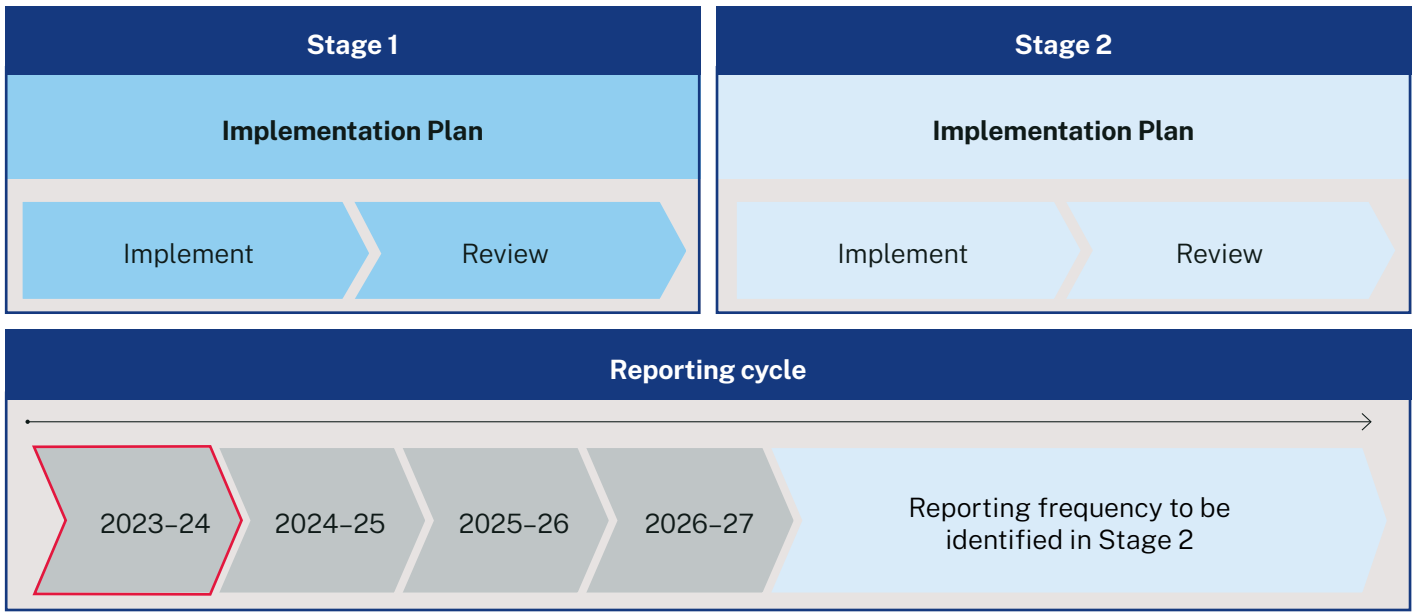


Image courtesy of Destination NSW. Oxley Scenic Lookout, Tamworth.

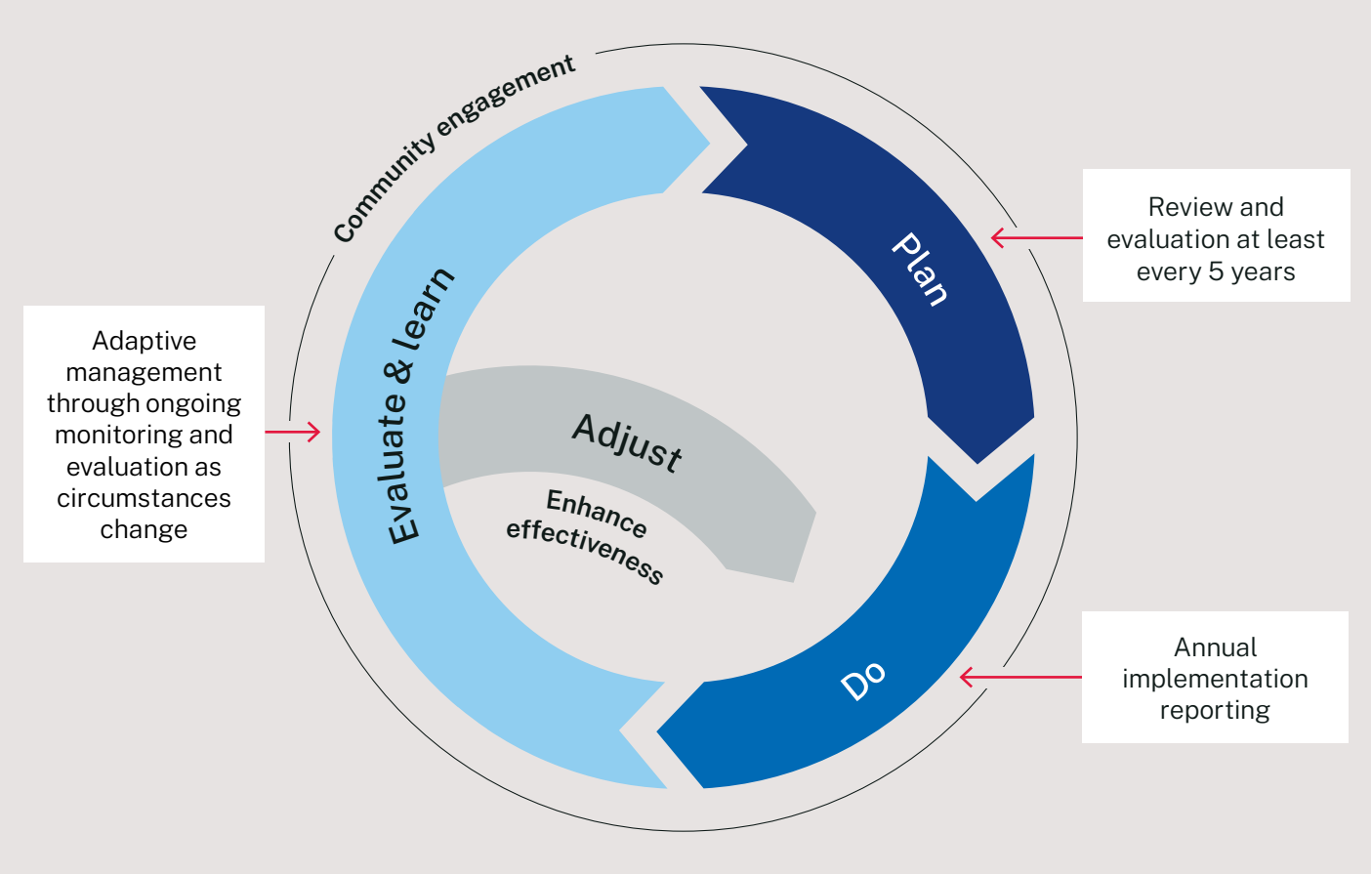
Ongoing monitoring, adaptation and reporting

The Namoi Regional Water Strategy is designed to respond to changing circumstances. We will undertake a formal review of the strategy at least every 5 years, or in response to significant changing circumstances. The formal review will ensure that the key assumptions, such as population and demographics, have not significantly changed.

Amendments may also be made in response to key changes in water demand, social preferences, science and technology, economic conditions, or other events, including how climate change assumptions and responses evolve. These amendments may result in a shift in priorities, and the implementation plan will be updated to reflect this.

We will report every year against actions in the implementation plan, so that the community can track our progress and we can demonstrate which actions have been delivered, or continue to be delivered, in that year.

Figure 31. Regional Water Strategy Process



Attachment 1

7

River, Regional NSW.

Gomeroi and Kamilaroi water challenge statement

In 2021, the Gomeroi/Kamilaroi water committee developed the following water challenge statement.

Aboriginal people have lost access to water and country

> We can't sing our song no more, we can't live on the river no more to look after her, for you all.' (Gomeroi)
>
> 'Yaama Nginda Gomeroi Wunnungulda. We are Gomeroi, we have our way of doing business. You have to be invited to sit around our fire. We share language and we engage together. You are asked to identify who you are and what you represent and be clear in your intent. Then, and only then can we do business together.'

Gomeroi and Kamilaroi people have occupied the Namoi Valley for at least 60,000 years. They have always been closely linked to rivers, groundwater, billabongs and wetlands, and this relationship is essential to culture, community and connection to Country.

The historical dispossession of land and the effect of colonial era settler laws continue to impact Aboriginal people's rights and access to water. Since European settlement, large areas of land have been converted to private property, and Aboriginal people forced onto Missions and Reserves. Private land, fences and locked gates prevent Gomeroi and Kamilaroi people from accessing country and water, carrying out cultural practices and using traditional knowledge to care for and manage waterways. Access to waterways is critical to providing a purpose and pathway for young people to connect to culture and provide a space for healing, as well as for food, medicine and teaching.

We heard during consultation that access to waterways is critical to providing a purpose and pathway for young people to connect to culture and provide a space for healing, as well as for food, medicine and teaching. In addition, access water entitlements now require Gomeroi and Kamilaroi people to buy it from the fully or overallocated market.

We know from consultation undertaken regionally and for the NSW Water Strategy that there is strong community support for Aboriginal water rights and access, with the small amount of water in Aboriginal ownership frequently identified as a key area for improvement.

Aboriginal water values are not well-supported by water management

Current water legislation and water management frameworks have evolved over the last 130 years but do not fully reflect Gomeroi and Kamilaroi water values. This is exacerbated by the limited involvement of Gomeroi and Kamilaroi people in water policy and planning processes, which is the result of:

- changes to Aboriginal water programs
- consultation timeframes and processes around water policy changes not allowing the time needed for Gomeroi/Kamilaroi cultural governance processes, leading to erosion of trust
- Gomeroi/Kamilaroi people not being informed or having a say in when and where environmental and cultural water is delivered
- the complex set of state and national laws and systems around water management, which is often not explained in plain English or in a visual manner (taking into account levels of water literacy)
- inadequate resources and support for Gomeroi/Kamilaroi people to engage in water management
- Gomeroi/Kamilaroi people now having to buy rights to water that they once had from a fully allocated market
- structures around water management not providing for Gomeroi/Kamilaroi people's cultural governance structures or shared management.

Changing this system and empowering Aboriginal communities to make decisions on water requires the NSW Government to 'flip the model on its head' and develop an approach to engagement that works for Gomeroi/Kamilaroi people. For many years, the government has committed to models around committees and advisory bodies that are not made up of local Aboriginal people with cultural connection to, or authority to speak about, their Country. We need an innovative approach that allows Gomeroi/Kamilaroi people in their Nation area to get the right people involved or appointed to seats at the table where decisions about water are being made.

Gomeroi/Kamilaroi people would like to have a direct line of contact with regional water managers, compliance officers and decision makers, and have their knowledge and science actively sought, respected and heeded. To do this, water policy makers, planners and managers need to 'sit at the fire', listen to the knowledge holders and develop a cultural governance structure that is familiar to Gomeroi/Kamilaroi people, supported by the time that is needed to engage, consult and listen genuinely.

We need an innovative approach that allows Gomeroi/Kamilaroi people in their Nation area to get the right people involved or appointed to seats at the table where decisions about water are being made.

Image courtesy of Department of Planning and Environment–Environment and Heritage.
Warrumbungle Range from Pilliga Forest lookout tower.

Department of Planning and Environment

NSW GOVERNMENT