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Regional Water Strategy

Lachlan

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Cover image Image courtesy of Shutterstock. Gum Bend Lake, Condobolin.

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Acknowledgements

Thanks to the Murray–Darling Basin Authority, Snowy Hydro Limited, Department of Energy, Environment and Climate Action Victoria, ACT Government and Icon Water for their collaboration in hydrological modelling to inform the development of this strategy.

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 practice the oldest living culture on earth.

The NSW Government acknowledges the Barkandji, Maljangapa, Nari Nari, Ngiyampaa, Wiradjuri and Yita Yita people as having an intrinsic connection with the lands and waters of the Lachlan 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 practice their traditional culture and lifestyle. We acknowledge that Bila Galari is the traditional Wiradjuri name for the Lachlan River.

We recognise the 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 will 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/Traditional Owners hold a strong voice in shaping the future for all communities.

Artist and designer Nikita Ridgeway from Aboriginal design agency, Boss Lady Creative Designs, created the People and Community symbol.

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Image courtesy of Shutterstock. Boat moored near pedestrian bridge on Lachlan River, Hillston.

About the Lachlan Regional Water Strategy

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Image courtesy of Destination NSW. Windmill, Booligal.

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

Changing demands for water, increased climate variability and shifting community expectations mean that the department will need to plan for and invest in improved long-term regional water security.

This strategy identifies the key water-related regional challenges that need to be tackled over the coming decades, and outlines the actions to respond to them. The best and latest climate evidence, along with a wide range of tools and solutions, has been used to chart a progressive journey for water needs for the next 20 years and beyond.

Image courtesy of iStock. Cowabbie Creek, NSW.

The regional water strategies

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

This strategy is one of a suite of catchment-based strategies across the state (Figure 1). The strategies identify critical challenges that the department will need to tackle over the coming decades and outline the priorities and actions 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 the ability to achieve the objectives and identifies priority actions that address the challenges and work 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.

The aim is for each strategy to have a comprehensive, balanced package of actions that delivers on all the regional water strategy objectives and aligns with the priorities and actions of the NSW Water Strategy.[1]

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.[2]

When all or part of a water sharing plan has been suspended because of an extreme event, such as drought, the focus is on securing water for critical human needs. At these times, under section 60 of the *NSW Water Management Act 2000*, taking water for domestic purposes by people with basic landholder rights, and for domestic purposes or essential town services with an access licence, is the first priority and the environment is the second priority. Outside of these extreme events, there is greater flexibility to deliver across all objectives of the *Water Management Act 2000*.

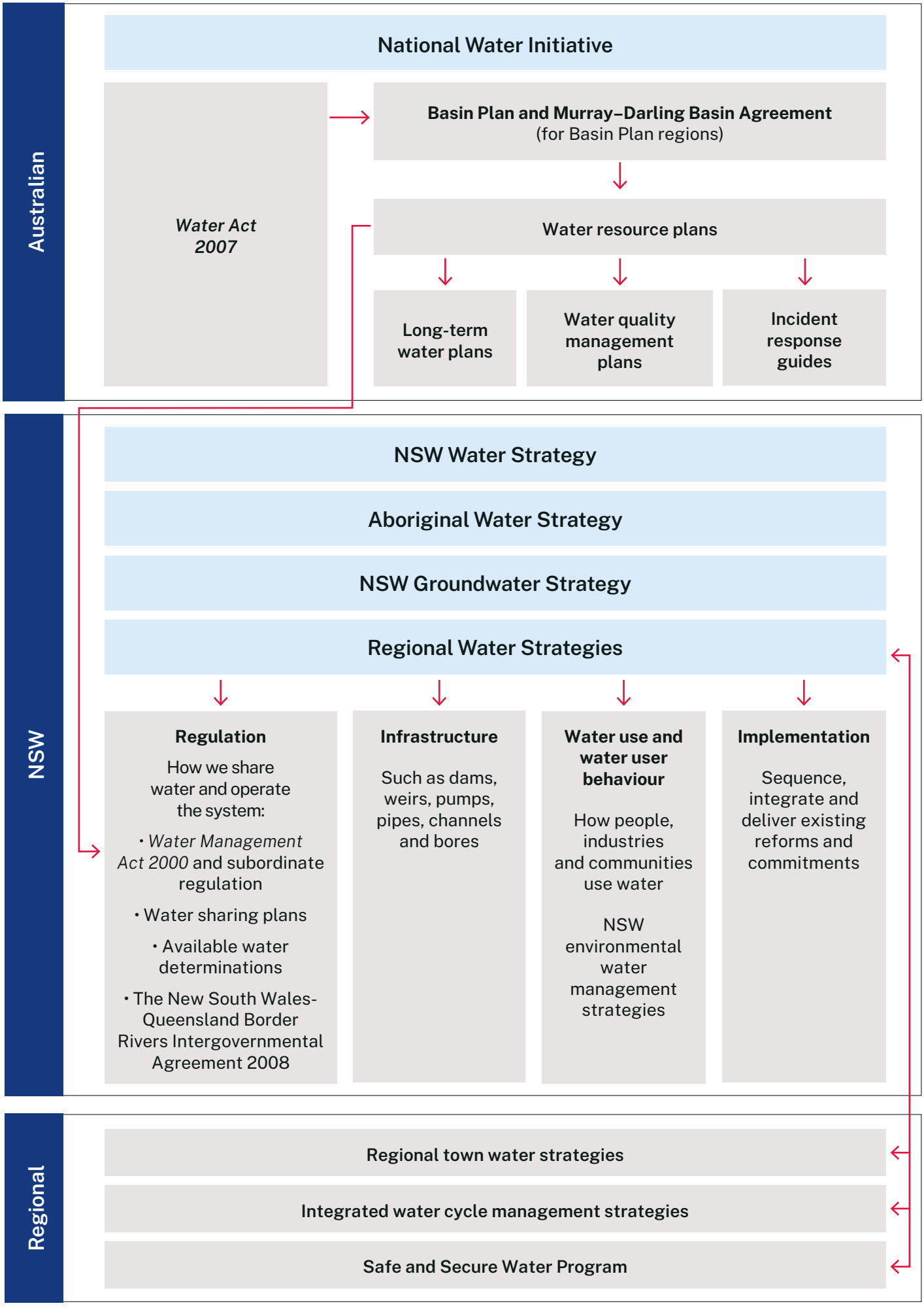
1. Available at: water.dpie.nsw.gov.au/our-work/plans-and-strategies/nsw-water-strategy
2. Subsections 9(1)(b), 5(3)(a) and 5(3)(b) of the *Water Management Act 2000*.

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. Canola fields, Parkes.

Figure 3. NSW strategic, policy and planning context for water



The strategic planning framework for water management in NSW includes the NSW Water Strategy,[3] 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. 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.

The NSW Water Strategy and the Lachlan Regional Water Strategy also complement other whole-of-government strategies, including government commitments to the Net Zero Plan,[4] the State Infrastructure Strategy[5] and the following regional plans: Central West and Orana Regional Plan 2041,[6] the Riverina Murray Regional Plan 2041,[7] the draft Far West Regional Plan 2041,[8] and the draft South East and Tablelands Regional Plan 2041.[9]

Regional water strategies primarily relate to strategic water resource management. For example, regional water strategies set out actions to:

- reduce water security/drought risks, which can act as an input to local and statewide disaster planning
- mitigate flooding through natural or hard infrastructure, for example actions relating to catchment revegetation or potential alterations to dams. These may also influence flood behaviour and can be investigated in flood risk management studies in accordance with the *Flood Risk Management Manual*,[10] to inform local or state disaster planning
- mitigate the secondary effects of disasters, for example actions to address fish kills and water quality, can also inform state disaster planning.

A State Disaster Mitigation Plan[11] has been developed, and regional disaster adaptation plans are under development by the NSW Reconstruction Authority.[12]

The authority will collaborate with local councils to develop local disaster adaptation plans, so communities and stakeholders can identify the disaster risks and vulnerabilities in their unique regions.

The NSW Reconstruction Authority has recently updated the NSW Recovery Plan, which outlines the responsibilities, authorities and mechanisms for disaster recovery in NSW.[13]

Further information relating to local council and state agency roles and responsibilities for flooding is included in Challenge 2: Understanding flood risks to individuals, businesses and communities of this strategy and a breakout box under Action 1.2.

3. Available at: water.dpie.nsw.gov.au/plans-and-programs/nsw-water-strategy
4. Available at: dcceew.gov.au/climate-change/emissions-reduction/net-zero
5. Available at: sis2022.infrastructure.nsw.gov.au/
6. Available at: planning.nsw.gov.au/plans-for-your-area/regional-plans/central-west-and-orana-regional-plan-2041
7. Available at: planning.nsw.gov.au/plans-for-your-area/regional-plans/riverina-murray-regional-plan-2041
8. Available at: planningportal.nsw.gov.au/draftplans/under-consideration/draft-far-west-regional-plan-2041
9. Available at: planning.nsw.gov.au/plans-for-your-area/regional-plans/south-east-and-tablelands
10. Available at: environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-manual
11. Available at: nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority/reducing-risk/state-disaster-mitigation-plan
12. Statewide disaster planning is primarily the responsibility of the NSW Reconstruction Authority, which was established in response to the 2022 Flood Inquiry. Further information is available at: nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority
13. Available at: www.nsw.gov.au/rescue-and-emergency-management/supporting-plans/disaster-recovery

The regional water strategy's response to flooding

The role of regional water strategies is to support the delivery of healthy, reliable and resilient water resources that sustain a liveable and prosperous region. Local councils are primarily responsible for managing flood risks in their local government areas as outlined in the *Flood Risk Management Manual*.[14]

The Department of Climate Change, Energy, the Environment and Water is the lead NSW flood risk management agency and provides technical advice and financial support to assist local councils' flood risk management activities.

Further improvements to flood risk mitigation have been considered through the 2022 NSW Flood Inquiry and the NSW Government's response to the inquiry.[15]

Flooding and flood risk management are discussed under Challenge 2: Understanding flood risks to individuals, businesses and communities.

Two actions in this strategy are intended to support holistic flood management:

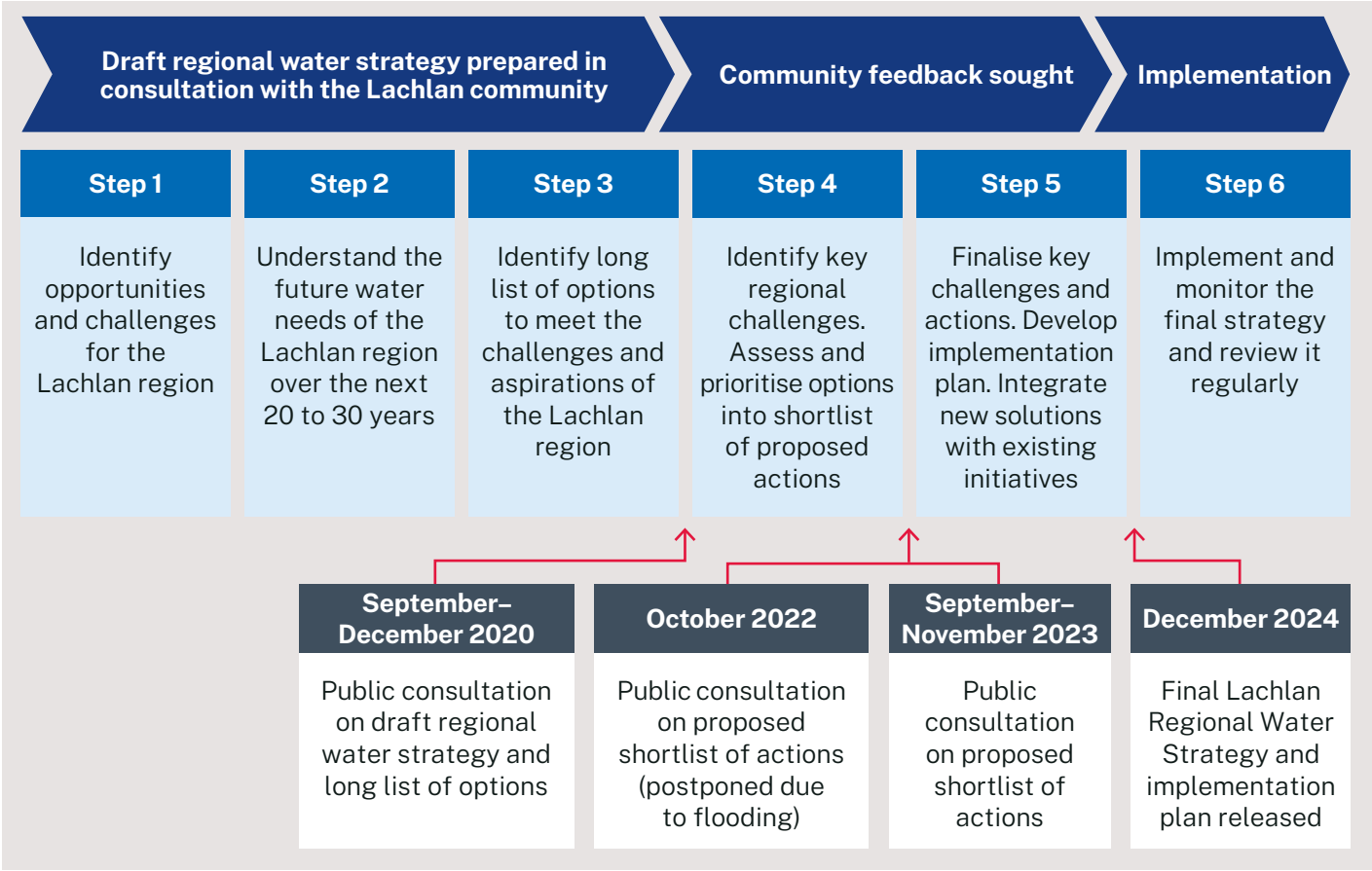
- Action 1.2: Support local councils to improve flood risk management
- Action 2.7: Support the development and implementation of the Lachlan Valley Floodplain Management Plan and address floodplain structures.

14. Available at: environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-manual
15. Available at: nsw.gov.au/nsw-government/projects-and-initiatives/floodinquiry

Development of the Lachlan Regional Water Strategy

The Lachlan Regional Water 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 Lachlan Regional Water Strategy

We have used feedback from the community and the most recent data from a wide range of sources to inform this strategy and ensure it is founded 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 this strategy included:

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

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 give us a more sophisticated understanding of past and future climatic conditions. These improved datasets integrate recorded historical data with paleoclimate data[16] to inform 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, it is easier to understand how this natural climate variability will be influenced by human-induced climate change. Both scenarios were used to assess risks to future water availability in each region.

This updated climate information has been used to help develop this strategy and compare the effectiveness of the actions. It will also support all water users in making more informed decisions to better plan and prepare for climate risks.[17]

The section *What the future climate could be in the Lachlan region* summarises the results from the analysis of new climate data for the region. The best and latest evidence about the future climate will continue to be used to help develop solutions for water challenges in the region.

Regional water strategy modelling and flood analysis

The hydrological models used in the development of regional water strategies produce information that helps us understand a region's long-term water security. They provide information that considers the whole waterway system, including catchment inflows, water storage behaviour, river flows and how water is used across the landscape.

Understanding flooding involves different hydrological approaches that consider shorter-term weather events and hydraulic flood models that require a detailed understanding of the shape of the floodplain and the features that influence flood behaviour. These models are purpose built to support an understanding of existing flood risk and how this may change with changes in climate, development and landscape.

16. Paleoclimate data is data reconstructed from before instrumental records began, using sources such as tree rings, cave deposits and coral growth. The data set is available at: datasets.seed.nsw.gov.au/dataset/water-modelling-stochastic-climate-data-lachlan
17. 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 available at: datasets.seed.nsw.gov.au/dataset/water-modelling-stochastic-climate-data-lachlan

Extensive community consultation

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

Feedback was sought on the draft strategy through public exhibition periods in 2020, 2022 and 2023 and a range of targeted engagement sessions (Figure 5). Community feedback was critical in shaping the final strategy and implementation plan.[18] A summary of key insights from community feedback is shown in Table 1.

Figure 5. Stakeholder engagement that informed the strategy

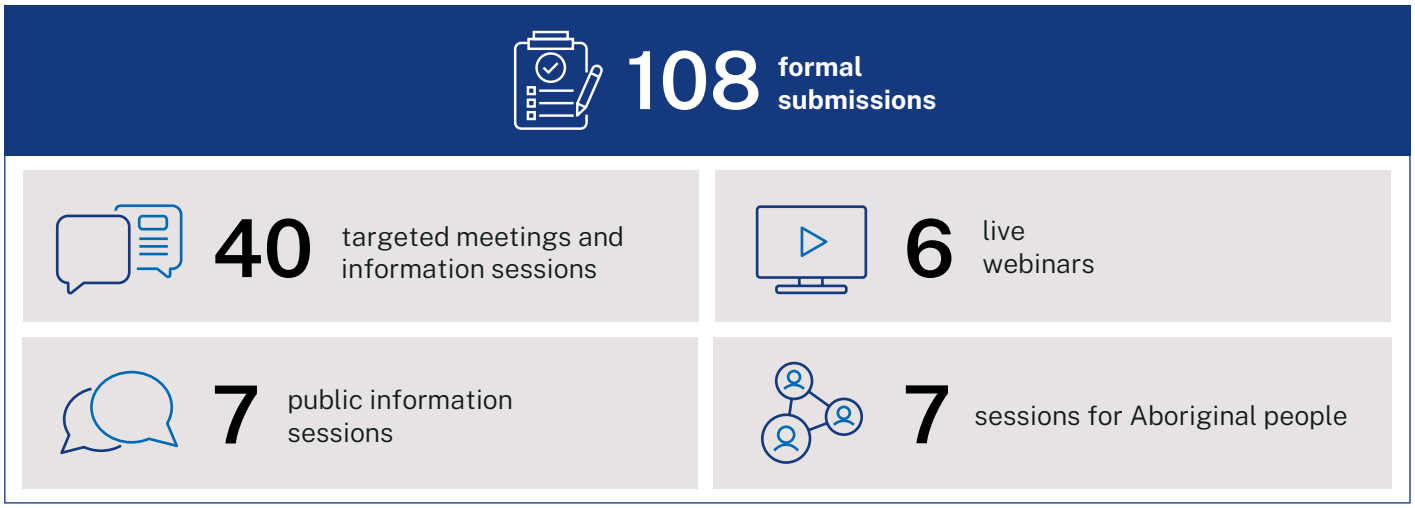


Image courtesy of Destination NSW. Ivanhoe-Menindee Road, Ivanhoe.

18. Information on community feedback that informed this strategy is available at: dpie.nsw.gov.au/water/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy/lachlan-regional-water-strategy

Table 1. Summary of community feedback received during consultation on the draft strategy

Feedback theme	Feedback summary
Building resilience to climate extremes and enhancing water security	There was widespread concern about flooding across the Lachlan Valley, with the role of local councils and state agencies, management of existing infrastructure, and suggestions for further flood mitigation measures, discussed by several stakeholders. Enhancing town water security was widely supported, as was improving understanding and management of groundwater; however, there was concern about ensuring this was done in a sustainable way. Improved coordination between the NSW Government and local councils for drought planning and flood mitigation planning was seen as critical, but there were differing views on how this should occur. Adequately acknowledging projected population growth within the draft strategy was also considered important, as was better integrating land use planning processes to consider water management and river health. There was strong support for the development of ongoing arrangements for participation of local Aboriginal people in water management.
Support improvement of catchment health and cultural outcomes for Aboriginal people	The focus on catchment and river health was generally supported. Salinity and erosion, sand slugs, loss of in-stream pools and streambank habitat were seen as key issues to be addressed through a multi-agency, community and adjoining landholder approach. Upgrading regulating structures was also supported, but there was concern about the associated cost and funding. The importance of conducting thorough environmental assessment of re-regulating structures before implementation occurs was noted. There was strong support for place-based initiatives to deliver cultural outcomes for Aboriginal people.
Understanding water use and climate impacts on water availability	Increasing the understanding of water use and availability through reviewing extraction limits was considered important, as was reclassifying environmental water as high security. There was support for sharing climate information, data and modelling, and making it more accessible and useful to a variety of stakeholders groups, including councils and businesses. There was widespread support for employment and business opportunities for Aboriginal people in the Lachlan region. There was concern that the draft strategy does not do enough to support general security licence holders, and that they may also bear the cost of implementing strategy actions and policy settings through increased user charges. Investigating certain water infrastructure projects further was considered important by some stakeholders, especially as the Wyangala Dam Wall Raising Project is not proceeding.
Stakeholder engagement and communication improvement feedback	There was support for ongoing consultation in implementing the final strategy, and for the timing and duration of the consultation and public exhibition periods to be given further consideration. Appropriate engagement with Aboriginal stakeholders needs to be completed before finalisation of the strategy and during implementation. Better explanation of the alignment of the draft strategy with other water-related plans and strategies was considered important, as was effective governance, transparency and accountability in relation to the final strategy and its actions.

Economic, environmental and hydrological analyses

Robust assessments have been used to select the actions in this strategy, including:

- hydrologic analysis of options that have 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 requirements, 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 analyses include:

- **town water supply risks** focused on surface water availability for the towns supplied by Wyangala Dam, Carcoar Dam and Lake Cargelligo and do not consider existing alternative supply sources such as groundwater
- **population changes** have been included in accordance with the medium population growth forecasts in the NSW Government's Common Planning Assumptions.[19] High population growth forecasts were also used as a sensitivity analysis for assessing the water security risks of some towns
- **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 Lachlan region, will change the amount of water used and may require a review of the strategy.

Climate variability outside the bounds of the datasets used to inform this strategy may also trigger its review.

Image courtesy of Shutterstock. Wyangala Dam, near Cowra.

19. More information is available at: treasury.nsw.gov.au/information-public-entities/nsw-common-planning-assumptions

Existing studies

A significant amount of work has been done to understand the risks affecting water resource management in regional NSW.[20] In the Lachlan region, this work includes 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 this strategy:

- WaterNSW's *20-Year Infrastructure Options Study for Rural Valleys*
- the *Independent Assessment of Social and Economic Conditions in the Murray–Darling Basin*, commissioned by the Australian Government[21]
- the *Lachlan Long-Term Water Plan*[22]
- the Australian Competition and Consumer Commission's inquiry into markets for tradeable water rights in the Murray–Darling Basin.[23]

This strategy has also been guided by NSW's commitments under the Murray–Darling Basin Authority's *Basin Plan* (the Basin Plan).[24]

Building on existing commitments and reforms

The NSW Government is preparing regions for the future. Some statewide water initiatives include:

- improving water and sewage 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.[25]

In 2020, the department started to implement all environmental water reforms from the Water Reform Taskforce, which was set up following the *Independent Investigation into NSW Water Management and Compliance report*.[26] Regional water strategies improve water security and reliability in our regions by building on existing actions being taken by governments.

20. More information is in the Regional Water Strategies Guide available at: publications.water.nsw.gov.au/watergroupjspui/bitstream/100/1841/1/Regional_water_strategies_-_guide.pdf
21. Available at: mdba.gov.au/publications-and-data/publications/independent-assessment-social-and-economic-conditions-basin
22. Available at: environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/lachlan
23. Available at: accc.gov.au/about-us/publications/murray-darling-basin-water-markets-inquiry-final-report
24. Available at: mdba.gov.au/water-management/basin-plan
25 The NSW Government and the Australian Government have committed $23.6 million and $12.5 million respectively to the metering program to ensure that meters are upgraded effectively. This funding includes rebates for water users who switch to telemetry-based systems.
26. Available at: water.dpie.nsw.gov.au/about-us/how-water-is-managed/independent-review-of-water-management-and-compliance

The Lachlan region

2

Image courtesy of Chris Watson, NSW Department of Climate Change, Energy, the Environment and Water. Sunset over dam, Canowindra.

Figure 6. Snapshot of the Lachlan region

100,000
population

90,000
km² area

Aboriginal Nations:
Barkandji, Maljangapa, Nari Nari, Ngiyampaa, Wiradjuri and Yita Yita

Key regional centres include:
Cowra, Forbes, Parkes and Young

Smaller regional centres include:
Blayney, Booligal, Boorowa, Gunning, Canowindra, Condobolin, Crookwell, Euabalong, Gunning, Hillston, Ivanhoe, Lake Cargelligo, Oxley, Temora and West Wyalong

Main surface water sources:
The regulated Lachlan and Belubula rivers plus a number of unregulated rivers and creeks

Council areas:
Upper Lachlan Shire Council, Temora Shire Council, Blayney Shire Council, Cowra Shire Council, Cabonne Shire Council, Bland Shire Council, Forbes Shire Council, Parkes Shire Council, Weddin Shire Council, Lachlan Shire Council, Cobar Shire Council, Carrathool Shire Council, Central Darling Shire Council, Hay Shire Council, Balranald Shire Councils and Hilltops Council

Major water storages:
Wyangala Dam with a storage capacity of 1,217 GL and Carcoar Dam with a storage capacity of 35.8 GL as well as 2 re-regulating storages: Lake Brewster and Lake Cargelligo

Main groundwater sources:
Upper Lachlan Alluvial Groundwater Source, Lower Lachlan Groundwater Source, Belubula Valley Alluvial Groundwater Source, Lower Murrumbidgee Deep Groundwater Source, Orange Basalt Groundwater Source, Young Granite Groundwater Source

Water for the environment:
Approximately 19% of licences in the regulated Lachlan River, or 127 GL of licensed water entitlements are managed by state and federal environmental water holders. The majority of these licences are general security licences

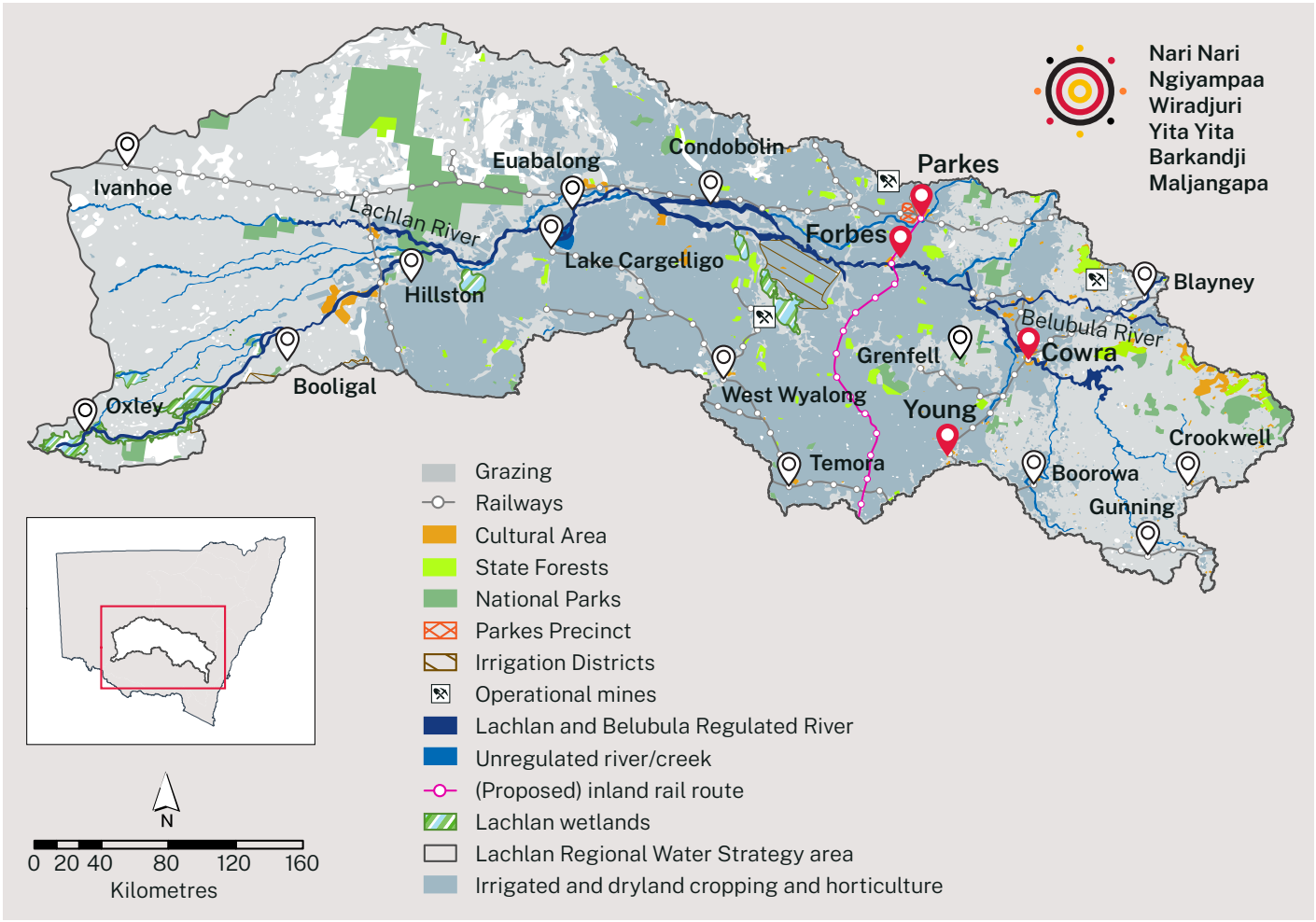
The Water Sharing Plan for the Lachlan Regulated River also includes an environmental water allowance, a water quality allowance and daily environmental releases (also referred to as translucent flows)

Key environmental assets:
Region supports 8 national important wetlands including Lake Cowal and the Wilbertroy Wetlands, the Booligal Wetlands and the Great Cumbung Swamp and the region provides habitat for rare, endangered and threatened animal and plant species

Gross Regional Product (2020–21): **$6.73 billion**

Engine industries: agriculture, mining, manufacturing

Figure 7. Map of the Lachlan region



The Lachlan region (Figure 7) lies at the geographic heart of NSW and includes stunning natural landscapes that change from mountainous terrain in the east to flat alluvial plains in the west. The region is home to many vibrant towns and communities, productive agricultural and mining industries, critical ecosystems and nationally important and culturally significant wetlands. These include the Lake Cowal–Wilbertroy Wetlands, the Booligal Wetlands and the Great Cumbung Swamp.

The region is located within the traditional lands of the Nari Nari, Ngiyampaa, Wiradjuri, Barkandji, Maljangapa and Yita Yita nations. These nations have been caretakers of the Lachlan region for over 60,000 years. The Bila Galari is the traditional Wiradjuri name for the Lachlan River.

Environmental significance of the Lachlan region

Water is a significant feature of the Lachlan region's landscape and environment. The river system, floodplains, swamps, aquifers and wetlands provide habitat for many aquatic species, including birds and native fish. The lower Lachlan floodplain is home to 8 nationally important wetlands, which feature areas of valuable river red gum forest and woodlands, black box woodland and lignum. The Lachlan waterways and floodplains support up to 17 species of native fish of which 9 are listed as threatened or endangered in NSW, including the Murray cod, freshwater catfish and Booroolong frog.

Areas of high ecological value aquatic ecosystems overlap in many places with groundwater dependent ecosystems. These areas include the Great Cumbung Swamp, where the groundwater to surface water interactions are central to ecological health. There are also significant amounts of groundwater dependent ecosystems identified in the area around Condobolin.

Environmental assets in the Lachlan region play a crucial role in the liveability of the region, as well as providing recreational and tourism opportunities and have important cultural significance.

Addressing the environmental challenges facing the Lachlan region

Changes in water use and management, such as water infrastructure, river regulation and water extraction, have altered flow variability, water quality and the distribution of water throughout the catchment. This has impacted the health of species and ecosystems, as well as Aboriginal social and cultural outcomes.

Inappropriate land-use management has also contributed to poor water quality, including salinity, nutrients and high turbidity. For example, algal blooms, which are often caused by excessive nutrients, can lead to the death of aquatic plants and animals, as well as affect drinking water for communities.

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 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.

This strategy outlines a suite of actions that will be delivered by the NSW Government to advance water for the environment in the Lachlan region (see Priority 2: Improve catchment health).

More information and analysis of the Lachlan region's ecological assets and challenges is in Challenge 5: Sustaining the health and resilience of the region's water dependent ecosystems.

Water use in the region

Surface water

The Lachlan region has 2 main river systems: the Lachlan and the Belubula (Figure 7). Many of the region's water needs are supported by these river systems including the major storages listed in Table 2.

Lachlan River system

The Lachlan River flows from the Great Dividing Range near Gunning to its junction with the Murrumbidgee River near Oxley. At around 1,400 km in length, it is the fourth longest river in Australia.

Large water users and environmental assets are spread along the river. Wyangala Dam is located around 200 km downstream of Gunning, the town of Forbes is located a further 200 km downstream from Wyangala Dam, Lake Cowal is located about 275 km downstream of Wyangala Dam and other nationally important wetlands are 700 km from the dam. These distances are a challenge for water delivery along the Lachlan River.

Lower Lachlan re-regulating storages, such as Lake Brewster wetland and weir pool and Lake Cargelligo, capture tributary inflows below Wyangala Dam and provide greater flexibility in managing flows. However, despite the Lake Brewster Water Efficiency Project, higher evaporation losses from Lake Brewster and Lake Cargelligo compared to Wyangala Dam mean that these re-regulating storages are emptied first and only filled from unregulated tributary flows.

The length of the river and high evaporation rates can make it difficult to deliver water to towns, stock and domestic users, industries and environmental assets during dry periods when the Lower Lachlan re-regulating storages are below effective capacity.

Belubula River system

The Belubula River is approximately 60 km long, rising midway between Bathurst and Orange and flowing through Canowindra before meeting the Lachlan River near the town of Gooloogong.[27] The Belubula River meets the Lachlan River approximately 50 km downstream of Wyangala Dam.

27. Department of Industry 2018, *Lachlan Surface Water Resource Plan: Appendix A – Surface water resource description*, p. 5.

Table 2. Major water infrastructure in the Lachlan region

	Wyangala Dam [28]	Carcoar Dam[29]	Lake Rowlands[30]	Lake Cargelligo	Lake Brewster
River/ creek	Lachlan and Abercrombie	Belubula	Coombing Rivulet	Lachlan Regulated	Lachlan Regulated
Storage (GL)	1,217	35.8	4.5	36	153
Operating authority	WaterNSW	WaterNSW	Central Tablelands Water	WaterNSW	WaterNSW
Purpose	Irrigation, stock, households, environmental needs	Irrigation, stock, households, Cadia Mine, environmental needs	Stock, households, towns	Irrigation, stock, households, environmental needs	Irrigation, stock, households, environmental needs
Major towns supplied	Cowra, Forbes, Parkes, Condobolin, Lake Cargelligo	Carcoar	Grenfell, Eugowra, Manildra, Canowindra, Carcoar, Blayney, Millthorpe	Lake Cargelligo	

Table 3. Regulated and unregulated river licences in the Lachlan region

Entitlement	Proportion of shares compared to total share pool (%)*			
	Regulated		Unregulated	
	Lachlan	Belubula	Lachlan	Belubula
Domestic and stock	2	1	2	<1
Town water	2	-	5	33
High security	4	4	-	-
Conveyance	3	-	-	-
Supplementary	-	12	-	-
General security	89	83	-	-
Unregulated	-	-	93	67

*Proportion of shares calculated from the total number of water access licences for the period 2023/2024 as at 28 May 2024 from the NSW Water Register. Information available at: waterregister.waternsw.com.au/water-register-frame

28. More information is available at: waternsw.com.au/nsw-dams/regional-nsw-dams/lake-wyangala
29. More information is available at: waternsw.com.au/nsw-dams/regional-nsw-dams/carcoar-dam
30. More information is available at: ctw.nsw.gov.au/your-water/lake-rowlands/

Unregulated rivers and creeks

A series of creeks and unregulated rivers run through the Lachlan region. Many smaller towns in the region rely heavily on unregulated rivers for their water supply.

In the upper Lachlan and Belubula areas, the towns of Boorowa, Crookwell, Gunning and Canowindra (with a combined population of approximately 5,400)[31] rely predominantly on unregulated surface water supply.

An extensive town water supply system exists across the region, capturing water from unregulated systems in smaller capacity dams and weirs, and moving this water around the region via a pipeline system that connects many towns. The largest of these town water storages is Lake Rowlands, which captures water from an unregulated tributary of the Belubula system near Blayney.

The region's creeks are not regulated and do not always flow. Despite their intermittent flow, the creeks are an important water source to meet environmental, industrial, stock and domestic needs.

In the Lower Lachlan area, creeks are provided with replenishment flows from the regulated river when there is enough water.

During droughts, one of the first water management measures is to limit the delivery of stock and domestic water to some of these creeks. This is because the transmission losses associated with delivering this water during drought conditions are very high.

Securing water for users of unregulated rivers and creeks will become increasingly difficult in a future with even greater climate variability.

Groundwater

The region's 3 main groundwater sources are the Upper Lachlan Alluvial, Lower Lachlan and Belubula Valley Alluvial groundwater sources.

The Lower Lachlan Groundwater Source is the most productive and contains areas of high-quality water, although in its western extent the water quality is generally poor. Groundwater is also available from fractured rock water sources such as the Lachlan Fold Belt and Young Granite. The Lachlan Fold Belt is mainly used for stock watering due to the low yield rates and lesser quality of the water. As the fractured rock groundwater sources extend beyond the boundaries of the Lachlan Regional Water Strategy, the Lachlan and adjoining regional water strategies will be further refined to consider challenges and opportunities for these groundwater sources.

Groundwater is an important town water source for the Lachlan region as a primary source, for towns such as Parkes and Hillston, or as an alternative supply for towns such as Forbes. Groundwater also plays an important ecological role in supporting ecosystems, particularly during extended dry periods in the Lower Lachlan region. During these times, groundwater can maintain biota and fish refuges.

For some agricultural industries, groundwater is their only source of water. For others, it can be an important water resource when surface flows are unavailable. During the Millennium Drought, the NSW Government stopped the Lachlan River flowing at Condobolin to preserve water for critical human needs. This meant that producers without groundwater licences either did not produce a crop or had to trade in temporary water allocations to bring water to their properties.

31. Australian Bureau of Statistics 2016, *Australian Census of Population and Housing*, via TableBuilder Pro.

Table 4. Groundwater licences in the Lachlan region

Entitlement	Proportion of shares compared to total pool (%)*					
	Orange Basalt Groundwater Source	Young Granite Groundwater Source	Lower Lachlan Groundwater Source	Upper Lachlan Alluvial Groundwater Source	Belubula Valley Alluvial Groundwater Source	Lower Murrumbidgee Deep Groundwater Source
Domestic and stock	-	-	-	1	-	-
Town water	3	-	4	5	-	1
Aquifer	97	100	97	94	-	99
Aquifer (high security)	-	-	-	-	100	-

*Proportion of shares calculated from the total number of water access licences for each water source for the period 2023/2024 as at 28 May 2024 from the NSW Water Register. Information available at: waterregister.waternsw.com.au/water-register-frame

Image courtesy of Greg Russell, Department of Primary Industries. Groundwater monitoring, NSW.

What the future climate could look like in the Lachlan region

3

Image courtesy of Samantha Ellis, NSW Department of Climate Change, Energy, the Environment and Water. Kalyarr National Park, Hay, Lachlan River Visitor Area.

Climate data and modelling used to develop the strategy

We have used 3 climate datasets to understand the key regional challenges and to assess the effectiveness of actions under different climate scenarios:

- **historical climate (observed data):** about 130 years of observed rainfall, temperature and evaporation records collected by the Australian Bureau of Meteorology
- **long-term historical climate (stochastic data):** 10,000 years of stochastically generated climate data developed using paleoclimatic information by the University of Adelaide
- **dry future climate:** 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. These scaling factors have been applied to every climate timeseries used in the modelling.

Combined, these 3 datasets provide a range of plausible climate futures that cover a range of wet and dry sequences.[32]

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[33] is the SRES A2,[34] which represents a high carbon emissions scenario and therefore results in higher projected climate change impacts on the region.[35] 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, companies and people around the world are already acting on climate change. Using this 'worst-case' scenario helps to plan strategically and focus on the key challenges facing a region. It also helps to 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. A more refined assessment of climate change risk will need to be completed when many of the strategy's actions are implemented. These additional assessments will be based on both the actions' planning horizons and the latest climate science.

The need for additional assessments 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, the department 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. The future climate is uncertain, and work is progressing to further enhance understanding of the region's climate and how it affects our vital water resources, including groundwater.

32. Further detail about the new climate data and modelling is available at: water.dpie.nsw.gov.au/our-work/science-data-and-modelling/modelling/climate-risk-data-and-water-modelling
33. 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 the NARCLiM 1.0 Project is on the NSW Government, AdaptNSW website available at: climatechange.environment.nsw.gov.au/climate-projections-used-adaptnsw
34. The Special Report on Emissions Scenarios (SRES) is a report by the Intergovernmental Panel on Climate Change (IPCC) that was published in 2000. The greenhouse gas emissions scenarios described in the Report have been used to make projections of possible future climate change. The A2 scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is regionally orientated and per capita economic growth and technological change are more fragmented and slower than in other scenarios.
35. The SRES A2 assumes a 2°C warming over the regional water strategy planning horizon.

Climate snapshot

The Lachlan region has a naturally variable climate

The Lachlan region has a highly variable climate, ranging from temperate conditions around Cowra to semi-arid conditions in the west. There is a significant elevation difference between the upper and lower Lachlan regions, which partially accounts for differences in average seasonal temperatures and rainfall.[36] Average, maximum and minimum temperatures in the region have been increasing over the length of the observed historical record and, over the last 30 years, there have been more hot days[37] and consecutive days above 38°C each year.[38]

Rainfall across the region is extremely variable. Average annual rainfall varies from 1,100 mm per year in the eastern part of the region to less than 300 mm in the far west. Rainfall is usually well distributed throughout the year; however, as seen in the past, it can vary significantly between months.[39] Spring and winter rainfalls are particularly important for the Lachlan region and for inflows into Wyangala Dam. Like many other inland catchments across northern NSW, the Lachlan region can experience multiple consecutive years dominated by either wet or dry conditions. Over the past 130 years, the region has undergone several transitions between wet and dry periods:

- the 1900s to 1940s was a comparatively dry period and most of the recorded short droughts (1–5 years) and decadal droughts (10 years) occurred 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. However, the past decade has illustrated the extreme climate variability that can be experienced, with Wyangala Dam going from flood operations in 2016, to almost empty during the 2017–2020 drought, and back to flood operations again in 2021–2023.

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

We do not know for certain what the Lachlan region's future climate will be like. It may be similar to the past climate or it may be more variable than has been seen in our lifetimes.

The NSW Government's new climate data has improved understanding of the natural variability of the state's climate, beyond the observed historical records. This includes a more realistic picture of the frequency and severity of past wet and dry periods in the Lachlan region.

The new data suggests that there have been more extreme dry and wet conditions in the long-term past than have been seen in the last 130 years. If the region's future climate is like its past climate – before observed records began – there could be more variability in rainfall, particularly during summer and winter, more variability in catchment inflows and potentially more extreme droughts.

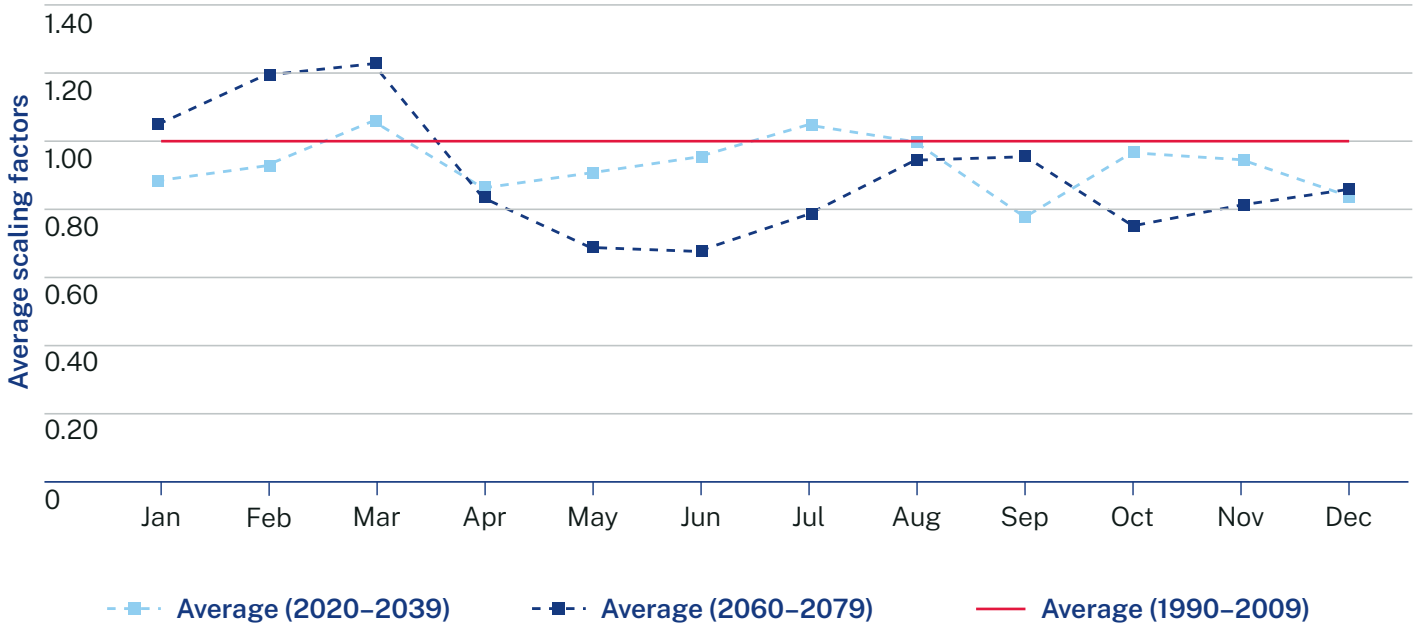
Our analysis of different climate scenarios tells us that there could be hotter and longer droughts, higher evaporation rates and more unpredictable rainfall events and variable river flows.

Our analysis of climate change projections shows us that under the worst-case dry climate scenario, if no action is taken, by 2070 there could be:

- **potentially less average annual rainfall:** there could be decreases in winter/spring rain and increases in summer/autumn rainfall (Figure 8)
- **more extreme events:** droughts could become more frequent and rainfall events could become more intense
- **higher evaporation:** there could be an increase in evapotranspiration of up to 5% by 2070 compared with levels between 1990 and 2009
- **changes to river flows:** there could be less average total volume of water flowing each year in the regulated and unregulated rivers
- **lower inflows to Wyangala and Carcoar dams:** average annual inflows into the region's main storages could decline and storage levels could be consistently lower under future dry climate projections (Figure 9).

36. Department of Industry 2018, *Lachlan Surface Water Resource Plan*. Appendix A–Surface Water resource description, p.9.
37. Since January 2001 there have temperatures of 45°C recorded 4 times. Prior to 2001, Parkes has never recorded temperatures this high.
38. Regional Weather and Climate Guide 2019, *A climate guide for agriculture – Central West, NSW*.
39. Department of Industry 2018, *Lachlan Surface Water Resource Plan*. Appendix A – Surface Water resource description, p.7.

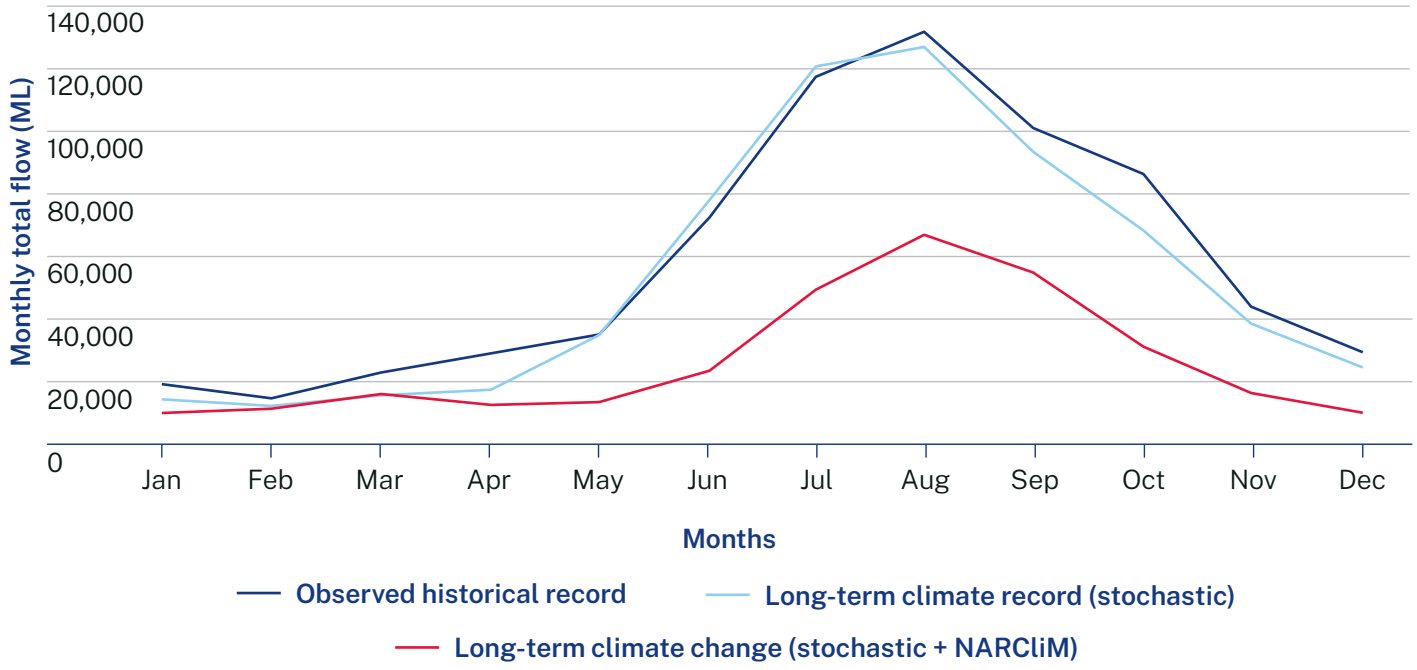
Figure 8. Changes in average monthly rainfall for the Lachlan region for the periods 2020–2039 and 2060–2079 compared to the period 1990–2009 from NARCliM projections



Source: Department of Planning and Environment, 2022

Note: Average scaling factor above 1.00 indicates an increase in rainfall; below 1.00 indicates a reduction.

Figure 9. Monthly inflows into Wyangala Dam under observed historical climate records, long-term climate and long-term climate change scenarios



The challenges facing the Lachlan region

4

Image courtesy of Chris Watson, NSW Department of Climate Change, Energy, the Environment and Water. Cowra dust storm.

Like all regions across Australia, the Lachlan region faces a more variable and changing climate. We need to transition to a scenario where more can be done with less water, smarter decisions are made about water use and management (based on better knowledge and information) and important water needs are protected.

We have identified 6 key challenges that are immediate priorities for the region.

1. managing water resources during more extreme events for people, industry and the environment
2. understanding flood risks to individuals, businesses and communities
3. improving water quality
4. addressing barriers to Aboriginal water rights
5. sustaining the health and resilience of the region's water-dependent ecosystems
6. supporting a sustainable and diverse regional economy.

Addressing these challenges will help meet the vision and objectives in this strategy.

Image courtesy of Shutterstock. Drought at Wyangala Dam.

Challenge 1: Managing water resources during more extreme events for people, industry and the environment

Water management in the Lachlan is challenging due to the region's variable climate and the extensive, low-gradient river system. Climate change is predicted to bring more extreme events (floods and droughts), warmer temperatures and higher evaporation, stressing the system and giving it less time to recover. Climate change will also likely result in more variable river flows and groundwater recharge rates, affecting water supplies to all water users, including towns and communities, industries and environmental water holders.

Less reliable water supplies for towns relying on the regulated river system

During public consultation, we heard about the importance town water supplies play in supporting businesses, the economy and prosperity of the region. They are also important for the smaller towns and villages that rely on drinking water from larger town water supplies during droughts.

Based on our current water sharing plan rules, our new climate datasets and hydrological modelling suggest that the region's major centres, including Cowra, Forbes and Parkes, have low surface water supply shortfall volumes[40] (<5% of unrestricted demand). This is true under both historical data and the new long-term historical climate scenario.

Under the dry climate future scenario, our modelling indicates that the surface water supply shortfall volume for towns and communities could increase notably[41] (Table 5).

We have estimated the economic cost of putting in place measures such as water restrictions and alternative supplies to address town water supply shortfalls. A summary of this economic analysis can be found in Attachment A of the Consultation paper.[42]

From a town water perspective, this possible risk of future surface water supply shortfall needs to be monitored, in conjunction with any risks to groundwater sources. This is particularly true for towns which rely on groundwater as an alternative supply.

40. In the context of the regional water strategy program, a shortfall is defined as conditions where surface water supplied is less than a water utilities' unrestricted demand.
41. The Lachlan Regional Water Strategy only assesses shortfall risks to surface water supplies and does not factor in other water supply sources that towns may have access to, except in the case of Parkes. All major regional centres in the Lachlan region have access to surface water and groundwater.
42. *The Consultation Paper including Attachment A* is available at: dpie.nsw.gov.au/water/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy/lachlan-regional-water-strategy

Table 5. Town water regulated surface water supply shortfall assessment

Town/Supply	Average annual shortfall (megalitres)	Average annual demand (megalitres)	Shortfall as a % of demand
	Historical data (observed)		
Cowra	13.5	2,889.9	0.5
Forbes	63.5	2,238.6	2.8
Parkes	39.5	4,147.4	1.0
Condobolin	25.5	954.9	2.7
Lake Cargelligo	1.3	400.8	0.3
	Long-term historical past climate scenario		
Cowra	31.0	2,893.5	1.1
Forbes	76.8	2,257.1	3.4
Parkes	40.0	4,166.3	1.0
Condobolin	31.0	953.8	3.3
Lake Cargelligo	3.3	400.8	0.8
	Dry climate change scenario		
Cowra	422.5	2,955.1	14.3
Forbes	398.0	2,376.4	16.7
Parkes	72.3	4,288.6	1.7
Condobolin	159.5	989.7	16.1
Lake Cargelligo	52.8	400.8	13.2

Aside from the completed surface water supply shortfall analysis, the department understands that towns that rely on the Lachlan Regulated River can face town water security risks during severe and prolonged droughts. This is because conveyance water[43] requirements and transmission losses[44] along the Lachlan Regulated River can be so large that it may be difficult to maintain flows along the entire length of the river system. This could become worse under a dry future climate.

For towns that have supply from the Lachlan River, the potential for town water supply failures[45] under the historical climate and a dry future climate has been modelled. This modelling is based on town water demand, not entitlement, and the results are the same for all local water utility entitlements from the Lachlan Regulated River. The probability of a risk of failure under the historic scenario is 1 in 63 years and this increases to 1 in 7 years under a dry future climate.

To minimise losses and conserve water for essential needs closer to Wyangala Dam, management decisions can be taken during these extreme events that may result in ceasing to supply water along the entire length of the regulated river system.[46]

In response to the region's variable climate and past extreme events, most towns and communities in the region have pursued access to more than one water source, including groundwater. It will be important that this 'multisource' approach to town water supply is supported and strengthened at a local level.

To support this multisource approach to town water supply, the department needs to better understand the impact of climate change on groundwater sources to ensure towns can access groundwater in case surface water is not available.

In addition, the department needs to evaluate the merit of expanding water re-use and recycling initiatives. The department also needs to assess the benefits for redundancy options like pipeline linkages that extend beyond local government areas and that can be called on as drought severity increases.[47]

Image courtesy of Destination NSW. Cotton field, Condobolin.

43. Conveyance water is water required to operate regulated rivers and utility supply networks to enable the delivery of water.
44. Transmission losses is water, from an accounting perspective, that is considered lost through surface water seeping into the ground or evaporation.
45. A town water supply failure is defined as an inability to supply at least 50% of unrestricted demand.
46. During the Millennium Drought, flows along the Lachlan Regulated River were cut off at Lake Cargelligo.
47. The results of a preliminary assessment of direct connection to the region's major storage Wyangala Dam, to access dead water storage during extreme drought emergencies are available in Attachment B of the September 2023 draft Lachlan Regional Water Strategy Consultation Paper: www.dpie.nsw.gov.au/water/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy/lachlan-regional-water-strategy

To further enhance town water security in the Lachlan region, this strategy includes:

- Action 1.5: Support groundwater use for towns and communities
- Action 1.6: Investigate water security for small and remote communities
- Action 1.7: Investigate expanding the regional water supply grid

Work across local government areas

There are existing town water supply linkages in the Lachlan region that extend across local government boundaries and neighbouring catchments (Figure 10).

Water sourced from the Murrumbidgee catchment supplies the townships of Temora, West Wyalong and Young via the Goldenfields Water network. Also, Murrumbidgee Irrigation Limited supplies the small town of Goolgowi, which is in the Lachlan region.

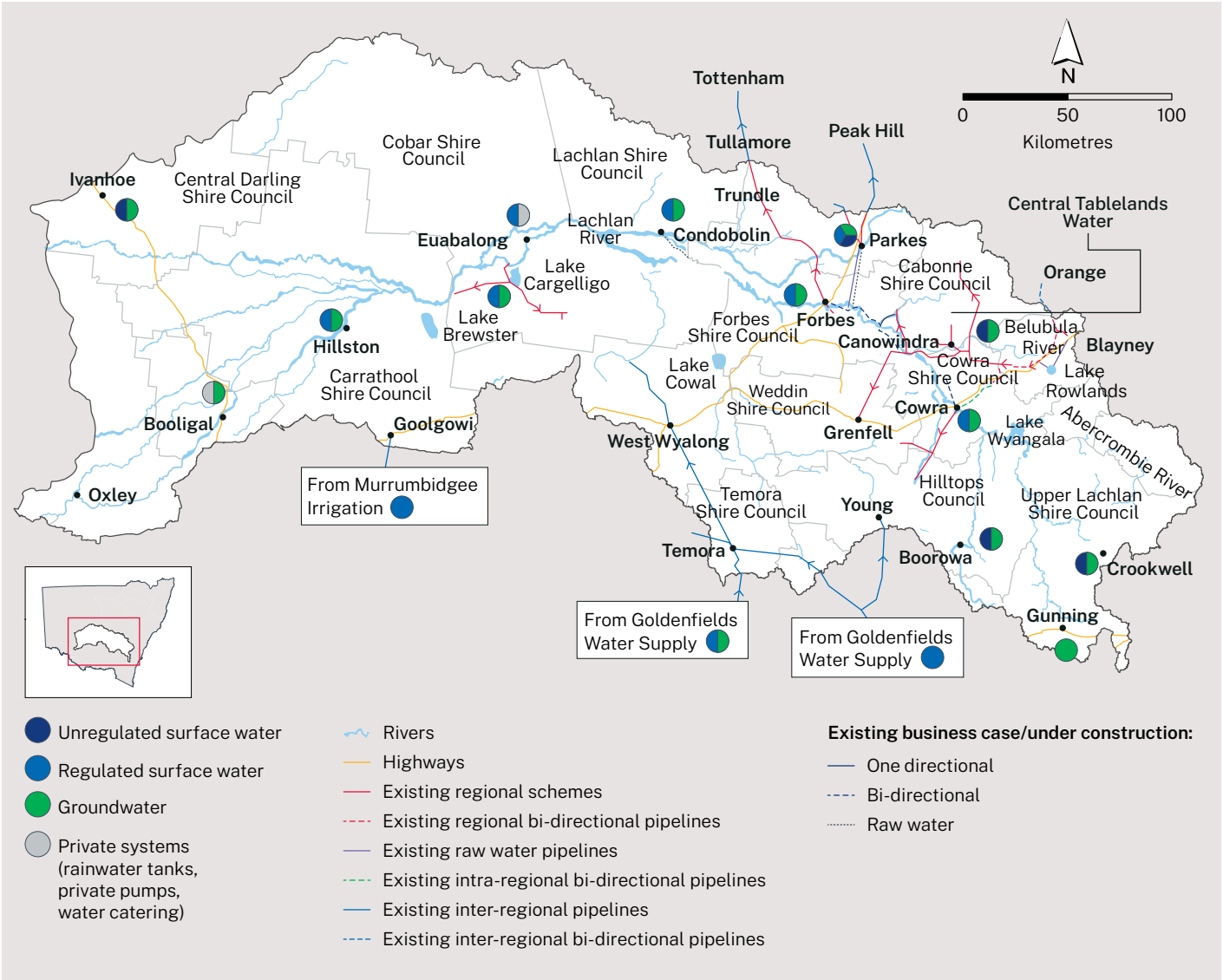
In the Macquarie–Castlereagh catchment, Tottenham relies on water sourced from the Lachlan River, while Orange is connected to the Central Tablelands Water network via an emergency pipeline. Cobar is located within the Lachlan catchment but draws water from the Macquarie–Castlereagh region.

Local water utilities are constantly exploring new ways to better service their communities. These include the following projects.

- There is a business case for a pipeline from the Forbes water treatment plant to the Parkes pump station to Gooloogong bores. This would expand the existing Central Tablelands Water network linking Parkes and Forbes to the Central Tablelands Water Supply network.
- Cabonne Council, Central Tablelands Water and Orange City Council have established a working party to develop a subregional town water strategy. This regional town water strategy is considering several pipeline connections between the Lachlan and Macquarie–Castlereagh regional water strategy areas to improve urban water security.
- Central Tablelands Water is working with the department on the Belubula Water Security Project.
- Lachlan Shire Council is progressing a sewerage scheme upgrade and Hilltops Council is progressing the Boorowa Drought Security Project.
- Over the last 5 years, work was completed for a pipeline connecting Gooloogong and Grenfell to transfer potable water from Carcoar Water Treatment Plant to Grenfell. In addition, a pipeline between Orange Water Treatment Plant and Carcoar Water Treatment Plant was completed to transfer of potable water in both directions.
- A pipeline between Billimari and Cowra is under construction and Lachlan Shire Council is progressing work to connect a set of groundwater bores to the Condobolin water supply system.

To provide ongoing support to local councils in the Lachlan region and to ensure an ongoing dialogue around water management during extreme events, this strategy includes Action 1.1: Improve town water security in the Lachlan region.

Figure 10. Existing town water pipeline network in the Lachlan region



Greater water supply risk for communities relying on unregulated rivers and streams

Several smaller towns in the Lachlan and Belubula catchments rely on unregulated rivers and streams for their water supply, as are many rural properties that require water for domestic and stock needs.

- In the upper Lachlan catchment above Wyangala Dam, Boorowa, Crookwell and Gunning rely on unregulated rivers and streams. For example, the Boorowa River and Hovells Creek, the Lachlan River above Reids Flat, and the Crookwell River and the Abercrombie River above Wyangala Dam.
- In the Belubula catchment, Central Tablelands Water[48] captures water in Lake Rowlands from Coombing Creek, an unregulated tributary of the Belubula River.
- In the lower Lachlan, Ivanhoe partially relies on an unregulated effluent creek (Willandra Creek) that receives replenishment flows from the Lachlan Regulated River system.

Our capacity to use the new climate datasets to assess water security risks for towns and communities relying on unregulated water sources in the Lachlan region is limited. However, our preliminary work suggests that these towns could be more at risk in the future due to more variable river flows and more frequency of cease-to-flow events under a dry future climate scenario.

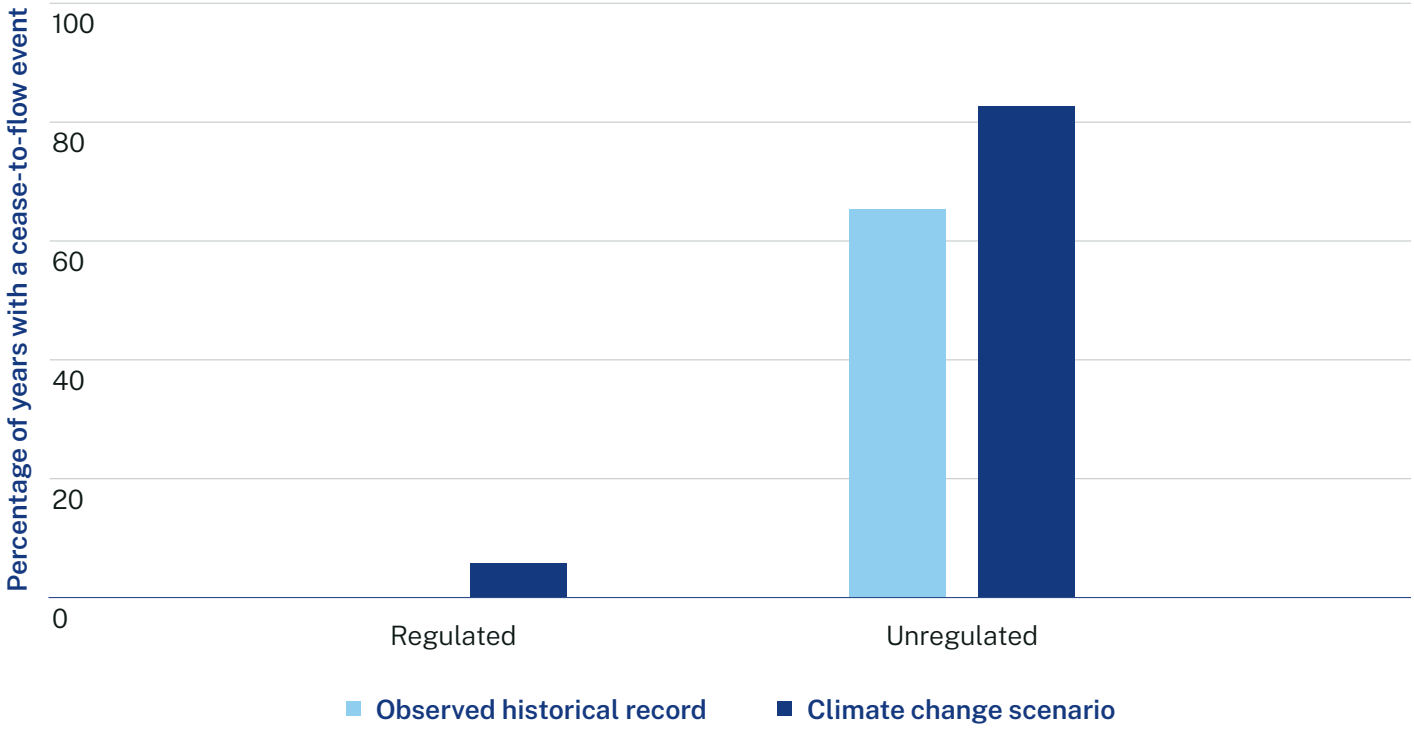
48. Central Tablelands Water supplies 14 towns and villages in Blayney, Cabonne and Weddin Council areas through an extensive water supply pipeline network that spans beyond the Belubula catchment.

Upper Lachlan

Our preliminary modelling results for the upper Lachlan (Boorowa River at Prossers Crossing) indicate there could be more years with cease-to-flow events in unregulated streams under a dry climate scenario (Figure 11). Further modelling needs to be completed to verify the magnitude and frequency of flow changes at other locations along unregulated streams in the Lachlan region.

Despite the potential changes in flows and the greater likelihood of cease-to-flow events, it is important to recognise that many towns and communities that rely on these unregulated rivers and streams often have access to alternative water supplies. This can include groundwater or off-stream storages that would help mitigate risks to town water supplies.

Figure 11. Possible impacts of climate change on cease-to-flow events in the Lachlan region



Source: Department of Planning and Environment, 2022

To better understand the water-related risks to towns and communities relying on unregulated rivers and creeks, this strategy includes Action 1.6: Investigate water security for small and remote communities.

In the Belubula catchment, Central Tablelands Water is working with the department to develop the Belubula Water Security Project,[49] which also includes further detailed investigations into Central Tablelands Water future town water security risks.

Central Tablelands Water

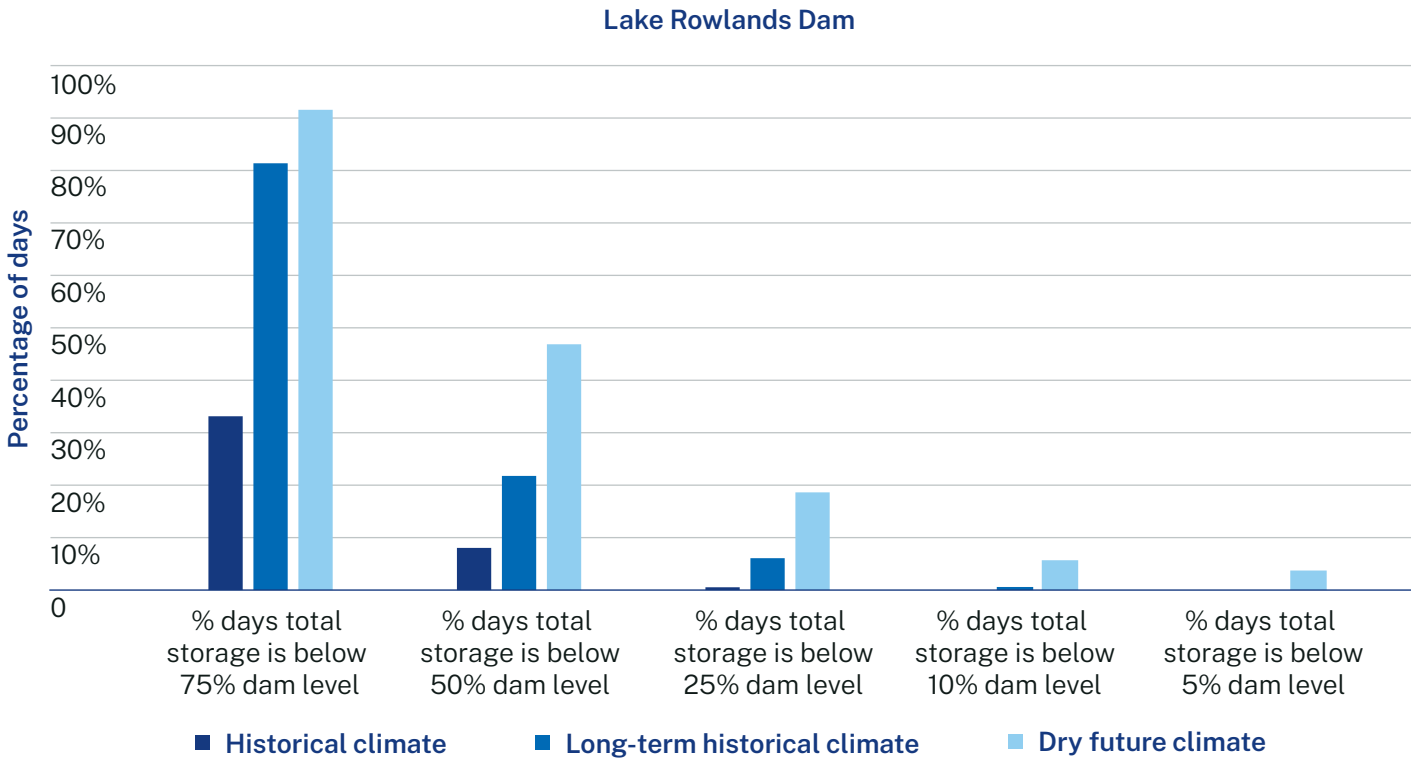
For the regional water strategies, preliminary surface water shortfall investigations have been undertaken. Modelling suggests that towns and communities relying on Central Tablelands Water are more likely to experience surface water supply shortfalls under all climate scenarios than towns relying on the Lachlan Regulated River. Water security risks increase significantly under a dry future climate scenario (Table 6). This is also reflected in our analysis of Lake Rowlands storage level,[50] which could be lower more frequently under a dry climate scenario (Figure 12).[51]

49. Belubula Water Security Project is available at: water.dpie.nsw.gov.au/our-work/water-infrastructure-nsw/regional-projects/belubula-water-security-project
50. Lake Rowlands is owned and operated by Central Tablelands Water.
51. The Central Tablelands Water supply is supplemented by groundwater, mainly from the Gooloogong bores, which supplement supply to the western end of the system. Current access to groundwater is insufficient to meet Central Tablelands Water demand.

Table 6. Central Tablelands Water's unregulated surface water supply shortfall assessment

Town/Supply	Average annual shortfall (ML)	Average annual demand (ML)	Shortfall as a % of demand
	Historical data		
Central Tablelands Water	102	1,899	5
	Long-term historical climate		
Central Tablelands Water	106	1,899	6
	Dry climate future		
Central Tablelands Water	234	1,899	12

Figure 12. Percentage of time Lake Rowlands storage level is below certain storage levels



Source: Department of Planning and Environment, 2022

Note: Long-term historical climate refers to climate information derived from the paleo-stochastic modelling. The department understands that when Lake Rowlands drops below 20% capacity, deep water recovery measures need to be initiated, which requires a floating pontoon and pump-set to access the volume of storage below the 20% capacity level. This is an untested emergency drought contingency measure.

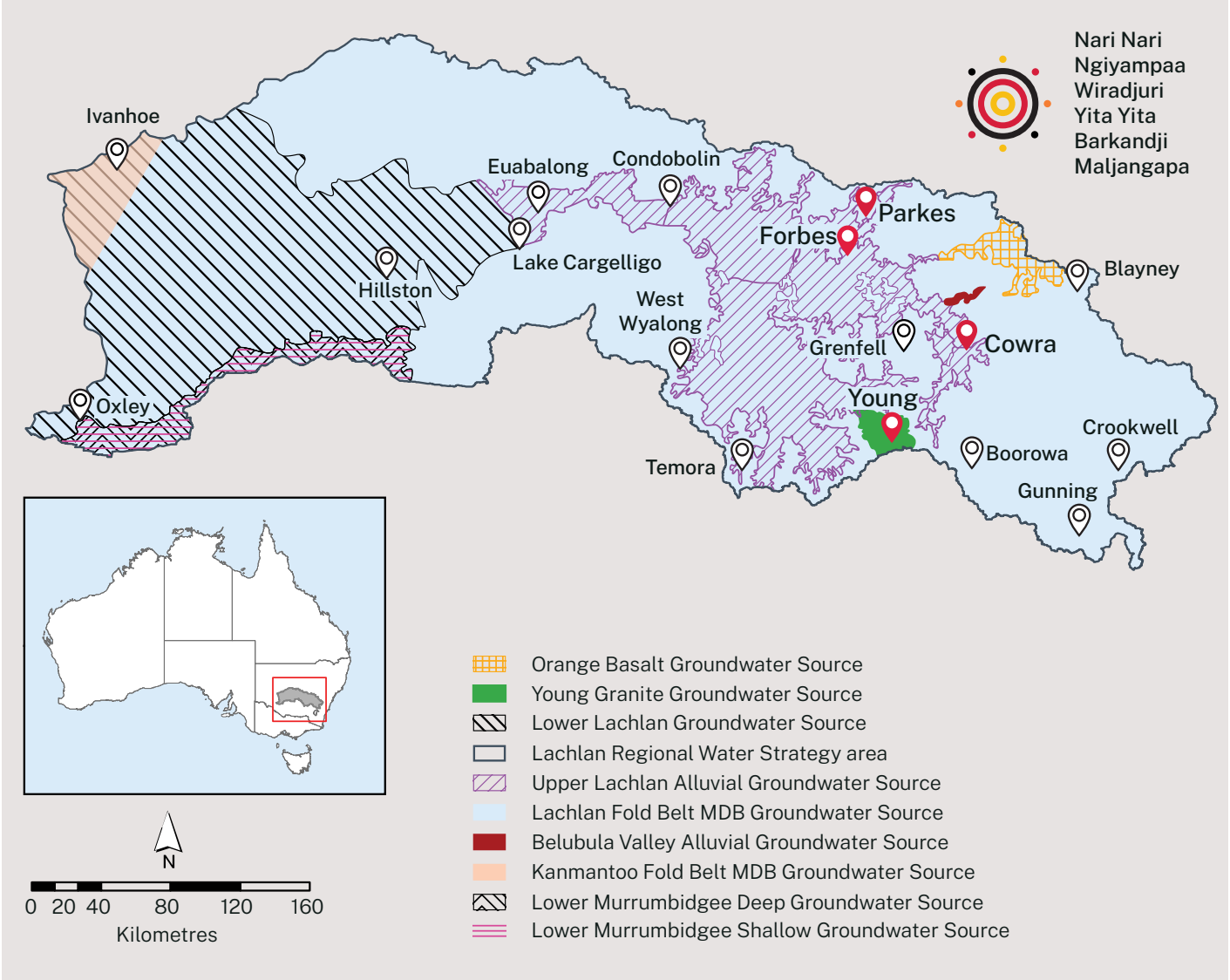
Lower Lachlan

In addition to groundwater, Ivanhoe draws surface water from Willandra Creek. Willandra Creek receives replenishment flows from the Lachlan Regulated River system via the Willandra Weir. Modelling of river flows indicates that flows at the Willandra Weir gauge 412038 could decrease up to 57% from an average of 584 GL/year to 330 GL/year.

Groundwater could become less reliable

There are a variety of groundwater sources in the Lachlan region (Figure 13) and most regional centres have access to groundwater.[52]

Figure 13. Map of groundwater sources in the Lachlan region



In contrast to the Lower Lachlan Groundwater Source, which was part of the NSW's Achieving Sustainable Groundwater Entitlement Program, the Upper Lachlan Alluvial Groundwater Source and the Belubula Valley Alluvial Groundwater Source continue to have very high entitlement levels compared to the water sharing plan extraction limit (Figure 14).

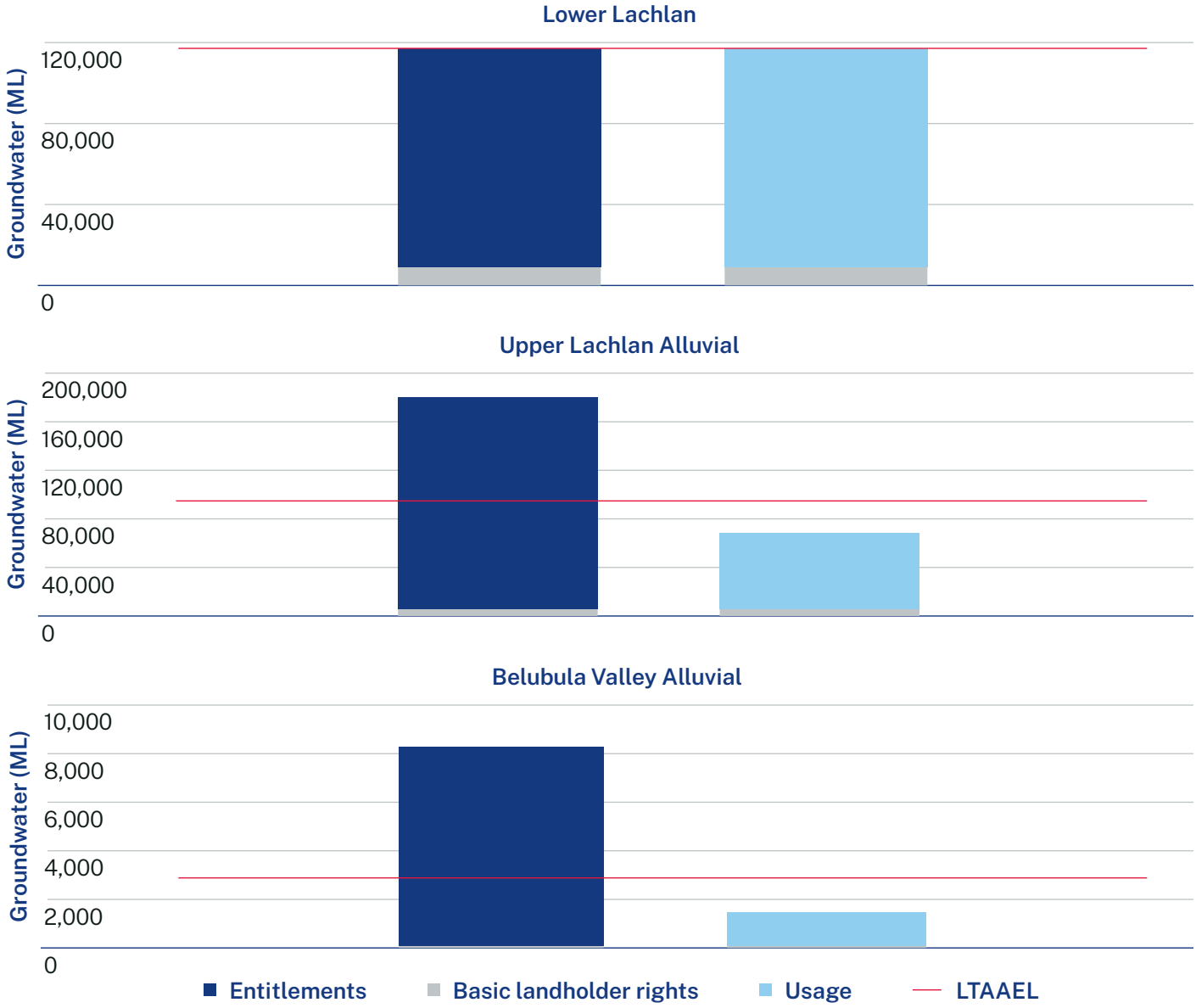
These high entitlement levels will create some challenges if groundwater use by existing entitlement holders increases under a drier future climate.

This could see groundwater use get closer to the extraction limit and potentially trigger actions such as reduced annual allocations. A drying climate may also make groundwater less reliable in the longer term, as the amount of water seeping into the ground and replenishing groundwater could decrease while groundwater demands increase as surface water becomes scarcer.

52. Cowra, Forbes, Parkes and Condobolin have access to the Upper Lachlan Groundwater Source. Hillston has access to the Lower Lachlan Groundwater Source.

While local water utility licences have a higher level of priority than other groundwater licences under the *Water Management Act 2000*, decreases in the reliability of groundwater will potentially affect all categories of water access licences. Local councils will require more information on anticipated future demands and how groundwater is managed in the region.

Figure 14. Volume of groundwater for long-term average annual extraction limits (LTAAEL), basic landholder rights, total share component and average annual metered use from 2015 to 2020 for groundwater sources in the Lachlan region

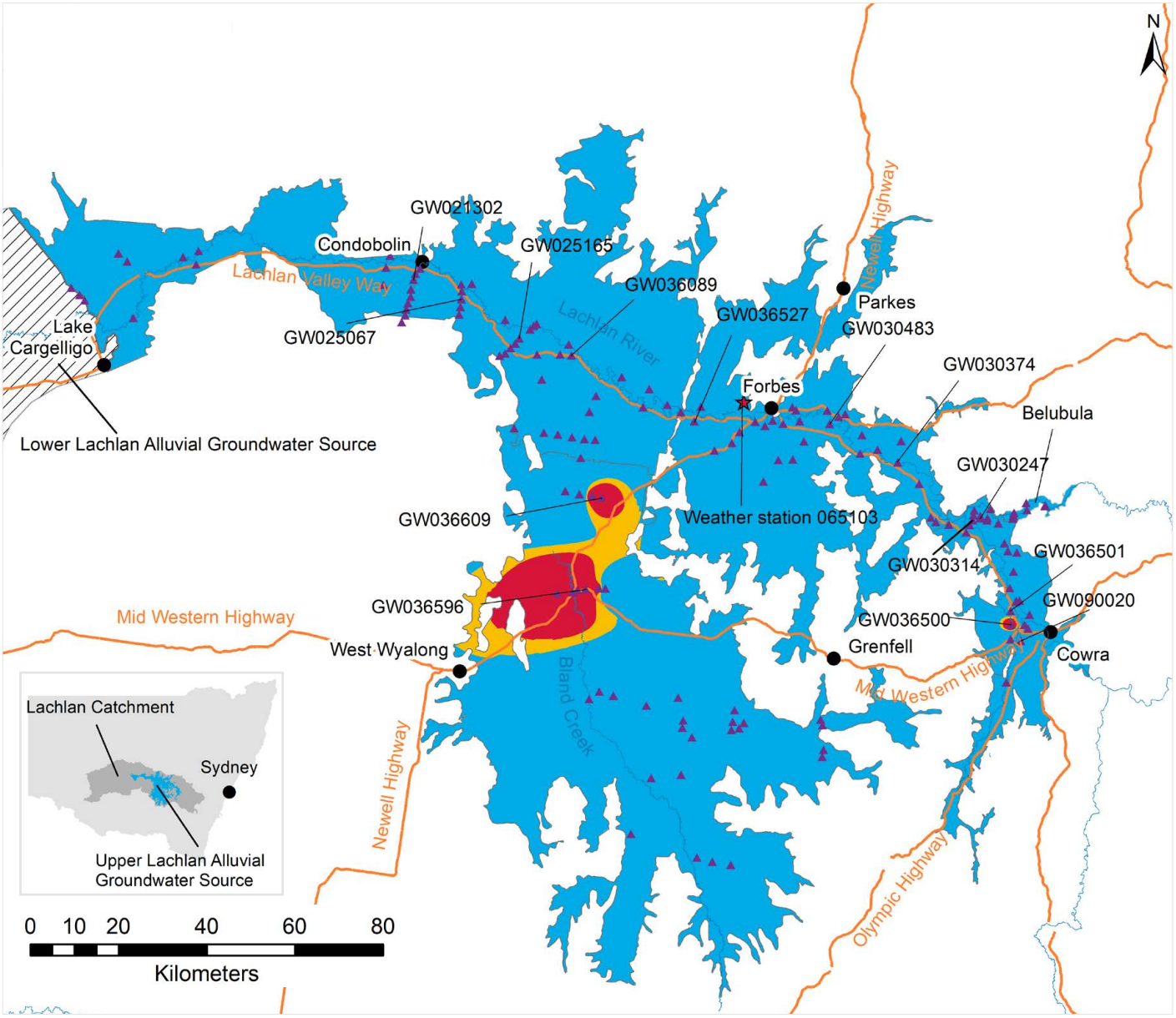


Source: Department of Planning and Environment, 2022

Note: Other sources where entitlements are about the same or less than the long-term average annual extraction limits (LTAAEL) include: Young Granite, Lower Murrumbidgee Deep, Lower Murrumbidgee Shallow, Lachlan Fold Belt Murray–Darling Basin, and the Orange Belt.

Groundwater extraction in the Upper Lachlan Alluvial and Belubula Valley Alluvial has been below the water sharing plan extraction limits over the period 2015–2020. However, high and more concentrated use in certain years has led to a decline in groundwater levels in some areas (Figure 15).[53]

Figure 15. Maximum drawdown level during the pumping season of 2019–2020 as a percentage of total available drawdown in the Upper Lachlan Alluvial Groundwater Source



Legend:

★ Forbes Airport Weather Station ▲ Monitoring Bores — Rivers/creeks — Road ● Town

2018–19 recovered water level as percentage Total Available Drawdown:

< 25% 25 – 30% > 30%

Note: The change in groundwater levels is expressed as a percentage of the total available drawdown, which is calculated based on the physical characteristics of the groundwater system. In the Upper Lachlan Alluvial Groundwater Source, the maximum drawdown level during the pumping season should not exceed 40% of the total available drawdown.[54]

53. On 1 July 2021, a temporary water restriction order was imposed on the Upper Lachlan Alluvial Zone 1 Management Zone of the Upper Lachlan Alluvial Groundwater Source. This order was put in place to protect groundwater levels and associated impacts on access for critical needs and groundwater dependent ecosystems. The order expired 30 June 2024. Further information is available at: water.dpie.nsw.gov.au/our-work/allocations-availability/temporary-water-restrictions/current/upper-lachlan-alluvial-groundwater-management-zone-1-order-2021
54. Department of Planning and Environment, *Upper Lachlan Alluvial Groundwater Source – 2021 Groundwater Level Review* (December 2021). Available at: water.dpie.nsw.gov.au/our-work/allocations-availability/managing-decline-in-groundwater-levels

Access to groundwater will become increasingly important in the context of diminishing surface water availability under a drier climate. Greater demand on groundwater sources associated with growth in population, housing and employment, may also pose a risk to future water security for towns, communities and other users relying on these sources[55] in the Lachlan region.

The NSW Government has developed and published a statewide Groundwater Strategy.[56] In addition, the Lachlan Regional Water Strategy includes Action 1.8: Improve the understanding and management of groundwater resources.

Supporting general security water access licence holders

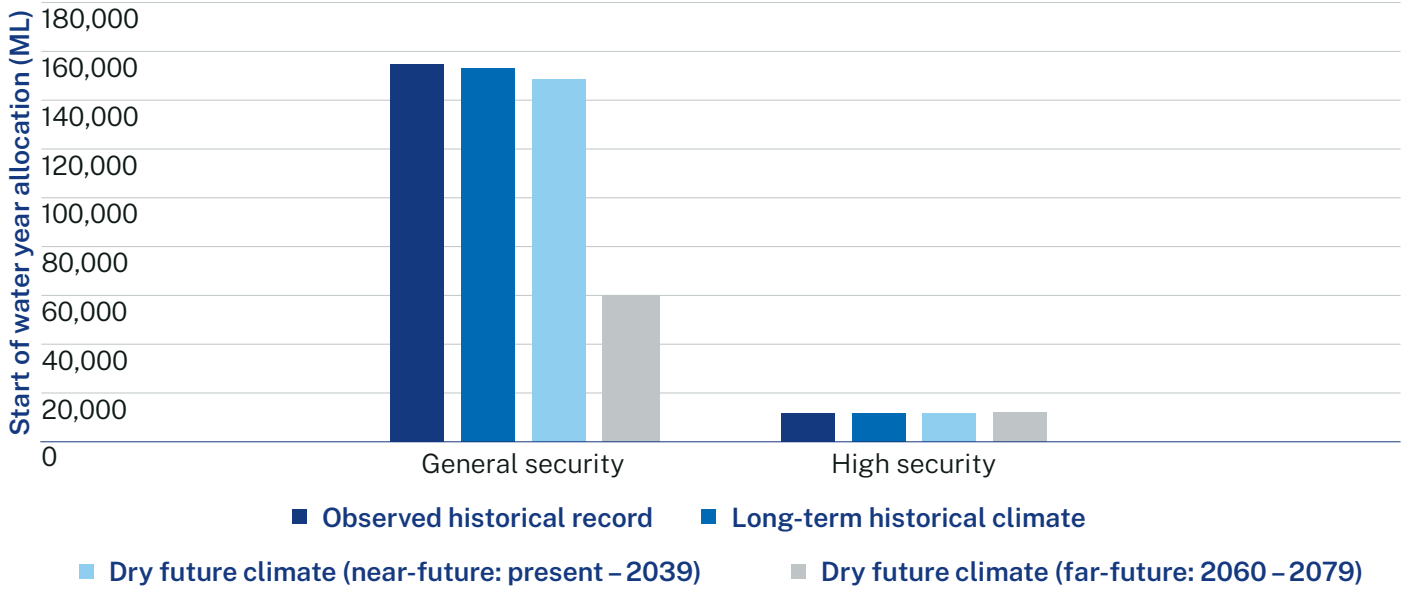
The region's key industries and the environmental water managers rely predominately, but not exclusively, on general security water access licences to meet their water needs.

General security water access licences make up 89% of all surface water access licences in the Lachlan Regulated River water source and 83% in the Belubula Regulated River water source. These licences have a lower reliability than high security water access licences or local water utilities' licences.

During drought periods, general security water access licences frequently received zero or low water allocations.[57]

A more variable climate and future climate change could increase the frequency and severity of extreme events and cause even greater variability in water availability to general security water access licence holders. This creates uncertainties for businesses and could affect the region's economy and the health of water dependent ecosystems. New climate datasets have been used and models have been updated to better understand the impact of a changing climate on the availability of water for general security water access licence holders at the start of the water year (Figure 16).

Figure 16. Impact on general security water access licence holders under an 'average 122-year period' under different climate scenarios



Source: Department of Planning and Environment, 2020

55. The construction of new bores could also be a challenge for towns and communities in the Lachlan region. All new groundwater bores will be assessed against the impact on the groundwater source, the broader environment and other existing users. In broad terms, the operation of a new groundwater bore cannot result in 'greater harm' than any other water supply works approval and a new bore would need to be located in areas where water level declines are not an issue. As such, new bores may need to be located further away from existing borefields, which adds to the challenge, and additional costs, of connecting them to the town water supply system.
56. The NSW Groundwater Strategy is available at: water.dpie.nsw.gov.au/plans-and-programs/nsw-groundwater-strategy
57. Lower water allocations defines the access restrictions that have previously been applied to water accounts in the Lachlan region to protect water for critical needs.

In addition, the department has further investigated the potential implications on future annual allocation for general security water access licence holders under different climate scenarios.[58] The potential implications for general security water access licence holders needs to be an ongoing focus for this strategy to ensure industries and the environment can be effectively supported under a dry future climate scenario.

Water account rules provide industries with flexibility to meet their water needs

The *Water Sharing Plan for the Lachlan Regulated River Water Source 2016* has some unique features that assist general security water access licence holders to meet their water needs despite the variable water supply:

- the ability to 'carry over' allocations between years
- the provision of a 200% account limit[59]
- potential access to other water sources, including groundwater or town water supply systems or water trade.

Despite the 200% account limit, water use is managed by a 'use limit', which cannot exceed 100% of the licensed entitlement in any year, regardless of how much water is held in accounts.[60] As general security entitlements are last in the hierarchy of the allocation framework, the 200% account limit allows these entitlement holders to manage their water needs over multiple years.

We have completed some preliminary investigations into increasing the take limit to 110% of the licensed entitlement in any year (1.1 ML/unit share) to better understand whether it could provide greater flexibility to general security entitlement holders to access water in their accounts. Future related work is discussed in Action 3.5.

In the Belubula catchment, the water accounting rules are slightly different. The *Water Sharing Plan for the Belubula Regulated River Water Source 2012* provides general security water access licence holders with a 130% account limit. Those general security water access licence holders can carry over unused water allocations up to a maximum account limit of 130%.

It could become increasingly difficult to meet environmental water requirements

The amount of licensed water and environmental water allowance available for use varies year by year, depending on the available water determinations and how much water the environmental managers have decided to carry over from previous years. This variability is considered as part of the annual planning process and long-term strategic planning by the environmental agencies.

During dry periods, less water is available for all water users, including the environment, and in some instances this limits the opportunities to protect critical environmental needs at the extremities of the system. In particular, it is often challenging to meet the environmental water requirements as specified by the *Lachlan Long-Term Water Plan*[61] during extreme drought periods. Also, there may be frequent reductions, or cessation of replenishment flows to the many effluent creeks in the Lower Lachlan during these times, which affect stock and domestic users, and that can also affect environmental and Aboriginal people's cultural assets.

58. See the draft Lachlan Regional Water Strategy Consultation Paper. Available at: dpie.nsw.gov.au/water/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy/lachlan-regional-water-strategy
59. General security accounts are split between a 'take' sub-account to hold water that can be used within a water year and a 'hold' sub-account that enables general security entitlement holders to park water that can be used in future years. The take account cannot be more than 100% of the licensed entitlement, unless take water from another licence is transferred during the year. Although there is no direct limit to the volume of water that can be transferred into a general security account in any year, the account balance cannot exceed 200% of the licensed entitlement at any time.
60. If Wyangala Dam, Lake Cargelligo and Lake Brewster are all at full capacity, any water held in (spillable) sub-accounts is at risk of spill. Both physical spills and airspace operations will result in account resets.
61. This is why environmental water managers take a long-term strategic view of the portfolio and often rely on wet, unregulated flows to build resilience into the system. The strategies deployed by environmental water managers in the Lachlan region are sophisticated and adapted to the natural boom and bust cycle of the environmental system. Available at: www.environment.nsw.gov.au/research-and-publications/publications-search/lachlan-long-term-water-plan-part-a-catchment

Challenge 2: Understanding flood risks to individuals, businesses and communities

Floods are a vital natural process that support ecosystems, provide significant groundwater recharges, sustain connectivity between rivers and wetlands and create the productive soils valued by landholders in the region's floodplains. However, development on the floodplain has meant that floods significantly affect people and businesses, damage infrastructure, create safety risks and cause financial and economic loss. The management of extreme floods is an ongoing challenge for the Lachlan region that could worsen with climate change.

The management of floods is an ongoing challenge for the Lachlan region. The region has experienced significant flood events over the past 123 years of observed records[62] and the intensity of heavy flood-producing rainfall events could increase under climate change scenarios.

Many areas of the region are subject to flood risk. Development on the floodplain has meant that floods can significantly affect people and businesses, damage infrastructure, create safety risks and cause financial and economic loss. The devastating flood event in the Lachlan region in late 2022 highlighted the flooding risks to many communities in the region at an unprecedented and catastrophic scale.

Floods are also a vital natural process that support the region's ecosystems, providing benefits such as significant groundwater recharge and connections between rivers and their wetlands and floodplains, such as the Great Cumbung Swamp and Booligal Wetlands in the Lower Lachlan River. Tributary flows downstream of the region's major headwater storages are often a major contributor to flooding in the region. Floods are also responsible for the productive soils valued by landholders on the Lachlan region's floodplains.

62. Since observed records started in 1891, the Lachlan region has experienced some major floods, notably in 1891, 1916, 1951, 1952, 1956, 1961, 1974, 1976, 1990, 1993, 1998, 2012, 2016 and 2022.

2022 NSW Flood Inquiry

In response to the widespread floods in 2021 and 2022, the NSW Government commissioned an independent expert inquiry into the preparation for, causes of, response to and recovery from the 2022 flood events in NSW.[63] The final inquiry report was published in August 2022 and included 28 recommendations.[64] The NSW Government supported all 28 recommendations, either in full or in principle. One recommendation led to the establishment of the NSW Reconstruction Authority.

Several of the report's recommendations and the NSW Government's response are relevant for this strategy, including the NSW Government's in-principle support for:

- building more accurate and complete data for flood threat identification, warning and modelling systems (recommendation 1)
- building on existing initiatives around climate and weather research to identify opportunities to build and align disaster research and technology development (recommendation 2)
- strengthening the delivery of evidence-based, targeted education campaigns aimed at building disaster resilience (recommendation 14)
- developing further essential service infrastructure above the flood planning level, where appropriate (recommendation 28).

These actions are being progressed through the implementation of actions in the State Disaster Mitigation Plan.[65]

Achieving integrated flood management in multijurisdictional catchments can be challenging: the future role of disaster adaptation plans

Local councils are primarily responsible for managing floods within their boundaries with the support of the NSW Government, with roles and responsibilities outlined in the *Flood Risk Management Manual* and its toolkit.[66] WaterNSW has a legislated role in managing flooding in rural areas under the *Water Management Act (2000)*.

Effective coordination between state agencies and local councils can be challenging. The Lachlan River catchment contains 16 local government areas. This means that development or geomorphic changes in rural areas in one local government area can influence flood behaviour in downstream local government areas.

The development of a regional multi-hazard disaster adaptation plan for areas across this region may help overcome these challenges. Disaster adaptation plans are to be prepared under the *NSW Reconstruction Authority Act 2022* with the support of the NSW Reconstruction Authority. Disaster adaptation planning in NSW will be locally shaped, regionally coordinated and state facilitated. Guidelines for development of these plans will be finalised in late 2024, and agreement on the development of disaster adaptation plans across the Lachlan region will be a priority.

63. NSW Government, 2022. *2022 NSW Flood Inquiry*. Available at: www.nsw.gov.au/nsw-government/engage-us/floodinquiry
64. Available at: nsw.gov.au/nsw-government/engage-us/floodinquiry
65. Available at: nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority/reducing-risk/state-disaster-mitigation-plan
66. Available at: environment.nsw.gov.au/topics/water/floodplains/floodplain-manual

Managing flood risks

Local councils develop floodplain risk management plans in line with the flood risk management process outlined in the *Flood Risk Management Manual*,[67] which is issued by the NSW Government under the NSW Flood Prone Land Policy. This process and the flood risk management framework support local councils to:

- understand flood behaviour and risk and how this may vary into the future with climate change and development
- assess the flood risk management, emergency management and land use planning options to address flood risk
- implement actions identified in flood risk management plans
- make recommendations on the need for new or upgraded flood risk management measures and improvements to emergency management planning and land use planning arrangements.

Planning considerations that take flooding into account aim to ensure that development is located appropriately and that controls, such as minimum habitable floor levels, are implemented and complied with. These measures are important for reducing flood risks to communities due to new developments.

Local councils are taking steps to address flood risks in the region: Lachlan Shire Council case study

Lachlan Shire Council completed a flood risk management study and plan for the Lachlan River at Condobolin in November 2018.

The plan recommended implementing flood-related development controls, updating the 2013 Lachlan Local Environmental Plan, updating the Lachlan Shire Local Flood Plan, improving flood warnings by installing a water-level gauge on Goobang Creek at Mulgutherie Road crossing, undertaking a condition assessment report for the Willow Bend Village Ring Levee and including 2 properties in the Voluntary House Raising Scheme.

The department is the lead NSW flood risk management agency. It provides technical advice to government and technical and financial support to assist local councils' flood risk management activities. The NSW Government provides support in several ways:

- ***Flood Risk Management Manual* and guidance:** The manual and associated guidance outlines roles and responsibilities in flood risk management and supports local councils to develop and implement local floodplain management risk plans in accordance with the NSW Government's Flood Prone Land Policy
- **Floodplain Management Program:** This program provides financial assistance and technical advice to local councils to assist them understand and manage flood risks in both the existing climate and by considering climate change. Since 2011/12, the NSW Government has granted over $10 million under this program to local councils in the area covered by the Lachlan Regional Water Strategy to help them better understand and manage flood risk in their communities. Financial support under this program is provided by the Climate Change Fund
- **Interagency collaboration:** Local councils work closely with the department and the NSW State Emergency Service to develop and implement flood risk management plans which provide the basis for understanding and managing flood risk to communities. These plans consider the need for flood risk management to local communities, including recommending management works and providing information to support land use planning and emergency management processes that consider flood risk.

Additionally, the NSW flood-prone land package 2021[68] provides updated advice to local councils on how to consider flooding in strategic and statutory land use planning instruments to better manage severe to extreme flood events.

The NSW Reconstruction Authority has developed the State Disaster Mitigation Plan[69] and is supporting local councils to undertake local and regional disaster planning.

67. Available at: environment.nsw.gov.au/topics/water/floodplains/floodplain-manual
68. See the *Considering flooding in land use planning: guidance and statutory requirements circular* (PS 21-006) under the flood-prone land package. Available at: planning.nsw.gov.au/policy-and-legislation/resilience-and-natural-hazard-risk/flooding/flood-prone-land-package
69. Available at: nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority/reducing-risk/state-disaster-mitigation-plan

Rural floodplain management planning

The Lachlan River Valley has one declared floodplain and 3 localised floodplain management plans historically prepared under Part 8 of the *Water Act 1912*.[70]

The Natural Resources Commission completed an audit[71] of the 3 historical floodplain management plans in 2020. The department is replacing these plans under the *Water Management Act 2000* with a single whole-of-valley floodplain management plan and associated declared floodplain. This is anticipated to be completed in 2025.

To improve the way floodplains are managed, this strategy includes Action 2.7: Support the development and implementation of the Lachlan Valley Floodplain Management Plan and address floodplain structures.

Image courtesy of Chris Watson, NSW Department of Climate Change, Energy, the Environment and Water.
Nyrang Creek Bridge flood – between Eugowra and Canowindra.

70. More information on the southern floodplain management plans is available at: water.dpie.nsw.gov.au/our-work/floodplain-management/plans/southern-floodplain-management-plans
71. The Natural Resources Commission audited the implementation of floodplain management plans for the Lachlan, Murrumbidgee and Murray regions and the results are available at: nrc.nsw.gov.au/water/wsp-reviews/completed

Challenge 3: Improving water quality

Poor water quality has a direct impact on the health, wellbeing and resilience of all water users and is a prevalent environmental risk in the Lachlan region. Our challenge is to address the root causes of water quality issues.

Ecological health relies on good water quality

A variety of water quality problems exist in the Lachlan region, which can lead to poor ecological health. Dissolved oxygen can be depleted during hypoxic blackwater events and harmful algal blooms – often caused by excessive nutrients – can lead to the death of aquatic plants and animals. Unseasonal temperatures and cold water pollution can also directly contribute to fish deaths and high turbidity can reduce the light penetrating the water column and stress benthic plants. Salinity (both dryland and in-stream) can impact vegetation and cause erosion, which can result in high turbidity, as well as increase salt loads beyond the tolerance level of some native plants and animals.

The *Water quality technical report for the Lachlan surface water resource plan area (SW10)*[72] provides an overview of the water quality condition for the region. It provides the background and technical information to develop water, land and vegetation management measures to maintain or improve water quality in the catchment.

The use of the Water Quality Allowance[73] has been effective in both preventing and reducing poor water quality events in the region.

Low dissolved oxygen

Blackwater events occur naturally in all river systems when organic matter on the floodplain is washed into the river during floods. A reduction in the magnitude and timing of floodplain inundations and overbank events in the Lachlan region can lead to a prolonged build-up of organic matter on the floodplain. When there is eventually an overbank flow, this organic load can cause hypoxic blackwater events that are more likely to lead to sustained low dissolved oxygen, changes to pH and sometimes result in localised death of aquatic organisms.

Excessive nutrients and algal blooms

Excessive nutrients (nitrogen and phosphorous) are linked to sediment transfer and polluted run-off from agricultural fertilisers and waste, as well as sewage treatment plants, industrial activity and natural processes. Land clearing and access by stock to waterways can also lead to degradation of riparian zones, increasing riverbank erosion, sediment transport and nutrient input. These impacts affect ecological health by reducing the ability of the landscape to filter pollutants from overland run-off and decrease water quality. Excessive nutrients in waterways can increase algal growth, which can reduce dissolved oxygen and lead to harmful algal blooms.

Harmful algal blooms can occur in Wyangala and Carcoar dams, in Lake Cargelligo and Lake Brewster and in various weir pools throughout the region. These blooms are rare but can have potentially toxic cyanobacteria numbers reaching the red-alert level for recreational use and requiring significant cost to treat at water treatment plants. Potentially toxic cyanobacterial blooms can also quarantine water in storages such as Lake Brewster, making it unavailable for consumptive or environmental use. However, mitigation measures can be effective, including circulating water through the Brewster system and filtering via the outflow wetlands.

72. For more information on elevated levels of nutrients see the Water quality technical report for the Lachlan surface water resource plan area *February 2020 (SW10)* available at: water.dpie.nsw.gov.au/our-work/science-data-and-modelling/surface-water/document-library
73. The Water Quality allowance helps ensure the best use of existing water for the environment. In the Lachlan region, 20 GL of water quality allowance (WQA) is allocated in accordance with the water sharing plan. The opening water allocation for 2024 was 10 GL for Wyangala and 10 GL for Brewster.

Dryland and in-stream salinity

Dryland salinity and in-stream salt loads are an issue in the Lachlan region. For example, the mid-Lachlan, the upper Lachlan and Belubula rivers contribute significantly to salinity and should be a target for land management intervention, particularly grazing and soil rehabilitation. Alluvial aquifers adjoining the rivers in these areas need to be managed in association with the rivers as groundwater salinity levels may affect ecosystems (for example, aquatic plant germination and species richness decreases significantly with increasing salinity), town water supplies and productive users.

High turbidity and sedimentation

High turbidity is linked to sediment transfer from areas including Hovells Creek, the upper Lachlan River, Back Creek and Bland Creek and the slopes surrounding the Boorowa River.[74] In addition to land-use changes, invasive species like carp can contribute to increased turbidity.[75] However, turbidity and suspended sediments are closely related to discharge, with a general trend of increasing turbidity with distance down the catchment.

Sediment transfer from bank slumping and increasingly eroded areas has caused a build-up of sediment in creeks, riverbeds,[76] crossings and drains[77] in some parts of the catchment, including a 150 km sediment slug between Wyangala and Forbes.[78]

To improve long-term water quality, this strategy includes Action 2.1: Reduce salinity and soil erosion in the upper Lachlan and Belubula catchment.

Cold water pollution

Existing water infrastructure can also cause cold water pollution impacts, which can reduce the range and abundance of native fish. Wyangala and Carcoar dams have been ranked as high and moderate impact, respectively, for cold water pollution.[79]

Good water quality supports reliable and affordable drinking water

Local water utilities are required to treat water to a minimum standard for drinking, based on the water quality targets in the *Australian Drinking Water Guidelines 2011*.[80] Severe water quality events in the catchment can result in significant treatment costs to local water utilities to meet these targets.

Despite past investments, some water treatment infrastructure in the Lachlan region may be unable to cope with future water quality incidents. Also, some Aboriginal communities live in more remote locations in the Lachlan region, and the NSW Government and NSW Aboriginal Land Council are working to ensure safe and effective water and sewerage services to for these communities.[81] With a possible drier future climate and increased pressure on existing water sources, communities at a significant distance from the regulated river will face extra costs in obtaining and maintaining supply security.

To provide ongoing support to local councils in the Lachlan region and ensure ongoing dialogue on key water management issues concerning local governments, the strategy includes Action 1.1: Improve town water security in the Lachlan region.

74. Department of Planning, Industry and Environment 2020, *Lachlan Long-Term Water Plan Part A: Lachlan catchment*. Available at: environment.nsw.gov.au/research-and-publications/publications-search/lachlan-long-term-water-plan-part-a-catchment
75. Koehn, J.D. 2004, Carp *(Cyprinus carpio)* as a powerful invader in Australian waterways. *Freshwater Biology* 57: 882–894.
76. Upper Lachlan Council has recently cleared a 3-metre-deep sand slug from the low-level road crossing across the Lachlan River at Bevandale, above Wyangala.
77. In 2019, the Hilltops Council spent weeks removing many truckloads of sand, silt and organic debris from creek crossings and table drains along the Hovells Creek valley.
78. Identified by NSW Fisheries for Central Tablelands Local Lands Services in 2020.
79. For more information about water temperature outside natural ranges, see section 6.5 of *Water quality technical report for the Lachlan surface water resource plan area February 2020 (SW10)* available at: water.dpie.nsw.gov.au/our-work/science-data-and-modelling/surface-water/document-library
80. National Health and Medical Research Council 2011, *Australian Drinking Water Guidelines*. Australian Government. Available at: nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines
81. The department is seeking to address these risks through the Aboriginal Communities Water and Sewerage Program, available at: water.dpie.nsw.gov.au/our-work/projects-and-programs/aboriginal-water-program/aboriginal-communities-water-and-sewerage-program

Impacts of mines on water quality

During public exhibition of the draft Lachlan Regional Water Strategy in 2020, we heard concerns about potential water quality impacts from existing and proposed mining operations.

Mining proposals are subject to the NSW Development Assessment process. Under the *Environmental Planning and Assessment Act 1979*, development that is important to the state for economic, environmental or social reasons can be classified a state significant development or state significant infrastructure. This type of development requires the approval of the Minister for Planning or Independent Planning Commission.

Mining operations are regulated in NSW[82] to ensure minimum impacts to land, waterways and aquifers. For example, new and expanding mines are required to have surface water management plans and groundwater management plans for the construction and operation phases and these plans are developed in collaboration with the NSW Department of Climate Change, Energy, the Environment and Water.

In the Belubula catchment, new water quality monitoring sites have recently been added to existing sites to give a better understanding of the mine area and provide an early warning mechanism if any water quality issues emerge.[83]

Acknowledging that mining can have serious impacts on water sources and water quality if sites are not properly designed and managed, it will be important to plan and work together with industry to develop appropriate risk management plans to address future extreme events associated with climate change.

Image courtesy of Chris Watson, NSW Department of Climate Change, Energy, the Environment and Water. Carcoar wind turbines at sunset.

82. Department of Regional NSW. *Mining, Exploration and Geoscience Compliance and Reporting*. Available at: regional.nsw.gov.au/meg/exploring-and-mining/compliance-and-reporting
83. McPhillamys Gold Project. Fact sheets. Available at: mcphillamysgold.com/the-project/fact-sheets/

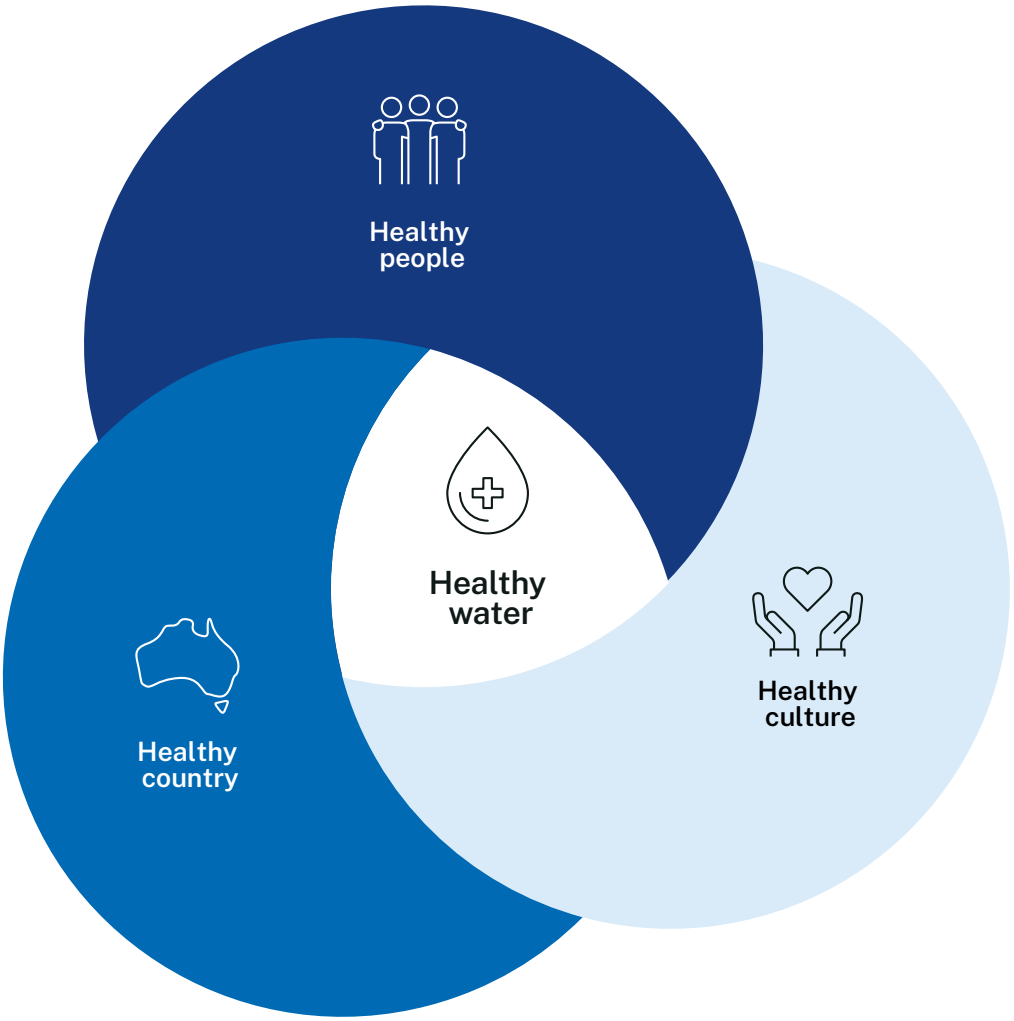
Healthy waterways are critical for connection to Country

Aboriginal people rely on good water quality of waterways for their health, wellbeing and continued practice of cultural traditions (Figure 17).

If important cultural sites dry up or are impacted by ongoing poor water quality, the traditional story or the meaning of a particular cultural site can be severely affected or lost forever.

Over the last 200 years, and with increased development around waterways in the Lachlan region, there has been a decline in water quality at many sites. Of the 11 monitoring sites along the length of the Lachlan catchment, 8 are rated as fair or poor, and recent water quality data indicates that turbidity and nutrient levels are often too high and risk exceeding water quality targets.[84]

Figure 17. Australian Aboriginal people's view of the relationship between water, environment, culture and people



Source: Adapted from Moggridge, B. 2010, Aboriginal Water Knowledge & Connections, in: *Water and its Interdependencies in the Australian Economy*, 22 to 23 June 2010, Australian Academy of Technological Sciences and Engineering, Sydney.

To improve water quality in the Lachlan Regulated River over the long-term and assist in better protecting important cultural sites in the region, this strategy includes Action 2.2: Protect and rehabilitate regionally significant riparian and in-stream habitats in the Lachlan Regulated River.

84. Department Planning, Industry and Environment. 2020. *Water quality technical report for the Lachlan surface water resource plan area February 2020 (SW10)*. Available at: water.dpie.nsw.gov.au/our-work/science-data-and-modelling/surface-water/document-library

Challenge 4: Addressing barriers to Aboriginal water rights

Historical dispossession of land, the effects of colonisation and water management processes continue to affect Aboriginal people's access to water and their ability to care for Country. There is a need to restore lost access to water, and to change the way we engage with Aboriginal people so that we can all benefit from traditional knowledge in managing water resources.

Increasing Aboriginal representation in water management decisions

In the past, water management decisions in the Lachlan region have not been comprehensively informed by Aboriginal people's history, knowledge and experiences, which are based on many thousands of years of living on Country. Although Aboriginal people's cultural knowledge is increasingly being recognised as an essential element of water management, there are still limited opportunities for Aboriginal people to participate in water decision-making or to be involved in co-management activities.

Involving Aboriginal people more closely in the decision-making processes around water management could enrich and improve our water-management decisions and, in turn, provide employment and economic advancement opportunities for Aboriginal people, including youth. Genuine involvement based on the principles of free, prior and informed consent is essential to incorporate traditional knowledge and expertise into strategic water planning, while respecting the rights of Aboriginal people.

To help support the new Lachlan Aboriginal Water Committee, established in late 2023, this strategy includes Action 1.4: Work with local Aboriginal people to ensure they can participate in water management.

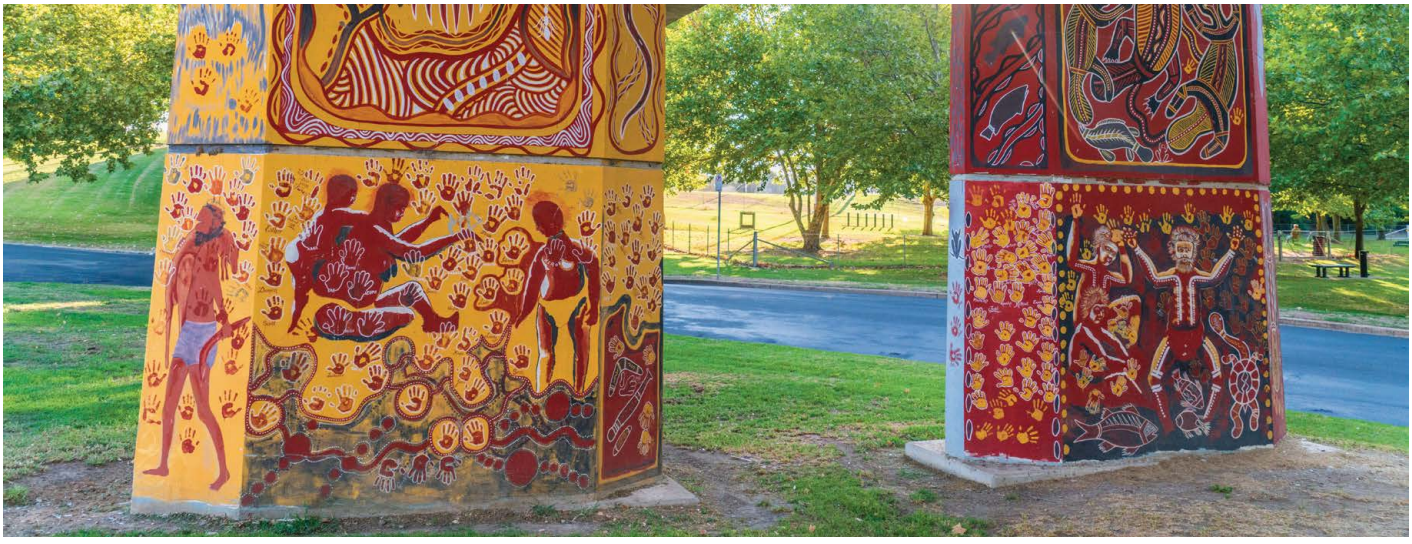


Image courtesy of Destination NSW. Aboriginal murals painted by indigenous artist Kym Freeman, Cowra.

Improving Aboriginal access to water and Country

Access to waterways is critical to provide a purpose and pathway for young people. Waterways are used for passing on traditional knowledge through storytelling on Country and provide a space for healing, as well as for food, medicine and teaching.

Noting the importance of access to water and Country, there are opportunities to build on existing community lead programs such as 'Down the track'. This program organises annual Aboriginal youth camps on Robinson Crusoe Island at Lake Cargelligo and teaches about the environment, including about birds, fish and water quality. Programs like these provide young Aboriginal people with opportunities to explore different pathways around water and water management.

Reducing barriers to Aboriginal water ownership

Aboriginal people have raised concerns that water management in NSW is largely seen as an allocation problem between agriculture, towns and the environment. This allocation distribution overlooks the interest, perspectives, knowledge and rights of Aboriginal people and their cultural obligation to Country.[85]

While there are ways of accessing water for cultural purposes, we heard from Aboriginal people that the current provisions in the *Water Management Act 2000* are not meeting their spiritual, cultural, social and economic needs. For example, Aboriginal people can apply for individual Aboriginal cultural water access licences, but these licences can only be used for a limited range of purpose and not economic gain.[86]

The licensing framework and costs associated with purchasing water on the market create significant barriers for Aboriginal people to buy and own water entitlements. Associated costs of also purchasing and maintaining water-related infrastructure, like pumps and pipes, makes it prohibitively expensive. Ownership of water entitlements by Aboriginal people or communities remains small, despite government commitments to set aside funding to help Aboriginal communities to invest in water entitlements.

This lack of ownership provides a significant obstacle to Aboriginal people having a voice in water management decisions and advancing the economic and social needs of Aboriginal people.

To address the lack of ownership of water entitlements and the complexity of applying for Aboriginal cultural water licences, the NSW Government is progressing the Aboriginal Water Strategy. This strategy also includes Action 3.4: Develop and enable employment and business opportunities for Aboriginal people.

85. Jackson, S., Woods, R. and Hooper, F. 2021, Empowering First Nations in the governance and management of the Murray–Darling Basin., in *Murray–Darling Basin, Australia* (pp. 313–338).
86. Licences may be granted for personal, domestic or communal Aboriginal cultural activities conducted by an Aboriginal person or community, including drinking, food preparation, washing, manufacturing traditional artefacts, watering domestic gardens, cultural teaching, hunting, fishing, gathering and for recreational, cultural and ceremonial purposes.

Challenge 5: Sustaining the health and resilience of the region's water-dependent ecosystems

The river system, floodplains, swamps, aquifers and wetlands in the Lachlan region are habitat for many aquatic species, including birds and native fish. The lower Lachlan floodplain is home to 8 nationally important wetlands, which feature areas of valuable river red gum forest and woodlands, black box woodland, common reed and lignum. Our challenge is to sustain the health and resilience of these natural assets and ecosystems now and into the future.

Water infrastructure, river regulation and water extraction have influenced flow variability, water quality and the distribution of water throughout the catchment. For example, headwater and re-regulating storages[87] have resulted in a decline in medium- and high-flow frequencies and low-flow patterns have become more common due to releases for consumptive use and end-of-system target flows (Figure 18).[88]

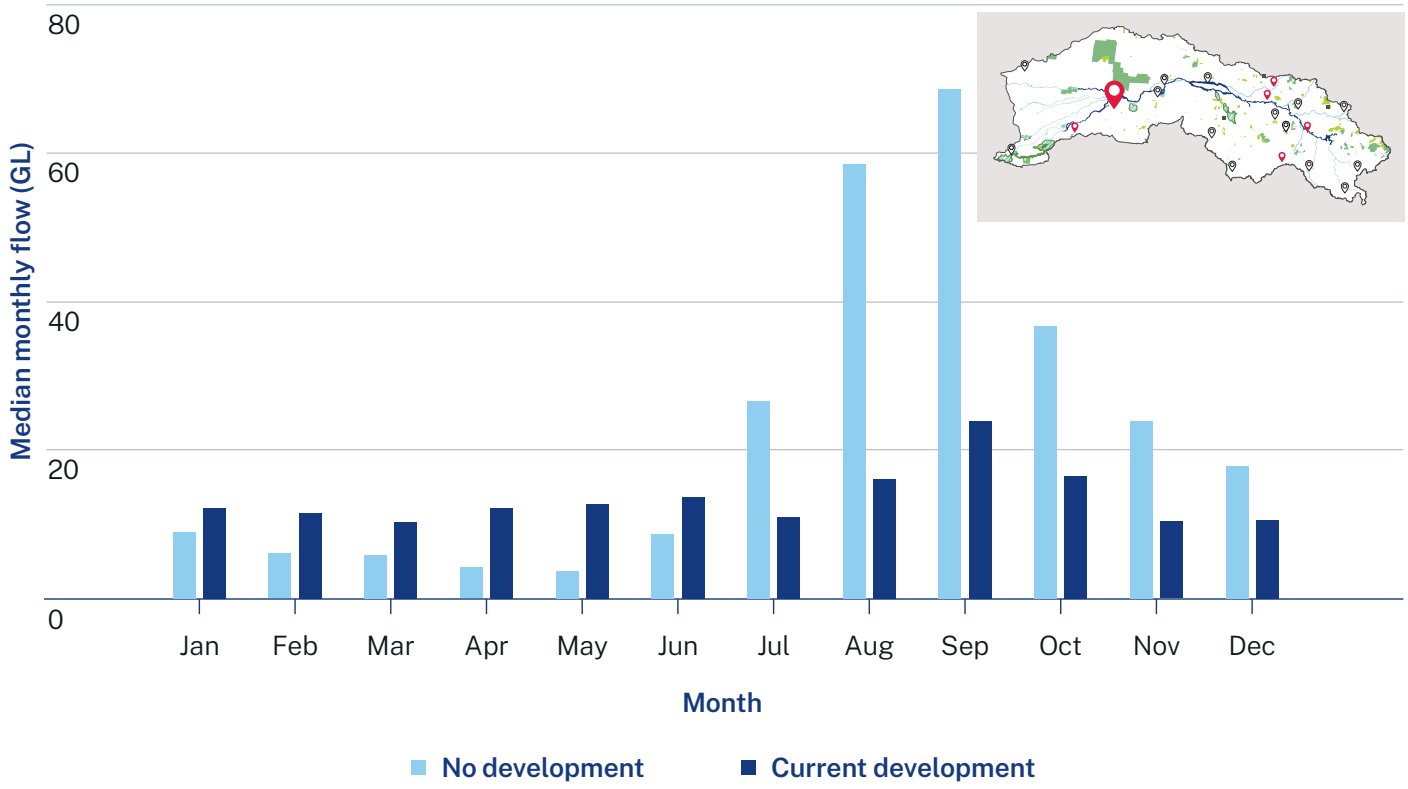
In addition, modelling comparing predevelopment and current conditions suggests a sizeable loss in the natural flow variability, reduced inundation of wetlands[89] and decreased flows at Booligal (Figure 19).

While these findings are based on modelled datasets, they suggest that more could be done to improve lateral connecting flows to meet the environmental water requirements, as outlined in the *Lachlan Long-Term Water Plan*,[90] without the intention to return to predevelopment conditions.

Improving lateral connectivity would support water quality, system-scale productivity and drought refugia[91] and facilitate the movement of aquatic fauna from stressed state to more moderate conditions.

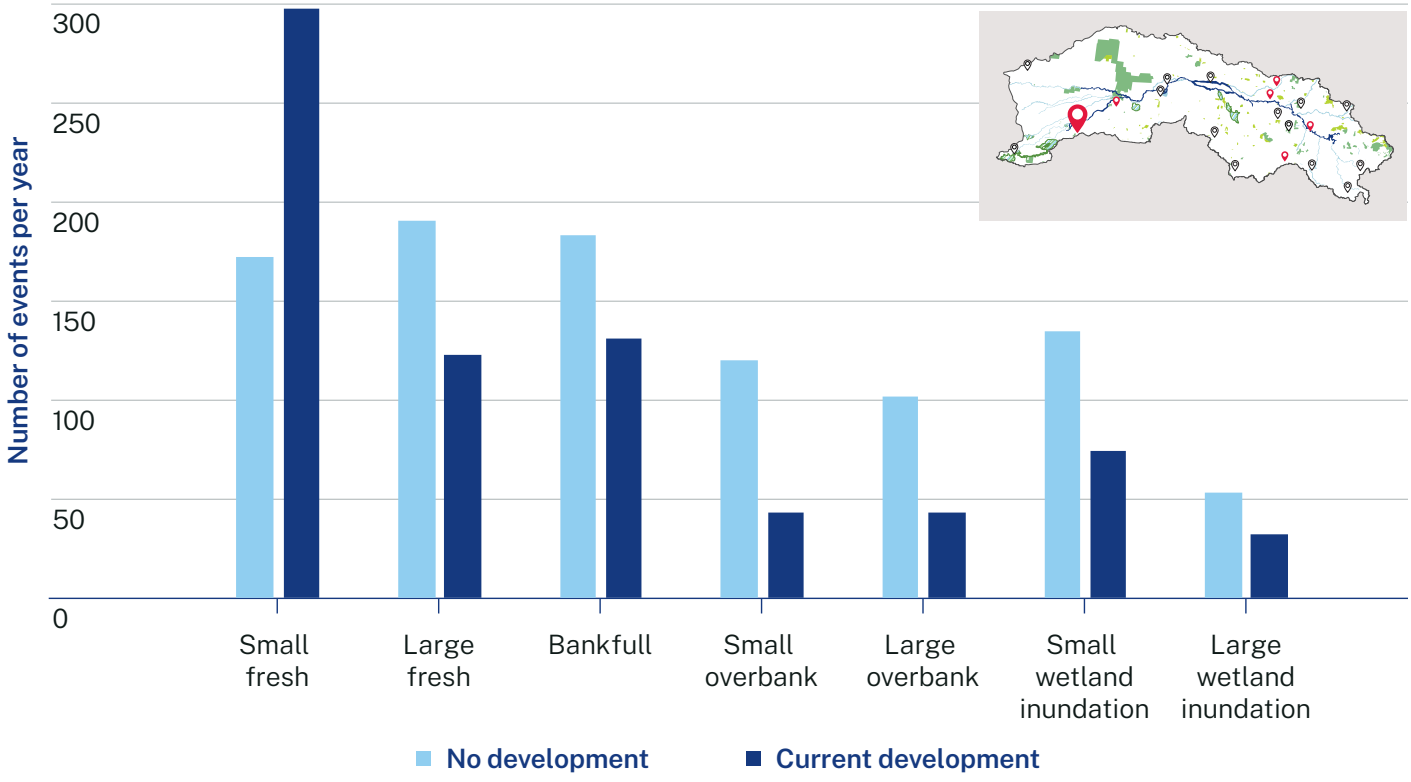
87. This includes the main storages of Wyangala Dam and Carcoar Dam, as well as Lake Rowlands and the re-regulating storages – for example Lake Brewster and Lake Cargelligo – and several weirs and regulators. Larger flows can also be subject to re-regulation at Lake Brewster and to a lesser extent at Lake Cargelligo.
88. The *Lachlan Long-Term Water Plan* available at: environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/lachlan and Hilman, M. and Brierly, G. 2005, A critical review of catchment-scale stream rehabilitation programmes, in Progress in Physical Geography: Earth and Environment Volume 29, Issue 1.
89. Wetland inundations at the Booligal gauge (412005) is defined at a flow rate above 650 ML/day for longer than 30 days (small) and a flow rate above 1,200 ML/day for longer than 60 days (large) as outlined in the *Lachlan Long-Term Water Plan*.
90. Available at: environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/lachlan
91. Drought refugia are habitats or environmental factors that give spatial and temporal resistance and resilience to biotic communities impacted by drought.

Figure 18. Modelled median monthly flow rate at Hillston under current conditions and under 'predevelopment' conditions



Source: Department of Planning and Environment, 2022

Figure 19. Frequency of different flow events at Booligal, under current conditions and under a 'predevelopment' condition, based on modelling



Source: Department of Planning and Environment, 2022

Changes to the natural flow regime are not only impacting the environment but are also influencing Aboriginal social and cultural outcomes. Aboriginal people have called for the introduction of 'cultural flows', which are not explicitly provided for in the *Water Management Act 2000* or in the region's water sharing plans.

The Echuca Declaration describes cultural flows,[92] which could assist in returning river systems to a more natural flow regime. These cultural flows would encompass a broader range of water-related aspirations for Aboriginal people.

Environmental water managers have already made progress towards achieving cultural and ecological co-benefits, such as delivery of water for the environment to improve the health of Booberoi Creek, in partnership with the Ngiyampaa Nation. In the context of a variable and changing climate, more work[93] and partnerships like these are needed to ensure the spiritual, cultural, social and economic needs of Aboriginal people can be better met in the Lachlan region.

Flows in the Belubula system

In addition to regulated releases from storages, flow variability is introduced to the Lachlan Regulated River system due to the frequency of dam spilling events and contribution from downstream tributaries, such as the Mandagery, Goobang and Gunningbland creeks.

Carcoar Dam rarely spills,[94] so flows into the regulated Belubula River generally occur downstream of Carcoar Dam from unregulated streams such as Coombing Creek. Unregulated flows have environmental and downstream user benefits and help to keep the natural variability of flow in the Belubula River. However, protecting unregulated flows downstream of Carcoar Dam and Lake Rowlands[95] can be challenging and changes to infrastructure[96] could have additional impacts on flow variability in the Belubula River, which need to be further investigated.

In addition, high groundwater connectivity in the lower reaches of the Belubula River has a significant influence on river flows and on the connectivity between the Belubula River and the Lachlan River. In July 2019, during the most recent drought, the *Water Sharing Plan for the Belubula Regulated River Water Source 2012* was suspended because the end-of-system flow requirements in the Belubula River could not be met.[97] During the development of the new water sharing plan, alternative rules for the end-of-system flows will be investigated.

The Natural Resources Commission completed a statutory review of the *Water Sharing Plan for the Belubula Regulated River Water Source 2012*. This review will help identify opportunities to improve water sharing provisions and associated outcomes during the remake of the *Water Sharing Plan for the Belubula Regulated River Water Source*.

92. Under the 2007 Echuca Declaration, cultural flows are defined as 'water entitlements that are legally beneficially owned by the Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, natural, environmental, social and economic conditions of those Nations'. More information is available at: mldrin.org/what-we-do/cultural-flows/
93. The National Cultural Flows Research Project is working to secure a future where First Nations' water allocations are embedded within Australia's water planning and management regimes to deliver cultural, spiritual and social benefits, as well as environmental and economic benefits, to Aboriginal communities in the Murray–Darling Basin and beyond. More information is available at: culturalflows.com.au/
94. In contrast to Carcoar Dam, Lake Rowlands has spilled on several occasions over the recent wet period. These spills are being considered as part of the Belubula Water Security Project.
95. Department of Planning, Industry and Environment 2020, *Lachlan Long-Term Water Plan Part B: Lachlan planning units*. Available at: environment.nsw.gov.au/research-and-publications/publications-search/lachlan-long-term-water-plan-part-b-planning-units
96. Department of Climate Change, Energy, Environment and Water, *Belubula Water Security Project*. Available at: water.dpie.nsw.gov.au/our-work/water-infrastructure-nsw/regional-projects/belubula-water-security-project
97. Department of Planning and Environment, *Suspension to Water Sharing Plan for the Belubula Regulated Rivers Water Sources 2012*. Available at: dpie.nsw.gov.au/water/plans-and-programs/water-sharing-plans/status

Improving the resilience of the region's nationally significant wetlands

Floodplain creeks and wetlands[98] in the Lachlan region have retained some degree of their ecological function and resilience, although their condition can be poor. They are nationally important feeding and breeding habitats for waterbirds and other animals and support a range of vegetation communities. The floodplains and creeks are vulnerable to changes in natural flow regimes and prolonged dry periods. For example, the Booligal Wetlands with its small, isolated wetland areas of river red gums and a larger area of lignum shrubland, experienced a significant decline in conditions during the Millennium Drought.

However, these assets also recovered with the help of water for the environment and by the wetter conditions that followed this prolonged drought period. The most significant loss of ecological structures and functions is at the lower end of the floodplain creek systems (for example, Merrowie Creek below Cuba Dam, Merrimajeel Creek below Murrumbidgil Swamp and lower Willandra Creek).

The effect of built structures (dams and weirs) has also reduced the number of connectivity events for some floodplain habitats[99] in the Lachlan region by up to 60%.[100] A reduction in connectivity can have serious consequences for some birds[101] and water-dependent species, and have implications for deep- and shallow-groundwater resources, which sustain riparian and floodplain vegetation ecosystems.

To improve the resilience of the region's significant wetlands and build functional resilience of critical ecosystems, this strategy includes:

- Action 2.3: Upgrade and automate existing re-regulating structures
- Action 2.5: Review and evaluate the Lake Brewster Water Efficiency Project.

Image courtesy of Stephen Mahony, NSW Department of Climate Change, Energy, the Environment and Water. Booroolong Frog.

98. Examples include Booligal Wetlands, Lake Brewster, Lake Cowal, Murrumbidgil Swamp and the Great Cumbung Swamp.
99. Whealbah Billabong and Booligal Swamp
100. Higgisson, W., Higgisson, B., Powell, M., Driver, P., Dyer, F. 2019, Impacts of water resource development on hydrological connectivity of different floodplain habitats in a highly variable system. *River Research and applications. 36(4)*.
101. Such as the straw-necked ibis, which are particularly sensitive to falling water levels in their colony sites and surrounding habitat that can cause adult birds to abandon their nests. *Lachlan Long-Term Water Plan Part A: Lachlan catchment*. Available at: www.environment.nsw.gov.au/research-and-publications/publications-search/lachlan-long-term-water-plan-part-a-catchment

Protecting the region's threatened or endangered fish

The Lachlan and Belubula waterways, including their floodplains, support a variety of native fish, with several listed as threatened or endangered in NSW. In addition to changes in the region's flow regimes, the following factors have contributed to the poor health of the native fish community in the Lachlan region:

- the presence of barriers[102] affect fish passage by preventing migration, disrupting life cycles and reducing gene pools. Barriers also create conditions where fish populations become more susceptible to the impacts of habitat loss, water quality issues, for example hypoxic blackwater events, invasive species, disease and predation[103]
- a loss of aquatic habitat[104] and a reduction in access to habitat is negatively impacting native fish in the Lachlan region[105]
- pumps with ineffective screens result in fish, especially juveniles, and other aquatic animals being either sucked into the diversion or impinged and injured on the screen
- cold water pollution can reduce the range and abundance of native fish as they require a specific water temperature range for survival.[106] Cold water pollution may prevent, inhibit or delay spawning[107] as water delivery for industry such as irrigation users occurs during the warmer months, which coincides with spawning and migration of native fish
- exotic species[108] thrive in disturbed habitats compared to native fish. The presence and dominance of introduced species can have a significant impact on the health and condition of native fish populations.

To improve conditions for native fish, this strategy includes Action 2.4: Mitigate impacts to native fish.

Protecting groundwater-dependent ecosystems

The Lachlan region has areas of high ecological value aquatic ecosystems that also overlap, in many places, with groundwater-dependent ecosystems, such as the Great Cumbung Swamp, where the groundwater to surface water interactions are central to ecological health. There are also significant amounts of groundwater-dependent ecosystems identified in the area around Condobolin.

During periods of drought with limited surface water availability, groundwater extractions can increase, subject to licensed entitlement holdings by water users and extraction limits, which can lead to reduced groundwater levels.[109] Increased and prolonged reliance on groundwater during extended dry periods, or under a future drier climate, could accentuate existing risks and put more pressure on groundwater sources and groundwater-dependent ecosystems.

To better protect groundwater-dependent ecosystems, this strategy includes Action 1.8: Improve the understanding and management of groundwater resources.

102. Such as dams, weirs and road crossings.
103. NSW Department of Industries 2006, *Reducing the impact of weirs on aquatic habitat — NSW Detailed Weir Review*. Report to the NSW Environmental Trust, Lachlan Catchment Management Authority.
104. Disturbance and deliberate removal are responsible for the loss of large woody habitat, with impacts on nesting species such as Murray cod.
105. Flow events of a sufficient size are used to inundate woody debris of new habitat or, during low-flow conditions, allow connectivity between refuge pools.
106. Michie, L., Thiem, J., Facey, J., Boys, C., Crook, D., Mitrovic, S. 2020, Effects of suboptimal temperatures on larval and juvenile development and otolith morphology in 3 freshwater fishes: implications for cold water pollution in rivers. *Environmental Biology of Fishes*, 103 (1527–1540).
107. Boys, C., Miles, N., and Rayner, T. 2009, *Scoping options for the ecological assessment of cold water pollution mitigation downstream of Keepit Dam, Namoi River*, Murray–Darling Basin Authority. NSW Department of Primary Industries.
108. Such as European carp, eastern gambusia, goldfish and redfin perch.
109. This is particularly important downstream of Hillston and in 2 areas above Lake Cargelligo, where groundwater levels have declined.

Ensuring best use of existing water for the environment

The NSW Minister for the Environment and the Commonwealth Environmental Water Holder hold and manage[110] a portfolio of water entitlements for environmental outcomes. The majority has been purchased from the consumptive pool, but a portion has been acquired through water efficiency projects.[111]

Environmental water is managed at a catchment scale and the use of held water is also linked to the availability and use of planned environmental water.[112] Held environmental water retains the same water access licence framework as the entitlement purchased from consumptive users. However, as the watering requirements of environmental assets and functions in the *Lachlan Long-Term Water Plan*[113] are fundamentally different to other industries, such as mining and agriculture, management strategies differ accordingly. These differences are reflected in the held and planned environmental water used over the last few years (Figure 20).[114]

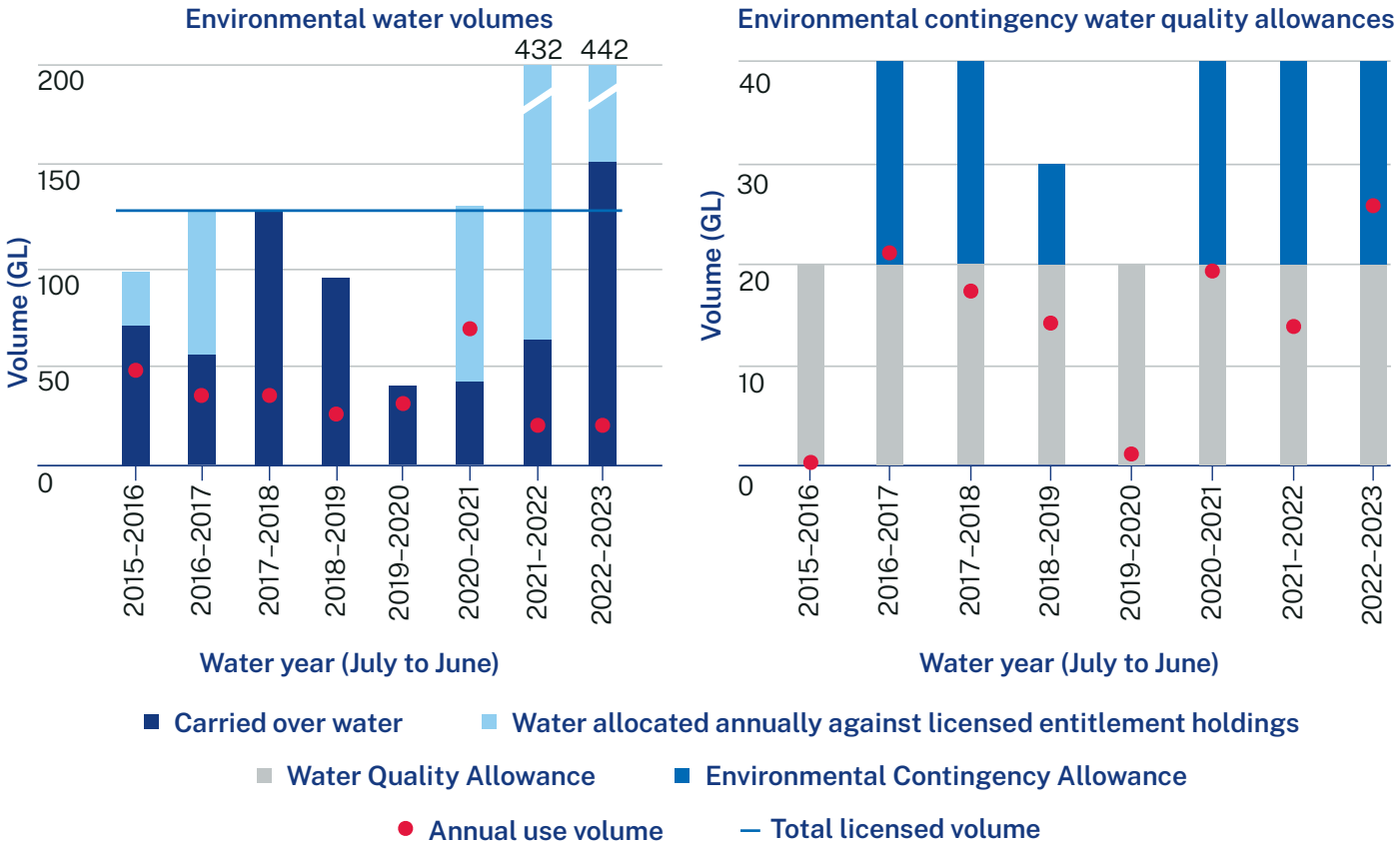
Given the inherent challenges, constraints and uncertainty around water-resource planning and management, environmental water managers[115] have adapted to the prevailing conditions by using both preventative and responsive strategies to manage the needs of aquatic ecosystems. Despite this, challenges for the environment remain with poor water quality and changes to in-stream flows under long-term climate change projections. In addition, water for the environment cannot always be used effectively when it is needed due to constraints such as:

- failing and inaccessible re-regulating structures and a limited gauging network
- daily or peak discharges are limited by the maximum capacity of the delivery infrastructure
- river operations along the length of the system during drought.

Image courtesy of Clint Comelli, Director Toopuntul Holdings Limited. Great Cumbung Swamp.

110. Day-to-day planning and management activities are carried out by the Department of Climate Change, Energy, the Environment and Water's Biodiversity and Conservation Division under delegated authority from the Minister for the Environment.
111. Funding from the Australian Government's Water Smart Australia fund was granted to extend NSW RiverBank investment under the NSW Rivers Environmental Restoration Program. By the end of January 2011, NSW Rivers Environmental Restoration Program and RiverBank had purchased 24,103 ML of general security water access entitlements and 1,000 ML of high security water access entitlements in the Lachlan region. In addition, the Lake Brewster Water Efficiency Project provided 12,000 ML of general security water access entitlements in June 2009. A further 795 ML of high security water access entitlements was recovered in September 2012 from the Pipeline NSW Program (Noonamah Water Authority).
112. Measures of success are less tied to system operational efficiencies because outcomes are measured by different indicators.
113. Available at: environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/lachlan
114. Department of Planning and the Environment, *Environmental water dashboard and analysis*. Available at: industry.nsw.gov.au/water/environmental-water-hub/public-register/dashboard
115. In the Lachlan region, existing management structures ensure the effectiveness of environmental watering.
    - The Lachlan Environmental Water Advisory Group is made up of representatives from industry, the environment and government. Regular meetings are held throughout the year and as required to seek advice, ensure consistency of objectives and maximise the outcomes from both held and planned environmental water.
    - The Biodiversity and Conservation Division of the Department of Climate Change, Energy, the Environment and Water and Commonwealth Environmental Water Office are in regular communication (at the beginning of the water year, and during watering events) to develop and implement multi-year and annual water plans.

Figure 20. Environmental water volumes available for use in the Lachlan region



Source: Department of Planning and Environment – Water 2022, compiled from data available on the Allocations Dashboard, available at: water.dpie.nsw.gov.au/our-work/allocations-availability/allocations/allocations-dashboard

Note: Figure 20 highlights the volumes of held environmental water available and its uses in the Lachlan Valley since 2015–16.

There were 2 seperate spill transactions in the reporting periods for 2021–22 and 2022–23. As set out in the water sharing plan this refers to the resetting of the general security allocation accounts to level as defined in the water sharing plan when Wyangala Dam either spills or releases water to maintain airspace and both Lake Brewster and Lake Cargelligo are full. When this occurs all remaining water in the general security accounts is withdrawn and an Available Water Determination of up to 1.36 ML per share (with a value deemed to be the maximum that general security accounts can hold) is made to reset the accounts. In addition, any high security account water traded from general security licences before the spill will also be forfeited.

To ensure the best use of existing water for the environment, this strategy includes Action 2.3: Upgrade and automate existing re-regulating structures.

Challenge 6: Supporting a sustainable and diverse regional economy

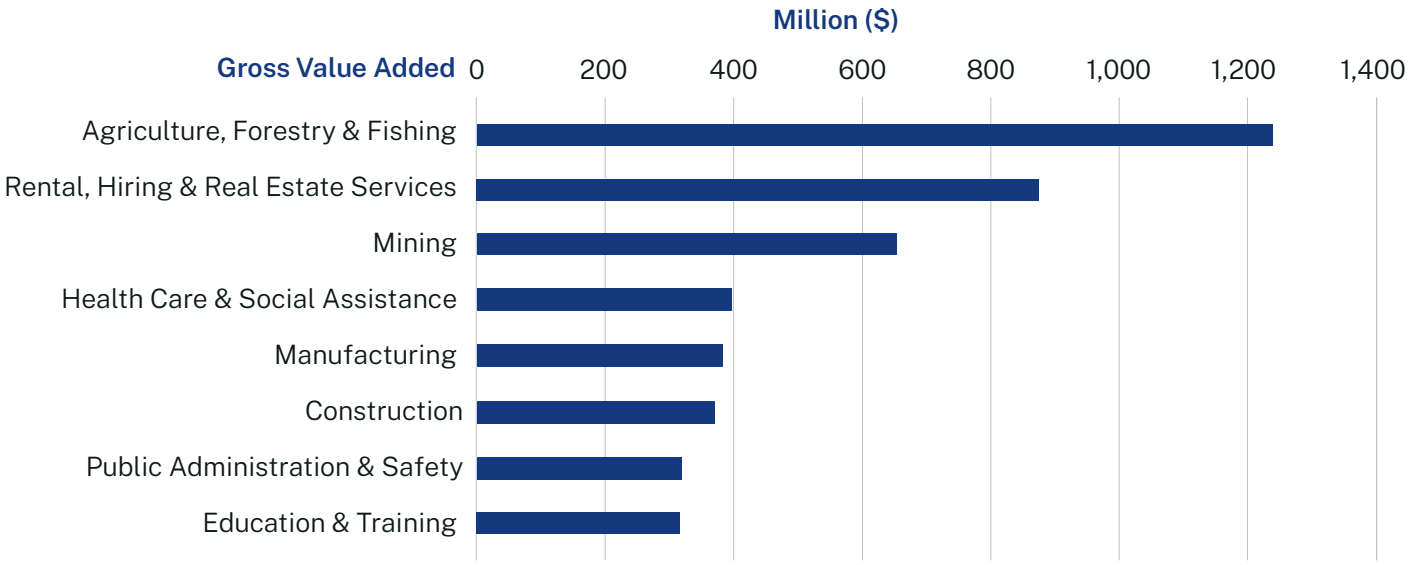
The industry profile in the Lachlan region is changing. Over the next 20 years, food processing and agriculture, mining and renewable energy production is expected to expand, aided in parts by upgrades to roads and transport links. Our challenge is to support new and existing industries in the context of a variable and changing climate and fully committed water resources.

Improve the integration of water into regional planning

The Lachlan region has a diverse regional economy that contributed $6.73 billion to the state's gross regional product in 2020/21.[116] Most key industries rely on the region's water resources, including agriculture, mining and manufacturing (Figure 21). Tourism, including water-related recreational activities around Lake Cargelligo, are also dependent on high-quality water resources and healthy waterways.

Attracting new high-value industries and supporting economic diversification is a strong focus for the region and access to reliable water is important to realise this vision. As well as expected growth in agriculture, food processing and renewable energy production over the next 20 years, there is likely to be an increase in exploration and mining activity (Figure 22) due to increased global demand for extractive resources, including critical minerals.[117]

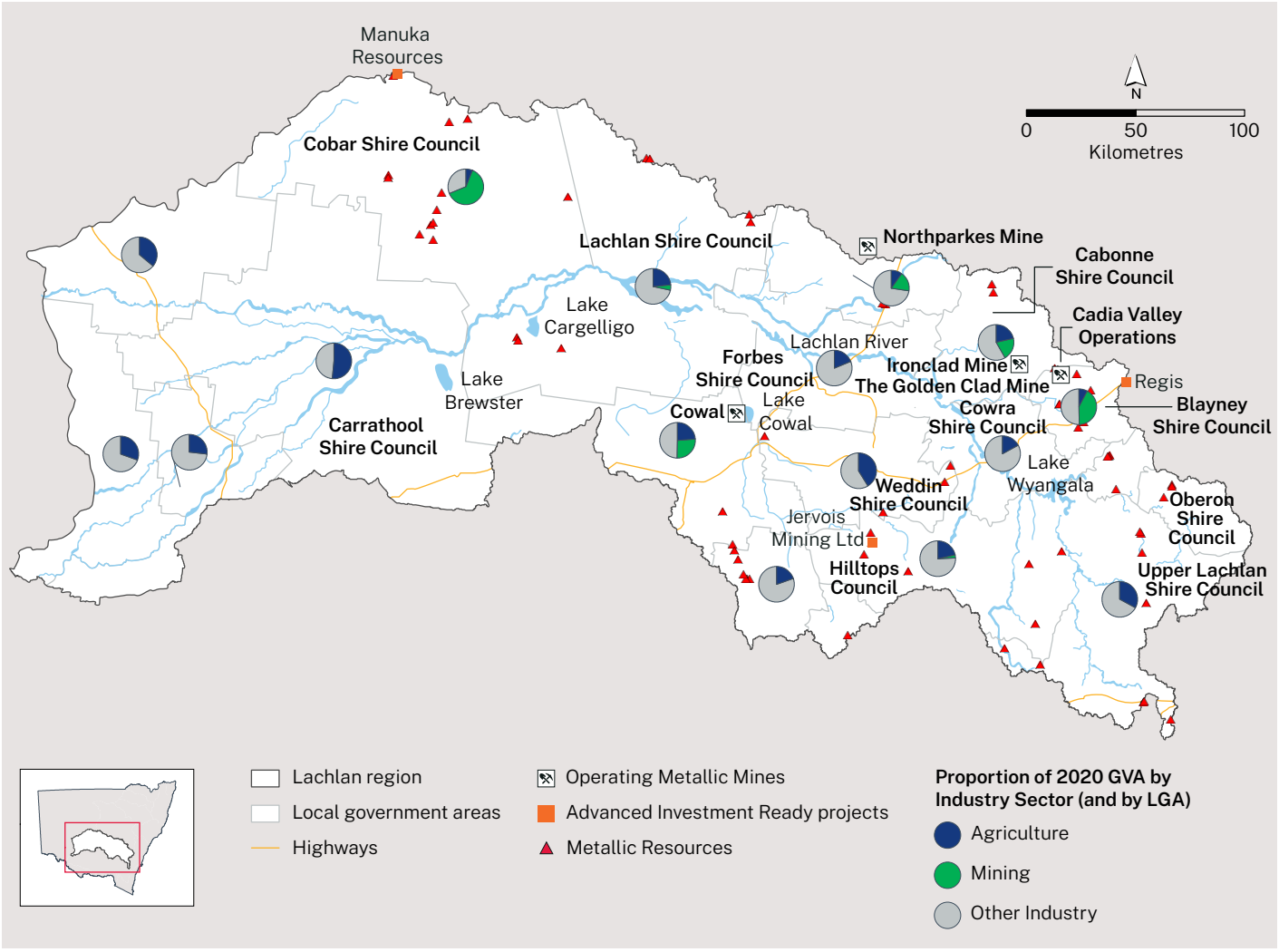
Figure 21. Gross value added for key industries in the Lachlan region



Source: Remplan Economy, Lachlan Regional Water Strategy boundaries data, 2022

116. $6.73 billion in 2020/21 as measured by gross value added, which accounts for 1% of NSWs economic output as measured by gross value added.
117. The *Critical Minerals and High-Tech Metals Strategy* outlines the NSW Government's vision to build on our existing potential and position NSW as a major global supplier and processor of critical minerals and high-tech metals well into the future. Under this strategy the NSW Government will establish a Critical Minerals Hub in the Central West of NSW, to activate benefits of collaboration across the critical minerals supply chain, leveraging our existing investments in the Central–West Orana Renewable Energy Zone and Parkes Special Activation Precinct.

Figure 22. Industry sector contribution to the regional economy (gross value added, 2020/2021), including proposed mine expansions



Sources: 1. REMPLAN Economy: Lachlan Regional Water Strategy boundaries 2022. 2. Department of Regional NSW MinView 2021.

The Inland Rail project, the Parkes Special Activation Precinct, and upgrades to the Newell Highway will also enable the broader Central West region to leverage its position along nationally significant rail and road corridors. This will in turn encourage further industry development and job growth. It will also likely change water-use patterns and drive greater competition for available water resources.

Regional areas are also becoming increasingly attractive places to live given that more people work remotely and that there is access to more affordable housing. For example, the 2022 NSW Population Projections estimate significant growth in the Forbes local government area, with a 32% increase in population expected over the next 20 years.[118] In this context, regional housing will be a key focus in future years, which will also require further consideration of the implications on future water demand.

To ensure that water resources are considered earlier in future land-use planning processes, this strategy includes:

- Action 1.9: Better integrate strategic land use and water planning
- Action 3.3: Work with industries to better understand, mitigate and adapt to the impacts of climate change for water management.

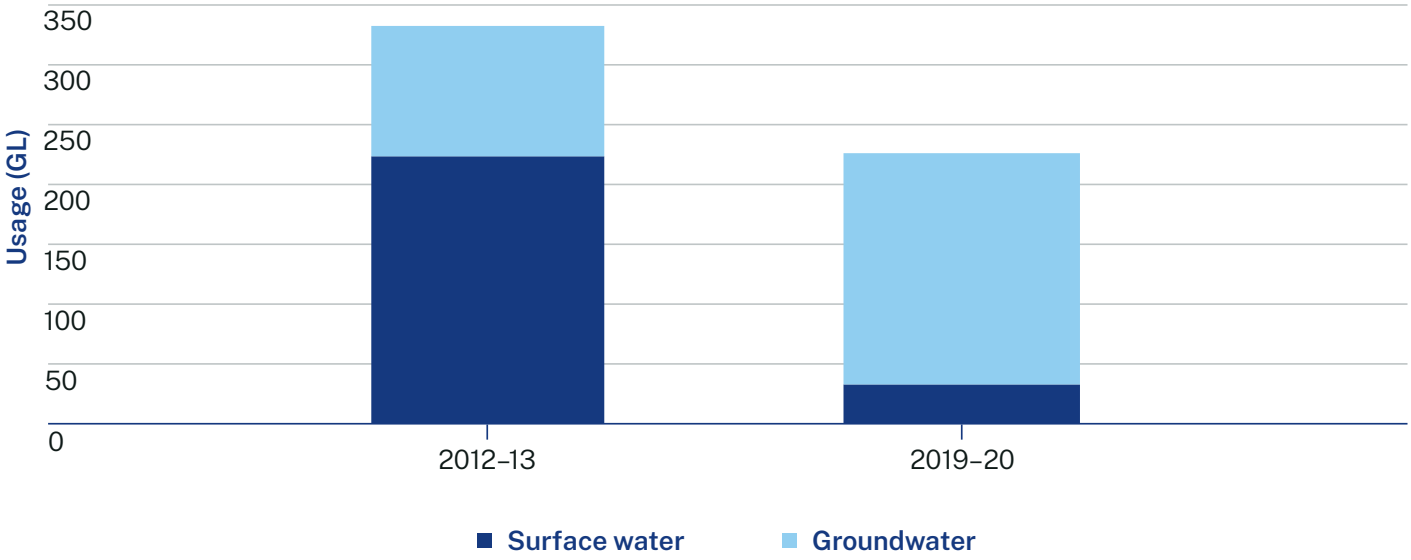
118. Available at: pp.planningportal.nsw.gov.au/populations

Improve our understanding and management of groundwater resources

Businesses and industries that are not located close to a surface water source often rely on groundwater to meet their water needs. Although allocations to aquifer access licences have historically been high, prolonged dry conditions and reduced surface water availability could increase demand for groundwater. This could in turn could push groundwater extraction closer to the water sharing plan extraction limits. In instances where use exceeds these limits, compliance actions would be needed to ensure groundwater extraction remains within allowable extraction limits on average.

Figure 23 shows that groundwater use can fluctuate significantly from year to year and is often linked to climate conditions and the availability of surface water. In 2012–13, the Lachlan region experienced significant rainfall events and groundwater use was relatively low. During the most recent drought in 2018–19, groundwater use was relatively high and contributed more to the total water use than surface water in the Lachlan region. This suggests that groundwater could become an even more important water source during future dry conditions, as surface water availability becomes constrained, especially in the Lower Lachlan region.

Figure 23. Groundwater use during high and low surface water availability years



Source: Department of Planning and Environment – Water, 2022. Available at: www.dpie.nsw.gov.au/water/our-work/allocations-availability/water-accounting

Note: Groundwater combines usage in the Upper Lachlan Alluvial Groundwater Source and the Lower Lachlan Groundwater Source. Surface water use only includes use in the Lachlan Regulated River.

Under dry future climate projections, this trend of using more groundwater will become more pronounced both in terms of demand, as well as the duration of sustained high groundwater use. Groundwater use will increase the risk that extraction may reach or exceed water sharing plan extraction limits, which would trigger reductions in future allocations or restrictions for water access.

Greater and more sustained reliance on groundwater could cause further declines in groundwater levels, with impacts on the quality of water from these resources and on surface water resources, particularly in intermittently flowing streams as flows can be dependent on groundwater levels. As observed in parts of the catchment, declines in groundwater levels pose risks to industries, particularly to businesses with an inflexible water demand,[119] and town water users.

To advance our scientific understanding of groundwater resources, including the connectivity between groundwater and surface water, and to inform better groundwater management approaches, this strategy includes Action 1.8: Improve the understanding and management of groundwater resources.

119. Future growth in the number of permanent plantings in the Lower Lachlan region could worsen the decline in groundwater levels.

Investigating water-use behaviour in the region

All water-dependent industries need to hold water access licences or have access to an existing town water supply system to meet their needs. In the Lachlan and Belubula regions, both surface water resources and groundwater sources are fully allocated[120] and extraction limits guide how much water is permitted to be extracted. This means there are challenges for existing and new industries if they require additional water.[121]

- For existing industries, a change in water needs must be met through either a more efficient or innovative use of water or through the acquisition of licences via the water market.
- For new industries relying on water, acquisition of water access licences or an alternative water supply contract is critical. However, opportunities to set up the system efficiently at the onset and consider how to drive the productivity of existing water resources, for example through re-use and recycling schemes, could provide additional opportunities for growth.

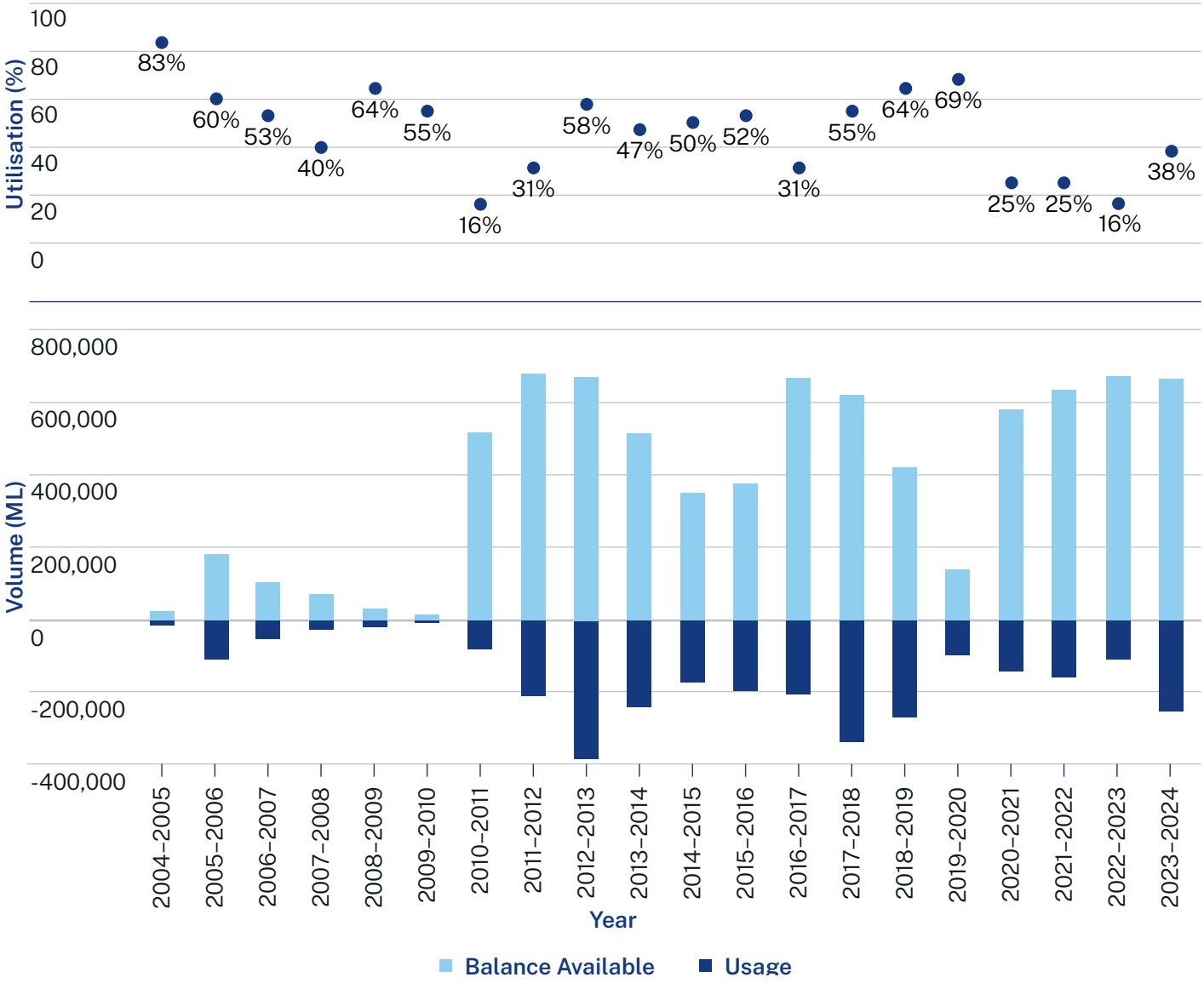
To mitigate the implications of the regions' variable climate and the associated fluctuations in general security allocations, many general security entitlement holders have accessed the water market[122] or have adopted conservative water-use behaviour, as well as making use of existing water accounting rules to carry over water between years. This is reflected in the account utilisation (Figure 24 and Figure 25). However, aside from a conservative water-use behaviour, industry stakeholders have suggested that the existing water sharing plan rules or other related policies are also leading to a systemic 'underuse'.[123] This issue requires further analysis.

To get a better understanding of how water is used in the region, this strategy includes Action 3.2: Investigate water use in the Lachlan region.

Image courtesy of iStock. Sheep grazing below the Blayney to Carcoar windfarm.

120. There may be an opportunity to issue new licences in marginal groundwater sources, potentially through controlled allocations.
121. To meet their different water needs, many businesses in the region hold a portfolio of surface water and groundwater entitlements and trade water on the temporary and permanent market, if required.
122. Department of Planning and Environment's Trade dashboard. Available at: water.dpie.nsw.gov.au/our-work/licensing-and-trade/trade/trade-dashboard
123. Underuse refers to the underuse of an entitlement. In most cases, average annual use remains under the extraction limit because many licence holders do not use their full entitlement. Those entitlement holders using their full entitlement can operate without restriction due to underuse of entitlements by others.

Figure 24. Account utilisation in the Lachlan Regulated River water source – water use relative to maximum amount available

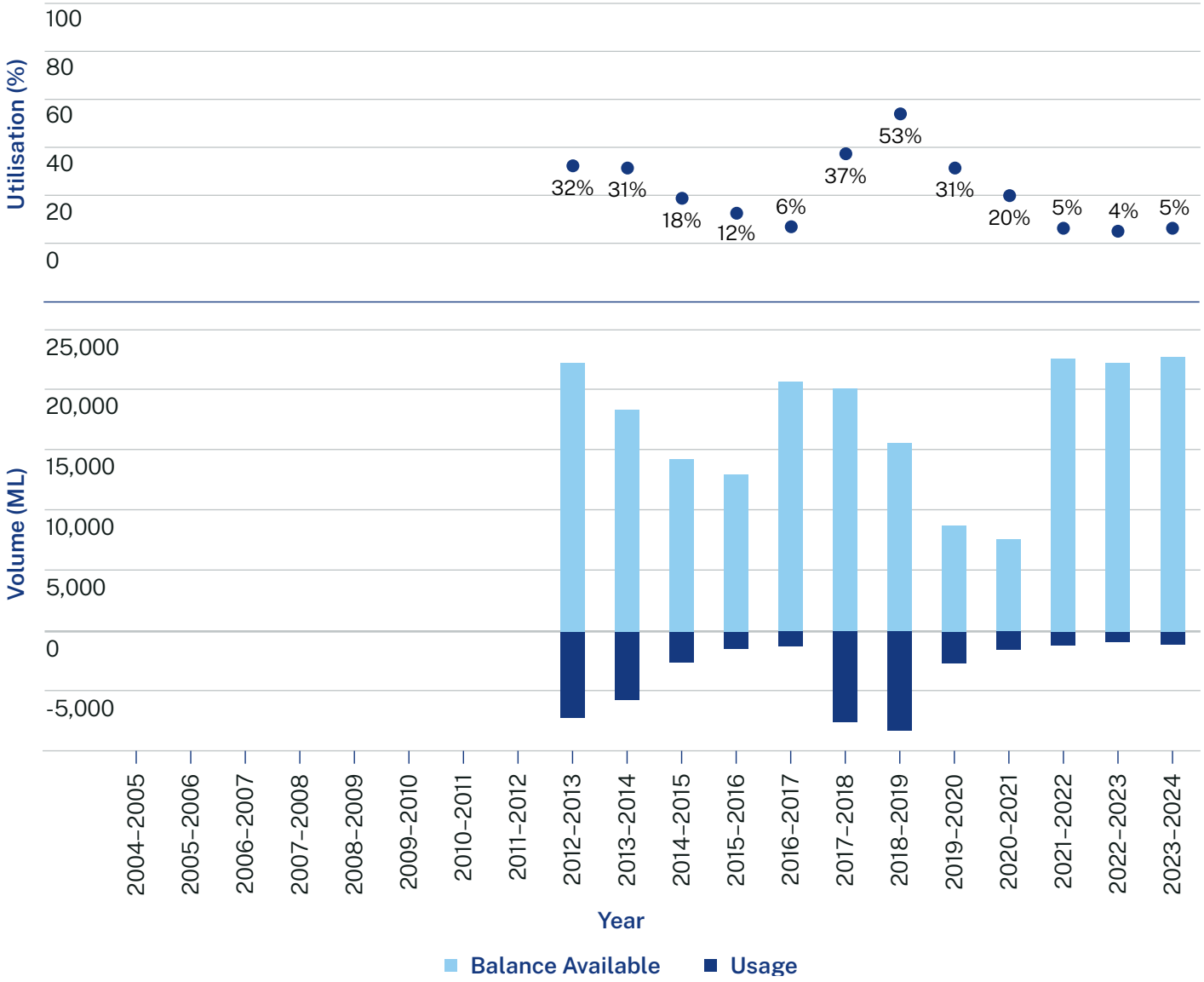


Explanatory notes:

- Account utilisation reflects the amount of water used from regulated supplies, relative to the maximum amount available for use.
- Utilisation rate calculation is the water availability plus trade in from external water sources against account usage and trade out to external water sources.
- Utilisation rate calculation excludes Supplementary, account usage restrictions, tagged trading, annual use limits and uncontrolled flow access.

Source: Department of Planning and Environment – Water, General Purpose Water Accounting Report – NSW Lachlan and Belubula Catchments 2020–21, water.dpie.nsw.gov.au/allocations-availability/water-accounting/nsw-general-purpose-water-accounting-reports

Figure 25. Account utilisation in the Belubula Regulated River water source – water use relative to the maximum amount available



Explanatory notes:

- Account utilisation reflects the amount of water used from regulated supplies (excluding supplementary water) relative to the maximum amount of available for use.
- Utilisation rate calculation is the water availability plus trade in from external water sources against account usage and trade out to external water sources.
- Utilisation rate calculation excludes supplementary, account usage restrictions, tagged trading, annual use limits and uncontrolled flow access.

Source: Department of Planning and Environment – Water, General Purpose Water Accounting Report – NSW Lachlan and Belubula Catchments 2020–21, water.dpie.nsw.gov.au/allocations-availability/water-accounting/nsw-general-purpose-water-accounting-reports

Enhance water-related business decisions

Critical water-management decisions are being made based on the last 130 years of climate records. Our new climate modelling and the last drought have demonstrated that the past is not necessarily a good indicator of the future, and the last 130 years of data could be inadequate for forecasting future water availability. There is also little published information on long-term water availability and drought risk for unregulated rivers and stream flow records for many unregulated rivers are short.

A limited understanding of future water availability and publicly available climate information can lead to poor investments, business decisions and drought security planning as well as a loss of opportunities to invest in alternative water supplies.

While government provision of climate and water availability information has improved in recent years, more can be done to ensure it meets the expectations of water users. The new climate data published in regional water strategies is the first step in providing more information to water users on the future risks to water availability; however, tailoring that data's application for industry and communities is likely to deliver the greatest benefits.

To ensure access to information and forecasts are suitable for water users and their business planning needs, this strategy includes Action 3.1: Improve public access to climate information and water availability forecasts.

A plan to secure water for the Lachlan region

5

Image courtesy of Paul Packard, NSW Department of Climate Change, Energy, the Environment and Water. Azolla, floating pondweed and milfoil growing in Cumbung swamp after translucent flow.

The vision for the Lachlan region is to support the delivery of healthy, reliable and resilient water resources for a liveable and prosperous region. To achieve this vision, the region needs to be positioned so the right amount of water of the right quality is delivered in the right way for water users, Aboriginal communities, towns, industries and the environment.

To address the 6 challenges in the Lachlan region, actions have been categorised into 3 priorities:

- Priority 1: Build resilience to climate extremes (Action 1.1–Action 1.9)
- Priority 2: Improve catchment health (Action 2.1–Action 2.7)
- Priority 3: Support the water needs of a strong and sustainable economy (Action 3.1–Action 3.6).

Together, these actions can improve the region's readiness to adapt to a more variable climate and support the decisions needed to ensure healthy, reliable and resilient water resources for the future.

The regional priorities do not override the priorities for water sharing in the *Water Management Act 2000*. Instead, they identify actions that need to be progressed over the coming decades. Each priority contributes to all the objectives of the regional water strategies. The actions are not listed in any priority order.

How actions are presented in the strategy and implementation plan

The Lachlan Regional Water Strategy contains 22 actions to address the key water challenges of the region over the next 20 to 30 years. Each action within the strategy is comprised of a number of sub-actions. Not all sub-actions can be progressed at once, and funding is a key consideration in planning when and how the actions will be implemented. Each sub-action is categorised on current commitments for funding and resourcing:

- **funded sub-actions** are works that are underway or planned and funded for delivery within 5 years
- **currently unfunded sub-actions** are works that are not currently planned or funded and will have a 5-20-year timeframe for delivery.

The implementation plan[124] for the Lachlan Regional Water Strategy focuses on funded actions and sub-actions that will be delivered in the first 5 years. Sub-actions that do not appear in the implementation plan are longer term priorities, that will be carried out subject to funding availability.

This staggered implementation recognises that although all actions are important, we cannot implement all sub-actions immediately.

To assist the department to monitor and evaluate implementation, the strategy also includes intended short-term (5-year) and long-term (5-20-year) outcomes for each overarching action.

We have heard from stakeholders that most actions in the strategy should be a priority to implement. However, not all sub-actions can be started at once, and funding is a key consideration in planning when and how the actions will be implemented.

Regional water strategies are a key tool in seeking funding as future opportunities arise. If funding is secured for currently nonfunded sub-actions, the implementation plan may be reviewed to accelerate their delivery.

124. The implementation plan for the Lachlan Regional Water Strategy is PUB24/1007. Available at: water.dpie.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy/

Figure 26. Lachlan Regional Water Strategy: overview of strategy vision, objectives, water security challenges and priorities

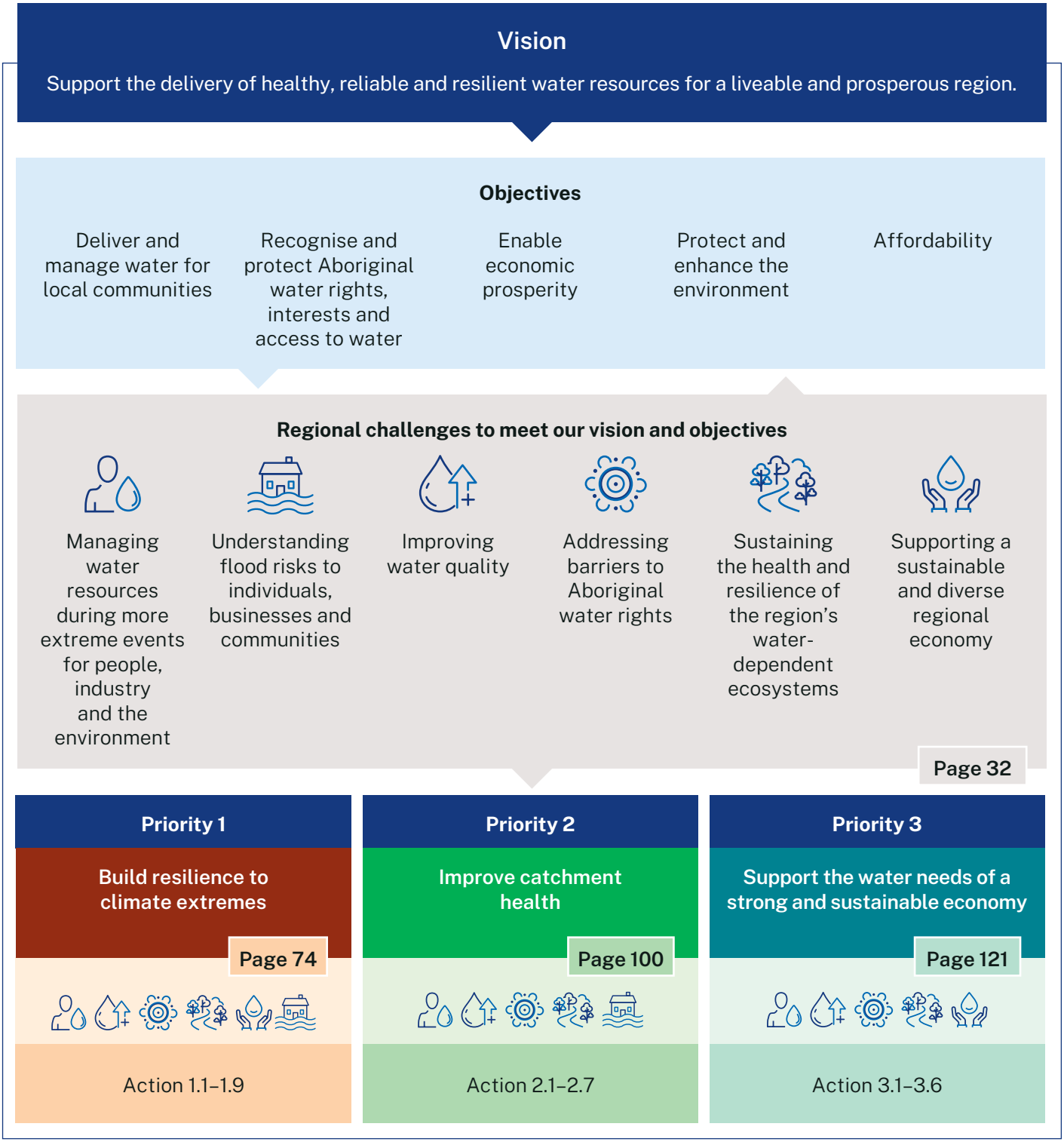
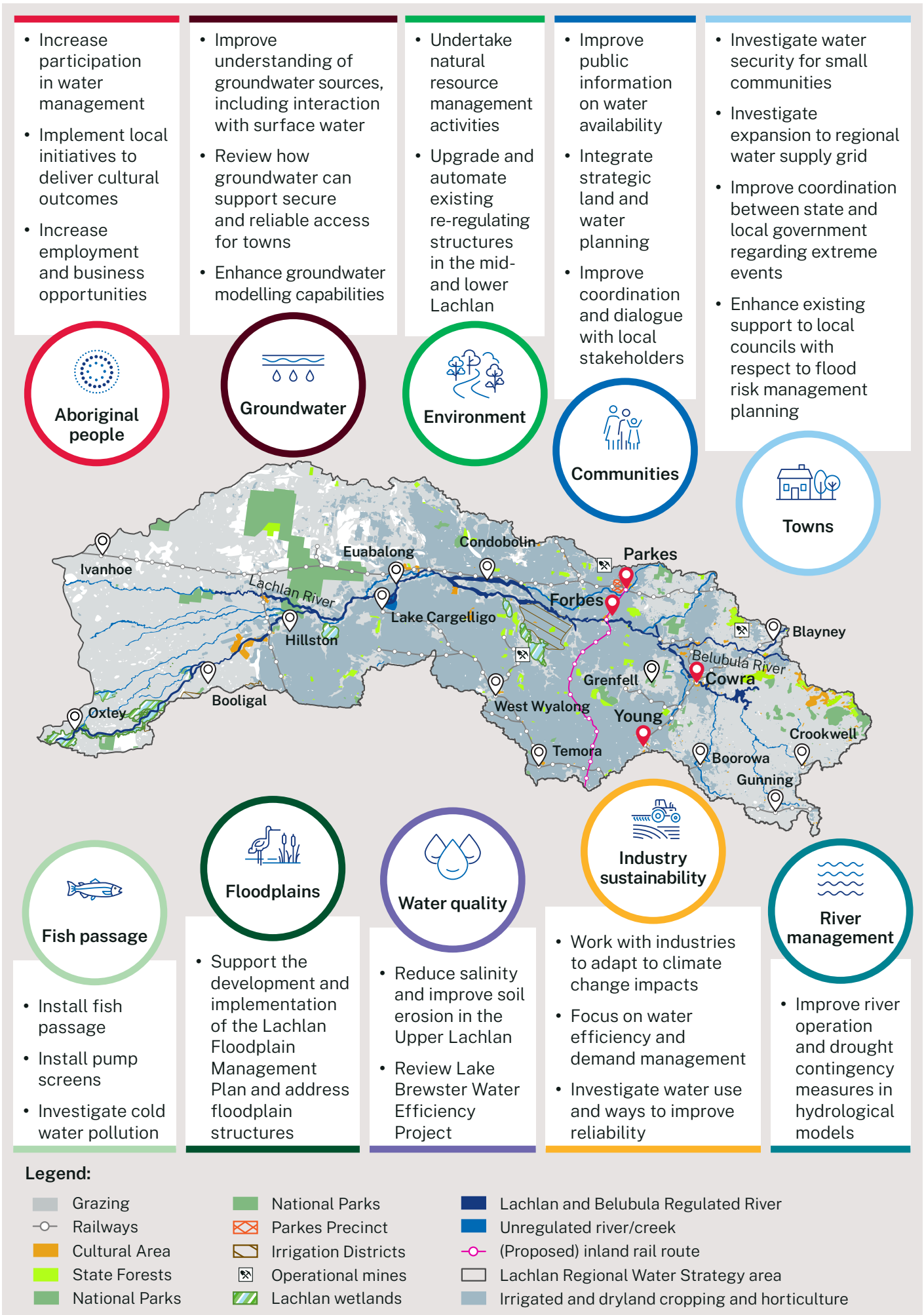


Figure 27. Summary of Lachlan Regional Water Strategy actions



Priority 1

Build resilience to climate extremes

We want to continue to work with communities on how water resources should be shared during times of scarcity and abundance. Relationships between the NSW Government and local governments will be particularly important during future extreme events, and to complete the sub-actions in the implementation plan. Our new climate research is an opportunity to enhance this work and ensure it is fit-for-purpose to address and mitigate more extreme conditions in the future.

Actions under Priority 1 (Figure 28) focus on building resilience through a more holistic, inclusive and transparent approach to planning, while doing the groundwork to enhance water security in the region to prepare for more extreme events.

Image courtesy of Destination NSW. Victoria Park, Forbes.

Existing programs to help build resilience to climate extremes

Over recent years, investments have been made to help secure water supplies for towns across the Lachlan region and to support critical needs during drought periods. The NSW Government will continue to support local water utilities to reduce risks to water security.

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

The NSW Water Strategy[125] has committed to supporting resilient, prosperous and liveable cities and towns through inclusive engagement, transparency and accountability.

The NSW Government is partnering with First Nations and Aboriginal people to co-design a statewide Aboriginal Water Strategy that will identify a program of measures to deliver Aboriginal people's water rights and interests in water management. This is intended to help address the statewide systemic issues to better enable Aboriginal people's rights and access to water.

The NSW Government has developed the *NSW Groundwater Strategy*[126] that identifies the key risks to our groundwater resources and the associated management challenges for NSW. The strategy sets out the actions required to respond to these challenges and provides a logical framework for funding groundwater management reform work over the next 20 years.

The department has developed region-specific information about drought management, and committed to a range of region-specific actions to improve the management of future droughts.[127]

The NSW Government published a report on how groundwater levels have been changing since monitoring began in the 1970s and 1980s, across 29 alluvial groundwater systems.[128] The department reviewed and analysed data from 1,300 groundwater monitoring sites. A specific report about the Upper Lachlan Alluvial Groundwater Source, Management Zone 2 was published.

The NSW Government is progressing work to replace floodplain management plans in the southern NSW regions, including the Lachlan Valley.[129] The existing 10 plans will be remade and expanded to ensure they align with the principles of the *Water Management Act 2000.*

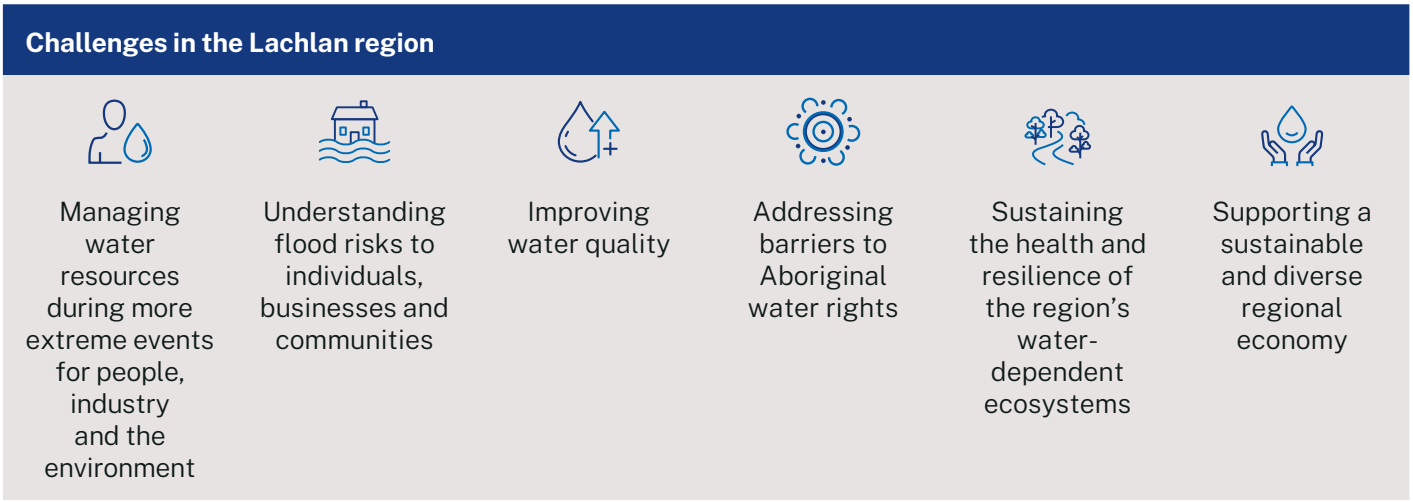
Through the NSW Reconstruction Authority, the NSW Government has developed a State Disaster Mitigation Plan[130] and is supporting local councils with local and regional disaster planning.

The Australian Government announced it will provide $236 million over 10 years to remediate high-priority flood warning infrastructure. The NSW Government is working with the Bureau of Meteorology on priority flood warning service improvements in NSW.

The Department of Planning, Housing and Industry developed a suite of regional plans so all of NSW is covered by strategic land-use plans. The Department is completing the first 5-year reviews of all regional plans to reset priorities and to extend the plans' reach to 2036–2041.

125. Department of Planning, Industry and Environment 2021, *NSW Water Strategy*. Available at: www.dpie.nsw.gov.au/water/our-work/plans-and-strategies/nsw-water-strategy
126. NSW Groundwater Strategy available at: water.dpie.nsw.gov.au/plans-and-programs/nsw-groundwater-strategy
127. More information on the departments drought management, including actions to address future droughts can be found at: water.dpie.nsw.gov.au/our-work/allocations-availability/drought-and-floods
128. Department of Planning and Environment 2022, *Managing decline in groundwater levels*. Available at: water.dpie.nsw.gov.au/our-work/allocations-availability/managing-decline-in-groundwater-levels
129. Department of Climate Change, Energy, the Environment and Water's program for valley-wide floodplain management plans in the southern Murray–Darling Basin. Available at: water.dpie.nsw.gov.au/our-work/floodplain-management/plans/southern-floodplain-management-plans
130. Available at: nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority/reducing-risk/state-disaster-mitigation-plan

Figure 28. Actions for Priority 1: Build resilience to climate extremes



Action	Summary	Challenges addressed
Action 1.1	Improve town water security in the Lachlan region	
Action 1.2	Support local councils to improve flood risk management	
Action 1.3	Upgrade the Lachlan Regulated River hydrological model to better represent river operations and drought contingency measures	
Action 1.4	Work with local Aboriginal people to ensure they can participate in water management	
Action 1.5	Support groundwater use for towns and communities	
Action 1.6	Investigate water security for small and remote communities	
Action 1.7	Investigate expanding the regional water supply grid	
Action 1.8	Improve the understanding and management of groundwater resources	
Action 1.9	Better integrate strategic land use and water planning	

Action 1.1: Improve town water security in the Lachlan region

Short-term outcome (up to 5 years): reduced risk to town water security in the Lachlan.

Long-term outcomes (5 to 20 years): improved drought resilience of local councils with better coordination of water security actions and planning processes across different levels of government.

The department supports local water utilities to improve town water security by undertaking effective, evidence-based strategic planning in accordance with the Local Water Utilities Regulatory and Assurance Framework.[131] However, the department has heard that there is desire for state agencies to better collaborate with local councils on implementing water security measures.

The NSW Government, in partnership with local water utilities and the wider water sector, is collaborating on the Town Water Risk Reduction Program.[132] This seeks 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 local councils and local water utilities and provides opportunities for these stakeholders to design and refine better solutions in collaboration with the department.

Phase 1 of the program worked with the sector to identify the most fundamental barriers within state and local government that prevent effective and strategic risk management, and to develop and implement long-term solutions to these barriers. Phase 1 was completed in December 2022.

Phase 2 of the Town Water Risk Reduction Program will:

- address critical skills shortages and boost water operations training and employment opportunities in regional NSW for school leavers, Aboriginal and First Nations students and existing water operators, in partnership with Training Services NSW
- deliver a new program in partnership with NSW Health to help optimise the performance of high-risk water treatment infrastructure using innovative technology so that more regional towns have reliable, resilient and safe water services
- enable local water utilities to accelerate responses to audits to improve local dam safety and address water quality risks, leveraging the systems and expertise of WaterNSW.

The department will consider the need for a sector-wide forum in the Central West. This approach is intended to allow local councils in both regions to raise drought and water security issues with state agencies to be resolved in a consistent and coordinated manner.

Figure 29. Projects and initiatives to achieve Action 1.1

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.1.1 Continue to support local councils and communities to address water security risks in line with the Regulatory and Assurance Framework for Local Water Utilities.	✓	
1.1.2 Continue to deliver phase 2 of the Town Water Risk Reduction Program.	✓	
1.1.3 Investigate ways to bring together the Lachlan and upper Macquarie–Castlereagh regions in a sector-wide forum to coordinate water security issues in the Central West.	✓	

131. More details on the framework is available at: water.dpie.nsw.gov.au/our-work/local-water-utilities/regulatory-and-assurance-framework
132. Town Water Risk Reduction Program available at: water.dpie.nsw.gov.au/our-work/local-water-utilities/funding-and-other-programs/twrrp-phase-1/town-water-risk-reduction-program

Action 1.2: Support local councils to improve flood risk management

Short-term outcome (up to 5 years): local council flood risk management is supported in a coordinated manner by relevant NSW Government agencies.

Long-term outcomes (5 to 20 years): flood risk management is improved for local councils.

Understanding the nature of flooding and the complexities of flood risk management is challenging, and integrated management between urban and rural areas and across local government areas requires effective coordination.

Local councils, supported by the NSW Government, are primarily responsible for managing floodplains within their boundaries with roles and responsibilities outlined in the *Flood Risk Management Manual* and its toolkit.[133] In rural areas, the department has a legislated role to manage floodplain development under the *Water Management Act 2000*. To improve the coordination of floodplain development across the Lachlan Valley, the department is replacing 3 existing floodplain management plans with a single, valley-wide floodplain management plan (Action 2.7). WaterNSW assesses flood work applications for their customers and has flood risk obligations related to their assets, including releases from dams to mitigate flood risk. WaterNSW also operates a subscription- based Early Warning Network, which provides updates on dam and supply initiatives, including releases from dams that may impact river levels.[134]

Under Action 1.2, the NSW Government will continue to support local councils with flood risk management via existing mechanisms (see breakout box below). Collaboration will be directly between local councils and state government agencies.

Figure 30. Projects and initiatives to achieve Action 1.2

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.2.1 Replace 3 existing floodplain management plans with a single, catchment-wide floodplain management plan (see Action 2.7).	✓	
1.2.2 Assess and manage flood work applications, and flood risk obligations, including release from dams to minimise flood risk.	✓	
1.2.3 Continue to progress actions from the 2022 NSW Flood Inquiry through the State Disaster Mitigation Plan (see Challenge 2: Understanding flood risks to individuals, businesses and communities).	✓	
1.2.4 Continue to improve WaterNSW provision of information to the Early Warning Network.		✓

133. Available at: environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-manual
134. Early Warning Network – WaterNSW.

Local councils and various state agencies have responsibility for flood preparedness and planning

The department's Biodiversity Conservation and Science group is primarily responsible for providing flood risk management advice to government and supporting local councils to undertake their flood risk management planning responsibilities for urban communities. This support aligns with the NSW Flood Prone Land Policy and the Flood Risk Management Manual and its supporting toolkit and the Floodplain Management Program.[135]

The department's Water group is responsible for developing, reviewing and replacing rural floodplain management plans under the *Water Management Act 2000*. Rural floodplain management plans coordinate development on declared floodplains by establishing management zones and setting clear and consistent rules and assessment criteria for each management zone. The plans also identify and protect flood-dependent ecological and cultural assets and identify risks to life and property from the effects of flooding. There are currently 3 historical floodplain management plans in the Lachlan region. These plans will be replaced with a single Lachlan Valley-specific rural floodplain management plan, anticipated to be completed by 2025–2026 (see Action 2.7).

WaterNSW plays an important role in flood mitigation by managing 'airspace' – the amount of space available in a dam to capture flows – in the dams that it manages. Managing airspace balances the safety of the structures, maintains water security and mitigates and minimises impacts of events on downstream communities. Downstream tributaries can also contribute to flooding in the valley. When regional storage dams with control gates are at risk of spilling, WaterNSW sets up airspace reference panels to consult with downstream stakeholders and manages airspace in accordance with the relevant rules in the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.

The NSW Reconstruction Authority is legislated to assess and manage the risk of disasters and to lead disaster resilience, adaptation and mitigation in NSW. It developed the State Disaster Mitigation Plan[136] and is supporting local councils to undertake local and regional disaster planning. The State Disaster Mitigation Plan:

- identifies potential strategies and actions for reducing the impact of disasters
- assesses and considers the impacts of climate change on disasters
- determines priority projects for regions to mitigate the impact of disasters.

The State Disaster Mitigation Plan also sets priorities for the plan, local disaster adaptation plans and strategic plans under the *Environmental Planning and Assessment Act 1979*.

Other disaster planning and response roles

The NSW State Flood Plan outlines the NSW Government's multi-agency arrangements for responding to floods in NSW to protect life and property.

Under the *State Emergency and Rescue Management Act 1989* and *NSW State Emergency Service Act 1989*, the NSW State Emergency Service is the lead agency for flood, storm and tsunami.

The department plays a support role during emergency incidents, including drought and flooding, providing technical assistance and advice about emergency water security options or damaged local water infrastructure.

WaterNSW provides information and data about river and dam levels to the State Emergency Service and the Bureau of Meteorology for public reporting, including public notifications, warnings and reporting.

Under the *NSW Reconstruction Authority Act 2022*, the NSW Reconstruction Authority is also responsible for reconstruction and recovery after disasters and other emergencies, including:

- facilitating, coordinating and directing the recovery, planning and rebuilding of affected communities, including repairing and rebuilding land and infrastructure and other development
- balancing constraints to enable a focused, timely and expedited recovery of affected communities.

Other state agencies administer various funding and support programs to assist local councils with disaster planning (for example, the Regional Drought Resilience Planning Program administered by Regional NSW).

135. Further information about the policy, manual and programs available at: environment.nsw.gov.au/topics/water/floodplains/floodplain-management-program
136. Available at: nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority/reducing-risk/state-disaster-mitigation-plan

Action 1.3: Upgrade the Lachlan Regulated River hydrological model to better represent river operations and drought contingency measures

Short-term outcome (up to 5 years): the Lachlan Regulated River hydrological model is improved as needed and the forecast town water supply demands are in line with Common Planning Assumptions.

Long-term outcomes (5 to 20 years): the model is regularly maintained and upgraded and potential Mid-Lachlan efficiency measures have been assessed

The way the Lachlan Regulated River is operated has the potential to enhance environmental, water quality and social outcomes or exacerbate impacts.[137] Water sharing plans aim to ensure water resources are protected, and guide river operations in each NSW catchment.

Through the regional water strategies and the development of new climate datasets, there is an opportunity to review our hydrological models to ensure existing river operations, management practices and drought contingency measures are accurately reflected.

This work will enable us to establish a baseline that can be used to test existing or changes to river operations under different climate scenarios. It will also provide an underlying information base for environmental water managers in the Lachlan region to inform future watering decisions.

Within this action, the NSW Government will use the transition of the Lachlan Regulated River hydrological model to a new modelling platform[138] to improve the representation of river operations and drought contingency measures. This modelling could assist in developing options to optimise system-wide operations across the catchment.

Upgrades to the hydrological model and the new climate datasets could also be used in conjunction with the *Lachlan Long-Term Water Plan*[139] to inform future decisions on environmental water-management.

The department will continue to work closely with individual local water utilities to ensure the Lachlan Regulated River model accurately reflects local circumstances for town water supplies.

We can also expand the representation of the river system to test several potential system-wide efficiency measures. For example, the original Mid-Lachlan efficiency measures option in the draft strategy (option 26) cannot be assessed with our hydrological model. This limits our ability to understand the benefits and costs and prevents us recommending this option for further detailed assessment.

Alongside the transition of the department's hydrological model for the Lachlan Regulated River to a different modelling platform, Action 1.3 would enhance the current model to better represent the effluent streams in the Mid-Lachlan. This would enable more detailed assessments of the benefits and costs of the Mid-Lachlan efficiency measure option.

137. Social outcomes include, for example, the ability to use the river for recreation (swimming, kayaking) or visual amenity (water clarity, volume). Recreation and amenity can be affected if there is inadequate volume, unseasonal cold temperatures or if the river is moving quickly and is too dangerous to swim.
138. The department will transition the current Integrated Quantity and Quality Model to a Source model.
139. Available at: environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/lachlan

Figure 31. Projects and initiatives to achieve Action 1.3

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.3.1 Further improve the catchment hydrological models on an as-needs basis.	✓	
1.3.2 Update forecast town water supply demands in line with the Common Planning Assumptions.		✓
1.3.3 Consult with local councils and their local water utilities to: • ensure up-to-date town water supply demands are reflected in the Lachlan Regulated River hydrological model • incorporate groundwater availability and usage, where applicable, into the model.		✓
1.3.4 Reassess town water supply shortfalls and provide the results to local water utilities.		✓
1.3.5 Update the existing hydrological models for the Lachlan catchment to better represent river operations and drought contingency measures.		✓
1.3.6 Continue to consult with stakeholders while upgrading the models to consider issues such as: • usage and availability of: – regulated surface water – unregulated surface water – groundwater – recycled water. • flow constraints and viability of unregulated structures.		✓
1.3.7 Upgrade the department's hydrological model to better represent the effluent streams in the Mid-Lachlan. This upgrade would enable a more detailed assessment of the benefits and costs of the Mid-Lachlan efficiency measure option.		✓

Adjustments to the department's models undertaken to date

The department assesses water resources across the Lachlan catchment using hydrologic models for long-term, historically based assessment to support the development of water sharing plans and water planning decisions within the Lachlan region.

For the regional water strategies assessment, adjustments were made to ensure the models were fit-for-purpose for hydrologic assessment for a range of potential applications.

For the Lachlan model these consist of:

- separation of Forbes and Parkes town water supplies into individual demand nodes
- configuration of town water supply nodes to provide for Cowra, Parkes, Forbes, Condobolin, Cargelligo, Willandra, Hillston and Booligal
- climatically dependent demand behaviours
- functionality for demand growth.

For the Belubula model these consist of:

- including Central Tablelands Water, incorporating demand representation to include functionality for environmental releases from Lake Rowlands, restriction regimes and other operational behaviours based on discussions with Central Tablelands Water operational personnel
- updated Coombing Creek hydrology (Lake Rowland inflow)
- proposed amendments to the *Water Sharing Plan for the Belubula Regulated River Water Source 2012*.

For the Parkes town water supply:

- shortfall assessment was modelled to assess Lachlan River entitlements in meeting Parkes' unrestricted demand and without supply from Endeavour or Beargamil dams. While the model's functionality has been improved to include Endeavour and Beargamil dams, the specific local hydrology associated with these dams needs to be developed
- significant improvement in detailed Parkes supply system behaviours could be achieved with input of local knowledge and available data from Parkes Council.

General issues for noting:

- there is no explicit consideration of or allowance for groundwater entitlements or use in the Lachlan and Belubula catchment models
- there is no explicit consideration of the existing pipeline connections between towns and communities in the Lachlan region
- there are opportunities to improve the catchment models where there is potential for the access to groundwater or a pipeline connection to affect the outcomes of the surface water system being assessed
- forecast town water supply demands were updated in line with the Common Planning Assumptions[140] and will continue to be adjusted as the latest versions of these projections are available.

140. Available at: treasury.nsw.gov.au/information-public-entities/nsw-common-planning-assumptions

Action 1.4: Work with local Aboriginal people to ensure they can participate in water management

Short-term outcome (up to 5 years): fair remuneration for participation by First Nations and Aboriginal people in NSW Government decision-making about water management.

Long-term outcomes (5 to 20 years): appropriate mechanisms are in place to support Aboriginal people to participate in water management.

This action will support the Lachlan Regional Aboriginal Water Committee's and other existing and new Aboriginal groups' involvement in water-management activities and decision-making. The success of this action will be driven by the extent it enables self-determination and provides adequate support to the groups.

During consultation for this strategy, Aboriginal people told us that consultation with their communities on water issues had been infrequent and poorly executed.

We heard from Aboriginal people that the government has to earn the trust of the community as a first step in building a strong lasting relationship with them. To address this issue now and build on it over the next 20 years, Aboriginal people must be able to get the right people involved in decisions about water management in each local area and region.

Action 1.4 supports Priority Reform 1 in the National Agreement on Closing the Gap to enter formal partnerships and shared decision-making and to develop place-based partnerships to respond to local priorities. We are committed to supporting the involvement of Aboriginal people in decision-making around water management. In continuing to implement Priority 2 of the NSW Water Strategy, our approach will be informed by the department's Aboriginal Water Program and the Aboriginal Water Strategy (to be published in 2025).[141] The Aboriginal Water Program is an important program in NSW and will continue to be implemented in the Lachlan region and across the state. The Aboriginal Water Strategy will be finalised and progressively implemented to ensure better outcomes for Aboriginal communities.

141. Available at: water.dpie.nsw.gov.au/our-work/projects-and-programs/aboriginal-water-program/strategy

Figure 32. Projects and initiatives to achieve Action 1.4

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.4.1 Continue to implement Priority 2 of the NSW Water Strategy to strengthen the role of Aboriginal people in water planning and management.	✓	
1.4.2 Continue to support and regularly engage with the Lachlan Regional Aboriginal Water Committee by ensuring the Regional Water Strategies Program is a standing item on the Lachlan Regional Aboriginal Water Committee's agenda.	✓	
1.4.3 Explore how Aboriginal people want to be represented on the Lachlan Environmental Water Action Group and how their priorities may be represented in annual and long-term environmental water planning.	✓	
1.4.4 Put guidelines in place to ensure fair remuneration for participation by Aboriginal people.	✓	
1.4.5 Undertake direct engagement with Nations and representing organisations including on long-term watering plans.		✓
1.4.6 Provide training and support to Lachlan Environmental Water Action Group members to further develop their cultural competence and capacity.		✓
1.4.7 Progress longer-term priorities identified by the Lachlan Regional Aboriginal Water Committee and local communities.		✓
1.4.8 Enable the department to fund existing and new local Aboriginal-controlled organisations to increase their capacity to be more involved in water-related matters in an ongoing manner, subject to a NSW Government decision on funding.		✓
1.4.9 Seek direction from the Lachlan Regional Aboriginal Water Committee to ensure local protocols are being met.		✓

NSW's obligations under the Basin Plan

The NSW Government has obligations for the development of water resource plans under Chapter 10 of the Basin Plan.[142] These plans must meet Aboriginal people's objectives and desired outcomes for managing water resources in each region.

The objectives and outcomes as stated by the Barkandji and Maljangapa, Nari Nari, Ngiyampaa, Wiradjuri and Yita Yita nations in the Lachlan region's water resource plans will be the basis for further initiatives that will help to consider Aboriginal people's objectives and outcomes in water resource management.

142. Available at: mdba.gov.au/water-management/basin-plan

Action 1.5: Support groundwater use for towns and communities

Short-term outcome (up to 5 years): improved urban water planning for regional towns and cities using groundwater.

Long-term outcomes (5 to 20 years): secure and sustainable groundwater use by regional towns and communities.

Groundwater is important for towns in the Lachlan region, as a primary water source for towns such as Hillston, or as an alternative supply for towns like Forbes. However, groundwater use is at, or approaching, the extraction limit for important groundwater sources like the Lower Lachlan.[143] This means there is little potential for future increased use of this groundwater source.

There are also areas of declining groundwater levels in highly used aquifers like the Upper Lachlan (Figure 11). Local groundwater levels can decrease during the pumping season where there is a high density of irrigation bores. This decrease can make 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. Furthermore, groundwater levels may not recover if there is less rainfall to replenish the groundwater source.

The security of groundwater sources for town water supply is a concern. Water users, including local councils, require more information on anticipated future demands to improve groundwater management.

To maintain water supply security, towns need to protect their existing groundwater access and plan for their future water needs. Firstly, it is important to understand whether local town water bore infrastructure, combined with local groundwater conditions, is sufficient to sustain town water supply during droughts. For example, it is important to ensure an appropriate number of bores are constructed that are sufficiently deep and well-constructed so that their yield is not affected by declines in the groundwater levels during drought.

Secondly, it is important to quantify current and future groundwater demands. This would involve analysing trends in demand for groundwater from all users and where demand may change due to changes in land use, climate, population growth, development of new industries or public investments.[144] This analysis will determine the physical constraints (for example, borefield infrastructure) and access constraints (for example, licensed groundwater entitlements) for town water supply.

Action 1.5 would not replace the need for local councils to develop local water utility strategic plans, which were previously referred to as integrated water cycle management strategies. Instead, this regional analysis would likely be informed by local water utility strategic plans.

Image courtesy of Destination NSW. Parkes Railway Station, Parkes.

143. Available at: water.dpie.nsw.gov.au/allocations-availability/extraction-limits/tracking-groundwater
144. Whether certain industries could use lower quality groundwater to reduce future demand on high-quality groundwater sources should be considered.

Figure 33. Projects and initiatives to achieve Action 1.5

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.5.1 Continue to support towns and cities using groundwater to improve their urban water planning, in line with the Regulatory and Assurance Framework for Local Water Utilities.	✓	
1.5.2 Work with local councils, state government agencies and other stakeholders in line with the Regulatory and Assurance Framework to help better understand: • whether existing town water bore infrastructure can provide sustainable supply during droughts • if the current capacity of infrastructure and groundwater conditions are insufficient to meet demand • the likelihood and consequences of shortfalls of groundwater • any issues around the groundwater licence application and approvals process.		✓
1.5.3 Work with local councils, state government agencies and other stakeholders in line with the Regulatory and Assurance Framework to help assess solutions to shortfalls including: • the maintenance or upgrade of infrastructure such as bores and associated pipeline links (for example, a network of linked groundwater bores[145] to provide more strategic regional groundwater access) • use of saline groundwater and desalination technology • accessing under-utilised groundwater sources based on new scientific information, recognising potential impacts to other groundwater users in fully allocated systems • innovative licensing options for groundwater-based drought resilience.		✓
1.5.4. Assess the feasibility of managed aquifer recharge for towns and industry, including the recharge capacity of sites for temporary storage of stormwater, river flow or recycled water. A recent CSIRO feasibility study[146] highlighted the Upper Lachlan Alluvial Groundwater Source as a potential candidate for managed aquifer recharge.		✓

145. A network of linked groundwater bores may also contribute to the broader benefits of the future town water pipeline from Forbes to Parkes to Central Tablelands Water; that is bores would spread out along the aquifer rather than be focused in the current bore field.
146. Available at: research.csiro.au/mar/water-banking-potential-in-the-murray-darling-basin/

Groundwater research could allow under-utilised groundwater sources to be used as water supplies in the future

The Geological Survey of NSW is using aerial electromagnetic survey methods to explore minerals and groundwater between Dubbo and Forbes as part of a drought-proofing project. The surveys are looking at the groundwater potential of the deep sandstone and fractured rocks. A similar project is also using seismic testing of the Yathong–Ivanhoe Trough, located between Cobar and Ivanhoe.

There are opportunities for state government agencies and federal agencies like Geoscience Australia to collaborate on projects that maximise the technology and expertise of mineral exploration to gain valuable information about groundwater resources.

Taking a closer look at groundwater sources in NSW

The NSW Government has developed the NSW Groundwater Strategy[147] that identifies the key risks to NSW groundwater resources and the associated management challenges for NSW. The strategy sets out the actions needed to respond to these challenges, and provides a logical framework for funding of groundwater management reform over the next 20 years. Some of the actions identified in the NSW Groundwater Strategy will inform the implementation of the actions in this strategy.

Image courtesy of Ian Brown, NSW Department of Climate Change, Energy, the Environment and Water. Borenore Karst Conservation Reserve.

147. NSW Groundwater Strategy is available at: water.dpie.nsw.gov.au/plans-and-programs/nsw-groundwater-strategy

Action 1.6: Investigate water security for small and remote communities

Short-term outcome (up to 5 years): Currently funded water and sewerage projects are completed or have achieved significant progress.

Long-term outcomes (5 to 20 years): Improved water security for small and remote communities.

There are gaps in our understanding of the climate-related water security risks to some smaller and remote communities dependent on unregulated tributaries in the Lachlan region. This is because the department's existing hydrological models were built as compliance modelling tools for developing water sharing plans and only model the regulated system in the Lachlan region.

While the models have enabled us to assess water-related risks to towns and licence holders in the Lachlan and Belubula regulated rivers, they do not allow a detailed water security assessment of towns on the unregulated tributaries. Several small towns in the Lachlan region rely on sourcing water from unregulated rivers and streams (Boorowa, Crookwell and Gunning in the upper Lachlan) or unregulated effluent creeks (Ivanhoe). In addition, towns like Euabalong and Euabalong West rely predominately on groundwater. Our understanding of the climate risk impacts on groundwater sources in the Lachlan region remains limited.

When we have a greater understanding of small and remote communities, either through new or improved models or through more comprehensive analysis of the existing data, the department will work across government to investigate opportunities to enhance water security for small communities that may have heightened water security risks under a future drier climate.

Action 1.6 will also link with Action 1.3, which focuses on improvements to the hydrological model for the Lachlan Regulated River and Action 1.7, which will investigate expanding the regional town water supply grid.

Figure 34. Projects and initiatives to achieve Action 1.6

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.6.1 Continue to work with local water utilities in small and remote communities to roll out current co-funded water and sewerage projects.	✓	
1.6.2 Work with small and remote local councils, in line with the Regulatory and Assurance Framework to assist them identify and progress priority water security projects for small and remote communities. Projects will need to be scoped on an individual basis and could include investigating: • the need to develop specific guidelines to better manage extreme events for towns relying primarily on unregulated water sources[148] • upgrades to ageing assets, including town water supply pipelines • potential inter-regional pipeline connections • the feasibility of installing water tanks • the viability of introducing new and emerging technologies such as hydro-panels or off-grid containerised water filtration units.	✓	
1.6.3 Investigate the need to develop a new model for the upper Lachlan and build on Action 1.3, which focuses on improving the hydrological model for the regulated system.		✓

148. The NSW Government has developed an *Extreme Events Policy and Incident Response Guidelines* for inland NSW valleys, which provide a framework for how decisions are made during extreme events and sets out a range of increasing drought contingency measures to secure water for critical needs. Most of the measures focus on the regulated rivers that are controlled by large state-owned headwater dams, like Wyangala Dam in the Lachlan Valley. Further information on how extreme events are managed in NSW regions is available at: water.dpie.nsw.gov.au/about-us/how-we-work/legislation-and-policies

Safe and Secure Water Program

The Safe and Secure Water Program, established in 2017, has provided over $1 billion to address key risks to regional water safety and security. This co-funding has assisted non-metropolitan councils, local water utilities, county councils, water supply authorities and joint organisations on projects that provide safe, secure and sustainable water and wastewater services to regional NSW.

Recent projects in the Lachlan region funded under the program include:

- the Parkes-Peak Hill Water Supply Project, which will deliver 39 km of new pipeline to link new and existing infrastructure, 2 new pump stations, an upgraded Lachlan River pump station, 2 new pre-treatment plants in Eugowra Road and Akuna Road and a new raw water dam at the Parkes Water Treatment Plant
- Strategic Planning for Lachlan Shire Council and Cowra Shire Council
- Condoblin Water Treatment Works
- Condoblin Sewage Treatment Upgrade
- Lachlan Sewerage Effluent Management System
- Cowra Water Treatment Works
- Condoblin Bores Project
- Gosling Creek Dam.

The Safe and Secure Water Program has funded the resolution of priority risks and issues through infrastructure and non-infrastructure solutions that align with one of the following categories:

- water security: risks that may affect current or future continuity of reliable and uninterrupted town water supply
- water quality: risks to health posed by drinking water supplies, considering the source waters and the barriers present in treatment systems
- environment: risks to human health or the environment from sewage management that does not satisfy community expectations or regulatory requirements.

Each risk or issue has been assessed against a prioritisation framework to determine how critical it is to regional NSW water safety and security. Risks and issues are ranked based on the result of the prioritisation assessment.

Action 1.7: Investigate expanding the regional water supply grid

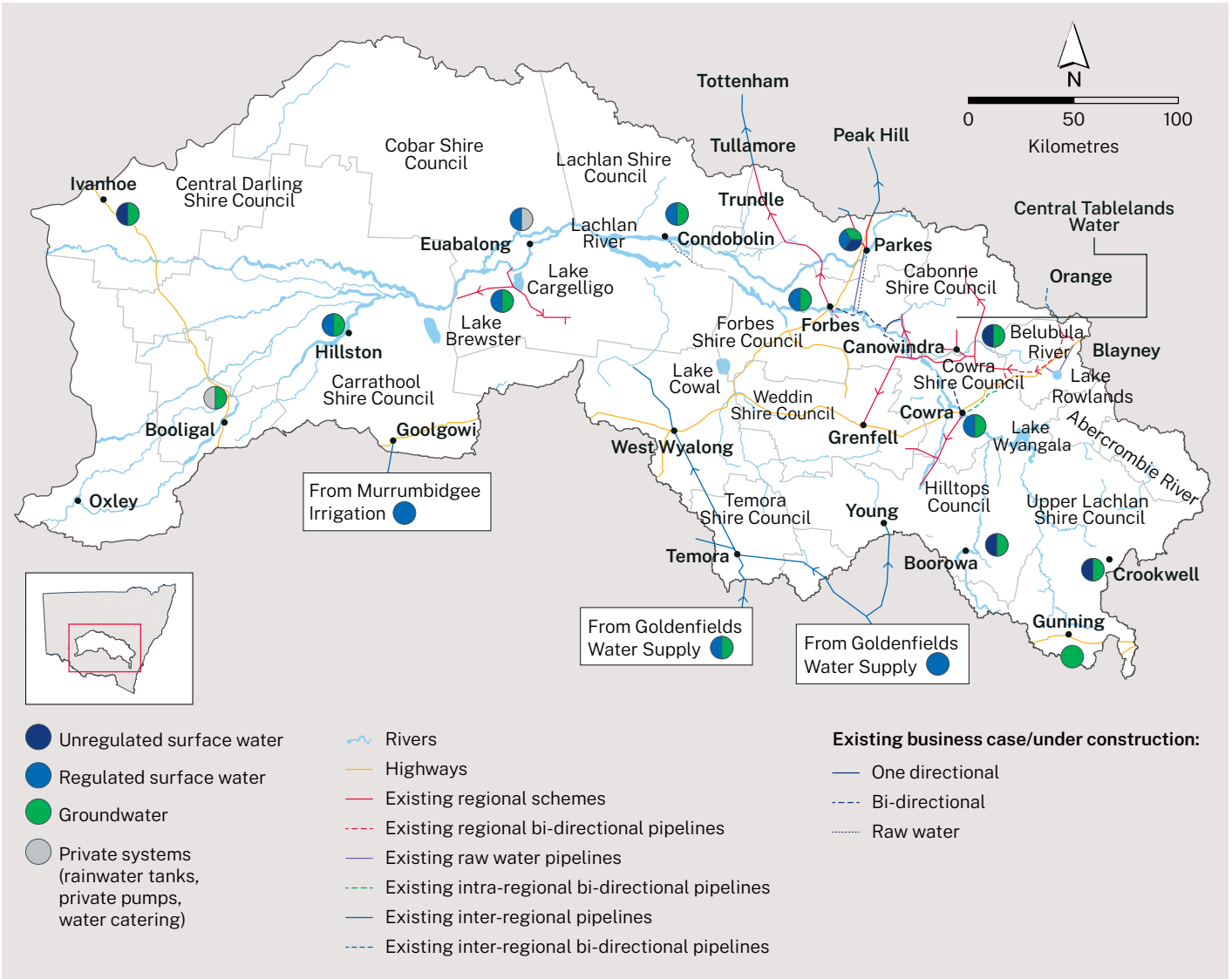
Short-term outcome (up to 5 years): councils in the Lachlan region are supported to undertake effective, evidence-based strategic planning in accordance with section 3 of the Local Water Utilities Regulatory and Assurance Framework.

Long-term outcomes (5 to 20 years): a regional water supply grid that provides a secure water supply to towns throughout the network.

There is an extensive water supply pipeline network in the Lachlan region (Figure 35); however, not all pipelines are interlinked, and many towns are only connected by a single supply pipeline. This presents a potential risk to towns at the extremities of the network[149] if supply is interrupted.

The arrangements for how the existing town water supply pipeline linkages are operated are a matter for local water utilities that have formal agreements in place or are negotiating these agreements. The NSW Government recognises these pipeline linkages are important water infrastructure assets, particularly during drought or emergency situations. The state government and local governments will work together to identify how to best use the existing town water supply pipeline network during extreme events to better protect town water security and build resilience. The department will collaborate with local water utilities to publish information about operating the pipelines, including when water transfers are triggered.

Figure 35. Existing town water pipeline network in the Lachlan region



149. For example, Tottenham, at the end of the B-section pipeline (Forbes to Tottenham), and Manildra if the emergency bore located at Cudal that supplies Cudal and Manildra fails.

During consultation for the draft strategy, we heard that protecting town water security should be a key priority and that there are benefits to taking a multisource approach to future town water security.

The NSW Government supports all options being explored to ensure water security to towns and communities in the region. Therefore, the department is committed to proactively supporting water utilities diversifying sources of water and implementing demand management and water efficiency measures.

To best meet the needs of towns and communities in the Lachlan region during extreme events, the department will need to better understand the minimum amount of water each town requires for critical human, social and environmental needs. The department also needs to understand how long residents and businesses are willing and able to endure extended water restrictions. This approach may require collaboration between the state government and local governments to develop guidelines and principles about how water should be shared to ensure all towns and communities receive the minimum amount of water required during extreme events.[150] This is because the existing town water supply pipeline network extends beyond local government boundaries, and in some instances beyond catchment boundaries.

These guidelines and principles would need to be agreed by all interconnected local water utilities and put in place before they are needed. This will provide an overarching obligation for each local water utility to consider the critical human needs of its interconnected neighbouring communities.

In addition, these guidelines and principles would also help prioritise the next major water supply augmentation and its cost. For example, the timing of large infrastructure investments could be pushed back by taking smaller incremental measures to reduce growth in demand. These could include reducing pipe leakage, adopting more water-efficient technologies and practices, sharing water across local government boundaries and substituting recycled water for some purposes.

Demand management and alternative, climate-independent water supply sources, such as recycled water, will be critical to support town water security, build resilience and provide opportunities for population growth, without increasing drought risks. The NSW Government has committed to progressing regulatory reform, guidelines and community acceptance campaigns to make the development and use of recycled water easier.[151] The department will continue to investigate ways to address any limitations at the state and local level and work with local water utilities to identify policy and regulatory barriers to recycled water use.

In the Lachlan region, water utilities and local councils are also investigating ways to upgrade the existing pipeline networks and develop a regional town water strategy to improve security and resilience. However, additional strategic upgrades have been identified that could improve a regional water supply grid.

Action 1.7 links in with:

- Action 1.5: Support groundwater use for towns and communities
- Action 1.6: Investigate water security for small and remote communities
- the NSW Government's Water Efficiency Program and Water Efficiency Framework.[152]

Action 1.7 will be implemented in collaboration with local councils and local water utilities in the Lachlan region.

Ultimately, decisions about priority projects will need to be based on the effective strategic planning of participating local water utilities, as assured by the department under section 3 of the Regulatory and Assurance Framework for Local Water Utilities. This includes being informed by section 3.6 of the framework for regionally based strategic planning. The implementation of infrastructure projects will also require funding sources to be identified by at the appropriate time.

150. Many stakeholders in the Lachlan Valley are strongly opposed to water being transferred to other regions, highlighting the need for extensive consultation with councils, community and industry in relation to the consideration of any options involving potential intervalley transfers of water.
151. Available at: dpie.nsw.gov.au/water/plans-and-programs/nsw-water-strategy
152. The department's Water Efficiency Program and Water Efficiency Framework available at: dpie.nsw.gov.au/water/our-work/projects-and-programs/water-efficiency

Figure 36. Projects and initiatives to achieve Action 1.7

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.7.1 Continue to support local water utilities to undertake effective, evidence-based strategic planning in accordance with section 3 of the Local Water Utilities Regulatory and Assurance Framework.	✓	
1.7.2 Ensure outcomes of the Belubula Water Security Project's final business case are considered in the regional water supply grid.	✓	
1.7.3 Assist and enable Central Tablelands Water to investigate a strategic upgrade of Central Tablelands Water trunk mains.		✓
1.7.4 Assist and enable local councils to investigate the most feasible and cost-effective strategic option(s)[153] to address the water security issue to the towns along the B-section pipeline, in particular Tottenham, as well any additional offtake points from the B-section pipeline.		✓
1.7.5 In collaboration with councils, identify additional priority expansion projects for a regional infrastructure grid and assist local councils to scope projects and identify funding opportunities, informed by the investigations.		✓

153. Options include:
- upgrading the B-section pipeline and associated pumping assets to meet current (and forecast) water demands
- additional water storage or source in Tottenham
- source additional surface water, for example from the Bogan River or Trangie/Nevertire irrigation scheme, and pipe it approximately 20 to 30 km to Tottenham's Leg O'Mutton Dam
- construct local ground tanks, for example the previously proposed 200 ML Caloola ground tank (piping 5 km to Leg O'Mutton tank) or alternatively to Albert (piping 25 km) or a number of small local ground tanks (piping 5 to 10 km)
- operational and demand strategies to maximise existing assets
- access to additional groundwater sources.

Dealing with water-related challenges in the Belubula catchment

During the last drought (2017–20), drought declarations in the Belubula catchment escalated from stage 1 to stage 3 over the course of 6 months. This was because there was insufficient water to maintain a constant flow of 10 ML/day at Helensholme gauge[154] without the risk of draining Carcoar Dam.

The Belubula catchment is especially sensitive to emerging drought. Much like an unregulated system, the Belubula catchment experiences highly variable inflows into a comparatively small headwater storage (Carcoar Dam capacity is 36 GL storage). The system also has no major re-regulating structures, despite highly variable unregulated tributary flows downstream of Carcoar Dam. Surface water and groundwater sources are highly connected at the end of the Belubula system. This makes it difficult to meet some of the existing water sharing plan requirements and means the Belubula does not always connect to the Lachlan River.

Significant work is already underway to review and address the water-related challenges in the Belubula catchment and to meet the future water needs of users and the environment.

The Natural Resources Commission completed a statutory review of the *Water Sharing Plan for the Belubula Regulated River Water Source 2012* and the *Water Sharing Plan for the Lachlan Unregulated River Water Sources 2012*. This review will help identify opportunities to improve water sharing provisions and associated outcomes.[155]

The department is leading investigations related to the Belubula Water Security Project,[156] a potential project that combines potential options to improve the efficiency and resilience of water management in the region. The Belubula Water Security Project will include an assessment of a pipeline linking the Central Tablelands Water owned Lake Rowlands, the WaterNSW owned Carcoar Dam and the augmentation of Lake Rowlands. An important aspect of the Belubula Water Security Scheme Project will be to further investigate the future town water demand from Central Tablelands Water's customers.[157] The outcomes of the Belubula Water Security Scheme Project Final Business Case will need to consider the regional water supply grid.

154. A requirement of the *Water Sharing Plan of the Belubula Regulated Water Source 2012*.
155. The Minister for Water considers the Natural Resources Commission's report before deciding to extend or make a new water sharing plan.
156. More information on the proposed Belubula Water Security Project is available at: water.dpie.nsw.gov.au/our-work/water-infrastructure-nsw/regional-projects/belubula-water-security-project
157. Action 1.6 of the *Macquarie Regional Water Strategy* seeks to identify the best long-term augmentation solution for towns in the Upper Macquarie, and includes a consideration of supply to Bathurst or Orange from the Lachlan Valley. Several other options will also be investigated as part of Action 1.6 in the *Macquarie Regional Water Strategy*.

Action 1.8: Improve the understanding and management of groundwater resources

Short-term outcome (up to 5 years): actions in the NSW Groundwater Strategy relating to improving understanding of groundwater sources have progressed.

Long-term outcomes (5 to 20 years): Improved understanding and management of groundwater resources.

During development of the draft strategy, stakeholders expressed concern about the current conditions of the region's groundwater sources. The region's main groundwater sources – the Upper Lachlan Alluvial Groundwater Source, the Belubula Valley Alluvial Groundwater Source and the Lower Lachlan Groundwater Source – are important water supplies. They help to meet the water needs of towns, communities, industries and groundwater-dependent ecosystems in the catchment. The volume of extraction, the number of existing bores and areas of water level decline mean these groundwater systems are under pressure. A drier future climate will likely increase these pressures and could reduce the availability of water for high priority needs such as towns and communities, and stock and domestic users.

The Lachlan region is home to important groundwater-dependent ecosystems that need healthy groundwater conditions to survive. Groundwater-dependent ecosystems are classified broadly as terrestrial (vegetation communities), aquatic (wetlands and springs) or subterranean (aquifers). They also have inherent environmental value, support a range of species and provide important ecosystem services, such as habitats.

The 2005 Achieving Sustainable Groundwater Entitlements Program aimed to ensure sustainable use of groundwater sources such as the Lower Lachlan Groundwater Source by reducing entitlements. The NSW Government needs to analyse the results of this program in combination with new information to review our approach to addressing declines for all groundwater sources in the Lachlan region. This is particularly true given the review of the sustainable diversion limits for the *Basin Plan*[158] in 2026.

There is a high degree of groundwater connectivity in the lower reaches of the Belubula River. The influence that each has on the successful management of the other needs to be further investigated, including a potential joint trigger arrangement in areas where it would be effective.

There are groundwater sources in the region, like the Upper Lachlan Alluvial and the Belubula Valley Alluvial, where the number of entitlements significantly exceeds the long-term average annual extraction limit.

That is, if each entitlement share was equal to 1 ML, the sum of the entitlement shares plus unlicensed rights to take groundwater exceed the groundwater source long-term average annual extraction limit. The average annual use of these groundwater sources remains under the extraction limit because many licence holders do not use their full entitlement. Those using their full entitlement are accruing the benefits of underuse by others.

If the entitlements that are not fully used were activated in a drier future climate scenario, the annual allocation would need to decrease for all shares, to keep total use within the groundwater source extraction limit.

Intensive and continuous groundwater pumping over years can cause groundwater drawdown, which is a drop in the water level. When groundwater levels are close to or exceed the 'trigger level' for acceptable drawdown, recovery assessments and use restrictions can be used to bring levels back. The NSW Government is developing a groundwater-level management framework to address drawdown. This framework will include interventions that will be used to manage declines and provide certainty to all water users about what actions the NSW Government will take and when. The framework will help all users plan for more extreme droughts when groundwater may not be a viable backup.

Action 1.8 is a longer-term action on a regional scale. While the outcomes may support local studies by councils, it is necessary for local councils to continue to build their own understanding of local groundwater availability and usage to inform local strategic water planning.

158. Available at: mdba.gov.au/water-management/basin-plan

Figure 37. Projects and initiatives to achieve Action 1.8

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.8.1 Progress actions in the NSW Groundwater Strategy that seek to improve our understanding and management of groundwater.	✓	
1.8.2 Develop a groundwater-level management framework with a series of escalating management actions corresponding to stages of localised water level decline. This is consistent with the NSW Groundwater Strategy.		✓
1.8.3 Establish and verify the location, extent, condition and risk to the health of groundwater-dependent ecosystems and improve our understanding of this dependence of these on groundwater in the Lachlan region.		✓
1.8.4 Review our approach to setting long-term average annual extraction limits in priority areas.		✓
1.8.5 Develop and publish guidance about the current approach to managing groundwater sources where the entitlement 'share value'[159] is low. Work with stakeholders to help them access and understand this updated information.		✓
1.8.6 Prepare a guideline with a series of escalating management actions corresponding to stages of groundwater-level decline.		✓
1.8.7 Investigate the degree of connectedness between groundwater and surface water in the region.		✓

Groundwater models

Groundwater models are computer-based tools that simulate the behaviour of aquifers over time, including recharge, the movement of water and the take of water through bores. By investing in improved groundwater modelling, there will be better tools to identify and manage risks to some of the most highly used and valuable groundwater sources in NSW.

For some groundwater sources across NSW, the department will:

- develop 3D geological, numerical flow and reactive transport models to inform future water level decline and quality management practices
- include any new understanding of the interconnectivity between surface water and recharge into groundwater models
- update groundwater models with shifts in demand that are likely driven by climate variability
- update software, maintain, recalibrate and review the numerical models on a regular basis
- explore opportunities to develop multidisciplinary models that incorporate socioeconomic and physical data, as well as groundwater volume, level and quality data.

159. For details of what 'share value' means, see Action 1.3 in the NSW Groundwater Strategy available at: water.dpie.nsw.gov.au/our-work/plans-and-strategies/nsw-groundwater-strategy

Action 1.9: Better integrate strategic land use and water planning

Short-term outcome (up to 5 years): water resources are considered up-front in NSW planning processes.

Long-term outcomes (5 to 20 years): strategic land use and water planning are integrated.

Water resources are not always considered up-front in the planning process, which can create inefficiencies and challenges around capitalising on the broader regional opportunities these changes, and investment bring. A lack of coordination between strategic land and water planning can also affect other existing water users and the environment and can result in population and industry growth in areas with pre-existing constraints on water availability. This can increase pressures on already stressed surface and groundwater resources.

There are opportunities to better integrate consideration of water resources in strategic planning processes, to more closely integrate future regional land-use plans and future regional water strategies. For example:

- the Central West and Orana Regional Plan 2041 states 'Strategic water and land use planning, at the regional and local scale, must consider opportunities to… locate, design, construct and manage new developments to minimise impacts on water catchments, including downstream impacts and groundwater resources' and 'Consider water needs and sources early in planning and development processes'[160]
- the Riverina Murray Regional Plan 2041 states 'Strategic planning will optimise water use by… considering water supply and quality issues and opportunities through the planning process in the context of climate variability and change, planned growth, integrated water cycle management (or equivalent), and water sensitive urban design and environmental needs'[161, 162]
- the NSW Water Strategy[163] contains actions under Priority 4 to better integrate strategic land-use planning with water-management outcomes:
  - establish processes to support communication and early engagement to better inform land-use, agriculture and industry investment decisions based on a clear understanding of water availability and constraints, and water allocation risk over the immediate and longer term
  - develop new planning policies, if required, to integrate land use and water cycle management decisions
  - identify opportunities for the planning system to support water resource health and resilience in a changing climate, for example through strategic recognition of critical groundwater resources in coastal areas and mitigate impacts from urban development
  - improve access to information about water availability to support development
  - examine opportunities for information on high-value water dependent ecosystems and cultural values to be considered in land-use planning decisions.

Note that regional water strategies do not prohibit land use in NSW regional areas. Land use planning will continue to be managed under the *Environmental Planning and Assessment Act 1979*.

160. *Central West and Orana Regional Plan 2041* (Strategy 8.1) available at: planning.nsw.gov.au/plans-for-your-area/regional-plans/central-west-and-orana-regional-plan-2041
161. *Riverina Murray Regional Plan 2041* (Strategy 11.2) available at: planning.nsw.gov.au/plans-for-your-area/regional-plans/riverina-murray-regional-plan-2041
162. Other Regional Plans for the Lachlan region include the *Far West Regional Plan 2036* and the *South East and Tablelands Regional Plan 2036* (noting a *draft Far West Regional Plan 2041* and *draft South East and Tablelands Regional Plan 2041* have been publicly exhibited).
163. See Action 4.4. Available at: water.dpie.nsw.gov.au/our-work/plans-and-strategies/nsw-water-strategy

Figure 38. Projects and initiatives to achieve Action 1.9

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
1.9.1 Take steps to better integrate land-use planning and water management including: • making improvements to governance, regulatory and advisory functions to enable better outcomes for water management through strategic land use planning and development assessment pathways • embedding water security analysis into regional plans • identifying opportunities for land use planning frameworks to respond to outcomes of climate risk assessments for water management and resilience.	✓	
1.9.2 Work with local councils, in line with the Regulatory and Assurance Framework to help prioritise activities under Action 4.4 of the NSW Water Strategy, including: • assessing projected trends in population growth and regional and local development, to identify spatial changes in water demand, growth in town water demands and sources of potential future flood risks, such as new developments • discussing if and how to make decisions on which areas should be elevated for water security due to planned strategic growth areas or concentration of industries in the region • identifying any water-related gaps in the current land use planning framework and assess the adequacy of the current land use planning controls to protect water resources and water dependent ecosystems • embedding water-management principles in local strategic planning to provide a clear implementation pathway for strategies related to water in regional land use plans.	✓	
1.9.3 Continue to support councils to better align land use planning with strategic water planning. This will be a multi-agency approach (including the Department of Climate Change, Energy, the Environment and Water and the Department of Planning, Housing and Infrastructure) and be undertaken in conjunction with ensuring councils undertake effective strategic planning (as per section 3 of the Regulatory and Assurance Framework, including being informed by section 3.6 for regionally based strategic planning).		✓
1.9.4 Continue to review and update local government and state government water and land use planning frameworks to ensure alignment.		✓

Land uses and the Environmental Planning and Assessment Act 1979

The main legislation governing land use planning in NSW is the *Environmental Planning and Assessment Act 1979* (EP&A Act). Other legislation that affects land use includes the *Local Government Act 1993*, *Crown Land Management Act 2016*, *Protection of the Environment Operations Act 1997* (NSW), *Aboriginal Land Rights Act 1983* (ALR Act), *Mining Act 1992*, *Biodiversity Conservation Act 2016* (BC Act) and *Water Management Act 2000*. Federal statutes, such as the *Water Act 2007* and the *Environmental Protection and Biodiversity Conservation Act 1999*, also affect land use outcomes in the region.

Under the EP&A Act, strategic planning occurs at the state, regional and local levels. Planning at the local level is primarily the responsibility of local councils, while the NSW Government is responsible for ensuring that NSW's goals are achieved at the regional level, in partnership with local councils.

In 2015, the EP&A Act was amended to legally require regional plans and the Act sets out what they need to address, including a requirement for regular review.

Before the release of regional plans in 2017, there was no formalised regional-level framework for strategic planning. Informal regional land use plans existed, but they were not recognised in legislation. Since then, the strategic planning framework has been strengthened at the local level with local strategic planning statements, which provide an opportunity for a local council to set a strategic vision for their local government area. Each local council in the region has a local strategic planning statement, which it is required to review at regular intervals.

Improving town amenity through blue and green grids and riverfront activation

A green, cool and resilient NSW with sufficient tree canopy, healthy waterways with native vegetation, and access to quality green open spaces, is essential to healthy, resilient and liveable communities. While using water to improve amenity sits with local government under the local water utility strategic planning process, regional land use plans[164] are improving amenity and public connectivity through blue and green grids and riverfront activation. Green and blue grids provide a spatial understanding of the network of open spaces and waterways and how to improve and better connect them. The development of any green and blue grid should feature leadership from the Aboriginal community and would benefit from close collaboration with the Regional Water Strategies Program.

164. The *Central West and Orana Regional Plan 2041*, *draft South East and Tablelands Regional Plan 2041* and other regional plans are available at: planning.nsw.gov.au/plans-for-your-area/regional-plans

Image courtesy of Shutterstock. Summer storm approaching Blayney.

Priority 2

Improve catchment health

Improved catchment health in the Lachlan region will support the environment, economy and liveability of our communities. It can enhance water quantity by managing erosion and controlling nutrient run-off, and improve water availability by promoting groundwater recharge, holding more water in the landscapes and sustaining resilience of the region's water dependent ecosystems. Improving catchment health has far reaching advantages, ensuring sustainable water resources for communities and ecosystems, and allowing the cumulative impacts of land-use change on water management to be considered.

The actions under this priority help to improve the overall health of the catchment and river systems. Catchment management practices that include floodplain planning, wetland restoration and riparian maintenance help to mitigate flood risks by reducing run-off and improve natural floodplain storage. Similarly, through enhanced water retention and groundwater recharge, healthy catchments can better withstand periods of drought. Additionally, healthy catchments provide recreational opportunities and support cultural values associated with water resources.

Existing programs to improve catchment health

The strategy builds on the existing evidence base and programs being implemented across the government, which include several plans and reports.

The *Lachlan Long-Term Water Plan*[165] was developed to describe the flow regimes projected to maintain or improve environmental outcomes in the region. It identifies water-management strategies for maintaining and improving the long-term health of the Lachlan's riverine and floodplain environmental assets and the ecosystem functions they perform. The NSW Water Strategy includes a commitment to consider the long-term water plans to protect and enhance ecological systems.

The *Lachlan Valley Salinity Technical Report* supports the *Water Quality Salinity Management Plan* and includes options for improved salinity management.

The *Water Quality Management Plan* developed for the *Lachlan Surface Water Resource Plan* and the *Lachlan Alluvial Water Resource Plan* aim to provide a framework to protect, enhance and restore water quality for the region.

The regional natural resource management plans developed by NSW Local Land Services support improving water quality as a priority and identify land managers as key partners to rehabilitate waterways and riparian zones.

The Natural Resources Commission has undertaken an independent review of the *Water Sharing Plan for the Belubula Regulated River Water Source 2012*[166] and the *Lachlan Unregulated River Water Source 2012* as per section 43a of the *Water Management Act 2000*. These reviews will help identify opportunities to improve water sharing provisions and associated outcomes.

The NSW Water Strategy contains actions under Priority 3 to improve river, floodplain and aquifer ecosystem health and system connectivity. These actions provide a strong foundation for the actions in the Lachlan Regional Water Strategy. They include:

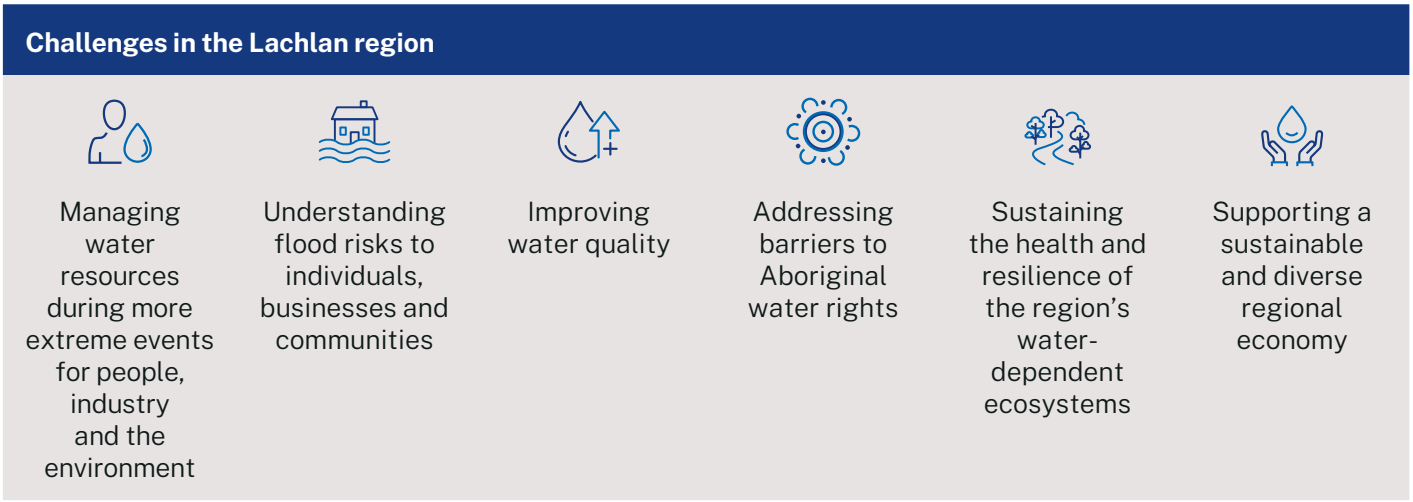
- taking landscape-scale action to improve river and catchment health
- adopting a more intense, statewide focus on improving water quality
- monitoring and reporting on environmental water delivery and management to inform adaptive management and reporting
- maintaining a water science strategy and prospectus that provide sector-wide guidance on future science, research and development.

The *NSW Water Quality Governance Roadmap*[167] includes 2 key pathways for improving water quality outcomes across NSW:

- better integrating management of land, water and natural resources
- improving water quality data management and monitoring.

165. Available at: environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/lachlan
166. Natural Resources Commission's water sharing plan reviews are available at: nrc.nsw.gov.au/water/wsp-reviews/home
167. Further information on the *NSW Water Quality Governance Roadmap* is available at: water.dpie.nsw.gov.au/our-work/science-data-and-modelling/surface-water/water-quality

Figure 39. Actions for Priority 2: Improve catchment health



Action	Summary	Challenges addressed
Action 2.1	Reduce salinity and soil erosion in the Upper Lachlan and Belubula catchments	
Action 2.2	Protect and rehabilitate regionally significant riparian and in-stream habitats in the Lachlan Regulated River	
Action 2.3	Upgrade and automate existing re-regulating structures	
Action 2.4	Mitigate impacts to native fish	
Action 2.5	Review and evaluate the Lake Brewster Water Efficiency Project	
Action 2.6	Develop and enable place-based initiatives to deliver cultural outcomes for Aboriginal people	
Action 2.7	Support the development and implementation of the Lachlan Valley Floodplain Management Plan and address floodplain structures	

Action 2.1: Reduce salinity and soil erosion in the Upper Lachlan and Belubula catchments

Short-term outcome (up to 5 years): a greater number of rehabilitated waterways and adjacent lands.

Long-term outcomes (5 to 20 years): reduced salt and soil entering waterways in the upper Lachlan and Belubula catchments.

In the upper Lachlan and Belubula catchments, land use management is contributing to salinity, with high turbidity and nutrients entering waterways into unregulated rivers. Nutrient management in the catchment area of Wyangala and Carcoar dams is essential to reduce the risk of algal blooms within the dams.[168]

Salinity (both dryland and in-stream) causes high salt concentrations in waterways and can also lead to vegetation die-off, which contributes to erosion and high turbidity. The upper Lachlan and Belubula catchments include areas of very high salinity hazard (Figure 40) and can contribute to high turbidity in waterways.[169]

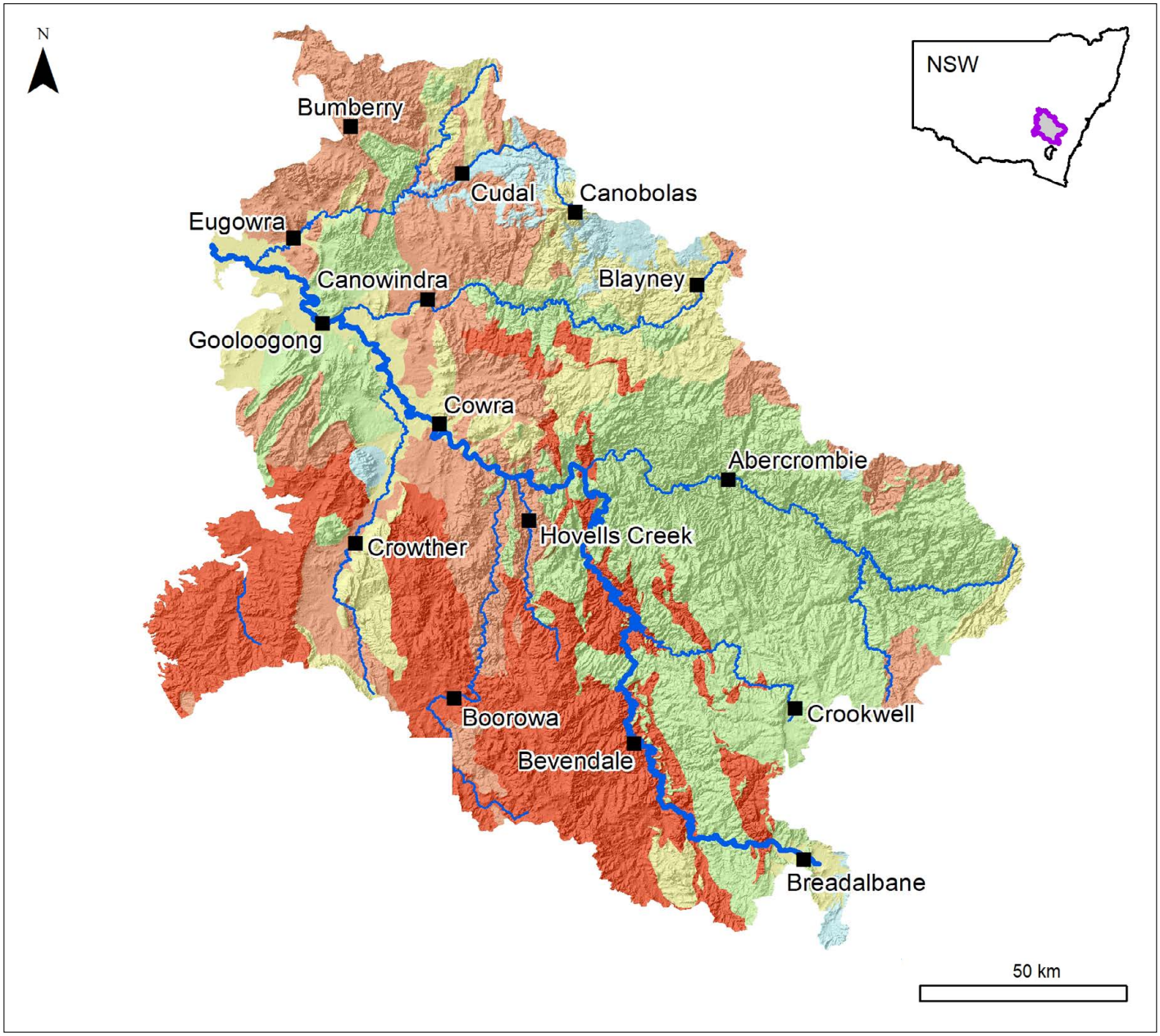
Historic land clearing resulting in large-scale soil erosion has led to a 150 km sediment slug downstream of the junction of the Boorowa and Lachlan rivers, which is causing problems with fish habitat and breeding, and localised flooding.[170]

We heard that local councils in the upper Lachlan have removed sand, silt and debris from low-level road crossings and drains in areas around Hovells Creek and Bevandale. In addition, Hovells Creek Landcare is working to reduce in-stream sediment loads through funded programs in erosion control, planting, and fencing[171] and Boorowa Landcare is developing on-ground rehabilitation projects under the Rivers of Carbon Program to improve water quality in and around the Boorowa River.[172] The department is looking to build on existing extensive research on salinity in the Boorowa and upper Lachlan regions. Increasing our understanding of the offsite impacts of salt exports is essential to long-term land rehabilitation of the region.

There has been extensive work to understand salinity and how it is expressed in the landscape of the upper Lachlan area. Action 2.1 will build on and expand past projects, such as those partially funded through the NSW Catchment Management Action Program, to improve land management practices and water quality in the upper parts of the catchment. To achieve effective outcomes, the NSW Government will work with local groups such as Landcare groups, landholders, Aboriginal people and interested parties to prioritise areas to improve soil retention onsite and reduce sediment and salt transfer to waterways in the upper Lachlan catchment.

168. *Water quality technical report for the Lachlan surface water resource plan area (SW10)* available at: water.dpie.nsw.gov.au/__data/assets/pdf_file/0008/456929/Water-quality-technical-report-for-the-Lachlan-surface-water-resource-plan-area-SW10.pdf
169. Department of Planning and Environment 2022, *Lachlan Valley Salinity Technical Report*.
170. Department of Primary Industries – Fisheries 2018, *Lachlan River Habitat Mapping – Inundation heights for key habitat features and management recommendations for Wyangala Dam to Cottons Weir reach of the Lachlan River*.
171. Available at: hovellscreeklandcare.org.au/current-activity/157-erosion-control-works-on-properties-to-address-threatened-species-andsedimentation- issues-in-hovells-creek-and-the-lachlan-river
172. Available at: riversofcarbon.org.au/boorowa

Figure 40. Overall salinity hazard in the upper Lachlan region



Legend

Overall hazard

- Very high
- High
- Moderate
- Low
- Very low
- Towns
- Lachlan River
- Major tributary

Source: Department of Planning and Environment 2022, Lachlan Valley Salinity Technical Report.

Figure 41. Projects and initiatives to achieve Action 2.1

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.1.1 Continue erosion control works at select locations.	✓	
2.1.2 Continue to build on knowledge programs that underpin and guide existing revegetation and fencing programs.	✓	
2.1.3 Investigate ways to complement existing programs and incentivise local councils and landholders to rehabilitate waterways and adjacent lands.		✓
2.1.4 Investigate ways to complement catchment improvements outlined in existing plans such as the *Lachlan Long-Term Water Plan*[173] and the *Central West Strategic Weed Management Plan*.[174]		✓
2.1.5 Consider setting up nutrient trading schemes or stewardship and certification systems that could incentivise private landholders to undertake rehabilitation work on their land.		✓
2.1.6 Investigate opportunities to incentivise local councils and landholders to generate biodiversity offset credits that could provide additional income while achieving environmental gains.		✓
2.1.7 Promote and support land use systems that minimise erosion and salinity.		✓
2.1.8 Monitor and measure the landscape by maintaining existing salinity gauging stations and expanding salinity gauging stations.		✓
2.1.9 Expand entry-level salinity and erosion management knowledge in local advisers in the public and private sectors.		✓
2.1.10 Work with local Landcare groups and Local Land Services staff to build and maintain peer networks of farmers who are managing the symptoms and drivers of salinity and erosion.		✓

173. Available at: www2.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/lachlan
174. Available at: www.lls.nsw.gov.au/help-and-advice/weeds-and-plant-diseases/regional-strategic-weed-management-plans

Action 2.2: Protect and rehabilitate regionally significant riparian and in-stream habitats in the Lachlan Regulated River

Short-term outcome (up to 5 years): better coordination of existing rehabilitation programs and improved integration of Aboriginal knowledge and expertise in river improvement works.

Long-term outcomes (5 to 20 years): improved condition of regionally significant riparian and in-stream habitats.

The degradation of native riparian vegetation is leading to bank slumping, which has been identified as a factor contributing to poor water quality and loss of in-stream habitats in the regulated system downstream of Wyangala Dam.[175] Restoring degraded riparian vegetation and in-stream habitats can strengthen the long-term resilience of rivers and improve the ecological response across the flow regime. The degradation of native riparian vegetation along water courses is recognised as a key threatening process under the *Fisheries Management Act 1994*.

Restoring and protecting riparian and in-stream habitats is particularly relevant for the regulated Lachlan River as the timing and volume of releases from Wyangala Dam and re-regulating storages can impact flows and lead to bank slumping. While the *Water Sharing Plan for the Lachlan Regulated River 2016* includes a clause to consider damage to riverbanks when changing the rate of release from a water supply storage, there is currently no operating protocol to ensure environmental impacts are considered. Furthermore, wetlands on private land –adjacent to or part of riparian vegetation – are often used for grazing, which can impact the native vegetation cover and cause bank instability.

During consultation we heard that more opportunities are needed to encourage improved land management and investment in natural resource management initiatives and rehabilitation work. There are existing initiatives to improve native riparian vegetation and in-stream habitats though the Murray–Darling Basin Healthy Rivers Program, and some landholders are already investing in ways to rehabilitate riparian land and manage land in a way that supports healthy waterways.

Action 2.2 proposes to improve native riparian vegetation, in-stream habitats and water quality in the Lachlan Regulated River by building on existing land management programs and other local initiatives.

175. *Water quality technical report for the Lachlan surface water resource plan area (SW10*). Available at: water.dpie.nsw.gov.au/__data/assets/pdf_file/0008/456929/Water-quality-technical-report-for-the-Lachlan-surface-water-resource-plan-area-SW10.pdf

Figure 42. Projects and initiatives to achieve Action 2.2

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.2.1 Understand and integrate local Aboriginal people's knowledge and expertise into delivering river improvement works.	✓	
2.2.2 Coordinate existing programs that protect Key Fish Habitats[176] to enhance on-ground river health outcomes at priority locations.	✓	
2.2.3 Complete detailed mapping of Key Fish Habitats for the Lachlan Regulated River and collate information on native fish conditions, threatened species distribution, or the River Styles framework.		✓
2.2.4 Investigate methods to clear the sediment slug near Boorowa and downstream of Wyangala Dam.		✓
2.2.5 Investigate opportunities to incentivise local councils and other landholders to rehabilitate waterways and generate biodiversity offset credits that could provide additional income for landholders, while achieving environmental gains.		✓
2.2.6 Develop an operating protocol to ensure environmental impacts, including damage to riverbanks, is considered when water storage release rates are changed.		✓

176. Key Fish Habitats include aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. More information is available at: dpi.nsw.gov.au/fishing/species-protection/legislation-and-approvals/habitat/protecting-habitats

The NSW Water Strategy is committed to long-term monitoring and statewide improvements to water quality

In the right locations, long-term monitoring is important for determining trends and identifying sites for remediation. It is also crucial for assessing whether remediation is successful. Improved information about water quality could be used to inform future planning and management of the Lachlan River, such as improvements to environmental water requirements, identifying components for protection, and preventing ecosystem harm.

In this context, the NSW Water Strategy[177] has committed to:

- invest in long-term and effective monitoring, evaluation, reporting and research (Action 3.4)
- implement monitoring, evaluation and reporting frameworks to track the effectiveness of plans and policies and inform future management actions
- apply the updated River Condition Index[178] across NSW to provide a baseline for addressing progress of the NSW Water Strategy and the regional and metropolitan water strategies
- adopt a more intense, statewide focus on improving water quality (Action 3.5)
- continue to monitor and review the *NSW Water Quality Objectives* across NSW to ensure they reflect contemporary community and environmental values and uses[179]
- define clear roles, accountabilities and frameworks for monitoring, assessing and addressing water quality risks across the state
- ensure the community can access information about water quality.

177. Available at: water.dpie.nsw.gov.au/our-work/plans-and-strategies/nsw-water-strategy
178. Available at: water.dpie.nsw.gov.au/our-work/science-data-and-modelling/surface-water/monitoring-changes/nsw-river-condition-index
179. Available at: environment.nsw.gov.au/topics/water/water-quality/protecting-and-managing-water-quality

Action 2.3: Upgrade and automate existing re-regulating structures

Short-term outcome (up to 5 years): a plan to upgrade 3 Mid-Lachlan weirs (Woolshed, Wallamundary and Nerrathong).

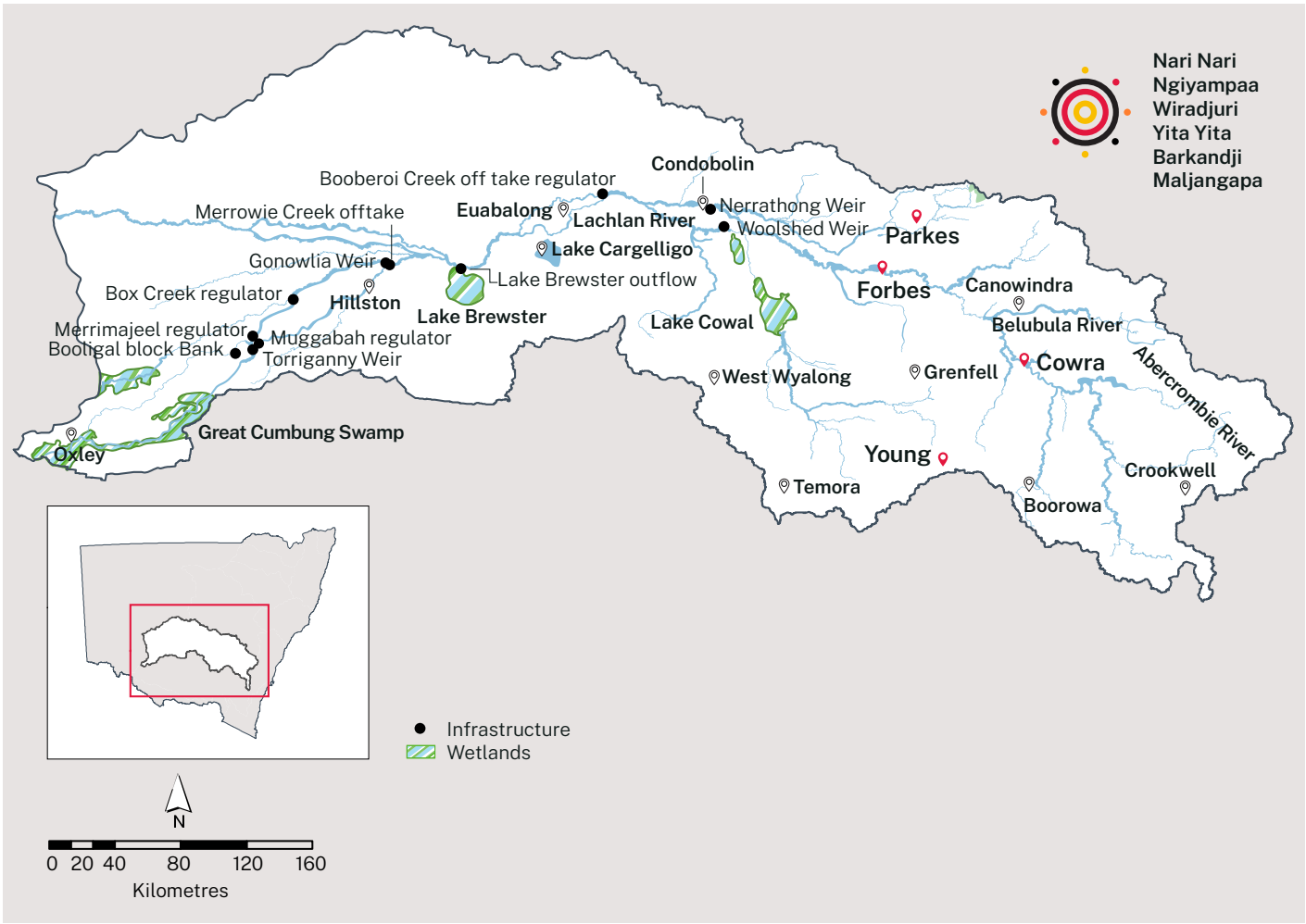
Long-term outcomes (5 to 20 years): improved delivery of water for the environment through the Mid- and Lower Lachlan system.

Re-regulating structures in the Lachlan region are important for delivering water throughout the catchment and for meeting the environmental water requirements that are outlined in the *Lachlan Long-Term Water Plan*.[180] Re-regulating structures are also important for maintaining the efficient delivery of water orders and minimising unplanned overbank losses.

Upgrades of re-regulating structures also typically trigger fish passage, which is an additional environmental benefit, and links to Action 2.4.

During development of the draft strategy in 2020, from consultation we heard there was a need to upgrade, automate or replace several re-regulating structures (Figure 43) to better manage flow targets in the Mid- and Lower Lachlan. Some structures were old, inefficient and have had little maintenance due to their remoteness and small number of users. These structures are at risk of leaking or failing during environmental watering events and other water deliveries, or are inaccessible and cannot be adjusted in line with adaptive management requirements. Enhancing the use of existing re-regulating assets through upgrades, automations or installing new re-regulating assets will improve the sensitivity and strategic targeting of important environmental objectives in the Mid- and Lower Lachlan. It would also improve the overall efficiency of the system.

Figure 43. Location of infrastructure requiring upgrades and investigations



180. Environmental water requirements support water quality, system-scale productivity and drought refugia and they also facilitate the movement of aquatic fauna from a stressed state to more moderate conditions.

Figure 44. Projects and initiatives to achieve Action 2.3

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.3.1 Support an investigation to improve the delivery of water through the Mid-Lachlan system to progress the replacement and upgrade of Woolshed, Wallamundary and Nerrathong weirs.[181]	✓	
2.3.2 Progress a system-level assessment of re-regulating structures in the Mid- and Lower Lachlan to identify additional critical infrastructure upgrades.		✓
2.3.3 Automate Gonowlia Weir (and Merrowie Creek offtake), Muggabah regulator, Merrimajeel regulator, Box Creek regulator, and Booberoi Creek offtake regulator and delivery channel.		✓
2.3.4 Conduct a feasibility study for upgrading the Booligal Block Bank.[182]		✓
2.3.5 Undertake a feasibility study for a new weir at Whealbah in the Lower Lachlan.		✓
2.3.6 Assess the feasibility of installing a flow monitoring gauge at Kiacatoo Bridge.		✓

181. Currently under investigation by Lachlan Valley Water and supported by the Department of Climate Change, Energy, the Environment and Water – Biodiversity, Conservation and Science.
182. The Booligal Block Bank is operated by the department's staff during major colonial bird-breeding events. Ownership of the Booligal Block Bank remains unclear, and the block bank itself and infrastructure, such as road culvert crossings, need to be upgraded to ensure compliance with the *Water Management Act 2000* and floodplain management plans.

Action 2.4: Mitigate impacts to native fish

Short-term outcome (up to 5 years): a published NSW Diversion Screen Strategy.

Long-term outcomes (5 to 20 years): improved conditions for native fish through increased numbers of fish passages, increased numbers of diversion screens and reduced cold water pollution.

Many species of native fish need to move freely within and between rivers to breed, source food and, at times, escape the impacts of drought. Improving conditions for native fish will increase their resilience and the resilience of all aquatic communities. Water infrastructure such as dams, weirs and pumps is impacting the movement of native fish by creating physical barriers, removing and killing juvenile fish and creating conditions removed from a natural state.

Native fish can only move freely through the Lachlan system during high flows when water flows over weirs and other in-stream barriers. Removing barriers to fish movement and allowing fish to breed and find food and essential habitat is critical to supporting resilient native fish populations in the Lachlan region.[183]

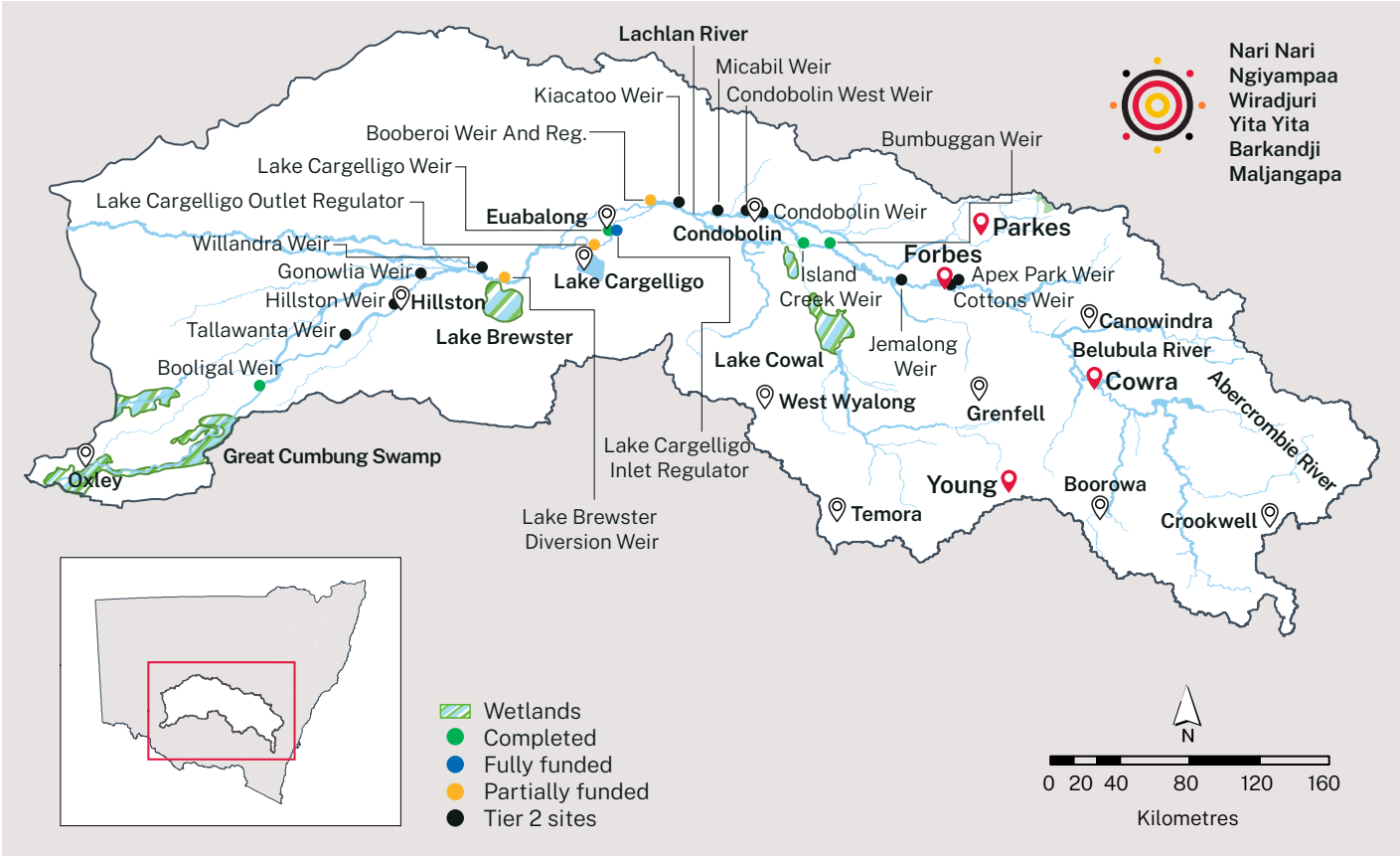
Improve fish passage at priority sites as guided by the NSW Fish Passage Strategy

The *NSW Fish Passage Strategy* outlined several priority sites for improving fish passage (Figure 45). One of these sites[184] has been fully funded and 3 Tier-1 sites require further funding. These are:

- Lake Cargelligo Inlet – detailed design and construction
- Lake Brewster Diversion Weir – construction
- Booberoi Weir and Regulator – construction.

Four fish passages[185] have been completed in the Lachlan region and are now operational. This action will improve fish passage at the remaining priority Tier-1 sites[186] within the Lachlan region and progress Tier-2 sites during the life of this strategy as funding and opportunities become available.

Figure 45. Location of NSW fish passage upgrade sites in the Lachlan Regulated River system



183. Available at: dpi.nsw.gov.au/dpi/fishing/fish-passage-nsw
184. Lake Cargelligo Outlet is scheduled for detailed design and construction by 2025.
185. Island Creek Weir, Bumbuggan Weir, Lake Cargelligo Weir and Booligal Weir.
186. Tier-2 sites could include Tallawanta Weir, Hillston Weir, Gonowlia Weir, Willandra Weir, Kiacatoo Weir, Micabil Weir, Condobolin West Weir, Condobolin Weir, Jemalong Weir, Cottons Weir and Apex Park Weir.

Implement diversion screens at priority pumps

Every year, large numbers of native fish are extracted from the Lachlan River by pumps and diverted into channels. Unscreened pumps or pumps with ineffective screens result in the death or injury of fish and other aquatic animals. With more than 750 pumps in the Lachlan Valley, there is an opportunity to prevent large-scale injury and death of aquatic animals.[187]

The Lachlan waterways and floodplains support up to 17 species of native fish, 9 of which are listed as threatened or endangered in NSW. The removal of large numbers of native fish eliminates individuals from breeding populations and the consequences accumulate over generations, adding to the stress on threatened and endangered populations.[188]

Modern screens can solve problems by stopping fish and debris entering pumps and diversions. The screens work by reducing the velocity of water entering a pump intake, without reducing the volume of water that can be extracted. Screens can reduce fish losses at water diversions by over 90%, protect native fish during upstream and downstream migrations, help more fish survive to maturity and boost native fish populations. The protection extends to other aquatic species such as crayfish and turtles.

Screening also improves pump operation, water delivery and extraction efficiency for asset owners through fewer blockages caused by debris.[189] In NSW, 25 modern screens have been installed with 42 more scheduled to be installed by 2025.

Action 2.4 will build on existing government commitments, such as Fish Screens Australia,[190] which continue to encourage and incentivise the installation of diversion screens at priority sites in the Lachlan region. The NSW Government is progressing consultation with large-scale water users in the Lachlan region to develop incentive schemes for pump owners to install appropriate screens.

Cold water pollution mitigation

Wyangala Dam was ranked as a high priority within the NSW Cold Water Pollution Strategy. Recently, the terms of reference for the Ministerial Taskforce on Fish Passage were updated to include responsibility for developing and implementing a strategy on cold water pollution mitigation.[191]

Remediating cold water pollution requires a long-term and collaborative effort between agencies, asset owners and river operators. This strategy will reconsider further actions to mitigate cold water pollution over the life of the strategy.

187. More information on modern fish screens is available at: dpi.nsw.gov.au/fishing/habitat/rehabilitating/fish-friendly-programs/fish-friendly-farms
188. Boys et al. 2021, Native fish losses due to water extraction in Australian rivers: Evidence, impacts and a solution in modern fish- and farm-friendly screens, *Ecological Management and Restoration*, Vol. 22, Issue 2, pp. 134–144.
189. 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.
190. More information is available at: fishscreens.org.au
191. More information on cold water pollution is available at: www.dpi.nsw.gov.au/fishing/habitat/threats/cold-water-pollution

Figure 46. Projects and initiatives to achieve Action 2.4

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.4.1 Progress the development of the NSW Diversion Screen Strategy.	✓	
2.4.2 Seek additional funding to complete Tier-1 site fish passages: • Lake Cargelligo Inlet – detailed design and construction • Lake Brewster Diversion Weir – construction • Booberoi Weir and Regulator – construction.		✓
2.4.3 Continue to review and update the NSW Cold Water Pollution Strategy, including an updated assessment of all large dams that have the potential to cause cold water pollution.		✓
2.4.4 Progress consultation with large-scale water users in the Lachlan region to incentivise the installation of appropriate screens.		✓
2.4.5 Progress investigations into alternative infrastructure, new technologies and operational changes to arrive at a preferred solution for mitigating cold water pollution from Wyangala Dam.		✓
2.4.6 Explore funding opportunities to implement the preferred capital and operational solution for cold water pollution from Wyangala Dam.		✓
2.4.7 Seek funding to improve fish passage at an additional 11 sites as part of the future fish passage remediation programs.		✓
2.4.8 Identify additional critical pump sites in the Lachlan Valley that could benefit from fish diversion screens and undertake a business case for obtaining funding.		✓

Better outcomes for fish in the Lachlan region

Fish Screens Australia[192] is an information hub that aims to provide the best and most current information on fish screens in Australia. It is a collaboration between senior fisheries scientists, water users, manufacturers, university researchers, engineers, anglers and conservation managers.

Screens have been installed at pilot sites near Cowra and Condobolin with the help of funding grants.

Image courtesy of Fish Screens Australia. Fish screen installed near Cowra in March 2020 with Fish Screens Australia.[193]

192. For more information, see: fishscreens.org.au/about/
193. Available at: fishscreens.org.au/case-studies/jimm-dara/

Action 2.5: Review and evaluate the Lake Brewster Water Efficiency Project

Short-term outcome (up to 5 years): restored water supply from Lake Brewster to the Lachlan River.

Long-term outcomes (5 to 20 years): improved water quality within Lake Brewster through fully implemented adaptive management processes and monitoring and evaluation plans.

Lake Brewster, in the mid-reaches of the Lachlan system, provides flexibility for water managers and river operators as a re-regulating storage. The lake assists in reducing lag-times for water orders, providing extra storage space for tributary inflows downstream of Wyangala Dam, or to mitigate flood releases.

To prevent the lake from drying out and improve water quality for downstream users, the Lake Brewster Water Efficiency Project was completed in 2010. It aimed to:

- reduce evaporation
- improve efficiency and water quality
- increase supply security to water users and the environment
- enhance wetland function and habitat for native fish, waterbirds and other species
- develop and implement an operational plan and monitoring plan.

Lake Brewster is listed in the Directory of Important Wetlands[194] and supported the recent record-breaking pelican breeding event.[195]

During consultation, we heard that Lake Brewster is an important storage for the lower end of the Lachlan River, but there are concerns about water quality and the operation of the storage, which can reduce its value as a re-regulating storage.

The Lake Brewster Water Efficiency Project is an example of how adaptive management and variability in the hydrological regime can achieve improvements in water quality while maintaining storage capacity. As the project has been operational for more than 10 years, it is timely to review it, learn from this approach and determine whether successful aspects can be applied in similar lakes.

194. Available at: environment.gov.au/cgi-bin/wetlands/report.pl?smode=DOIW&doiw_refcodelist=NSW048
195. Available at: abc.net.au/news/2022-05-08/pelicans-lake-brewster-breeding-season/101033032

Figure 47. Projects and initiatives to achieve Action 2.5

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.5.1 Progress permanent repair works to sections of Lake Brewster to ensure reliability of water supply to the Lachlan River.	✓	
2.5.2 Investigate how the adaptive management plans are used and followed in current operations of Lake Brewster.		✓
2.5.3 Investigate the need for improvements to existing infrastructure[196] including the installation of additional automated level gauges in Lake Brewster outflow wetlands, main cell and inflow wetland.		✓
2.5.4 Review and evaluate the adaptive management processes associated with the Lake Brewster Water Efficiency Project including: • *Lake Brewster Land and Water Management Plan* (2009) • *Lake Brewster Water Efficiency Project Fish Management and Operations Plan* (2009) • *Lake Brewster Water Efficiency Project Monitoring and Evaluation Plan* (2009). This review would also include: • investigating ways to fully fund the implementation of monitoring and evaluation plans • assessing the requirements for adaptive management processes to be adapted for other storages.		✓

196. During the floods in late 2022, some infrastructure in and around Lake Brewster was damaged. A review would include determining whether structures should be replaced with like or improved infrastructure based on learnings from the previous 10 years.

Record-breaking pelican breeding at Lake Brewster

Over the summer of 2021–22, Lake Brewster supported a record-breaking pelican breeding event. Through collaboration with environmental water holders and WaterNSW, storage water levels were kept at optimum levels to give the pelicans the best chance of breeding success without impacting on third parties.

It is vital that pelican nests are in an area with a ready supply of food because it takes 4 months for chicks to become totally independent. Pelican chicks can eat up to 900 g of food each day, while an adult can eat close to 2 kg of food. Their fish diet is supplemented with tadpoles, turtles and even other birds. Breeding seasons like these are vital for preserving pelican populations across Australia.

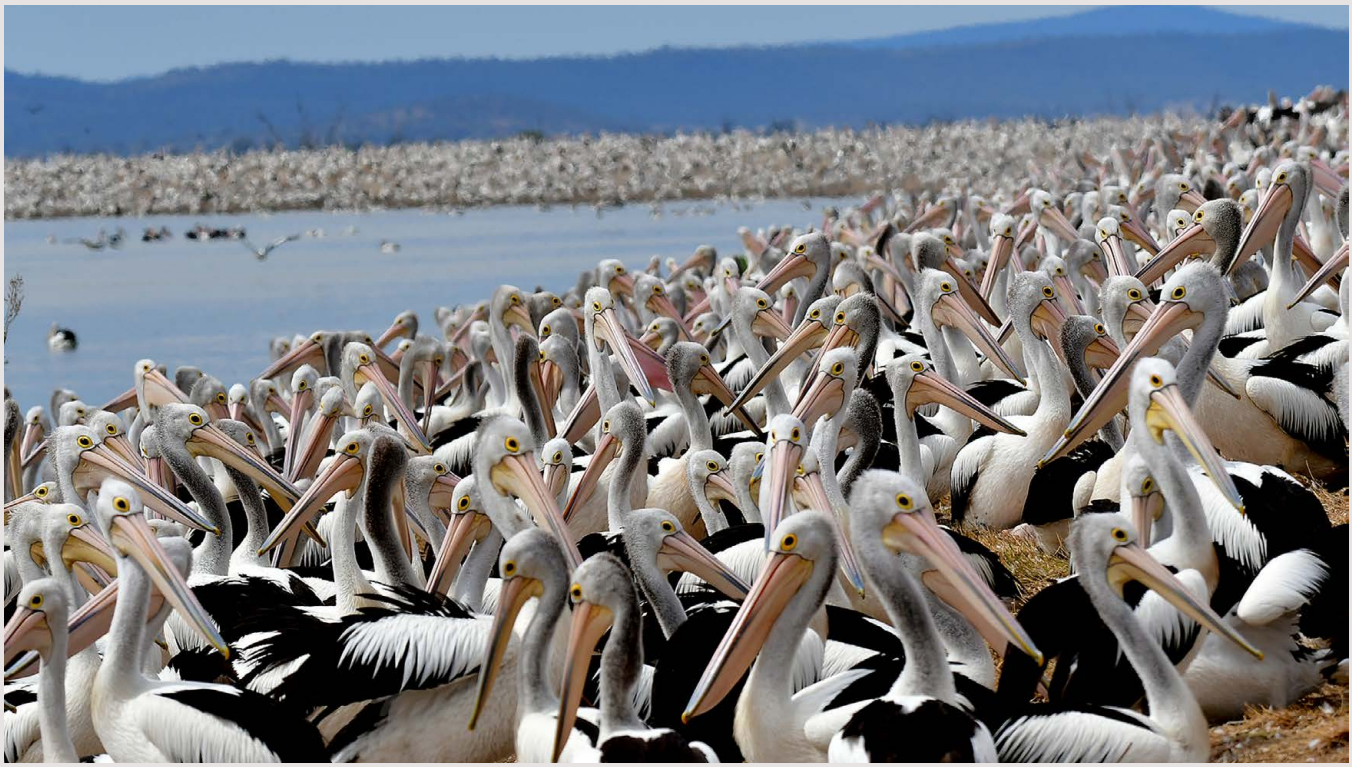


Image courtesy of Adam Kerezsy, Dr Fish Contracting. Pelican colony at Lake Brewster, Lachlan.

Lake Cargelligo work in progress

WaterNSW has started modifications to the existing embankment dams in Lake Cargelligo to stabilise, strengthen and increase their integrity. This work is designed to reduce the risk of failure and to ensure the embankments function effectively for the long-term.[197]

In the draft strategy, 2 draft options were proposed to augment the storage of the Lake Cargelligo system (option 27 and 31). These options were not progressed due to strong feedback from the community that they would cause irreparable environmental harm, disturb important cultural sites, and significantly impact the community and tourism at Lake Cargelligo.

The Lake Cargelligo system remains an important re-regulating storage for the Lower Lachlan region and there is increasing research to show its significance in providing habitat for native species.[198]

197. Further information is available at: waternsw.com.au/projects/regional-nsw/lake-cargelligo-embankment-dams
198. Kerezsy, A. 2021. *The aquatic fauna of the Lack Cargelligo system in the Lachlan catchment 2017–2021*. A report prepared for Department of Planning, Industry and Environment.

Action 2.6: Develop and enable place-based initiatives to deliver cultural outcomes for Aboriginal people

Short-term outcome (up to 5 years): an improved understanding of how to maintain and preserve water-related cultural sites and landscapes.

Long-term outcomes (5 to 20 years): place-based initiatives that deliver cultural outcomes for Aboriginal people.

The draft strategy identified high-level options to improve Aboriginal people's access to water and water rights.

There was significant support for these options to be progressed, but the needs of Aboriginal communities varied between different parts of the region.

The Australian Government's *Closing the Gap*[199] report and the Local and Indigenous Voice Program highlighted that Aboriginal people have a desire for strong and inclusive partnerships where local communities set their own priorities and tailor services and projects to their unique situations.

Action 2.6 would support Aboriginal organisations, such as those outlined in Action 1.4, and communities to build on or develop tailored projects for their communities.[200] This action will aim to move away from centralised decision-making and develop a flexible program that can be adapted and is driven by the principle of self-determination – local communities 'speaking with their voice' to make decisions about the programs needed for their community.

Figure 48. Projects and initiatives to achieve Action 2.6

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.6.1 Continue to progress recommendations in the Australian Government's *Closing the Gap Report* and Local and Regional Voice Programs.	✓	
2.6.2 Continue to work with the Lachlan Regional Aboriginal Water Committee to understand programs needed for their communities.	✓	
2.6.3 Progress Priority 2 of the NSW Water Strategy, which commits to maintain and preserve water-related cultural sites and landscapes for Aboriginal people.	✓	
2.6.4 Work with the Lachlan Regional Aboriginal Water Committee and other Aboriginal stakeholders to identify additional pathways to employment. This will involve developing fit-for-purpose programs that align with community values developed through engaging with regional Aboriginal water committees and local Aboriginal communities (see Action 1.4).		✓
2.6.5 Co-design at least one project with Aboriginal people in the Lachlan region that delivers cultural outcomes relevant to water, subject to available funding.		✓
2.6.6 Develop and implement a testing method for cultural flows, dependent on monitoring and evaluation and reporting plans for water management.		✓

199. Available at: closingthegap.gov.au/national-agreement
200. Such as the Down the Track Program available at: downthetrack.org.au

Figure 48. Projects and initiatives to achieve Action 2.6 (continued)

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.6.7 Secure flows for and undertake rehabilitation and land restoration of important cultural sites in the Lachlan region.		✓
2.6.8 Develop a cultural watering program that understands the location and water needs of important cultural assets, including surface water-dependent and groundwater-dependent cultural sites. This program will involve working with the department, WaterNSW and environmental water holders to identify whether co-benefits could be achieved.		✓
2.6.9 Collaboratively design and pursue options to improve access to culturally significant areas and waterways in the Lachlan region, including those located on crown reserves. This sub-action will also include investigating the benefits and constraints of setting up formal access arrangements between Aboriginal people and landholders or developing co-management arrangements for sites.		✓
2.6.10 Develop a river restoration program that incorporates cultural science and knowledge to rehabilitate Country. This could also be applied though Action 2.1 and Action 2.2.		✓

Image courtesy of Destination NSW. Sun rising over the Lachlan River, Condobolin.

Action 2.7: Support the development and implementation of the Lachlan Valley Floodplain Management Plan and address floodplain structures

Short-term outcome (up to 5 years): the Lachlan Valley Floodplain Management Plan has commenced.

Long-term outcomes (5 to 20 years): healthy floodplains managed in accordance with the Lachlan Valley Floodplain Management Plan.

There is strong stakeholder concern in the Lachlan region about existing structures on floodplains and their impact on the environment, Aboriginal cultural assets and values, and the increased risk to life and property.

In 2021, the department completed a review under section 43 of the *Water Management Act 2000* and is progressing the replacement of the 3 historical flood management plans for the Lachlan region with one, valley-wide floodplain management plan.[201]

A whole-of-valley approach to floodplain management will benefit some of the Lachlan region's most critical wetlands located at the end of the regulated system, and ensure healthy floodplains that support healthy catchments.

In addition to supporting the development and implementation of the Lachlan Valley Floodplain Management Plan, the department will address existing structures on floodplains that adversely impact the environment and Aboriginal cultural assets and values and increase the risk to life and property.

Figure 49. Projects and initiatives to achieve Action 2.7

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.7.1 Finalise the Lachlan Valley Floodplain Management Plan by: • developing new hydraulic models • identifying existing flood works (approved and unapproved) • identifying flood-dependent ecological assets • identifying flood-dependent Aboriginal cultural assets and values and heritage sites.	✓	
2.7.2 Define an overall boundary for the floodplain and categorise the different areas within it into management zones.	✓	
2.7.3 Cross-check depth and velocity of flood water in the models with existing floodway networks, aerial photography and river-gauge data of historical flood events, cultural values and environmental considerations to form the basis of the management zones.	✓	
2.7.4 Undertake a comprehensive consultation process incorporating local expertise with formal public consultation and opportunities for property-scale feedback.	✓	

201. Department of Climate Change, Energy, the Environment and Water's program for valley-wide floodplain management plans in the southern Murray–Darling Basin. Available at: water.dpie.nsw.gov.au/our-work/floodplain-management/plans/southern-floodplain-management-plans

Figure 49. Projects and initiatives to achieve Action 2.7 (continued)

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
2.7.5 Establish an interagency working group to review the Lachlan Valley Floodplain Management Plan throughout each stage of its development. All plans require approval from the Minister responsible for Water, and agreement from the Minister for the Environment.		✓
2.7.6 Work with the Natural Resources Access Regulator and WaterNSW to bring unapproved structures on floodplains into compliance.		✓
2.7.7 Consider options to accelerate the process of bringing unapproved or noncompliant structures on floodplains in the Lachlan region, into compliance. This could include rolling out a program like the Improving Floodplain Connections Program[202] for the Lachlan region.	✓	
2.7.8 Liaise with WaterNSW to investigate operational releases from dams and re-regulating structures and include operational river constraints for floodplain risk management.		✓

Image courtesy of Shutterstock. Receding flood waters from the Lachlan River.

202. The Improving Floodplain Connections Program is being delivered in the Northern Basin. More information is available at: water.dpie.nsw.gov.au/our-work/floodplain-management/improving-floodplain-connections-program

Priority 3

Support the water needs of a strong and sustainable economy

The Lachlan region lies at the geographic heart of NSW, leveraging its position along nationally significant rail and road corridors that encourage industry development, as well as population and job growth. The industry profile of the Lachlan region is changing and new and expanding industries will drive further demand for water and increase competitive pressure on existing water resources.

In the future, the region is also likely to experience higher water demand from a growing population, alongside potentially declining water availability. This trend will put pressure on all users, including the environment, and have flow-on impacts on the regional economy.

Agriculture, mining and tourism will continue to be important to the regional economy in coming decades, so it is vital to understand the risks and challenges to our industries and communities to better manage water supply. It is also important that operational, planning and development decisions take into account the likely reliability and security of future water supplies.

The actions shortlisted under this priority will support improved industry and community resilience to climate-related challenges.

Existing programs to support the water needs of a strong and sustainable economy

The department has developed a strategy for delivering Aboriginal community outcomes to help guide how it works with communities so they can share and benefit from the outcomes of investments in new water infrastructure.

The NSW Government has developed a *Critical Minerals and High-Tech Metals Strategy*.[203] The strategy outlines the NSW Government's vision to build on the existing potential and position NSW as a major global supplier and processor of critical minerals and high-tech metals well into the future.

The NSW Government has assisted local councils to develop regional economic development strategies[204] based on the concept of a functional economic region, which are under review.

The open data framework[205] recently published by the Department of Climate Change, Energy, the Environment and Water outlines how open data will be managed and driven to improve transparency and data sharing. This is part of a policy to provide more open and easily accessible data to all water users.

Aboriginal water rights are being advanced through a new inland waters target of 3% of water entitlements to be owned by Aboriginal people and organisations under the National Agreement on Closing the Gap by 2031.[206] The NSW Aboriginal Water Strategy is being co-designed with Aboriginal people and will identify a program of measures to deliver on Aboriginal people's water rights and interests in water management.

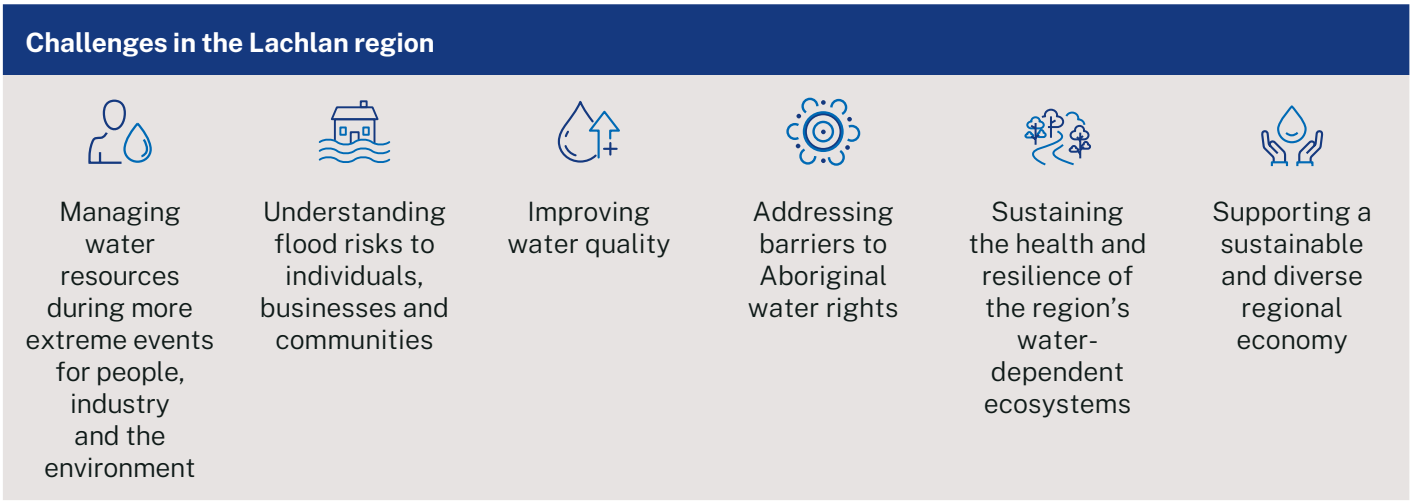
The *Climate Change Research Strategy*[207] is supporting projects that help primary industry sectors adapt to climate change.

Funding of $3.9 million has been provided under Future-Ready Communities Program to promote resilience and develop drought resilience plans that assess drought impacts and responses. Individual plans can focus on intra- or inter-industry diversification, leadership and social capital building, and planning local council works. The *Future Ready Regions Strategy* and Future-Ready Communities Pilot Program includes a commitment to upgrade the Enhanced Drought Information System[208] to provide farms with world-leading weather and climate data so they can make better business decisions, and to support local councils to develop drought resilience plans.

Funding of $48 million has been provided for the Farms of the Future Program[209] to support on-farm connectivity and encourage farmers to adopt technology that boosts productivity, water efficiency and drought preparedness.

203. Available at: nsw.gov.au/regional-nsw/critical-minerals-and-high-tech-metals-strategy
204. Available at: nsw.gov.au/regional-nsw/regional-economic-development-strategies
205. Available at: dpie.nsw.gov.au/water/our-work/science-data-and-modelling/data/open-data-framework
206. Available at: closingthegap.gov.au/national-agreement
207. Available at: dpi.nsw.gov.au/dpi/climate/about-dpi-climate/climate-change-research-strategy
208. Available at: dpi.nsw.gov.au/climate_applications/interactive-drought-map/Learn-more/how-does-edis-work
209. Available at: nsw.gov.au/grants-and-funding/farms-of-future-grant-program

Figure 50. Actions for Priority 3: Support the water needs of a strong and sustainable economy



Action	Summary	Challenges addressed
Action 3.1	Improve public access to climate information and water availability forecasts	
Action 3.2	Investigate water use in the Lachlan region	
Action 3.3	Work with industries to better understand, mitigate and adapt to the impacts of climate change for water management	
Action 3.4	Develop and enable employment and business opportunities for Aboriginal people	
Action 3.5	Adopt a stronger focus on water efficiency and demand management	
Action 3.6	Investigate ways to improve water reliability	

Action 3.1: Improve public access to climate information and water availability forecasts

Short-term outcome (up to 5 years): climate data and information is shared and easily accessed by the public.

Long-term outcomes (5 to 20 years): climate data and information is updated regularly and used by water users and communities to better prepare for extreme events.

Recent improvements in climate and water availability information were undertaken as a first step in meeting the needs and expectations of water users in the region.

Advancing our climate science and increasing the amount of publicly available climate-related information, including short- 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.

During public consultation, we heard that stakeholders are interested in the new climate datasets and they want our modelling to be made publicly available so the data can be used by water users and communities to better prepare for future extreme events.

Image courtesy of Shutterstock. Lake Cargelligo weir.

Figure 51. Projects and initiatives to achieve Action 3.1

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
3.1.1 Continue to update the Water Insights portal and information dashboards.	✓	
3.1.2 Continue to upload climate and flow data to the NSW Government's Sharing and Enabling Environmental Data portal,[210] including user guidance.	✓	
3.1.3 Consult with stakeholders in the Lachlan region to harness local knowledge and to identify opportunities for on-ground climate information to better understand the specific circumstances in the region.		✓
3.1.4 Improve communication of the regional water strategies' climate datasets and climate risk modelling (for example, by making more detailed information publicly available).		✓
3.1.5 Improve and apply our understanding of climate change impacts and risks on water management and the environment, including surface water, ground water, wastewater, stormwater and water quality.		✓
3.1.6 Investigate options to build on or complement existing state and national climate-related information platforms and products to assist water users in the Lachlan region to improve strategic water planning, including: • more detailed information about the regional water strategies' new climate datasets and climate risk modelling and the implications of long-term historical climate data on: – surface water availability and water quality – the likelihood of consecutive years of low or no water availability – periods where access to water allocations may be restricted by delivery problems in the regulated river system groundwater availability. • 12-month water storage outlooks and how this could influence water allocation decisions and other operational water sharing decisions: – a transparent framework for how available water determinations are made based on use, compliance triggers and carryover.		✓

210. NSW Government, Sharing and Enabling Environmental Data in NSW. Available at: seed.nsw.gov.au

Collecting more and better data

The NSW Government has a range of programs aimed at improving its understanding of water flows and water use in the Lachlan region.

Non-urban water metering framework

Under the non-urban water metering framework,[211] water supply works in the Lachlan region will need to adhere to the new metering rules, including the installation of meters on pumps.

The framework will be able to better collect and store data, through its cloud-based data acquisition service. This will assist the Natural Resources Access Regulator, WaterNSW and the Department of Climate Change, Energy, the Environment and Water – Water to undertake compliance and enforcement, billing and other water-management activities. Water users will also be able to access their water usage data via a private online dashboard.

This program will support better knowledge of water use and behaviour in the system including improved data on water use in unregulated river systems.

Murray–Darling Basin Compliance Compact

NSW is undertaking a review of its hydrometric (river gauge) network as part of the Murray–Darling Basin Compliance Compact.[212] The review is looking at the coverage and data quality obtained from the existing hydrometric network and identifying ways to improve information collected. The gauging stations will deliver transparent, accurate and accessible data in real time to water users, communities and stakeholders, building on more than 1,300 monitoring sites already available in real time to the public. Information available from the new stations will include stream levels, flow volumes and water quality.

These sites will enhance the network so that the department can better manage stream connectivity, compliance, environmental water release and extreme events. The new stations will add even more localised data, helping to better understand local conditions to better balance the needs of water users and the environment, and better prepare for floods and droughts. Water users can access the data through tools including WaterNSW's Water Insights portal and information dashboards and WaterLive App[213] and the Bureau of Meteorology's Water Information Portal and Water Data Online.[214]

211. Department of Climate Change, Energy, the Environment and Water, Non-urban metering. Available at: dpie.nsw.gov.au/water/nsw-non-urban-water-metering
212. Department of Climate Change, Energy, the Environment and Water, Hydrometric Network Review. Available at: dpie.nsw.gov.au/water/our-work/science-data-and-modelling/data/hydrometric-network-review
213. Available at: waterinsights.waternsw.com.au
214. Available at: bom.gov.au/water

Action 3.2: Investigate water use in the Lachlan region

Short-term outcome (up to 5 years): an improved understanding of potential future water supply and water availability.

Long-term outcomes (5 to 20 years): relevant water sharing plans are updated and reflect an improved understanding of water use against extraction limits.

Our new climate datasets and updated modelling have enabled us to enhance our understanding of potential future water supply and water availability risks.[215]

However, more detailed work is needed to understand these risks and future water demand in the region, particularly the drivers of water use.

Undertaking further research into water demand will also help us better represent different water demands in our hydrological models, which support our management and policy decisions and help us better understand emerging water security risks.

During development of the draft strategy, we heard that stakeholders would like the regional water strategies to be expanded to consider demand management initiatives. This gap in our actions needs to be addressed. However, a study of water demand across the Lachlan region is necessary so that actions can be tailored in future updates of this strategy.

Figure 52. Projects and initiatives to achieve Action 3.2

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
3.2.1 Continue to enhance the understanding of potential future water supply and water availability risks through the climate datasets and updated modelling.	✓	
3.2.2 Continue consultation with stakeholders to better understand the factors around water use in the Lachlan region.		✓
3.2.3 Scope an investigation of water use in the Lachlan region in consultation with stakeholders, including: • industry, to understand the timing and pattern of water use, and drivers to substitute surface water and groundwater • non-residential users in towns, to determine those relying on town water supplies • the environment, to collect data on water orders and site-specific use of environmental water to gain a better understanding of water demand and environmental watering behaviour • growth in town water users, to collaborate with other state agencies and local councils to better understand growth in town water needs over the next 20 years.		✓
3.2.4 When sub-action 3.2.3: is implemented, and with the assistance of the *Lachlan Water Resource Plan*,[216] further investigate how water use in the region compares to the water sharing plan extraction limits to understand any issues that need to be addressed.		✓

215. A detailed explanation of the new climate data and modelling being used for the regional water strategies is available at: water.dpie.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies
216. Available at: mdba.gov.au/publications-and-data/publications/lachlan-water-resource-plan

Water use and the Lachlan Water Resource Plan

Legal limits on surface water extractions 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). The Murray–Darling *Basin Plan*[217] will be revised in 2026. NSW water resource plans help define how much water can be taken from river and groundwater systems in specific parts of the Basin.[218]

In the Lachlan region, average regulated surface water account utilisation – water use relative to the maximum available for use – over the last 18 years has been around 44% (Figure 24). There needs to be a better understanding of what drives surface water use in the Lachlan region to determine whether there are issues that prevent water use from reaching the water sharing plan extraction limits. The Lachlan Water Resource Plan was accredited in May 2024 and will assist in assessing water availability in the region and use against the sustainable diversion limit.

Image courtesy of Chris Watson, NSW Department of Climate Change, Energy, the Environment and Water. Wyangala Dam during drought.

217. Available at: mdba.gov.au/water-management/basin-plan
218. More information on how surface water legal limits on watertake are defined is available at: water.dpie.nsw.gov.au/__data/assets/pdf_file/0008/404666/How-surface-water-legal-limits-on-water-take-are-defined.pdf

Action 3.3: Work with industries to better understand, mitigate and adapt to the impacts of climate change for water management

Short-term outcome (up to 5 years): improved understanding of climate change impacts on water-dependent industries.

Long-term outcomes (5 to 20 years): improved water management that mitigates and adapts to climate change impacts.

A coordinated whole-of-government approach is required to improve industry resilience across the Lachlan region, as well as regional NSW.

This will involve government agencies working in close collaboration with stakeholders to ensure policy settings are aligned and working harmoniously.

To support industry to mitigate and adapt to climate change, it is imperative to get a better understanding of:

- the impact of climate variability and climate change on the region's existing diverse industries, both primary and secondary for water availability and management
- the climate change information needs of industries in the region for water management, so they are empowered to understand the impact climate change may have on businesses and can make well-informed decisions.

Under Action 3.3, the department will lead further consultation with industries and local councils to better understand their views and needs and to identify and scope priority research and data projects. These projects will inform decision-making by governments and businesses about climate change adaptation and mitigation.

NSW Climate Change Adaptation Strategy

The NSW Climate Change Adaptation Strategy[219] outlines how the NSW Government will strengthen and expand climate change adaptation now and over the long-term. The strategy sets out key decision-making principles and objectives for adaptation, key priorities and a suite of actions, including:

- developing robust and trusted metrics and information on climate change risk
- completing climate change risk and opportunity assessments
- delivering adaptation action plans at least every 5 years
- embedding climate change adaptation in NSW Government decision-making.

The strategy requires all NSW Government agencies to identify climate change risks to their assets and services. The NSW Government is developing a statewide adaptation action plan to drive a coordinated, whole-of-government approach to adapting to climate change. Some government agencies, including the department, are developing specific action plans to embed climate change into their assets and services.

Building on the Vulnerability Assessment Project

The Department of Primary Industries completed an $8 million Vulnerability Assessment Project[220] to better understand the vulnerability and adaptability of NSW's primary industries to climate change. This project includes a subcomponent to assess the climate vulnerability of key broadacre crops to climate change. This work identifies risks and opportunities of a changing climate for the highest value broadacre cropping industries and provides an evidence base to support NSW Government policies and industry plans to address climate change impacts.

Reducing emissions across the NSW primary industries and land sector

The NSW Government launched the Primary Industries Productivity and Abatement Program[221] in 2022. This program focuses on developing market and industry foundations, building critical mass and capacity and accelerating finance for natural capital and low carbon farming. Together, these investments are supporting farmers and land managers to reduce emissions and access environmental markets while optimising productivity and seizing new market opportunities.

219. Available at: climatechange.environment.nsw.gov.au/about-adaptnsw/nsw-climate-change-adaptation-strategy
220. Available at: dpi.nsw.gov.au/dpi/climate/climate-vulnerability-assessment
221. More information is available at: energy.nsw.gov.au/business-and-industry/programs-grants-and-schemes/primary-industries-productivity-and-abatement

Exploring other opportunities

Understanding the impacts of climate change on industries will allow us to identify ways to strengthen industry resilience. This work can be in the form of further research and development, as well as efforts to retain the productive capacity of the region's industries, or to help them adapt to new ways of operating.

In addition to the opportunities identified in the Vulnerability Assessment Project, sub-actions for Action 3.3 were also identified during the development of this strategy.

Given the resource-intensive nature of this action, and its statewide relevance and applicability, further work is required to better understand the potential benefits and priority of these projects. This process will be undertaken in consultation with interested stakeholders in the region, as part of the whole-of-government response to improving industry resilience to climate change.

Some of this work will be progressed through the Department of Primary Industries – Agriculture's research projects and programs, which will lead efforts to translate world-leading research into practical improvements, including drawing on research to develop and coordinate local pilot initiatives, and information and training programs.

Figure 53. Projects and initiatives to achieve Action 3.3

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
3.3.1 Continue to roll out the Farms of the Future Pilot Program.	✓	
3.3.2 Monitor the outcomes of adoption of digital technologies under the Farms of the Future Program.	✓	
3.3.3 Start implementing stage 2 of the Climate Vulnerability Assessment Project. Stage 2 includes integrating water data from the regional water strategies into analyses and investigating adaptation responses for cotton.		✓
3.3.4 Progress implementation of the NSW Climate Change Adaptation Action Plan.[222]	✓	
3.3.5 Consult with stakeholders, including industry groups, businesses, landholders and local councils, to better understand industry needs and expectations about the level of support required (using the findings from stage 1 of DPI – Agriculture's Climate Vulnerability Assessment Project as a starting point).		✓
3.3.6 Undertake research and development to identify innovative and emerging technologies that support and promote water efficiency, which could potentially be developed into suitable water efficiency projects for future key industries to drive economic growth and productivity.		✓
3.3.7 Undertake a water pricing study to assess how evidence and climate change data gathered through development of this strategy would impact future water charge determinations under a 'no change scenario'.[223]		✓
3.3.8 Understand the level of support required by industries in the Lachlan and Belubula catchments, to adapt to and mitigate climate change for water management.		✓

222. Available at: www.climatechange.environment.nsw.gov.au/sites/default/files/2024-10/NSWClimateChangeAdaptationActionPlan 2025-2029.pdf
223. A water pricing study could help better understand what the financial implications would be for water-dependent businesses if we continued using the current water charge determination framework in the Lachlan region in a changing climate.

Helping primary producers adapt farming systems to climate change

The NSW Government Climate Change Research Strategy is supporting projects that help primary industry sectors adapt to climate change. For example, the Department of Primary Industries – Agriculture's Vulnerability Assessment Project is assessing the vulnerability of 28 primary industries and 14 related biosecurity risks to climate change.

The assessment is being conducted in 2 stages:

- an impact assessment looking at how current production might vary under future climate conditions in 2050
- an adaptation assessment looking at how the department might respond to negative impacts and provide direction for industry research and development; for example, developing crop varieties more suited to a drier climate.

Image courtesy of Jason King, NSW Department of Climate Change, Energy, the Environment and Water. Cattle farming.

Action 3.4: Develop and enable employment and business opportunities for Aboriginal people

Short-term outcome (up to 5 years): Aboriginal people have increased opportunities for meaningful career pathways through formal training and implementing learnings across the region.

Long-term outcomes (5 to 20 years): improved employment and business opportunities for Aboriginal people in the Lachlan region.

During our consultation on the draft strategy, we heard about the need for economic development and business opportunities in the region that are led by Aboriginal communities. Stakeholders showed strong support for initiatives that result in employment opportunities for Aboriginal people, particularly Aboriginal youth; however, it was stressed these roles needed to be based in the community. Training opportunities, particularly for Aboriginal youth, was identified as a key priority.

The NSW Government successfully delivered the Aboriginal Ranger Program in 2022 and 2023.[224] Participants gained exposure to Local Land Services and its operations, building a transferable skillset and a sound understanding of the workings of the public sector. Graduates of the program gained a Certificate III in Conservation and Ecosystems Management, enhancing Aboriginal people's connection to Country and provided meaningful career pathways, with some graduates securing employment both internally and external to Local Land Services. This structured employment and development program has paved the way for future employment initiatives that will be developed under the new Local Land Services Aboriginal Employment Strategy. The Aboriginal Employment Strategy will create broadscale employment and training opportunities for Aboriginal people and communities across NSW, identifying sustainable career pathways.

Action 3.4 will support Aboriginal people's business development opportunities in the Lachlan region and will be led by the Department of Primary Industries and Regional Development. Other support is also available through Department of Aboriginal Affairs, NSW Aboriginal Land Council and the National Indigenous Australians Agency.

Figure 54. Projects and initiatives to achieve Action 3.4

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
3.4.1 Continue to support development opportunities for Aboriginal businesses through a range of programs including the Regional Aboriginal Partnership Program.[225]	✓	
3.4.2 Support programs designed to enhance Aboriginal people's connection to Country and provide meaningful career pathways, including via the objectives outlined in the Local Land Services Aboriginal Engagement Strategy.[226]	✓	
3.4.3 Support the development of the Local Land Services Aboriginal Employment Strategy.[227]	✓	
3.4.4 Through the Regional Aboriginal Partnership Program and Outcomes team with Local Land Services, work with Aboriginal organisations, businesses and individuals to strategically identify business opportunities or provide further support or scope for grant funding.		✓
3.4.5 Explore market and nonmarket mechanisms for obtaining water to meet the inland waters target. These mechanisms will be examined in developing the Closing the Gap initiatives.		✓

224. More information is available at: lls.nsw.gov.au/what-we-do/our-major-projects/aboriginal-ranger-program
225. More information is available at: www.nsw.gov.au/regional-nsw/regional-aboriginal-partnerships-program
226. More information is available at: lls.nsw.gov.au/what-we-do/our-major-projects/aboriginal-ranger-program
227. More information is available at: lls.nsw.gov.au/what-we-do/our-major-projects/aboriginal-ranger-program

Action 3.5: Adopt a stronger focus on water efficiency and demand management

Short-term outcome (up to 5 years): improved support for industry to invest in water efficiency.

Long-term outcomes (5 to 20 years): improved water efficiency and demand management throughout the Lachlan region.

Water managers use water efficiency and demand measures to help reduce community demand on water sources and make existing water supplies go further. For large regional centres, such as Cowra and Forbes, these measures can be vital for sustaining water supplies through the region's regular dry periods and droughts. A stronger focus on water efficiency and demand management can support population and industry growth without increasing risks to water security. During public consultation on the draft strategy, we heard strong support for improving water efficiency.

There was a desire to invest more heavily in measures to do more with available water including:

- continued use of water restrictions to limit town water use during dry periods and prolong water supplies
- expanding 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
- exploring 'smart' metering and pricing
- improved re-use 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
- improving the efficiency of water delivery in the regulated system through the upgrade of re-regulating structures (see Action 2.3).

Figure 55. Projects and initiatives to achieve Action 3.5

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
3.5.1 Continue working with priority councils in the region to deliver state-led and collaborative initiatives that support urban water efficiency, water conservation and demand management measures. These initiatives include applying the resources, tools and guidance developed under the NSW Water Efficiency and Regional Leakage Reduction Program[228] to implement best-practice water efficiency programs. The resources include: • NSW Water Efficiency Framework • water conservation cost-benefit analysis guidelines and catalogue of values • non-residential water efficiency programs handbook • best-practice guidelines for sporting fields • water-loss management training.	✓	
3.5.2 Continue to work with all levels of government, water utilities, the private sector and the wider community to ensure communities have increased productivity and are better prepared to adapt and respond to drought and climate variability through the efficient use of water resources. This work includes: • reviewing and improving the NSW Government's and Australian Government's regulatory instruments, such as the Building Sustainability Index (BASIX), so that they are fit-for-purpose in driving cost-effective water-use behaviour • better integrating water conservation in water, land use and net zero policies, such as water sensitive urban design and water recycling • ensuring water efficiency has equal standing with additional supply-side options when balancing supply and demand to ensure water is being used efficiently before imposing costs on the community for additional water infrastructure.		✓

228. More information is available at: water.dpie.nsw.gov.au/our-work/projects-and-programs/water-efficiency

Resilient Rivers Water Infrastructure Program

The Resilient Rivers Water Infrastructure Program is an Australian Government initiative that provides a pathway for Murray–Darling Basin states to propose water-saving and efficiency measure projects for funding. The program builds on and replaces the Off-Farm Efficiency Program.

To support the delivery of the Basin Plan and its commitment to recover 450 GL/year of water to the Murray–Darling Basin environment, the Australian Government has developed Restoring Our Rivers: Draft Framework[229] for delivering 450 GL of additional environmental water. The draft framework proposes a range of programs and measures, including the Resilient Rivers Water Infrastructure Program, to deliver the 'additional options' commitment, including expanded activities through water recovery infrastructure projects.

The Resilient Rivers Water Infrastructure Program will provide up to $494 million over 4 years from 2023–24 for projects that assist in the recovery of 450 GL/y of additional water for the environment, including improving and modernising water delivery infrastructure. Applications are open until 31 March 2025.

Many local councils in the region, particularly those that rely on surface water, have invested in water security measures that have helped to improve the resilience of water for towns. For example, Parkes Shire Council has secured $65 million from NSW Government and Australian Government sources to upgrade existing water infrastructure and add additional water supply assets to preserve, protect and sustainably manage their water.[230]

Image courtesy of iStock. Wyangala, NSW.

229. Available at: consult.dcceew.gov.au/draft-restoring-our-rivers-framework
230. More information is available at: parkes.nsw.gov.au/Council/News-media-and-projects/Projects-and-works/Parkes-Water-Security-Program

Stronger focus on water efficiency and demand management for towns and communities

Local water utilities play an important role in managing urban water demand and improving water use efficiency in the Lachlan region. These management measures will continue to be needed into the future to support population and industry growth. We heard strong support for these measures during the first public consultation on the draft strategy.

Water efficiency should be considered in water demand and supply planning and implemented where it is cost-effective, considering the broad range of costs and benefits to customers. The NSW Government will support local councils in the region to implement the statewide Water Efficiency Framework.[231]

Water Efficiency Program

Over the last 3 years, the NSW Government established a statewide Water Efficiency Program and Water Efficiency Framework.[232] The program collaborated with key stakeholders[233] to increase investment in water-system efficiency, water conservation and demand management, which can delay the timing and reduce the scale of investment in new supply infrastructure.

Regional Leakage Reduction Program

A key aspect of the Water Efficiency Program is addressing network leakage and water loss as a priority. The need to focus on local water utilities' network leakage and water losses became apparent during the 2017–20 drought and has been reinforced during consultation with locals councils and the wider sector as part of the Town Water Risk Reduction Program.

The Central NSW Joint Organisation is also overseeing a water loss management program in its constituent local councils across the Macquarie and Lachlan catchments.

Local water utility performance data

The NSW Government maintains a public web-based database[234] for NSW regional water utilities to annually report their current water supply and sewerage data. Performance monitoring and benchmarking are required under the National Water Initiative[235] and provide assurance to the NSW Government that the requirements of the *Water Management Act 2000* are being met by each local water utility.

231. More information is available at: water.dpie.nsw.gov.au/our-work/projects-and-programs/water-efficiency/framework
232. More information is available at: water.dpie.nsw.gov.au/our-work/projects-and-programs/water-efficiency
233. Including the Water Directorate, Local Government NSW, water utilities, industry leaders, communities and other government agencies.
234. The database is available at: water.dpie.nsw.gov.au/our-work/local-water-utilities/local-water-utility-performance
235. Available at: dcceew.gov.au/water/policy/policy/nwi

Action 3.6: Investigate ways to improve water reliability

Short-term outcome (up to 5 years): a better understanding of where future investigations into water reliability should occur.

Long-term outcomes (5 to 20 years): improved water reliability in the Lachlan region through a more flexible water allocation and accounting framework.

Under a drier future climate scenario, severe droughts could re-occur, and Wyangala Dam could sit at lower storage levels for longer periods. This would place high-priority needs, including basic landholder rights and critical environmental needs, at greater risk and further reduce the reliability of general security access licences.[236]

During development of the draft strategy, we heard varied views about whether the drought of record that informs water sharing plans needs to be changed and whether the water allocation process should be amended to consider new climate information. Sharing water between communities, the environment and commercial users is a careful balancing act.[237] The NSW Government ensures, as far as practical, that essential requirements and high-priority needs[238] can be met first, before allocating water to other water access licence categories. The NSW Water Strategy has committed to update water allocation frameworks in response to new climate information and changing water availability.[239]

In the Lachlan region, the department will continue to consult with communities about the existing surface water allocation, accounting and drought management frameworks. We need to better understand the region's appetite for risk and a willingness to try a more flexible and risk-based approach to addressing the issue.

In developing this strategy, the department has:

- published preliminary modelling on the outcomes of changing reserve volumes in Wyangala Dam on storage levels and the effect this would have on towns and communities[240]
- modelled how converting a portion of general security water access licences to high-security water access licences would change water availability and change the length of time under drought operation measures[241]
- tested the impact of changing the existing water take limit for general security licence holders under the existing water accounting framework. Preliminary modelling did not show significant impacts of changing the water take limit to 1.1 ML/unit share. These results need to be further investigated and completing this modelling will enable us to enhance the representation of water uses in the department's hydrological models which is needed to further investigate the issue
- held initial consultation about alternative mechanisms for improving water availability. This included tying the allocation process more closely to existing climate drivers (for example, El Niño or La Niña) or reviewing existing drought operations rules and drought triggers in the Incident Response Guide.[242] It was suggested that this could be a more effective and less costly alternative option to ensure that high-priority water needs are protected when climate conditions change.

236. General-security water licence holders in the Lachlan Regulated River water source received 0% allocation in the 2018/19 and 2019/20 water years and temporary water restrictions were placed on general-security carryover in the 2019/20 water year and in parts of the 2020/21 water year.
237. For more information, see: water.dpie.nsw.gov.au/allocations-availability/allocations/how-water-is-allocated
238. These high-priority needs include the amount of water required for town water supplies, high-security licences, minimum dam releases, stock and domestic replenishment needs and water conveyance volumes, which are based on average transmission and evaporation losses.
239. Available at: dpie.nsw.gov.au/water/plans-and-programs/nsw-water-strategy/toward-2050/priority-4
240. See page 129 of the *Lachlan Regional Water Strategy Consultation Paper* for more information on the modelling of changing reserve volumes. Available at: dpie.nsw.gov.au/water/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy/lachlan-regional-water-strategy
241. See page 113 of the *Lachlan Regional Water Strategy Consultation Paper* for more information on licence conversion modelling. Available at: dpie.nsw.gov.au/water/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy/lachlan-regional-water-strategy
242. The NSW Government has published an updated Extreme Events Policy that establishes the principles for managing water resources within the NSW Murray–Darling Basin during an extreme event. The policy outlines a range of possible measures for water managers to use as conditions deteriorate. The details of these measures are outlined in the individual incident response guides for surface water systems (regulated and unregulated) and groundwater systems.

Draft Option 25[243] of draft Regional Water Strategy: Lachlan Options was not progressed because the options assessment process found it was not viable due to uncertain benefits and the high potential for net negative impacts for the region. However, pending the outcomes of discussions about replenishment flows as part of sub-action 3.6.1, there may be scope to further consider if smaller-scale, targeted efficiency measures are appropriate in parts of the Lower Lachlan. Any action of that nature would need to be undertaken in consultation with landowners in the area and the department's Biodiversity Conservation and Science Group, and would need to consider ongoing environmental and economic impacts. A review of replenishment flow rules would not be limited to efficiency measures and would consider options for enhancing how replenishment flows already support the ecological character of significant environmental assets and functions within the Unregulated Effluent Creeks Water. This aligns with recommendations of the Natural Resource Commission.[244]

Figure 56. Projects and initiatives to achieve Action 3.6

Sub-action	Funded (up to 5 years)	Currently unfunded (5 to 20 years)
3.6.1 Continue to consult with stakeholders to better understand where future investigations into water reliability should occur, including discussions with WaterNSW and the department to assess potential changes to the allocation framework within the Lachlan Regulated River, which would include: • the potential for better links with climate drivers • whether different allocation periods could be applied to different licence categories • the need to change reserve volumes based on a sequence of dry or wet years • a review of replenishment flow requirements for the Lower Lachlan.	✓	
3.6.2 On completion of Action 1.3, explore ways to enable better representation of water users in the department's hydrological models.		✓
3.6.3 Improve integration of drought- and incident-management planning in response to climate change, ensuring preparedness and capability are maintained.		✓
3.6.4 Investigate priority issues from sub-action 3.6.1 to inform whether a 'case for change' is warranted to the water allocation and accounting framework in the Lachlan Regulated River in response to extreme events. This case for change would likely be enacted through the water sharing plan revision process.		✓

243. Details for draft option 25 can be found in the draft Regional Water Strategy: Lachlan Options. Available at: dpie.nsw.gov.au/water/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy/lachlan-regional-water-strategy
244. See Natural Resources Commission, *Review of Water Sharing Plan for the Lachlan Unregulated River Water Sources 2012* and *Water Sharing Plan for the Belubula Regulated River Water Source 2012 Final report*. Available at: nrc.nsw.gov.au/water/wsp-reviews/completed-2023

Implementing the strategy

6

Image courtesy of Destination NSW. Canola fields, Parkes.

Getting our timing right

A critical feature of developing this strategy is deciding which actions and investments are needed now, and which will be needed in the future. With a 20-year timeframe, the strategy aims to time various actions to meet existing challenges, identify and prepare for coming challenges and lay the groundwork for adapting to future uncertainties and changed circumstances.

The strategy has a separate implementation plan[245] that outlines the sub-actions which will be delivered in the first 5 years following publication of the strategy. The implementation plan only focuses on sub-actions that are underway or planned (and funded) for delivery within 5 years by implementation partners in this time period.

If funding is secured for currently nonfunded sub-actions, the implementation plan may be reviewed to accelerate their delivery.

The implementation plan also outlines responsibilities for delivery, so that the department can monitor the progress of the actions, assess the effectiveness of the strategy and identify areas that need adaptation.

The implementation plan identifies the key partners involved in delivering the actions.

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

245. The implementation plan for the Lachlan Regional Water Strategy is PUB24/1007. Available at: dpie.nsw.gov.au/water/our-work/plans-and-strategies/regional-water-strategies/final/lachlan-regional-water-strategy

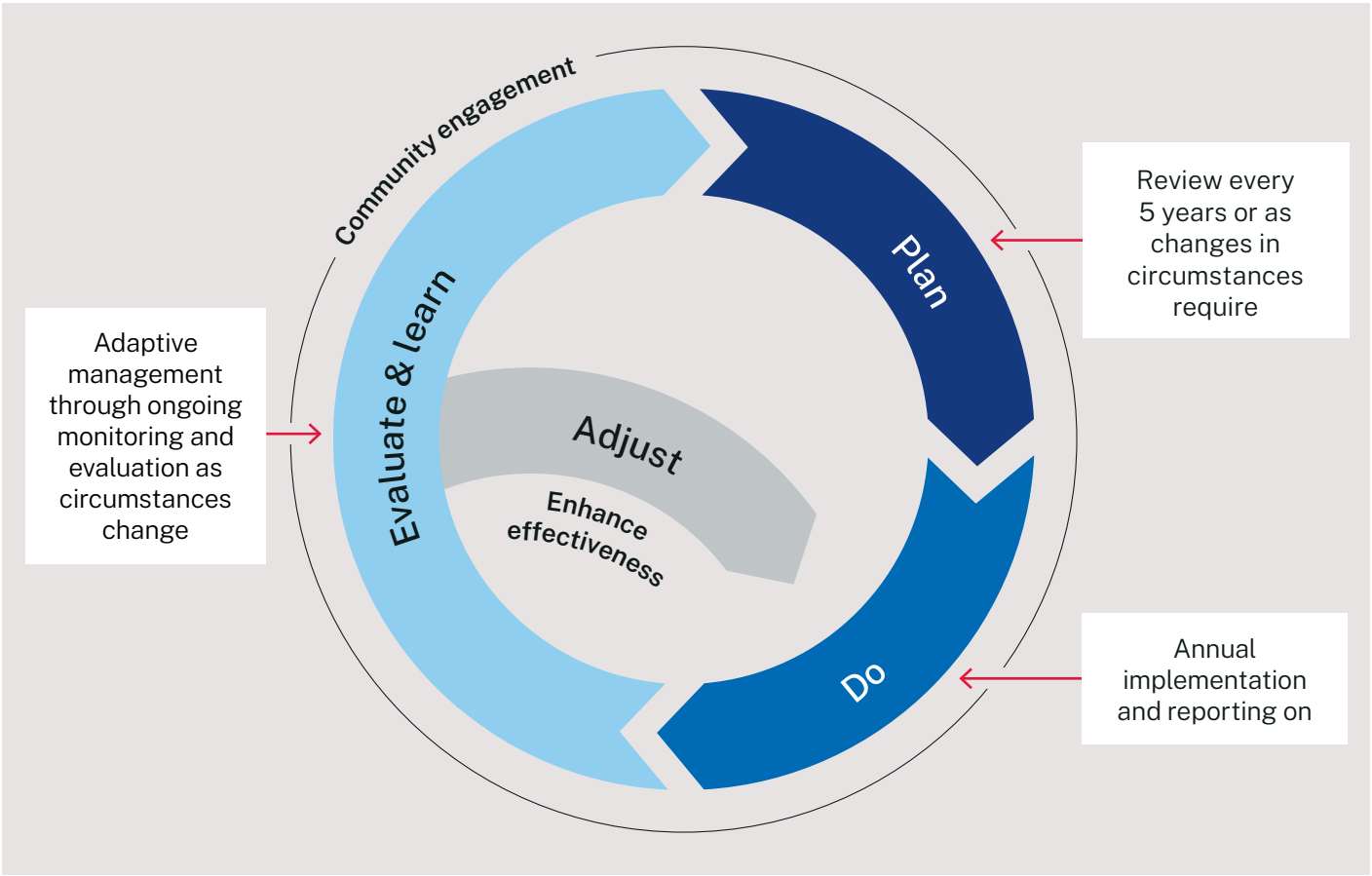
Ongoing monitoring, adaptation and reporting

The strategy is designed to respond to changing circumstances (see Figure 57). Ongoing monitoring and evaluation will be led by the department. Priorities for implementation may shift in response to funding availability, movements in population, climate cycles, economic conditions and other short to medium-term events. The implementation plan will be updated to reflect these changes.

The department will also formally review the strategy as circumstances change. Formal reviews ensure that key assumptions, such as population trends, have not significantly changed.

The strategy may need to be amended in response to major changes that fall outside what the strategy as accounted for, such as assumptions about water demand, social preferences, science and technology, economic conditions or other events, including how climate change assumptions and responses evolve. As a component of monitoring, evaluation and reporting, the department reports annually on water strategy implementation progress. The annual report is a way for the community to track progress and for the department to demonstrate which actions have been delivered, or continue to be delivered, in that year.

Figure 57. Monitoring and adaptive management cycle for the Strategy



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