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Regional Water Strategy

NSW Murray

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Cover image Image courtesy of Destination NSW. Kosciuszko National Park, NSW.

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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 Aboriginal people

The NSW Government acknowledges the Traditional Owners and Custodians of the lands, water, sea and Country. We pay respect to Elders past and present, and future leaders.

We recognise Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to place and their rich contribution to society.

We show our respect through thoughtful and collaborative approaches to our work. We seek to demonstrate our ongoing commitment to providing places where Aboriginal peoples and communities are included socially, culturally and economically to self-determine their own futures.

The NSW Government acknowledges the Bangerang, Barapa Barapa, Barkandji, Bidhawal, Kureinji, Maljangapa, Maraura, Mutthi Mutthi, Ngarigu, Ngiyampaa, Tati Tati, Wadi Wadi, Walgalu, Weki Weki, Wemba Wemba, Wiradjuri and Yorta Yorta people as having an intrinsic connection with the lands and waters of the NSW Murray Regional Water Strategy area. The landscape and its waters provide the Aboriginal people with essential links to their history and help them maintain and practice their traditional culture and lifestyle.

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 Aboriginal 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 Aboriginal people are included socially, culturally and economically.

As we refine and implement the NSW Murray Regional Water Strategy, we commit to helping support the health and wellbeing of waterways and Country by valuing, respecting and being guided by Aboriginal 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 Aboriginal 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 iStock. Murray River, Moama.

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Image courtesy of Destination NSW. Bellbridge, NSW.

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.

The NSW Murray Regional Water Strategy identifies the key water-related regional challenges we need to tackle 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 Vince Bucello, NSW Department of Climate Change, Energy, the Environment and Water. Wetland, 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 how to manage water efficiently and sustainably into the future.

This NSW Murray Regional Water Strategy is one of a suite of catchment-based strategies across the state (Figure 1). The strategies identify critical challenges that we 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 outlines the main challenges that affect the achievement of its objectives. It also identifies priority actions to address these challenges and work toward meeting at least one of the regional water strategy's objectives.

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 the objectives.

1. Available at: water.dcceew.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 NSW *Water Management Act 2000*.

Fitting regional water strategies with other water plans and policies

The NSW Murray Regional Water Strategy is aligned with the broader NSW Water Strategy, ensuring that the regional priorities are integrated into the state's overarching framework for water management (Figure 3). By aligning with the statewide strategies and programs, such as the NSW Aboriginal Water Strategy and the NSW Groundwater Strategy, the NSW Murray Regional Water Strategy underscores its relevance to state-level objectives. This strategic alignment positions the NSW Murray Regional Water Strategy as a critical element within the NSW Government's broader agenda, enhancing its decision-making weight when presented to investment decision makers like the Independent Pricing and Regulatory Tribunal (IPART) and the Australian Government. The NSW Murray Regional Water Strategy's incorporation of region-specific, place-based solutions tailored to local needs, further reinforces its significance, ensuring that it not only meets state-level goals, but also addresses specific regional challenges.

The NSW Water Strategy and the NSW Murray Regional Water Strategy also complement other whole-of-government strategies including government commitments to the *Net Zero Plan*,[3] the *State Infrastructure Strategy*[4] and the following regional plans *Riverina Murray Regional Plan 2041*,[5] draft *Far West Regional Plan 2041*[6] and the draft *South East and Tablelands Regional Plan 204*1.[7]

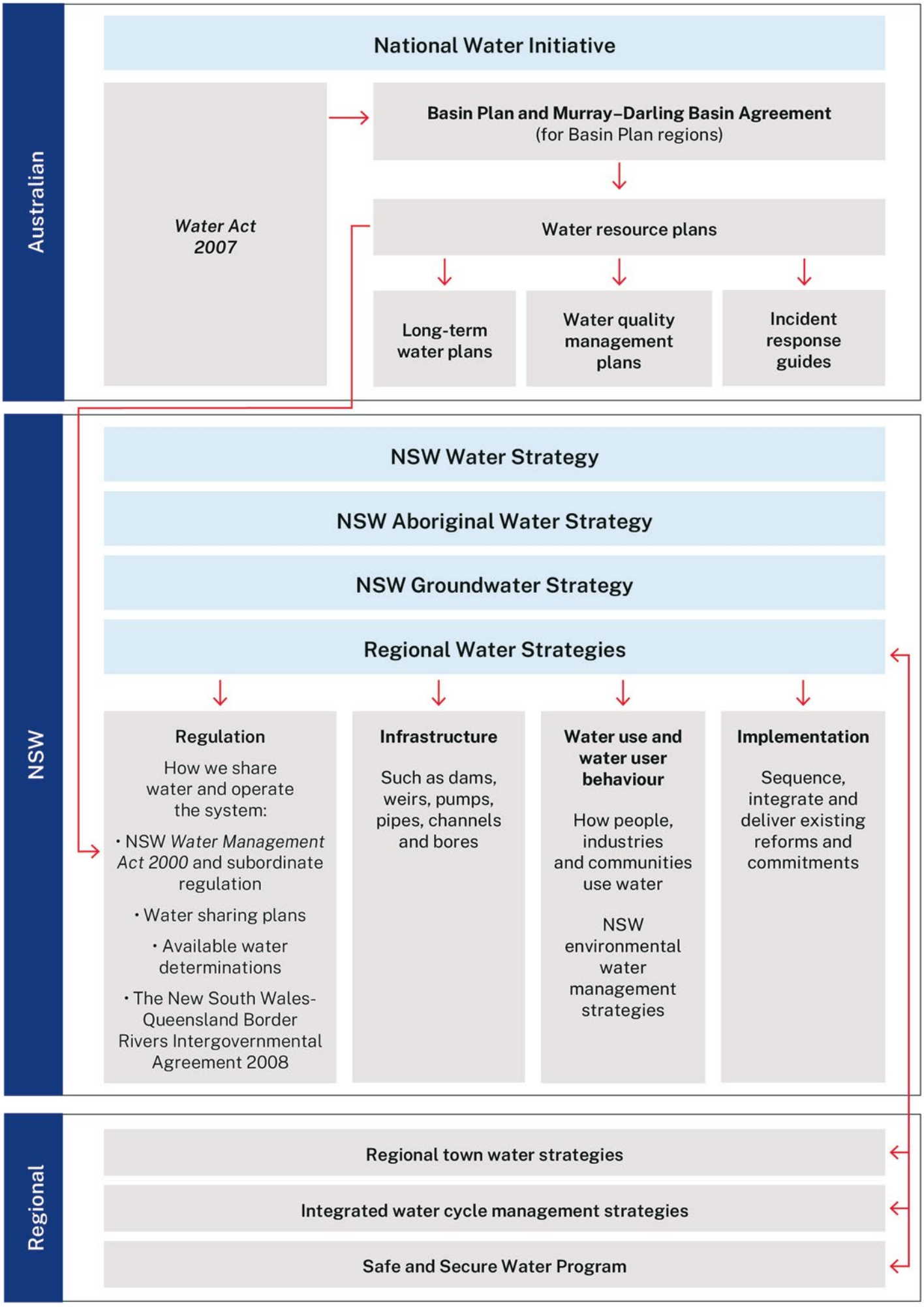
Regional water strategies primarily relate to strategic water resource management. For example, regional water strategies set out actions to:

- reduce water security and drought risks that 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 which may also influence flood behaviour and can be investigated in flood risk management studies in accordance with the Flood Risk Management Manual[8] to inform local or statewide disaster planning
- mitigate the secondary effects of disasters, for example, actions to address fish kills and water quality can also inform state disaster planning.

The integrated approach of the NSW Murray Regional Water Strategy not only highlights the strategy's role in building resilience in regional communities but also strengthens its case for investment by showcasing its alignment with long-term statewide and regional plans. Through this coordinated effort the NSW Murray Regional Water Strategy emphasises its strategic priority for NSW, ensuring it carries significant weight in investment decision making.

3. Available at: dcceew.gov.au/climate-change/emissions-reduction/net-zero
4. Available at: sis2022.infrastructure.nsw.gov.au/
5. Available at: planning.nsw.gov.au/plans-for-your-area/regional-plans/riverina -murray-regional-plan-2041
6. Available at: planning.nsw.gov.au/plans-for-your-area/regional-plans/far-west
7. Available at: planning.nsw.gov.au/plans-for-your-area/regional-plans/south-east-and-tablelands
8. Available at: www.environment.nsw.gov.au/publications/flood-risk-management-manual

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



Alignment with the National Water Initiative

The National Water Initiative,[9] with commitment from all state and territories, provides for the sustainable, equitable and efficient allocation of water. It aims to achieve better economic, cultural, social and environmental outcomes.

Assessments are undertaken every 3 years by the Productivity Commission under the *Water Act 2007* (Cth) to track the progress of all Australian governments in achieving the objectives, outcomes and timelines of the 2004 Intergovernmental Agreement on a National Water Initiative.[10]

The NSW Government is doing significant work with all Australian states and territories to progress renewal and modernisation of the National Water Initiative to account for changes in knowledge and technology, and to:

- better consider climate change and extreme events
- improve Aboriginal people's involvement and influence in water management
- improve the provision of safe and reliable drinking supplies.

This is an important opportunity to ensure that national water reform continues to deliver improvements for our communities, economies and sustainable environments while adapting to meet future water challenges. The NSW Murray Regional Water Strategy aligns with the opportunities identified by the Productivity Commission's 2020 and 2024 assessments – through specific actions relating to climate change, improving Aboriginal people's involvement in water management, and town water quality and security and the work underway by all Australian governments to renew the National Water Initiative.

Alignment with the Basin Plan

The Basin Plan 2012[11] aims to achieve a healthy and sustainable Murray–Darling Basin by managing the Basin as a connected system. The aim of the Basin Plan is to bring the Basin back to a healthier and sustainable level of take, while supporting farming and other industries for the benefit of the Australian community.

The NSW regional water strategies' program aims to enable forward planning for sustainable water management in the NSW Murray region for the benefit of local communities, industry and the environment. Actions realised through the NSW Murray Regional Water Strategy, may result in changes to NSW water sharing plans or water resource plans or be delivered through targeted programs and projects.

Table 1 outlines the alignment of the NSW Murray Regional Water Strategy with the key elements of the Basin Plan. The actions outlined in the NSW Murray Regional Water Strategy align with Basin Plan requirements and ensure that the interests of NSW communities are at the forefront of strategic water planning.

9. Available at: dcceew.gov.au/water/policy/policy/nwi
10. More information about the Intergovernmental Agreement on a National Water Initiative is available at: dcceew.gov.au/water/policy/policy/nwi
11. Available at: www.mdba.gov.au/water-management/basin-plan

Table 1. Alignment of the NSW Murray Regional Water Strategy with the Basin Plan

Basin Plan key elements	Alignment with regional water strategies
Setting limits on how much water can be used through water resource plans and sustainable diversion limits (SDL)	Any actions under the NSW Murray Regional Water Strategy will need to be implemented within the legislative requirements set by the Basin Plan, including the level of take in accordance with the SDL. Actions implemented in the NSW Murray Regional Water Strategy may impact future reviews of NSW water resource plans.
Effective delivery of water through adequate infrastructure	The NSW Murray Regional Water Strategy is not proposing any significant changes to the extensive water infrastructure asset portfolio. However, the NSW Murray Regional Water Strategy outlines continuing NSW support for programs run with partner governments to improve the delivery of water throughout the Murray River system.
Ensuring adequate volumes of water are set aside for the environment and used effectively and efficiently	The NSW Murray Regional Water Strategy does not propose changes to the volumes of water set aside for the environment. However, it does propose investigations into new and upgraded infrastructure (not currently considered by the Sustainable Diversion Limit Adjustment Mechanism (SDLAM)) that efficiently deliver water to significant ecological assets, as well as improvements to funding arrangements for NSW-held environmental water entitlements.
Managing and monitoring water quality in the Basin	The NSW Murray Regional Water Strategy includes actions to improve water quality through support for targeted land and waterway management initiatives, investigations into addressing cold water pollution, and improved input by water utilities in new development approvals that may impact water quality.
Enabling fair and transparent water trading across the Basin	The actions set out in the NSW Murray Regional Water Strategy work within the water trading rules set by the Basin Plan.
Enforcing compliance with the Basin Plan	The actions set out in the NSW Murray Regional Water Strategy comply with the requirements of the Basin Plan. The NSW Murray Regional Water Strategy does not propose any additional compliance measures beyond current arrangements.
Allowing for flexibility and changes through adaptive management	The NSW Murray Regional Water Strategy will be reviewed if circumstances change, that are not accounted for in the strategy. Any review will enable adaptive management to occur and continuous improvement of the long-term strategic management of water in the NSW Murray region.

Basin Plan Review

The Murray–Darling Basin Authority (MDBA) will review the Basin Plan in 2026. This review is a requirement of the Australian Government's *Water Act 2007* and is an opportunity to reflect on how the Basin Plan is working. It also explores responses to impacts of climate change, and ways to support the Basin into the future.

The MDBA has released its Roadmap to the 2026 Basin Plan Review[12] confirming a focus on 4 key themes: climate change, sustainable water limits, Aboriginal people, and regulatory design.

The Basin Plan Evaluation, released in mid-2025, provides a thorough assessment of Basin Plan implementation, its impact and its effectiveness to date. This evaluation will form the basis for the 2026 Basin Plan Review.

The NSW Government is actively engaged with the MDBA and other Basin governments in the review, noting NSW's positions and input is consistent with the strategic direction outlined in the NSW Water Strategy, regional water strategies and other guiding NSW policies.

Alignment with water market reforms in the Murray–Darling Basin

The Australian Competition and Consumer Commission (ACCC) inquiry into the water market recommended that governments with responsibility for managing the Murray–Darling Basin focus on 4 major areas for reforming the water market:

- governance of the Basin water markets
- market integrity and conduct
- trade processing and water market information
- market architecture.

In response, the Australian Government released the Water market reform: final roadmap report (Water market reform roadmap). The Water market reform roadmap includes 23 recommendations to drive water market reform to improve community trust and confidence in the Basin's water markets and to improve compliance in all jurisdictions. All Basin ministers signed a funding agreement to progress the implementation of priority recommendations of the Water market reform roadmap to 30 June 2024.[13]

The work to address the Water market reform roadmap recommendations remains a priority for the NSW Government and is ongoing (subject to Australian Government funding).

Actions in the NSW Murray Regional Water Strategy will align with or complement new water market and trade reforms, as necessary.

Alignment with statewide disaster and extreme event planning

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

- reduce water security and drought risks, which can also be inputs to local and statewide disaster planning
- mitigate flooding through natural or hard infrastructure, for example actions in regional water strategies relating to catchment revegetation or potential alterations to dams may also influence flood behaviour and can be investigated in flood risk management studies in accordance with the Flood Risk Management Manual (2023), which can then inform local or statewide disaster planning
- mitigate the secondary effects of disasters – for example, actions in regional water strategies to address fish kills and water quality, can also inform state disaster planning.

Local and statewide disaster and extreme event planning will be covered in the State Disaster Mitigation Plan and local disaster adaptation plans currently under development by the NSW Reconstruction Authority.[14]

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

The authority is currently also leading the review and updating of the NSW Recovery Plan it was last updated in late 2021.

The new NSW Recovery Plan will be a practical, action-oriented document, supported by a robust training program and will outline the responsibilities, authorities and mechanisms for disaster recovery in NSW.

12. Available at: mdba.gov.au/publications-and-data/publications/roadmap-2026-basin-plan-review
13. See dcceew.gov.au/water/policy/markets for updates on progress implementing the recommendations from the Roadmap.
14. Statewide disaster planning is primarily the responsibility of the NSW Reconstruction Authority, which was established in response to the 2022 Flood Inquiry. This is currently in development and will take a prevent, prepare, respond and recover approach. Further information is available at: nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority

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.

The NSW 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 councils' flood risk management activities. Responsibilities are also outlined in the Flood Risk Management Guideline: Administration arrangements[15] that accompanies the Flood Risk Management Manual.

Further improvements to flood risk mitigation have been considered through the 2022 NSW Flood Inquiry and the NSW Government's response to the inquiry.[16]

Flooding and flood risk management are discussed in Challenge 4: Supporting existing and emerging industries and livelihoods.

Regional water strategy modelling and flood analysis

Regional water strategies are underpinned by climate data and modelling that improves our understanding of past climate conditions and plausible climate futures, providing a more accurate picture of extreme climate events.

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

The regional water strategies have deliberately modelled a dry climate change scenario to stress-test he system. Using this together with the paleoclimate informed dataset, which represents climate without human induced climate change, allows us to test the resilience of adaptation options to a wide range of drying conditions. There is still a chance that we could see climate change outcomes outside of the range we have tested, including a wetter scenario. If this eventuates it would be a trigger to review the regional water strategies.

Understanding flooding involves different hydrological approaches that consider short-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. Regional water strategy modelling data operates on longer timescales, so it is not appropriate for short-term, event-scale flood analyses.

15. Available at: www.environment.nsw.gov.au/publications/administration-arrangements
16. More information about the 2022 NSW Flood Inquiry and the NSW Government's response to the inquiry is available at: nsw.gov.au/nsw-government/projects-and-initiatives/floodinquiry

Alignment with the NSW Water Quality Governance Roadmap

The NSW Government has an objective to improve river, floodplain and aquifer ecosystem health and system connectivity, which is reflected in the NSW Water Strategy 2021. Good governance that is enduring, statewide and focused on water quality outcomes is needed to help achieve this objective. The NSW Water Quality Governance Roadmap (June 2024) outlines how the NSW Government is, and will continue to, delivering improvements to water quality governance to achieve strategic and coordinated monitoring and management of water quality.

The NSW Water Quality Governance Roadmap identifies a suite of initiatives to support continual improvement and broader reforms to water quality governance. It recognises the challenges of shared management of water quality across NSW and presents the pathway for better integrating the management of land, water and other natural resources in NSW to improve water quality management.

The NSW Water Quality Governance Roadmap also outlines the pathway for data management improvements to increase transparency and visibility, and for more coordinated monitoring efforts of water quality to ensure appropriate and timely management decisions. It promotes improved application of the National Water Quality Management Strategy, ensuring greater alignment with local community values and goals and accountability in delivering of outcomes.

The NSW Government is progressing 2 key pathways for improving water quality outcomes across NSW:

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

The NSW Murray Regional Water Strategy aligns with the NSW Water Quality Governance Roadmap through adopting a catchment management approach to improving water quality and better integrating strategic land use and water planning.

Alignment with strategic planning by local water utilities

Regional water strategies are region- or catchment-wide strategic plans. They set regional strategic directions to achieve water security across multiple local council areas and the entire catchment. Strategic planning by local water utilities identifies the local risks to water services and actions to address those risks.

The modelling undertaken through development of the NSW Murray Regional Water Strategy does not replace any analysis undertaken as part of local councils' existing strategic planning.

Through the Safe and Secure Water Program, the NSW Government is co-funding:

- development of local water utility strategic planning across the state, recognising the importance of strategic planning to find solutions to address risks and provide services at adequate standards
- investment in infrastructure to address high priority water security risks for local water utilities
- joint organisation-led regional water supply strategies to help councils identify, analyse and plan regional town water supply solutions.

Since 1 July 2022, a new regulatory and assurance framework[17] has applied to local water utilities in regional NSW. It covers local government councils exercising water supply functions under Division 2 of Part 3 (Chapter 6) of the *Local Government Act 1993*, and utilities exercising water supply functions under the NSW *Water Management Act 2000*. The Regulatory and Assurance Framework is designed to ensure local water utilities manage risks effectively and strategically. Participation by local water utilities is voluntary.

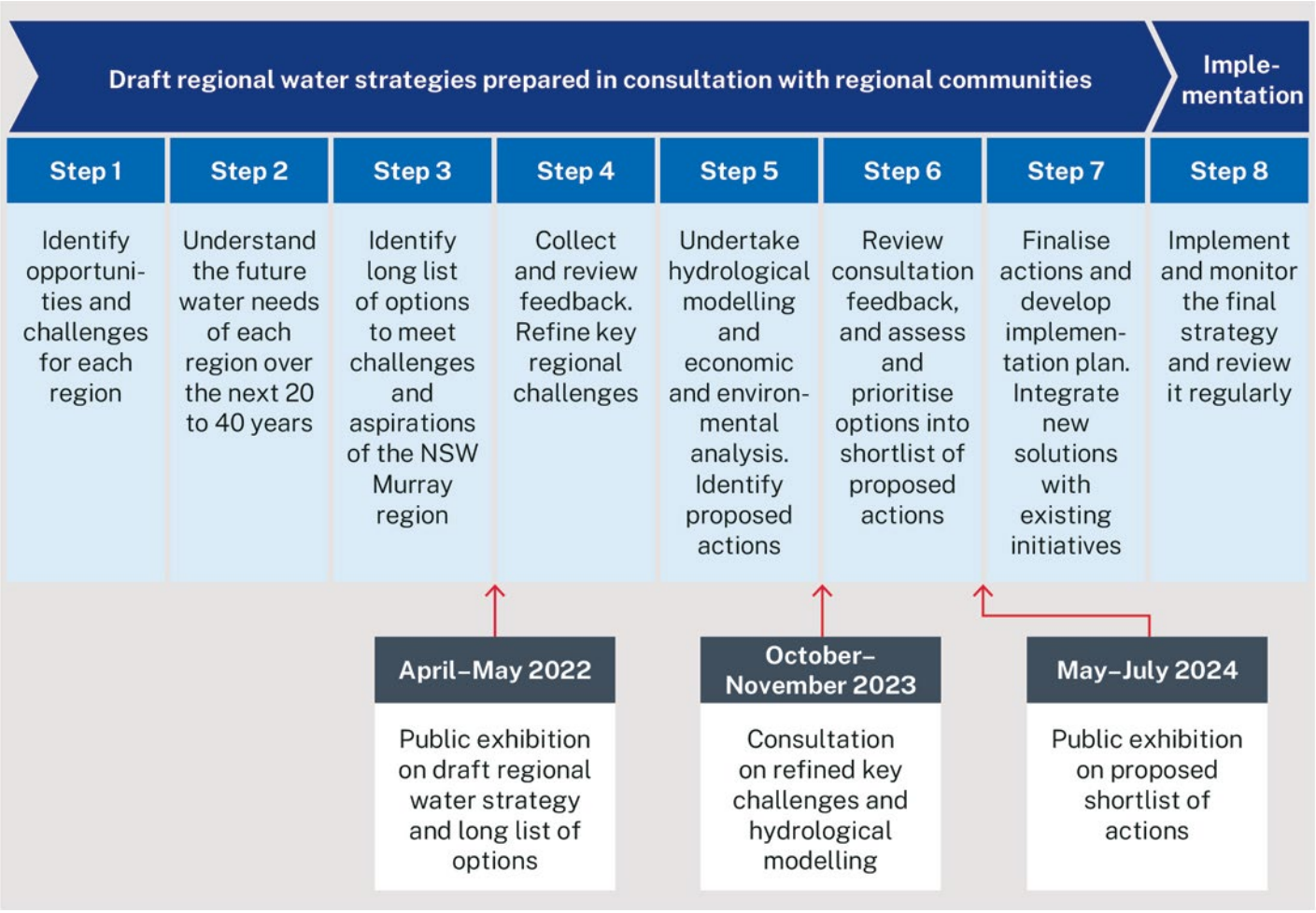
In 2021, the NSW Department of Climate Change, Energy, the Environment and Water committed to ensuring that local water utilities progressing an integrated water cycle management (IWCM) strategy would not be disadvantaged by the new strategic planning framework. The department continues to engage with all local water utilities that are developing an integrated water cycle management strategy, including those funded under the Safe and Secure Water Program.

17. water.dcceew.nsw.gov.au/our-work/local-water-utilities/regulatory-and-assurance-framework

Development of the NSW Murray Regional Water Strategy

The NSW Murray 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 8-step approach was used to prepare the NSW Murray Regional Water Strategy as shown in Figure 4.

Figure 4. Process for developing regional water strategies



What informed the NSW Murray Regional Water Strategy

We have used feedback from the community and the most recent data taken from a wide range of sources to inform the NSW Murray Regional Water 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[18] 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 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 the NSW Murray Regional Water 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.[19]

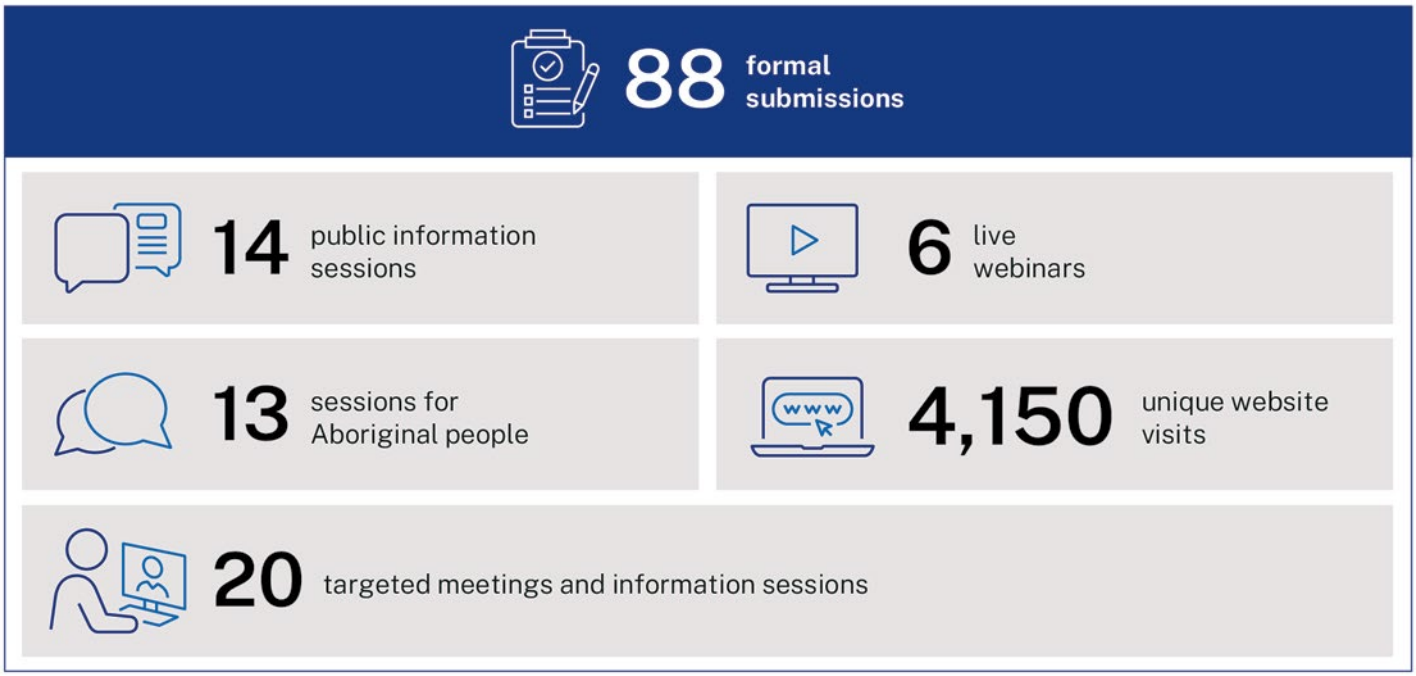
The Climate snapshot section (page 34) summarises the results from the analysis of new climate data for the NSW Murray region. The best and latest evidence about the future climate will continue to be used to help develop solutions for water challenges in the region.

Extensive community consultation

The NSW Murray Regional Water Strategy was developed over several years in consultation with water users and environmental groups, local government representatives and government agencies, Aboriginal groups and the broader community. This approach allowed the department to share information and gather feedback as it identifies priorities and action areas.

The department is committed to effective and genuine engagement with stakeholders and the broader community. We recognise that engaging with stakeholders and the community leads to better public policy outcomes, improved service delivery and enhanced customer satisfaction. We would like to acknowledge and thank all these groups and individuals for the time and effort they have given providing input into the NSW Murray Regional Water Strategy. Feedback was sought on the draft strategy through 3 public exhibition periods (2022, 2023 and 2024) and a range of targeted engagement sessions (Figure 5).

Figure 5. Stakeholder engagement that informed the strategy



18. 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-murrumbidgee
19. 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: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program

Community feedback was critical in shaping the final strategy and implementation plan.[20] Key insights from the 2024 public exhibition period are shown in Table 2.

Table 2. Summary of community feedback received during consultation on the draft strategy

Feedback theme	Feedback summary
Priority 1: Continue to improve water management	There were strong concerns about the proposed investigation into conversion of general security licences to high security licences, specifically about the impact to market values and general security entitlement reliability, as well as access to and pressure on conveyance licences during dry years. There was also a desire to understand the decision-making process for the proposed licence conversion. Collaboration and sharing information about groundwater was encouraged, and there was a desire for improved knowledge and greater accountability to better understand and protect groundwater sources. Flooding was also raised as an issue during the consultation process, with concerns about the impact of flooding on farming operations, transport and tourism, and a desire to understand how flood mitigation is addressed in the NSW Murray Regional Water Strategy.
Priority 2: Improve river and catchment health	Understanding how the NSW Murray Regional Water Strategy will ensure the maintenance and improvement of flows to support riverine and floodplain ecosystem health was considered important, as was monitoring water quality to understand the implications for overall river health. There was concern about the impact of carp on river health, including river habitat, native fish species and water quality. The impact of cattle and grazing on waterways was also highlighted. There was concern about declining populations of water rats and platypus and a desire to rehabilitate river red gums and protect yabbies and birdlife. Improving groundwater data collection was considered important, as was effectively engaging with Aboriginal people on groundwater management. The need for further information about how cultural water can be accessed and used by Aboriginal people was also highlighted by stakeholders.
Priority 3: Support sustainable economies and communities	There was concern about the impacts of population growth and climate change on town water security. It was suggested that in addition to encouraging water recycling for industry, a pilot program should be delivered to educate and encourage implementation of purified water recycling for towns, particularly those experiencing large population increases. There were mixed views about water infrastructure, with some stakeholders supportive of increasing water storage, while others were in support of improved demand management to manage delivery constraints, instead of additional infrastructure. It was recommended that the needs of the energy sector are better represented in the strategy to provide a more balanced perspective on issues where there are competing needs. There was also a recommendation that the implementation plan considers the impact on the economy of declining tourism due to water shortages.

20. Information on community feedback that informed this strategy is available at: www.water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program/nsw-murray-regional-water-0

Economic, environmental and hydrological analyses

Robust assessments have been used to select the actions in the NSW Murray Regional Water 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 water requirements, based on hydrologic modelling
- qualitative assessments based on feedback from scientific experts, industry representatives, 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 have been made. Significant changes to the critical assumptions used in the NSW Murray Regional Water 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 the major dams and regulated rivers. Considering interconnection with groundwater or towns reliant on groundwater was not possible with the current configuration of the models.
- **population changes** have been included in accordance with the medium population growth forecasts in the NSW Common Planning Assumptions.[21] High population growth forecasts were also used as a sensitivity analysis or 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 or location of the crops produced, or the industry mix in the NSW Murray region will change the amount of water used and may require a review of the NSW Murray Regional Water Strategy. Climate variability outside the bounds of the datasets used to inform this strategy may also trigger its review.

Existing studies

A significant amount of work has been undertaken to understand the risks affecting water resource management in regional NSW.[22] In the NSW Murray region, this work includes catchment studies, water security reports and existing water allocation and drought planning as well as regional development, infrastructure and environmental studies prepared by NSW Government departments and agencies. The following studies were critical for informing this strategy:

- WaterNSW's 20-Year Infrastructure Options Study-Rural Valleys
- the Independent Assessment of Social and Economic Conditions in the Murray–Darling Basin, commissioned by the Australian Government[23]
- the Murray–Darling Long-Term Water Plan[24]
- the Australian Competition and Consumer Commission's inquiry into markets for tradeable water rights in the Murray–Darling Basin.[25]

The NSW Murray Regional Water Strategy has also been guided by NSW's commitments under the Murray–Darling Basin Authority's Basin Plan[26] (the Basin Plan), interjurisdictional agreements under the *Snowy Water Inquiry Outcomes Implementation Deed* (SWIOID) 2002 and the Snowy Water Licence due for review in 2027.

21. Available at: www.treasury.nsw.gov.au/information-public-entities/nsw-common-planning-assumptions
22. More information is in the Regional Water Strategies Guide available at: www.water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program
23. Available at: mdba.gov.au/publications-and-data/publications/independent-assessment-social-and-economic-conditions-basin
24. Available at: environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/murrumbidgee
25. Available at: accc.gov.au/about-us/publications/murray-darling-basin-water-markets-inquiry-final-report
26. Available at: mdba.gov.au/water-management/basin-plan

Building on existing commitments and reforms

The NSW Government is preparing regions for the future. Some statewide 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.[27]

In 2020, the department started to implement all environmental water reforms from the Australian Government Water Reform Taskforce, which was set up following the Independent *Investigation into NSW Management and Compliance Report*.[28] Regional water strategies improve water security and reliability in our regions by building on existing actions being taken by governments.

Image courtesy of iStock. Murray River, NSW.

27. 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.
28. Available at: publications.water.nsw.gov.au/watergroupjspui/bitstream/100/570/1/Independent_investigation_into_NSW_water_management_and_compliance_-_Interim_Report.pdf

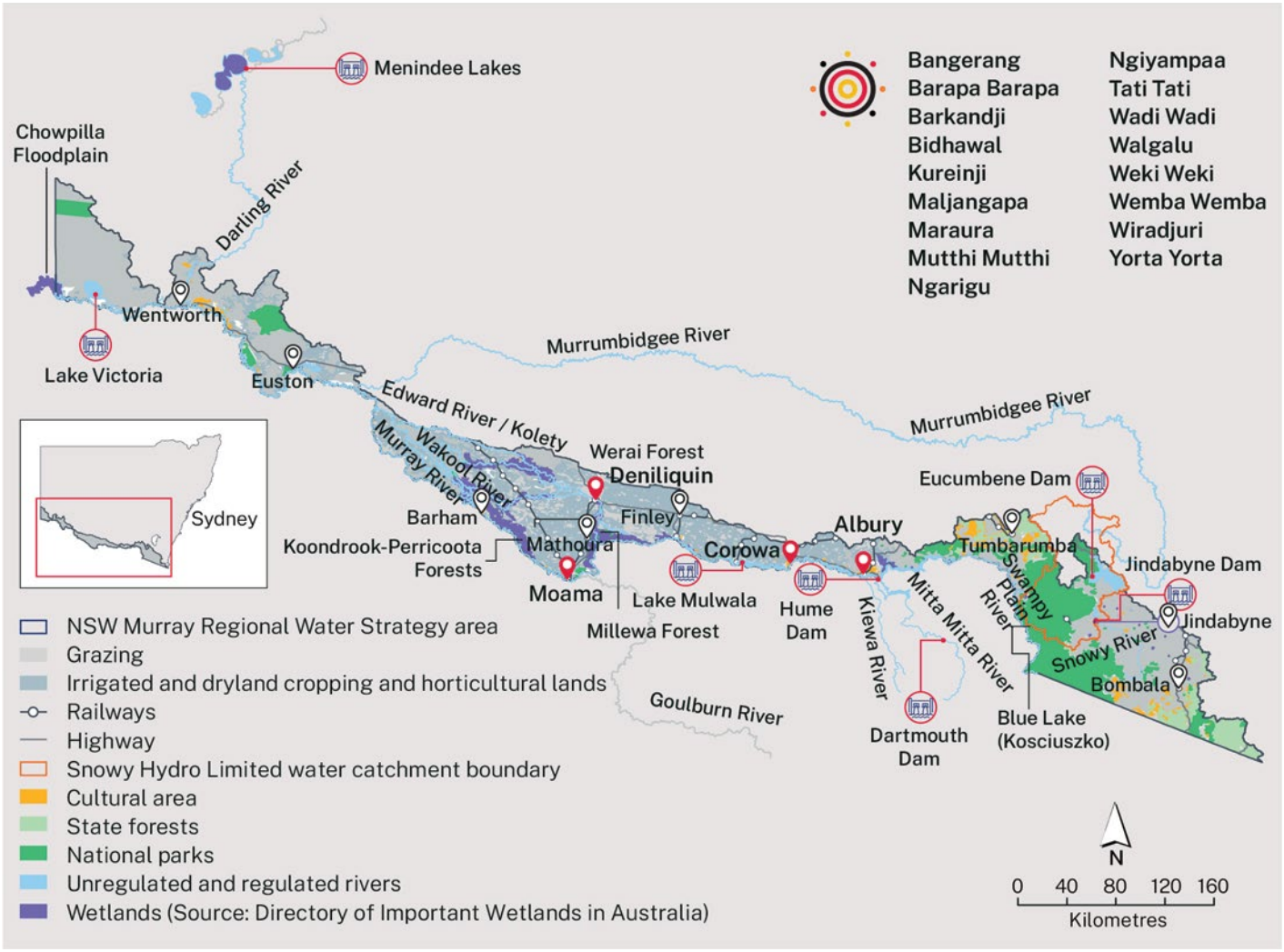
The NSW Murray region

2

Image courtesy of Destination NSW. Junction of the Darling River and the Murray River at Wentworth, NSW.

Figure 6. Snapshot of the NSW Murray region

Figure 7. Map of the NSW Murray region



The NSW Murray Regional Water Strategy region (Figure 7) lies in southern NSW and includes varying natural landscapes that change from mountainous terrain in the east to flat alluvial plains in the west. The region is home to many thriving regional centres and communities, productive agricultural industries and nationally important wetlands, including 2 that are Ramsar listed.

The region is located within the traditional lands of the Bangerang, Barapa Barapa, Barkandji, Bidhawal, Kureinji, Maljangapa, Maraura, Mutthi Mutthi, Ngarigu, Ngiyampaa, Tati Tati, Wadi Wadi, Walgalu, Weki Weki, Wemba Wemba, Wiradjuri and Yorta Yorta nations. These nations have been custodians of the NSW Murray region for over 60,000 years.

The NSW Murray region is part of the broader southern connected Murray–Darling Basin (MDB), with water systems intricately linked to the Murray, Darling, and Murrumbidgee rivers. Importantly, the strategy also covers areas to the east of the Murray River that drain into the Snowy River system, which are hydrologically connected to the MDB through the Snowy Mountains Hydro-electric Scheme (the Snowy Scheme). These eastern catchments play a vital role in regional water management and planning, with water transfers governed by the Snowy Water Licence contributing to flows within the MDB system. The region also includes coastal draining parts of South NSW.

Environmental significance of the NSW Murray region

Water is a significant feature of the NSW Murray region's landscape and environment. Environmental assets play a crucial role in the region's liveability and provide recreational and tourism opportunities.

The Snowy and Murray river systems, floodplains, swamps, aquifers, glacial lakes and wetlands provide habitat for many aquatic species, including birds and native fish. The NSW Murray is home to 2 nationally important wetlands and the region's waterways support several threatened or endangered species including the Murray cod, Macquarie perch, Southern bell frog and Corroboree frog. In addition to the waterways, the alluvial sediments of the Murray River also play an important role in supporting groundwater-dependent ecosystems.

Economic significance of the NSW Murray region

The NSW Murray region has a diverse economy, reflecting its varied landscape and climate. The region is acknowledged as one of Australia's premium agricultural areas. The wider Riverina–Murray area is renowned as Australia's 'food bowl' and makes the largest regional contribution to agricultural production in NSW.

In 2016, over 65,000 people were employed across the NSW Murray region. Economic output for the NSW Murray region was over $9.6 billion in 2018/19 and accounted for 1.7% of NSW's economic output (measured by gross value added). Agriculture is a key contributor to economic output across the NSW Murray region.

The estimated total regional exports for the NSW Murray region was over $8.7 billion in 2016, of which manufacturing (including value-added food or fibre processing) accounted for approximately 34%. Agriculture, forestry and fisheries accounted for approximately 23%.

The primary employment sector in the NSW Murray region is health care and social assistance, followed by agriculture and manufacturing. Tourism is also a major employing sector, with over 6,600 workers worked across the accommodation and food services and retail trade sectors. The tourism sector is the largest employer in the eastern Murray local government areas, employing 17% of the region's workforce. In both the central and western Murray areas, tourism employs 8% of the region's workforce.

Water is a critical enabler of many businesses in the region, especially agriculture and hydroelectricity. The region's water resources also support indirect water users, including the tourism and manufacturing.

Water use in the region

Water management in the NSW Murray region is highly complex. Interstate agreements and rules govern how water in the Murray River catchment is shared between NSW, VIC and SA, including water released from the Snowy Scheme. Within the NSW Murray region water is managed and shared under the NSW *Water Management Act 2000* with specific rules for water sharing set out in surface water and groundwater sharing plans.

The NSW *Water Management Act 2000* NO 92 sets out how water sharing is prioritised during normal operations (unless changed within a water sharing plan). The highest priority is reserved for the environment, followed by basic landholder rights. During extreme events such as prolonged drought or severe water shortages, the priorities change Figure 8.

Figure 8. Priorities for water sharing

Priority	Extreme events	Normal circumstances
Highest	• Critical human water needs	• Needs of the environment
High	• Needs of the environment	• Basic landholder rights
	• Stock • High security licences • Commercial and industrial activities authorised by local water utility • Water for electricity generation on a major utility licence • Conveyance in supplying water for any priority 3 take	• Local water utility access licences • Major utility access licences • Stock and domestic access licences
	• General security licences	• Regulated river (high security) access licences
Low	• Supplementary licences	• All other forms of access licences • Supplementary access licences

Source: s 60(3A) NSW *Water Management Act 2000* and NSW Murray and Lower Darling Surface Water Resource Plan: Schedule G – Incident Response Guide.

Surface water

The NSW Murray region is part of the complex and connected Southern Murray–Darling Basin. The system receives inflows from major tributaries in VIC, in addition to inflows from the adjacent valleys of the Murrumbidgee and Baaka-Darling rivers. Its water resources are shared between NSW, VIC and SA (Figure 9).

At around 2,530 km long, the Murray River is the second longest river system in the Basin and Australia's longest standalone river. The NSW portion of the Murray River is around 1,600 km long and is a highly regulated system with over 80% regulated by Hume Dam and a number of large weirs downstream (Table 3). The volume and pattern of flows in the NSW Murray River has been significantly altered by:

- the construction of 3 major storages in the valley, Hume Dam in NSW, Dartmouth and Eildon Dam in VIC
- the construction of major weirs and regulators along the river and its anabranches, downstream of Hume Dam
- inter-valley diversions from the Snowy Mountains Scheme
- diversions to, and drainage from, major irrigation systems.

In the Upper Murray, inflows are significantly influenced by inter-valley diversions within the Snowy Mountains Scheme from the Tooma, Snowy and Eucumbene rivers, increasing net flows to the Upper Murray River by an average of 580 GL per year. The Upper Murray drops around 1,000 m over its 250 km length upstream of Hume Dam.

The Mitta Mitta River is regulated by the Dartmouth Dam within VIC, before joining the Upper Murray just upstream of Hume Dam. All of these flows are considered part of the shared resource between NSW and VIC.

Between Hume Dam and Yarrawong Weir, the unregulated Ovens and Kiewa rivers from VIC contribute significant natural winter flows to the Murray River. Water coming into the Murray River from the Ovens River belongs to VIC. Outflows from the Kiewa River are considered part of the shared resource between NSW and VIC.

In the middle Murray, the majority of large tributaries are from VIC, including Broken Creek, the Goulburn, Campaspe and Loddon rivers. The flows entering the Murray River from these tributaries belong to VIC.

Downstream of Tocumwal, the regulated river system includes a complex network of anabranches and creeks, the main ones being the Edward/Kolety–Wakool River, the Yallakool Creek and Niemur River. The Murrumbidgee joins the Murray River near Boundary Bend. The Murrumbidgee contributes an average annual inflow of around 937 GL per year and outflows from this river belong to NSW.

Note that the Menindee Lakes and the Lower Darling–Baaka River are not part of this NSW Murray Regional Water Strategy area, and are instead included in the Western Regional Water Strategy.

Figure 9. Schematic of the southern connected basin

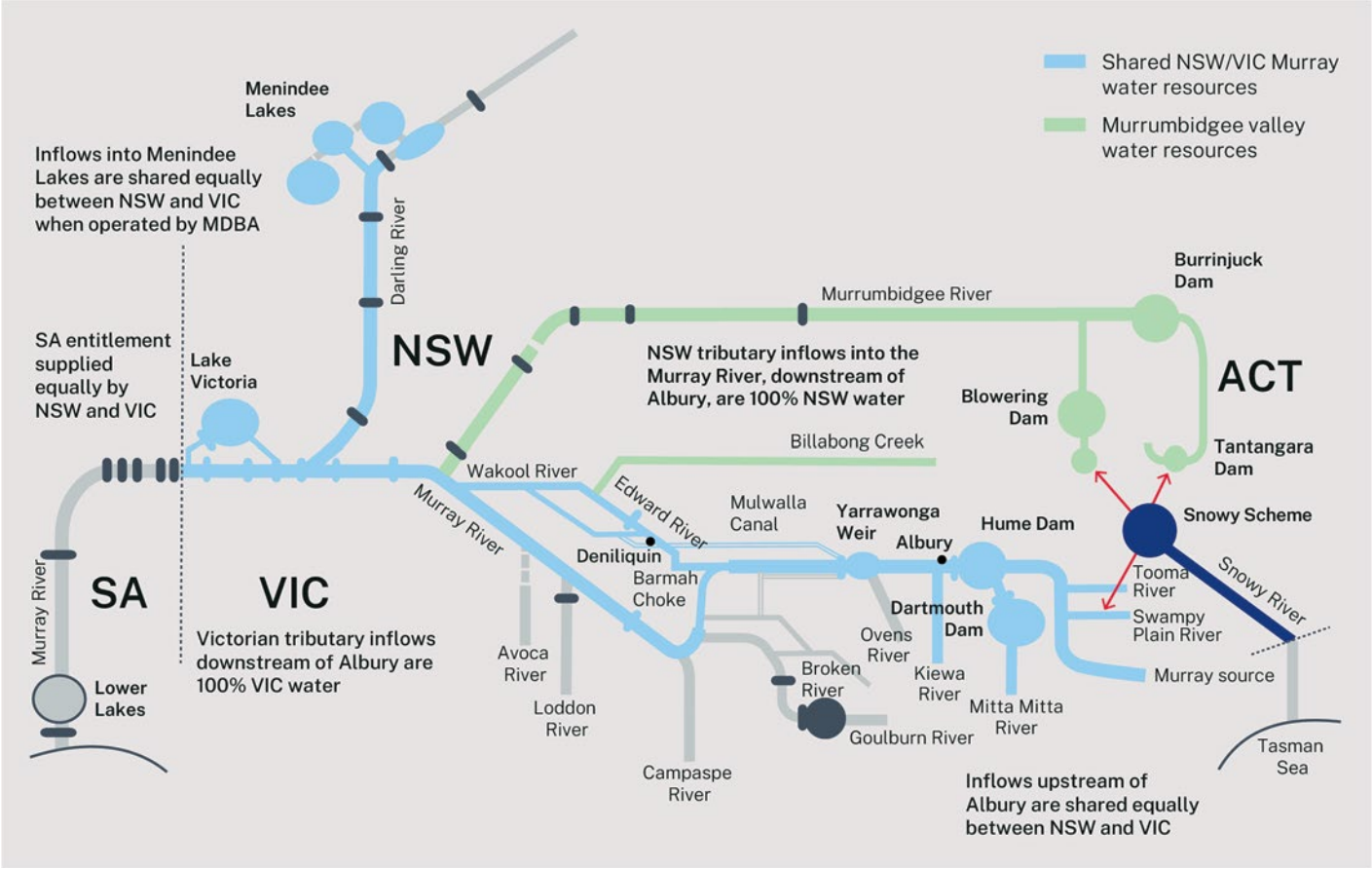


Table 3. Major storages of the shared Murray River system

Storage	Volume at full supply level (ML)	Main use purposes
Dartmouth Dam	3,856,000	Irrigation, environment, hydropower, town water supply, domestic and stock use and recreation.
Hume Dam	3,005,156	Irrigation, environment, hydropower, town water supply, domestic and stock use and recreation.
Lake Mulwala	118,000	Irrigation, environment, hydropower, town water supply, flow regulation, domestic and stock use and recreation.
Menindee Lakes	1,731,000	Irrigation, environment, town water supply, flow regulation, domestic and stock use and recreation.
Lake Victoria	680,000	Off-river storage to ensure SA receives its full water share as defined in the Murray–Darling Basin agreement.

Regulated river entitlements

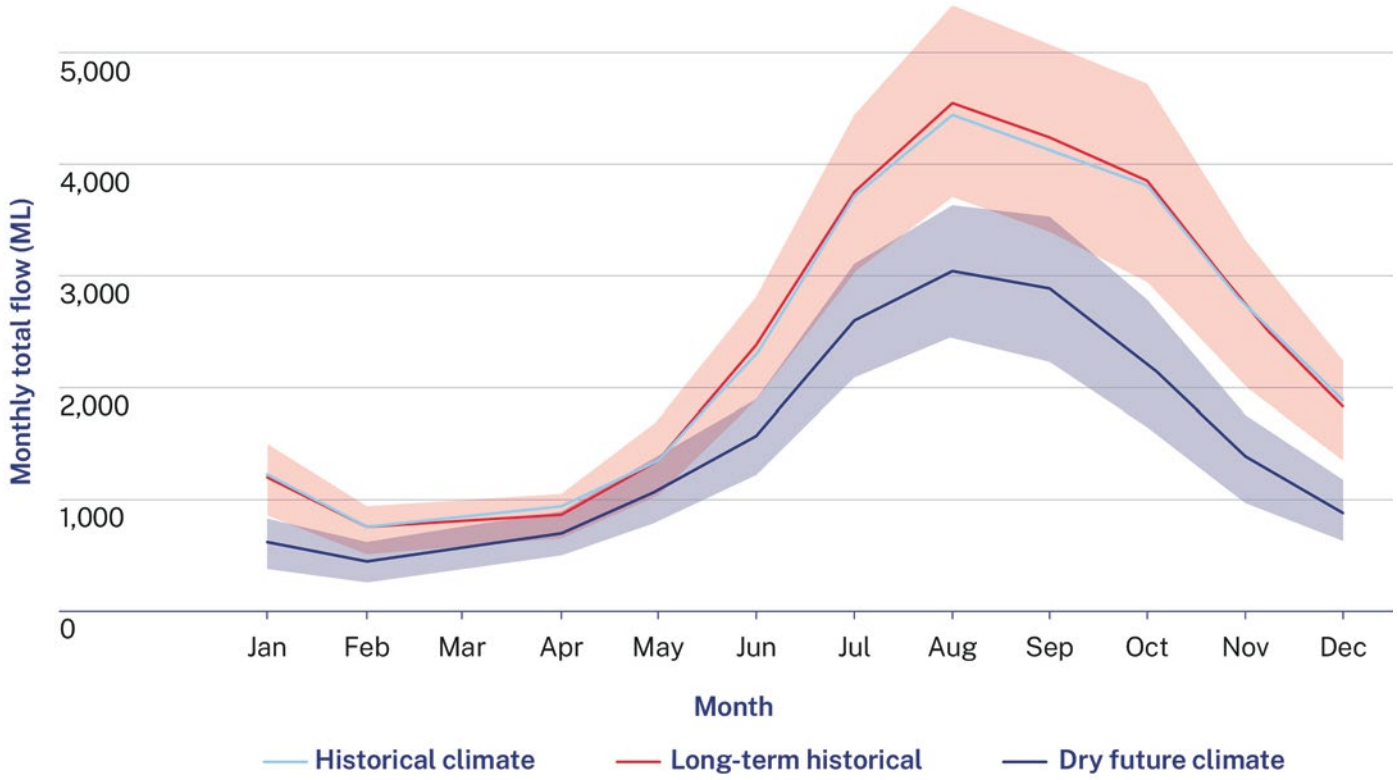
The majority of NSW Murray River irrigators hold NSW general security entitlements. Due to the highly variable climate, the amount of water allocated each year to NSW general security entitlements vary widely. There have been consecutive years (2006/07 and 2007/08 i.e. Millennium Drought years) of low allocations, and water use restrictions have applied in several years. This is why many agricultural producers hold a diversified portfolio of water entitlements and apply a conservative approach to mitigate their water supply risks.

Unregulated rivers and creeks

The Upper Murray catchment is located in southern NSW along the NSW–VIC border. It borders the upper reaches of the Murrumbidgee catchment to the north. It contains the headwaters and unregulated rivers that flow into Hume Dam, the main storage on the Murray River.

A series of unregulated rivers and creeks run throughout the NSW Murray region, particularly in the elevated areas east of Albury, including Tumbarumba and Mannus creeks and Bombala and Delegate rivers. Like the regulated rivers, unregulated watercourses in the NSW Murray region have also experienced a decline in flow, which is reflective of the drying pattern observed across the region. Under a dry future climate scenario, seasonal flows may decline further, as shown for Tumbarumba Creek in Figure 10. Factors such as the seasonality of rainfall, land-use changes and bushfires also impact the amount of run-off and streamflow.

Figure 10. Impact of climate scenario on seasonal flows in Tumbarumba Creek at Tumbarumba



Many smaller towns such as Tumbarumba, Bombala, Nimmitabel, Delegate and the alpine resorts generally rely on water from unregulated surface water supply, and some towns have a backup groundwater supply.

Most of these rivers are perennial or near perennial, but sometimes there is insufficient surface flow to provide a reliable supply.

Table 4 summarises surface water licences from regulated and unregulated water sources in the NSW Murray region.

Table 4. Surface water licences in the NSW Murray region

	Regulated water sources	Unregulated water sources
Entitlement	**Proportion of shares compared to total share pool (%)**	
Basic landholder rights	<1	1.2
Domestic and stock	<1	1.3
Local water utility	1.6	-
High security	7.5	-
General security	66.8	-
Supplementary	10.0	-
Regulated river Conveyance	13.1	-
Unregulated	-	97.6

Environmental water

In the NSW Murray region, planned environmental water is water committed for ecosystem health or other environmental purposes through provisions in water sharing plans. This water exists in the form of environmental water allowances that are adaptively managed by water managers – for example the Barmah–Millewa Environmental Water Allowance or the River Murray Increased Flows.

The NSW and Commonwealth environmental water holders own and manage a total of approximately 660,000 unit shares of held environmental water entitlement in the (NSW) Murray Water Source, which is 26% of the total for that water source. This environmental water is held in the following categories:

- 485,000 general security shares
- 100,000 supplementary shares
- 50,000 conveyance shares
- 25,000 high security shares.

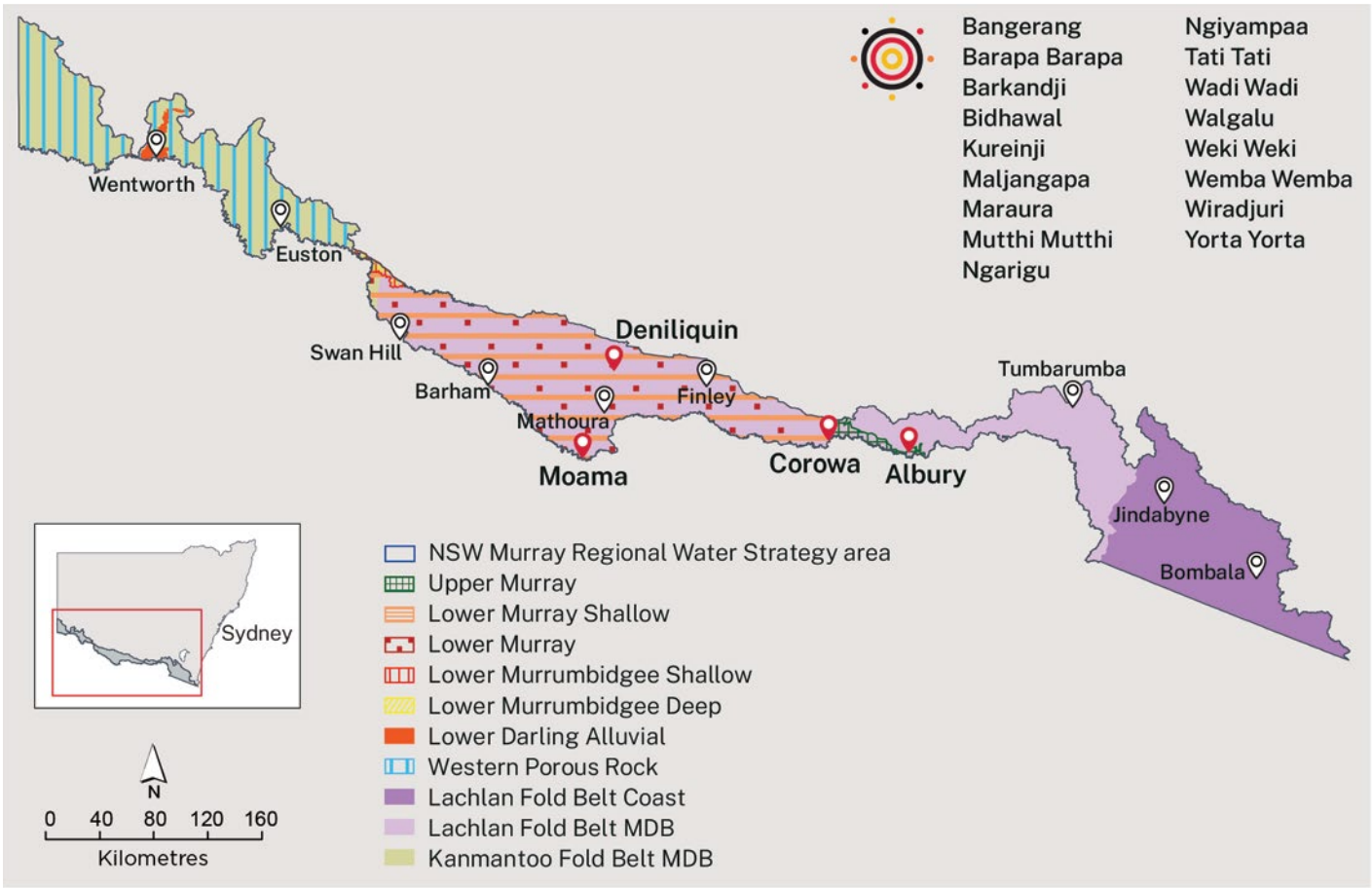
Like any other licence holder, the amount of water licensed for the environment and the environmental water allowance that is available for use varies year to year, depending on water allocations and how much water has been carried over. This variability is considered part of the annual planning process by environmental water managers. However, it can mean that during dry periods less water may be available to release for the environment.

Groundwater

Groundwater is used in the NSW Murray region for irrigation, industry, town water supply and stock and domestic use (Table 5). Groundwater availability and quality varies across the region according to the geology and location (Figure 11). Reliance on groundwater increases in dry years when surface water availability is limited. The region's main groundwater sources include:

- Billabong Creek Alluvial Groundwater Source, which supplies town water and irrigation bores, serving towns such as Walbundrie, Walla Walla, Culcairn, and Holbrook
- Upper Murray Groundwater Source, which serves as the primary source for stock and domestic water supply in the area and supplies water to Balldale
- Lower Murray Groundwater Source
- Lower Murray Shallow Groundwater Source – from which most extraction occurs in the Berriquin Irrigation District, between Deniliquin and Finley, where water quality is suitable for irrigation. It also contributes baseflows to the Wakool River and other streams west of Deniliquin.

Figure 11. NSW Murray groundwater sources



Note: The Billabong Creek Alluvial Groundwater Source is located in the Murrumbidgee region but is managed under the *Water Sharing Plan for the Murray Alluvial Groundwater Sources*.

The following table provides a summary of groundwater licences in the NSW Murray region.

Table 5. Groundwater licences in the NSW Murray region

Groundwater sources				
Entitlement	**Proportion of shares compared to total pool (%)**			
	Billabong Creek Alluvial	**Lower Murray**	**Lower Murray Shallow**	**Upper Murray**
Basic landholder rights	8.5	5.7	1.3	<1.0
Local water utility	19.8	<1.0	0.0	<1.0
Aquifer access licences	51.6	94.2	73.3	98.9
Salinity and water table management access licences	20.1	0.0	25.4	0.0

Note: Shares apply to domestic and stock entitlements, as well as aquifer access licence entitlements. Basic landholder rights and local water utility entitlements are measured in megalitres. For this comparison, data is presented in portions of shares.

Town water supplies

Town water supplies in the NSW Murray region are generally managed by local governments. Several local water utilities provide water supply in the region. Most utilities receive bulk water from the Regulated Murray River system, but are responsible for reticulating supply within towns. Snowy Valleys Council and the Snowy Monaro Regional Council provide both bulk water and reticulated water supply across their local government areas.

Both rely primarily on unregulated surface water sources for their water supplies, except for the town of Jindabyne that is supplied from Lake Jindabyne. Murray Irrigation Limited also supplies towns within the irrigation area, including Finley and Berrigan, from its irrigation canals. The largest town water supply scheme, run by Albury City Council, supplies several towns within the Greater Hume Shire Council, including Jindera, Gerogery, Burrumbuttock and Brocklesby.

What the future climate could look like in the NSW Murray region

3

Image courtesy of Visit River Country, Destination NSW.
Koondrook Barham Redgum Statue River Walk, Barham.

Climate data and modelling used to develop the NSW Murray Regional Water Strategy

Three climate datasets have been used to understand the key regional challenges and to assess the effectiveness of actions under different climate change scenarios:

- **historical climate scenario:** about 130 years of observed rainfall, temperature and evaporation records collected by the Australian Bureau of Meteorology
- **long-term historical climate scenario (stochastic data):** 10,000 years of stochastically generated climate data developed using paleoclimatic information by the University of Adelaide
- **dry future climate scenario:** modified version of the long-term climate variability data, scaled up or down using the NSW and Australian Regional Climate Modelling (NARCliM) climate projections. These scaling factors compare the baseline period of 1990–2009 with climate projections for the periods 2020–2039 and 2060–2079. 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.[29]

Why the dry future climate scenario has been used

Climate change has been considered in the regional water strategies options assessment process by using a dry future climate change scenario. The dry future climate change scenario[30] (SRES A2),[31] which represents a high carbon emissions scenario and therefore results in higher projected climate change impacts on the region. 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 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 dry future climate scenario together with the 2 other climate scenarios – the historical scenario and the stochastically-derived long-term historical scenario – is appropriate for this type of strategic-level assessment. It allows assessment of the full range of risks to the water system and helps build understanding of how different options might work under a range of future climate conditions. More refined assessments of climate change risk will need to be completed when many of the regional water strategies' actions are implemented. These additional assessments will be based on the planning horizon for each action and the latest climate science.

This new climate data and hydrological modelling is not appropriate for operational decisions made under water sharing plans, such as calculating available water determinations, and it will not be used for these purposes.

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.

Climate science is continuously improving. The climate modelling used to develop the NSW Murray Regional Water Strategy is 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.

29. New climate data and modelling is available at: water.dcceew.nsw.gov.au/our-work/science-data-and-modelling/modelling/climate-risk-data-and-water-modelling
30. 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 available on the NSW Government, AdaptNSW website: www.climatechange.environment.nsw.gov.au/climate-projections-used-adaptnsw. Note that newer versions of NARCLiM are available; however in order to integrate our modelling across the entire Murray–Darling basin, we used NARCLiM 1.0 as that was the only dataset available in 2018 when we commenced regional water strategy modelling. It was not possible to combine different NARCLiM datasets due to them using different climate models and emissions scenarios.
31. The SRES A2 assumes a 2°C warming over the regional water strategy planning horizon.

Climate snapshot

The NSW Murray region has a naturally variable climate

The NSW Murray region has a highly variable climate, ranging from temperate and alpine climates of the east to semi-arid conditions in the west.

Across the region rainfall is highly variable. Average annual rainfall varies from 2,000 mm per year (in the east) to around 286 mm (in the west). Average annual potential evapotranspiration ranges from around 1,000 mm in the Snowy Mountains to 1,150 mm in the west. Evapotranspiration is strongly seasonal across the region and around 4 to 5 times higher in summer than in winter.

The NSW Murray region has experienced extreme droughts over the past 125 years. Observed historical records indicate that persistent droughts have commonly and increasingly ended with significant rainfall events.

The NSW Murray region has also experienced significant flood events over the past 122 years of observed historical records. Flooding patterns are often sporadic. Several severe floods can occur in short succession.

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

We do not know for certain what the NSW Murray 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 NSW Murray region.

The new climate datasets show that the wet and dry cycles we have seen over the last 120 years are fairly normal when compared to the long-term climate beyond historical records. However, the stochastic datasets indicate that there have been more extreme dry and wet conditions in the long-term past than what we have seen in the last 120 years.

Analysis of climate change projections shows that under the dry future climate scenario, if no action is taken, by 2079 there could be:

- potential decreases in late autumn, winter and spring rainfall (Figure 12)
- more extreme events: droughts could become more frequent and rainfall events could potentially become more intense
- higher evaporation: there could be an increase in average evapotranspiration of up to nearly 5%
- changes to river flows: there could be less average total volume of water flowing each year in the regulated and unregulated rivers
- lower inflows into regulated storages: combined average annual inflows into the region's main storages could decline and storage levels could be consistently lower under future dry climate projections (Figure 13).

Figure 12. Average monthly changes in rainfall for the NSW Murray region for the periods 2060 to 2079 compared to the period 1990 to 2009 from NARCliM projections

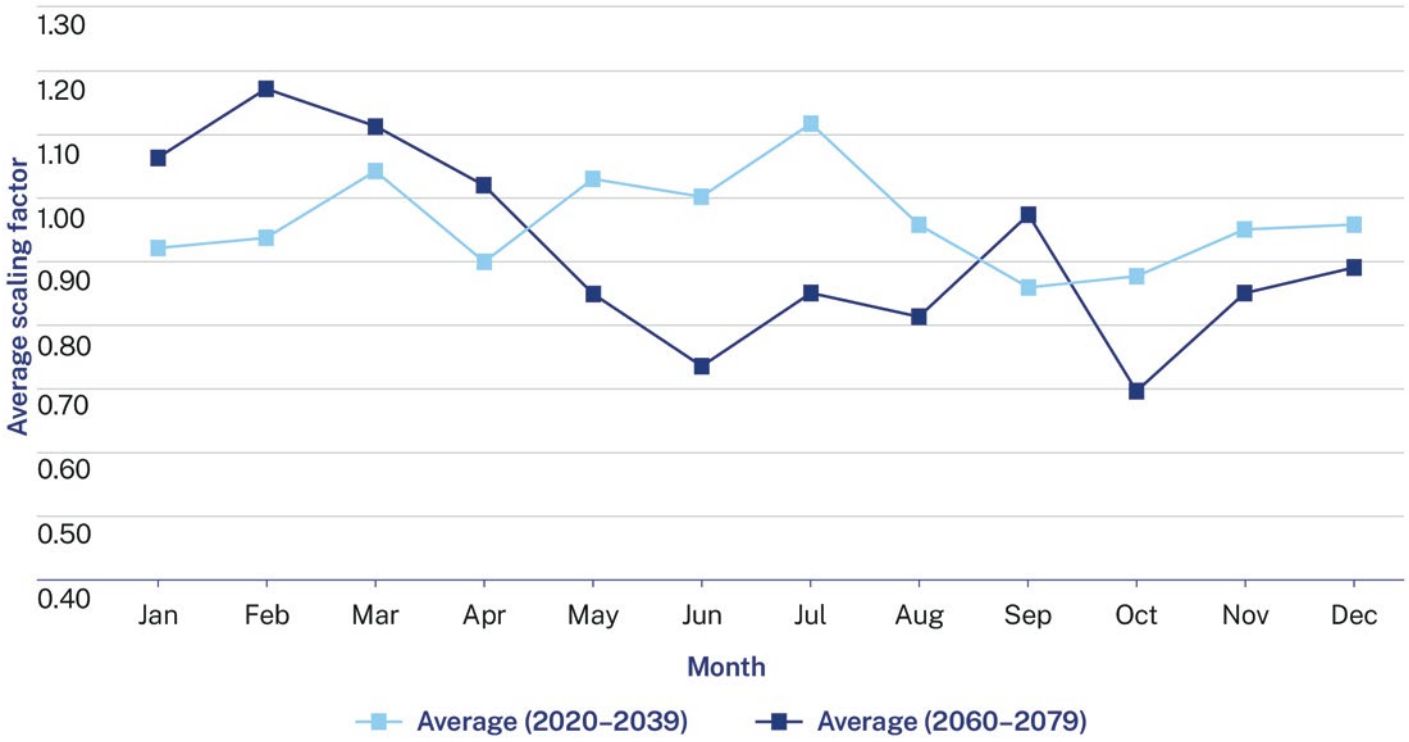
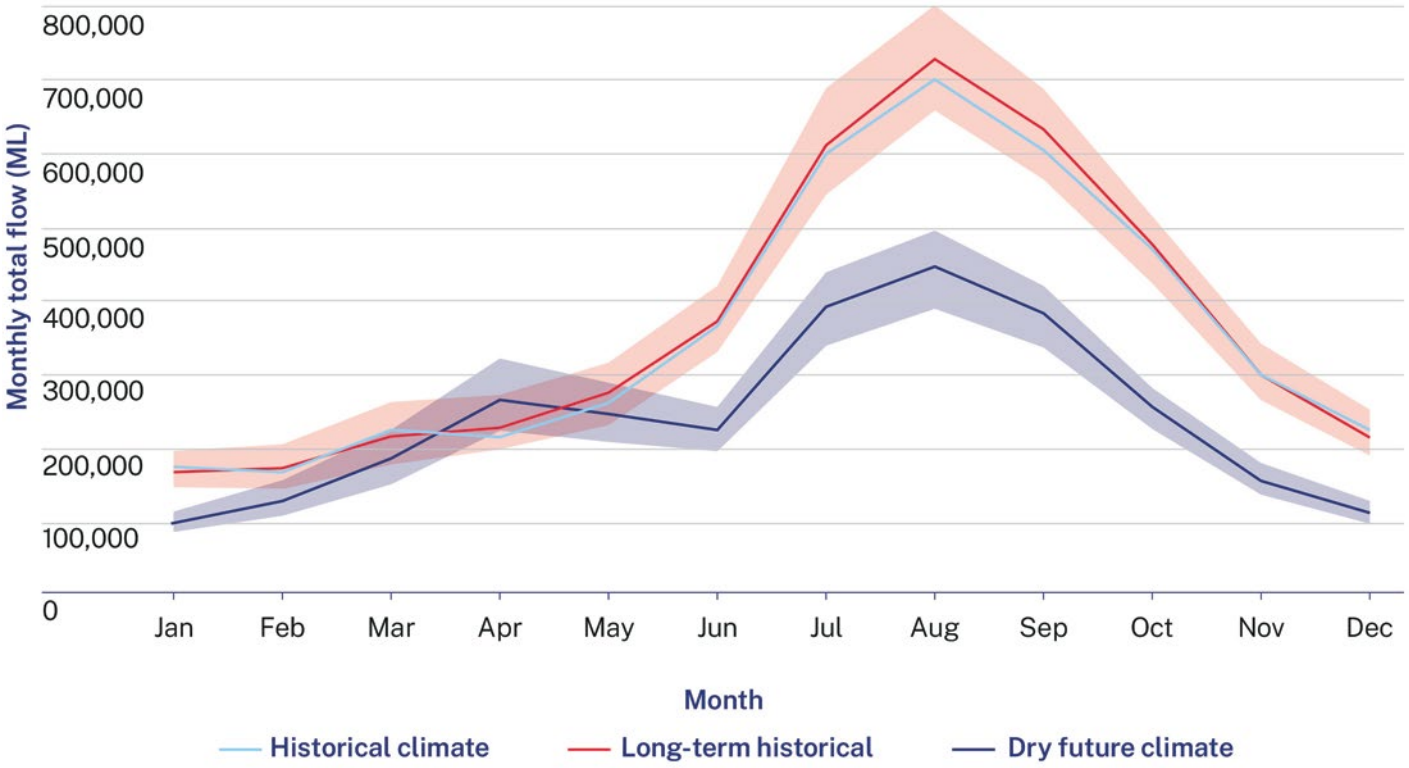


Figure 13. Impact of a dry future climate scenario on combined seasonal inflows of the NSW share of the shared Murray system storages



The challenges facing the NSW Murray region

4

Image courtesy of Destination NSW. Murray River, Albury.

We have identified 4 key challenges that are immediate priorities for the region:

1. Balancing competing interests for water
2. Improving the health and resilience of ecosystems
3. Addressing barriers to Aboriginal people's water rights
4. Supporting existing and emerging industries and livelihoods.

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

Image courtesy of Vince Bucello, NSW Department of Climate Change, Energy, the Environment and Water.
Overhead view of Murray River near Moama.

Challenge 1: Balancing competing interests for water

In the NSW Murray region, there are many, often competing, interests for water including, town water supply, the environment, electricity generation, irrigated agriculture, tourism and cultural needs.

Balancing the interests of such diverse water uses and stakeholders is made possible by many complex, inter-related governance and institutional arrangements that are overseen by multiple governments at state and federal levels.

Improving how water is shared and managed within these arrangements is often complicated and requires collaborative and inclusive approaches that address the diverse needs of stakeholders.

For example, changes to the way water is shared by and delivered to NSW water users may require consultation and potentially the consent of other governments. Further complications arise from the multiple tributaries that are influenced by highly variable and often different climate drivers and weather events. Growing regional centres and the changing nature of water and land use practices further strain available water supplies.

Water sources are fully allocated limiting growth of existing and emerging industries

In the NSW Murray region, the use of groundwater and surface water is limited by sustainable diversion limits (SDLs).[32] The Basin Plan limits the amount of water that can be taken for towns, industries, landholders and other uses that are not licenced.

Long-term annual average extraction limits are also set out in relevant NSW water sharing plans. These LTAAELs include licensed water access entitlements and basic landholder rights; they do not include other activities that are included in SDLs such as plantations and other unlicensed water use.

Given this, supporting economic growth and industry development in the NSW Murray region will be challenging. For example:

- 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 reliant on water, acquisition of water access licences or an alternative water supply contract is critical.

This separation of land and water and the introduction of trading markets were created in response to the National Water Initiative 2004 and partly due to systems being fully allocated.

This allows for water to be traded, temporarily or permanently, to where it is wanted or to the highest value use. These markets have been in operation for 20 years. As demonstrated through the ACCC's review into water markets,[33] there are opportunities to adjust the market system to become more flexible in meeting the water needs of businesses.

The potential benefits of any new water infrastructure seeking to increase supply capacity will be constrained, as long-term water diversions are not permitted to increase under the SDLs.

32. More information about sustainable diversion limits is available at: www.mdba.gov.au/water-use/water-limits/sustainable-diversion-limits
33. More information about the ACCC inquiry into markets for tradeable water rights in the Murray–Darling Basin is available at: accc.gov.au/about-us/publications/murray-darling-basin-water-markets-inquiry-final-report

Sustainable diversion limits

Sustainable diversion limits (SDLs) represent the long-term average amount of water that can be used for consumptive purposes. In general, they are based on the amount of water being taken just before the Basin Plan came into effect (2009) minus the shared and local reductions needed to reduce long-term water use to sustainable levels. They apply to each SDL resource unit, generally based on catchments for surface water and hydrogeology and planning boundaries for groundwater.

Compliance with the SDL is determined at the end of the water year by the Inspector General of Water Compliance. Where an exceedance of the SDL[34] in a resource unit is determined by the Inspector General, and the state does not have a reasonable excuse, the state may be required to place limits on water take to bring the level of take back within the limits required by the SDL.

All water resource plans for the NSW Murray and Murrumbidgee regions are now operational and being used to manage water resources. However, not all plans have completed the formal accreditation process. The formal assessment of SDL compliance by the Inspector-General of Water Compliance will commence for accredited plans from the 2024–25 water year.

NSW is working closely with the Murray–Darling Basin Authority (MDBA) to ensure that all remaining water resource plans meet the necessary accreditation requirements. It is important to note that all existing NSW water sharing plans covering the Murray–Darling Basin include rules and limits to manage water sustainably, and the department reports annually on SDL compliance to the MDBA.

Investigating potential underuse of surface water against sustainable diversion limits in the NSW Murray region

Stakeholders have raised and supported the need to develop a better understanding of people's behaviours and assumptions around surface water availability and use, including investigating existing water management rules and behaviours that may be leading to underuse in the region. This issue requires further analysis. A working group consisting of industry stakeholders and NSW and Australian Government agencies has been established to explore water-related issues, including the issue of potential underuse.

Water is not always considered in land use planning processes

Water resources are not always considered early in the planning process, which can create inefficiencies and challenges in capitalising on the broader regional opportunities these changes and investments could bring. The *Riverina Murray Regional Plan 2041*,[35] draft *Far West Regional Plan 2041*[36] and draft *South East and Tablelands Regional Plan 2041*[37] highlight that access to water is critical for some land uses, but is not always considered upfront in the planning process.

This can lead to population and industry growth in areas without enough water available, which creates greater pressure on stressed water resources.

A better understanding of water availability in the NSW Murray region will provide more guidance to manage growth within towns in Albury and Murray River councils. It will also provide guidance on suitable locations for industry growth and new development. Ensuring water resources are integrated better in the strategic planning process through effective government collaboration is essential to optimise the use and sharing of water and enable the growth of towns in a fully allocated system.

Ensuring water resources are integrated better in the strategic planning process through effective government collaboration is essential to optimise the use and sharing of water and enable the growth of towns in a fully allocated system.

To improve how water related matters are considered in strategic land use planning issues, this strategy includes Action 1.5: Better integrate strategic land use and water planning. See page 87.

34. For surface water SDL resource units, an exceedance occurs when the cumulative balance on the relevant Register of Take is a debit amount equal to or greater than 20% of the SDL.
35. More information about the *NSW Riverina Murray Regional Plan 2041* (2023) is available at: www.planning.nsw.gov.au/plans-for-your-area/regional-plans/riverina-murray-regional-plan-2041
36. More information about the draft *Far West Regional Plan 2041* is available at: www.planning.nsw.gov.au/plans-for-your-area/regional-plans/far-west
37. More information about the draft *South East and Tablelands Regional Plan 2041* is available at: www.planning.nsw.gov.au/plans-for-your-area/regional-plans/south-east-and-tablelands

Cross-border influences and complexities

The NSW Murray region forms part of the southern connected Basin (Figure 9). Managing water across regions in the southern connected Basin is complex. Interstate agreements and rules govern how water in the Murray River catchment is shared, traded and delivered between NSW, VIC and SA, including rules for water released from the Snowy Scheme. The water resources of the Murray River system are shared between NSW, VIC and SA in accordance with the Murray–Darling Basin Agreement.

The Murray–Darling Basin Agreement is a legal instrument that embodies the long history of collaboration between state government and Australian Government agencies to manage the southern connected Basin. Schedule 1 of the *Water Act 2007* (Cth) sets out rules and provides a framework of powers and responsibilities.

Cross-border water management at such a large scale can be challenging at times, and particularly because any changes to the agreement must be agreed (by consensus) by the Murray–Darling Basin Ministerial Council. There is a need for inter-jurisdictional discussion about the current settings of the agreement, and how current river operations can be improved or optimised to ensure river systems are adaptively managed.

In NSW, water is managed and shared under the NSW *Water Management Act 2000* with specific rules for water sharing set out in respective surface water and groundwater water sharing plans.[38]

During public consultation, strong feedback was received for improving interjurisdictional water sharing and management, noting the complexity of interstate agreements and rules.

While the complexity of water management arrangements will not change, the following action is included in this strategy to seek a fairer deal for NSW under the Murray–Darling Basin Agreement: Action 1.6: Work with Basin Governments to participate in the review of the Commonwealth *Water Act 2007*. See page 89.

Delivery constraints and changing water use patterns in the regulated Murray River create challenges for management of the system

The NSW Murray region's water resources underpin key economic drivers, including agriculture and other water-dependent industries, and the sustainable management of water resources will be critical to economic prosperity of the region. The mix of industry and crops in the region is changing, with horticulture expanding and value-added agricultural industries expected to grow over the next 20 years. This is likely to drive further changes in water use patterns. Long distances from storages to end users, channel constraints and minimising unseasonal flooding and inundation of low-lying lands impact the delivery of consumptive and environmental water to the regulated Murray River during periods of peak demand. With an increase in water demand in the Lower Murray River, the need to convey water through the Barmah Choke at maximum capacity to meet demand has degraded riverbanks.

Over the past 3 decades, the capacity of the Barmah Choke has fallen progressively from 11,500 ML/day in the 1980s to 9,200 ML/day in 2019, reducing daily delivery rates from Hume Dam. Getting water to where it is needed is often difficult and there is a potential for future supply shortfalls. To avoid unseasonal flooding of the Barmah Forest, high flows in the river are now also restricted from January to April each year to ensure water remains within the riverbanks. Irrigation demands are highest at this time, meaning that high flows regularly need to be delivered through the reach for several months. As a result of the declining capacity of the Barmah Choke and the need to restrict unseasonal flooding, there are adverse impacts on the environmental, cultural, social and economic aspects of the river.

Through the Water Delivery Optimisation Program, the Murray–Darling Basin Authority is leading work to address reduced flow capacity through the Barmah–Millewa Reach. As such, the NSW Murray Regional Water Strategy does not propose any further action to address this challenge.

38. More information about water policy and planning is provided in the Regional Water Strategies Guide is available at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program

Delivery and system shortfalls

When the required volume of water cannot be delivered to users when and where it is needed, it is called a shortfall. Delivery shortfalls occur when actual water use is higher than predicted irrigation and water for the environment needs. System shortfalls occur when the combined capacity of the system (storage and conveyance) is unable to supply all downstream requirements over the full season.

Some of the factors that can impact water delivery include climate, trade, demand patterns and river channel capacity.

The Murray–Darling Basin Authority, NSW, VIC and SA work together to manage water delivery shortfall risks. Management strategies include using tributaries or other storages, restricting trade through the Barmah Choke and adjusting operations based on forecast weather.

There have been no capacity or shortfall impacts since 2002.

Temporary water restrictions can be placed on water users in the event of a shortfall occurring and are usually undertaken by the relevant state water agency. These restrictions are very rare. However, changes in climate, timing and location of demand and land use, combined with the river system's capacity to carry volumes of water, mean these events are increasing in probability.

The risk is greatest for users downstream of the Barmah Choke as it restricts the maximum regulated flow, and for much of summer the flow is at its maximum. Upstream of the Barmah Choke the maximum flow rate is well above the normal flow rates, allowing peaks in demand to be met.

Water Delivery Optimisation Program

The Water Delivery Optimisation Program, led by the Murray–Darling Basin Authority aims to identify options to improve the movement and efficiency of water delivery through the Barmah–Millewa Reach and protect the health and cultural integrity of the river.

To begin to address delivery constraints, the program completed a feasibility study in 2022. The study investigated and assessed the feasibility of options to maintain and, where possible, reinstate the capacity to deliver water downstream of the Barmah–Millewa Reach. This feasibility study was presented to the Murray–Darling Ministerial Council on 24 February 2023.

To address the decline in delivery capacity through the reach identified in the study, Basin Ministers have progressed investigations on a range of options aimed at reinstating an additional 500 ML/day of capacity. Building on commitments made in 2023 and 2024, the focus remains on implementing practical solutions that can halt the declining capacity and support the health and resilience of the system.

Inundation of low-lying lands is impacting productivity and livelihoods

Low-lying areas, including wetlands and floodplains can be inundated by regulated flow deliveries for both environmental and consumptive purposes.

However, currently, rivers connect to wetlands and floodplains less often than is needed to maintain healthy ecosystems, due to river regulation and extraction. Constraints in delivering water for the environment restrict the effective use of this water, contributing to the continual decline of the health of Country, including species depending on these environments to survive.

While stakeholders generally support restoring this balance, they are calling for improved flow notification systems and more consultation around water management practices. These enhancements are seen as essential to supporting them effectively manage and sustain the productivity of their impacted floodplain land.

Details about the Reconnecting River Country Program, which focuses on relaxing or removing constraints on the delivery of water for the environment in the NSW Murray region, can be found in Challenge 2: Improving the health and resilience of ecosystems on page 49.

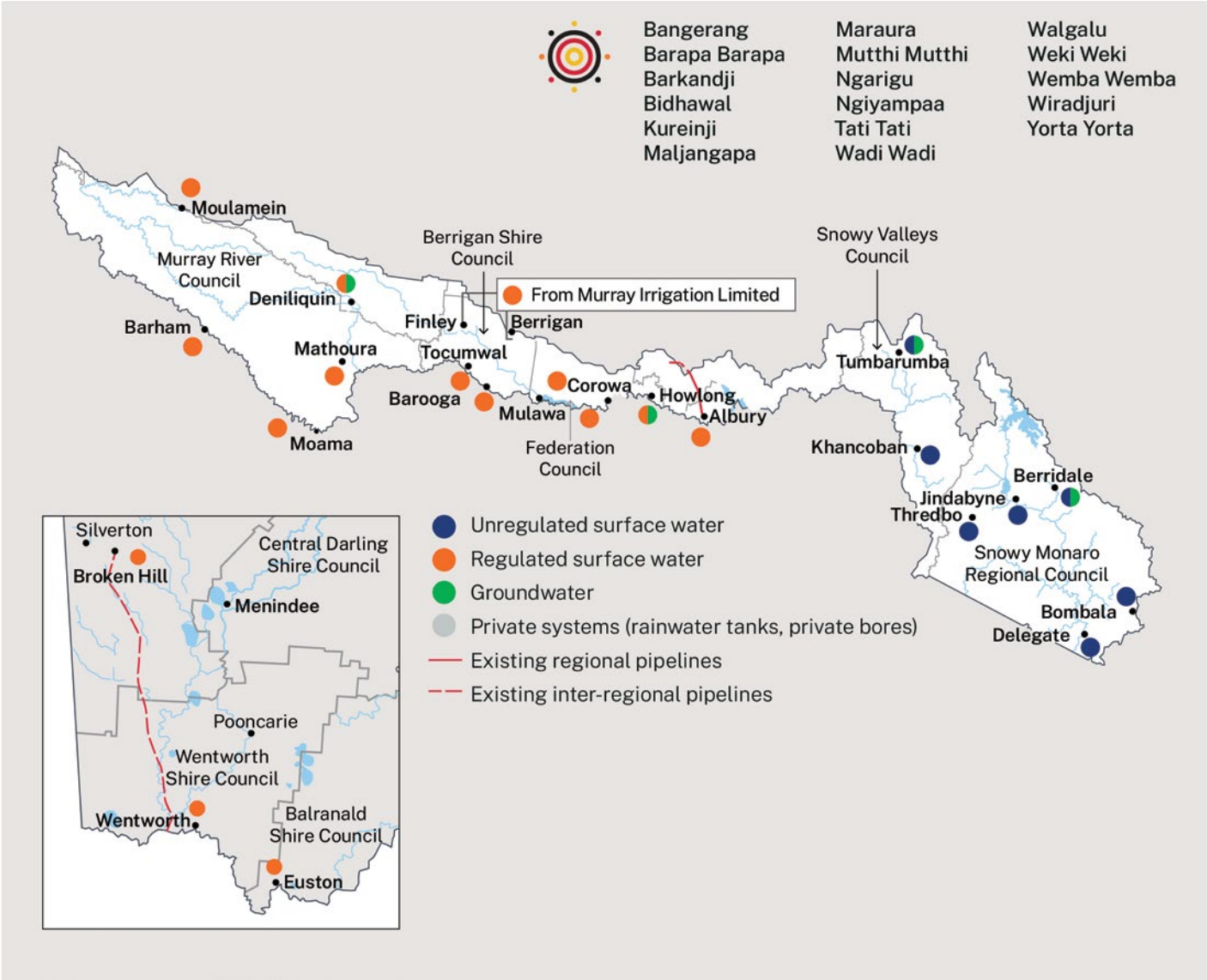
To address challenges associated with the inundation of floodplain lands in the NSW Murray region, this strategy includes the following actions:

- Action 1.2: Improve strategic water management and decision-making frameworks by incorporating new climate and modelled data. See page 83.
- Action 2.8: Seek agreement with the Australian Government to develop and implement the Reconnecting River Country Program in the NSW Murray region. See page 110.

There are water security risks for regional centres, towns and communities

Many of the towns in the NSW Murray region rely exclusively on surface water. However, groundwater forms a part of the supply to many towns, including Deniliquin, Dalgety and Tumbarumba. Figure 14 shows NSW Murray's town water supply sources across the region.

Figure 14. Town water supply sources for the NSW Murray region



Severe droughts, such as the Millennium Drought resulted in reduced water availability to towns and major centres like Albury, with significant implications for water-dependent businesses and social amenity as councils introduced water restrictions to conserve water for critical human needs.

Climate change could increase the risk of severe droughts in the NSW Murray region, placing towns and communities at risk of future shortfalls. New modelling[39] suggests that there are risks of surface water shortfalls[40] for Albury, Corowa, Deniliquin and Murray River Council local government areas.[41]

For example, under a dry future climate scenario with static population levels, supply shortfalls for these places could significantly increase by 2061 with critical shortfalls for all towns shown in Table 6.

Further investigation highlights that towns with water demand close to their water entitlement limits are more likely to record modelled shortfalls compared to towns that have demand levels much lower than their entitlement.

Regional areas are becoming increasingly attractive places to work and live, and significant population growth is expected over the next 20 to 40 years, which will increase town water supply demands. In particular, Albury has forecasted high population growth rates. Table 6 shows that with population growth projections to 2061, supply shortfalls increase significantly for all towns presented. Albury, Corowa and Murray River Council present a complete year of shortfalls (365 days in a year for a probability of 1 in 1000 years) with at least 50% of the demand not met under the Dry Future Climate Change scenario.

Image courtesy of Destination NSW. Lake Jindabyne, NSW.

39. A detailed description of the climate scenarios and other results for town water supply shortfalls are presented in the NSW Murray and Murrumbidgee Regional Water Strategies Climate and hydrological modelling report (December 2022). The report is available at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program/nsw-murray-regional-water-0
40. Shortfalls are measured by the number of days where a town's surface water supply is less than an identified level of demand (e.g. 5%, 10%, 25%, 50% and 75%).
41. Wagga Wagga, Narrandera and Coleambally were not assessed because a large part of their supplies come from groundwater, which is not able to be modelled with the new climate data at this time. Griffith and Leeton were also not assessed, as they take water from within large irrigation schemes.

Table 6. The number of days with town water supply shortfall with a probability of 1 in 1,000 years

Town		Historical climate			Dry future climate change scenario		
Current demand							
	No population growth	At least 10% of demand not met	At least 25% of demand not met	At least 50% of demand not met	At least 10% of demand not met	At least 25% of demand not met	At least 50% of demand not met
Albury	Current population	182	140	115	365	365	365
Corowa	Current population	186	154	133	365	365	365
Deniliquin	Current population	94	87	68	365	363	327
Murray River Council	Current population	129	118	100	365	365	365
Future population demand (2061)							
	Population growth over 40 years period (%)	At least 10% of demand not met	At least 25% of demand not met	At least 50% of demand not met	At least 10% of demand not met	At least 25% of demand not met	At least 50% of demand not met
Albury	95%	365	365	281	365	365	365
Corowa	9%	199	169	140	365	365	365
Deniliquin	1%	97	87	69	365	363	327
Murray River Council	56%	365	228	163	365	365	365

These results are a high-level comparative assessment to identify where town water supply shortfall risks occur across the region. They are not appropriate for detailed purposes like secure yield analyses or other strategic planning which is the responsibility of and done by local water utilities (LWU).

The results of the modelling coupled with the implications of projected population growth and the levels of local water utility licence entitlements held by each council, will have varying implications for councils and local water utilities in the region.

We will work with council and local water utilities to understand what the information means for their local area. Considering the new climate modelling data and future water availability risk will be important to understand shortfall risks and assess the performance of regional water strategy options.

The department provides specific guidance to local water utilities under the Regulatory and Assurance Framework on understanding water security for effective strategic planning. The strategic plans of local water utilities incorporate a secure yield study to identify the capacity and sizing of headworks infrastructure to meet the required levels of service.

Town water supply shortfall analyses and town water security analyses

Town water supply shortfall analyses, used by the NSW Government in the regional water strategies program, assess the difference between the available supply in a water source at the point of extraction against the climate adjusted demand of the local water utility. A supply shortfall will exist on a day when the demand is greater than the available supply. These assessments do not factor in customer levels of service (LoS)[42] nor water restriction rules imposed by local water utilities on customers. The aim is to understand, at a high level, where vulnerabilities in town water supplies might exist across a region.

This is a different assessment to town water supply security analyses, which are undertaken by individual local water utilities. These security analyses are about understanding how town water demands for defined customer levels of service (LoS) can be met under a range of water availability conditions by the local water utility's supply headworks. Town water security analyses are often referred to as 'secure yield' analyses, being the maximum annual demand that can be supplied from the headworks while meeting the nominated LoS and its operating environment (licence and works approval conditions, water sharing plan rules, etc).

These 2 types of analyses are used for different purposes, with the town water supply security analyses considering customer requirements at a far greater level of detail, leading to a more nuanced understanding of water supply risks by individual local water utilities.

To address water security risks for regional centres, towns and communities in the NSW Murray region, this strategy includes:

- Action 1.2: Improve strategic water management and decision-making frameworks by incorporating new climate and modelled data. See page 83.
- Action 3.4: Support towns and local water utilities to understand and manage their future water security risks. See page 121.

42. Level of Service (LoS) incorporates frequency, duration and severity of town water supply restrictions with an underlying principle of 'to not run out of water'.

Changes in land use are impacting water quality

Land management has a direct effect on water quality in downstream waterways. Stormwater run-off, wastewater discharge from agriculture and development in catchment areas are collectively a significant risk to water quality in the NSW Murray region. Poor water quality affects suitability for human use, increases the cost of treatment for towns and industry and affects the health of aquatic ecosystems.

Aboriginal people rely on good water quality of waterways for their health, wellbeing and continued practice of cultural traditions. If important cultural sites are impacted by ongoing poor water quality, the traditional story or the meaning of a particular cultural site can be severely impacted or lost forever.

Eleven out of the 13 monitoring stations across the NSW Murray region had water quality rated either moderate or poor in 2023/24[43] – one site scored lower than the previous year. Water quality in the catchment is highly variable from upstream to downstream depending on catchment impacts, but generally moderate and poor. Cold water pollution is possible from the releases from the Snowy Mountains lakes. Recent 2020 extensive bushfires across alpine bushland regions have resulted in elevated nutrient concentrations that may remain for many years.

Policy approaches for planning and managing water quality outcomes do not consider catchments as integrated systems, where upstream impacts, including land use and development, water extraction and pollution, can impact downstream water quality. There is a need to improve coordination of legislation and regulations for inter-related issues such as land management and water quality.

Water quality challenges for towns

Town water supplies along the Murray River are impacted periodically by blue-green algal blooms which can result in toxins in raw water supplies. Toxins are expensive to treat, and algal biomass can clog filters, which reduces their output.

Water supplied from Lake Jindabyne and the Bombala River to the towns of Jindabyne and Delegate[44] respectively are affected by turbidity during floods and high river flows, resulting in a constrained ability to treat water and temporary boil-water alerts. More intense storms and an increased likelihood of bushfires will put further pressure on maintaining town water quality. Local councils and the NSW Government are preparing for this by investing in upgrades to water treatment facilities.

Additional water quality challenges from cold water pollution are included in Challenge 2: Improving the health and resilience of ecosystems, on page 49.

To address catchment-based water quality issues in the NSW Murray region, this strategy includes:

- Action 1.5: Better integrate strategic land use and water planning. See page 87.
- Action 2.6: Adopt a catchment management approach to improve water quality in the NSW Murray region. See page 106.
- Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments. See page 111.

43. More information available at: publications.water.nsw.gov.au/watergroupjspui/bitstream/100/124/1/Murray_Valley_annual_surface_water_quality_report_2022-2023.pdf
44. These towns are included in the strategy area because of the strong hydrological links created by the Snowy Scheme.

Intense bushfires affect water quality and quantity

Bushfires can have adverse effects in the headwater catchments of the Snowy Mountains presenting significant water quantity and quality risks for downstream users and the environment.[45] Short-term water quality risks result from run-off of soil, ash and debris that can increase nutrient concentrations, which stimulates growth of blue-green algae. Contemporary fire retardants can also create challenges for water quality. There are also sedimentation impacts that can clog and reduce the effectiveness of Snowy Hydro Limited water infrastructure.

Long-term risks can result from post-fire vegetation regrowth that can have long-lasting impacts. For example, reductions in long-term catchment yields can be as high as 25% following major bushfires, the consequences of which can last for up to 90 years.[46] Another estimate of hydrological impact attributes a forecast of an 859 GL reduction of Murray River streamflow (downstream of the Ovens River confluence) by about 2026 due to the vegetation regrowth associated with the catastrophic 2003 bushfires in the Snowy Mountains and Victorian Alps.[47]

The Snowy Monaro Bush Fire Risk Management Plan[48] does not include the preservation of rainfall run-off processes as a strategic priority and given the significance of bushfire impacts, this needs to be investigated.

To address the impacts of intense bushfires in the NSW Murray region this strategy includes Action 3.3: Investigate innovative ways to improve run-off in water supply catchments. See page 119.

Image courtesy of Vince Bucello, NSW Department of Climate Change, Energy, the Environment and Water. Murray Valley Regional Park, NSW.

45. Further information about the impacts of bushfires on water resources can be found at: publications.water.nsw.gov.au/watergroupjspui/bitstream/100/1059/1/Impacts%20of%20bushfires%20on%20freshwater%20ecosystems%20and%20potential%20water%20management%20options%20-%20a%20literature%20review.pdf
46. Further information about the Impacts of bushfires on freshwater ecosystems and potential water management options can be found at: publications.water.nsw.gov.au/watergroupjspui/handle/100/1059
47. Hill, P.I., Mordue, A. Nathan, R.J., Daamen, C.C., William, K., Murphy, R.E. 2008, *Spatially Explicit Modelling of the Hydrologic Response of Bushfires at the Catchment Scale*. Australian Journal of Water Resources Vol 12. No. 3 and Water Down Under 2008. 1472–1480, www.tandfonline.com/doi/abs/10.1080/13241583.2008.11465354
48. NSW RFS 2009, *Snowy Monaro Bush Fire Risk Management Plan*, www.rfs.nsw.gov.au/__data/assets/pdf_file/0019/2629/Snowy-Monaro-BFRMP.pdf

Challenge 2: Improving the health and resilience of ecosystems

Development has changed flow variability, reduced water quality, and altered the distribution of water throughout the catchment. These factors are impacting the health and resilience of the region's ecosystems. The challenge is to maintain and restore the region's water-dependent ecosystems by using water effectively during wet, moderate and dry periods.

There has been extensive work in recent decades to improve ecosystem health in the southern regions. Since 2004, through water sharing plans, the Basin Plan and other initiatives, the NSW Government and other Basin governments have introduced an environmental flow regime to restore healthy flows. Water for the environment is managed through a combination of planned and held environmental water, and environmental watering works to enhance floodplain inundation at key environmental sites informed by the long-term water plan.[49]

While these reforms and initiatives have addressed many of the fundamental issues, some challenges remain that are impacting the health and resilience of riverine ecosystems and important species and ecosystems under stress.

Altered flows are affecting ecosystem health

Water infrastructure, river regulation and water extraction have influenced flow variability, water quality and the distribution of water throughout the catchment. Despite extensive reform initiatives[50] to improve water for the environment, the challenges of an altered flow regime continue to affect ecosystems in the NSW Murray region.

The current flow regime of the NSW Murray region is very different to predevelopment conditions, and the degree and type of hydrological change varying within the catchment.

The construction and operation of Hume and Dartmouth dams, the Snowy Scheme, and other infrastructure have resulted in:

- declines in medium and high flow frequencies
- change to the seasonality of flows
- regulated flow patterns being more common with a sizeable loss in natural flow variability, reduced inundation of wetlands and floodplains and decreased long-term average flows
- significant reduction in flows to the Snowy and montane rivers.

49. More information about the *Murray–Lower Darling Long-Term Water Plan: Part A Murray–Lower Darling catchment* (2020) is available at: environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/murray-lower-darling
50. Initiatives include development and operation of water sharing plans and the Murray–Darling Basin Plan, and programs such as The Living Murray Initiative and the Snowy Water Inquiry.

Water for the environment aims to restore the balance; however, constraints[51] restrict the effective use of this water contributing to the continual decline of environmental health, including the species that depend on these environments to survive.

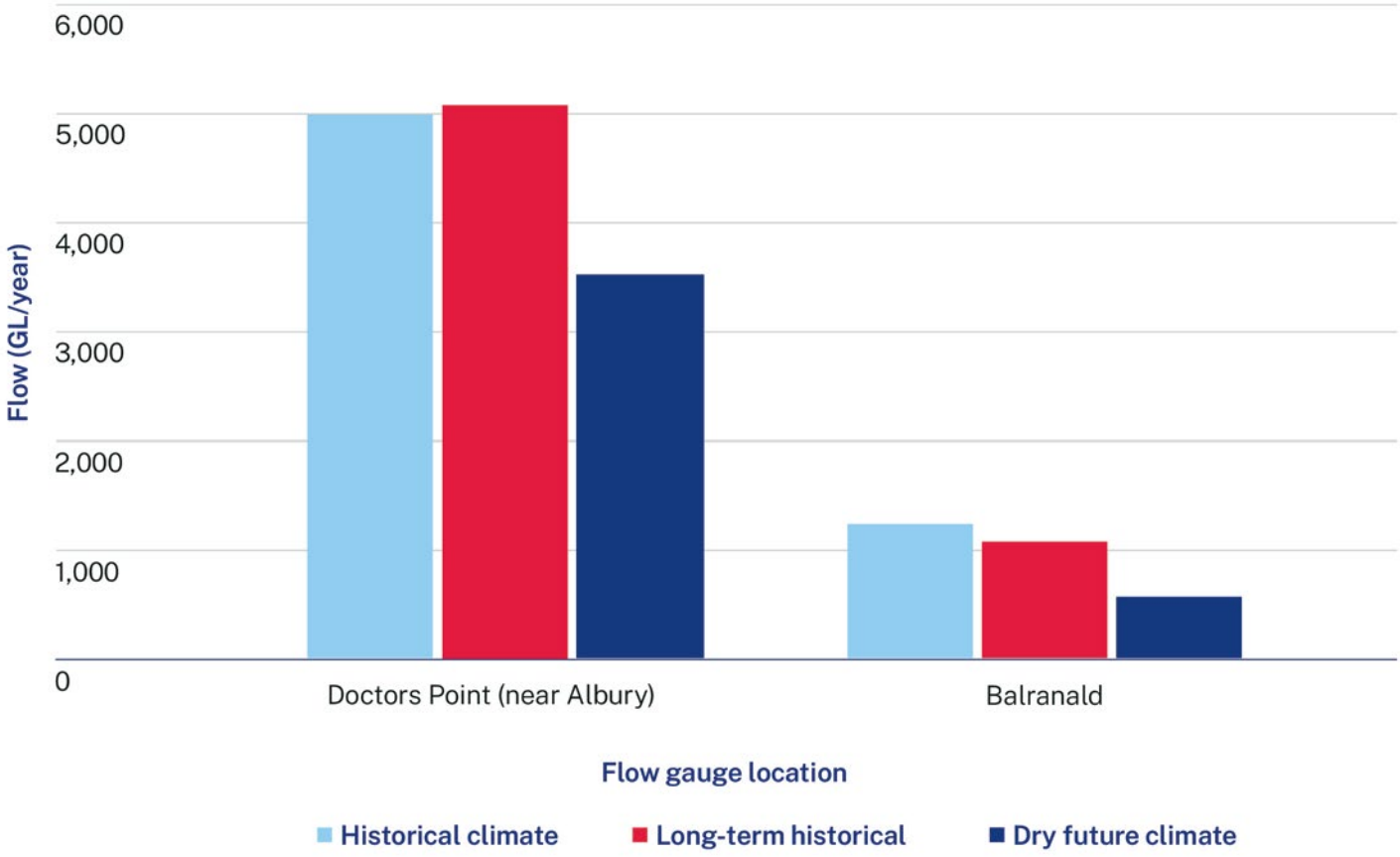
These outcomes have affected communities of vegetation, waterbirds, fish and other aquatic animals (such as platypuses and turtles), including some threatened species.

Climate modelling estimates that under a dry climate future there could be further changes to flows in the NSW Murray region with significant decreases in flows compared to those seen under the historical climate (Figure 15).

A future with reduced flow could constrain attempts to restore the health of key environmental assets along the NSW Murray River including Koondrook-Perricoota forests, mid-Murray anabranches and fish populations within the main river channel.

However, under a repeat of the long-term historical climate scenario, there could be a future with similar water availability to the lived experience.

Figure 15. Effect of long-term climate scenarios on the NSW share of median yearly flows (GL/year) in the NSW Murray River at Doctors Point, and in the Murrumbidgee River at Balranald near the confluence with the Murray River



Note: For a description of the climate scenarios, refer to Climate data and modelling used to develop the NSW Murray Regional Water Strategy on page 33.

51. A constraint is any physical, policy or operational barrier limiting the flow of water in river systems. There are a range of flow constraints in the Basin, some examples include: physical restrictions such as low-lying watercourse crossings, weirs and levees; operational restrictions such as river operation rules and practices; and policy barriers such as existing legislation.

Addressing altered flows and improving water for the environment

Sustainable Diversion Limit Adjustment Mechanism (SDLAM) Program

The SDLAM Program is designed to achieve similar or improved Basin Plan environmental outcomes in the Southern Murray–Darling Basin for rivers, wetlands and wildlife using less water as part of the Basin Plan.

Five SDLAM projects across the southern NSW have received an additional $115 million and extended time, until 31 December 2026, to deliver critical water infrastructure supporting the Murray and Murrumbidgee rivers, communities, wetlands and wildlife.

- Koondrook-Perricoota Forest Project is mitigating third-party impacts of water releases on landholders adjacent to the forest and creating breeding opportunities for thousands of native waterbirds and fish in the wetlands. It includes building critical levees, replacing regulators and removing constraints to improve flows.
- Mid-Murray Anabranches Project is improving connectivity between the Murray and Edward rivers, and other surrounding creeks. It includes constructing new bridges and rock crossings, upgrading levees and access roads, as well as removing barriers to fish movement.
- Lower Murray: Locks 8 and 9 Project is restoring and enhancing the river habitat across the interconnected Frenchmans Creek and Carrs, Capitts and Bunberoo Creek systems. It includes installing new regulators and fishways, upgrading fish passages and changing the operating principles for weirs 8 and 9 to reinstate a more variable watering regime.
- Murrumbidgee and Murray National Parks Project is improving the delivery of environmental water in the Yanga and Murray Valley (Millewa) national parks. It includes replacing water regulators and removing earthen embankments including levees.
- Yanco Creek Modernisation Project is modernising infrastructure to enable smarter use of water in the Yanco Creek System. It includes replacing water regulators and constructing and restoring fish passages.

There are also additional projects outside the SDLAM Acceleration Program. Work on these projects will not stop. We will continue to refine these projects and to seek the views of our community and industry.

The Reconnecting River Country Program[52]

The Reconnecting River Country Program is a critical Murray–Darling Basin initiative essential to creating healthier functioning river systems in the NSW Murray and Murrumbidgee regions. The program is proposing to remove constraints (any physical, policy or operational barrier limiting the flow of water in river systems) to enable the flexible use of water for the environment to increase the frequency and extent rivers connect to their wetlands and floodplains. Removing constraints is critical to achieving the Murray–Darling Basin Plan's improved environmental outcomes and making best use of existing water recovered from communities.

In the Murray River, the Reconnecting River Country Program area extends from the Hume Dam to the Wakool Junction.

A range of flow limit options are being considered for the Murray. Technical studies are being progressed by December 2026 to inform a future Final Business Case.

NSW is working with Basin jurisdictions on next steps for a future project in the Murray.

A recommended flow limit cannot be determined until all options have been assessed through a Final Business Case, including a comprehensive evaluation of benefits, risks and cost-benefit analysis.

If the program proceeds to delivery in the Murray, the program will seek to secure a flow corridor through voluntary negotiations under the Landholder Negotiation Scheme, explore public mitigation works and will deliver measures for First Nations outcomes.

To support the Reconnecting River Country Program, the NSW Murray Regional Water Strategy includes Action 2.8: Seek agreement with the Australian Government to develop and implement the Reconnecting River Country Program in the NSW Murray region.

52. More information on the Reconnecting River Country Program is available at: dpie.nsw.gov.au/water/water-infrastructure-nsw/sdlam/reconnecting-river-country-program

Snowy Water Licence Review

The construction of the Snowy Mountains Scheme caused a significant decline in the health of the Snowy River and other montane rivers regulated by the scheme. In response, the 1998 Snowy Water Inquiry resulted in the Snowy Water Inquiry Outcomes Implementation Deed (SWIOID). The SWIOID established environmental flow rules that would see more water and higher flows delivered to the Snowy River from a new outlet at Jindabyne Dam. A portion of flows was also returned to a number of other montane rivers. These environmental flows improved the health and condition of the Snowy River and a number of montane rivers.

Every 10 years, the Snowy Water Licence is subject to reviews under the *Snowy Hydro Corporatisation Act 1997 (Cth)*; the second review was completed in 2018 and the next review is scheduled to commence in 2027. These reviews focus on a range of administrative and technical issues including exploring better ways to deliver environmental flows.

The NSW Department of Climate Change, Energy, the Environment and Water is continuing to implement the actions of the 10-Year Snowy Water Licence Review in collaboration with the Snowy Technical Working Group (TWG). The TWG is made up of representatives from the NSW, Victorian, South Australian and Australian governments, the Murray–Darling Basin Authority and Snowy Hydro Limited. An integrated water model of the Snowy, Murray and Murrumbidgee systems has been developed. This was used to analyse priority issues and assess potential changes to the Snowy Water Licence relating to water releases to the Murray and Murrumbidgee rivers (including the Upper Murrumbidgee). This modelling is the first time an evidence-based tool has been available to test changes to licence rules. The department has completed ecological, social and economic studies to assess potential licence changes that could improve outcomes from environmental flow releases to the Snowy River. The TWG is currently deliberating on a package of options.

To support the next Snowy Water Licence Review, the NSW Murray Regional Water Strategy includes Action 1.3: Continue to build the climate evidence base for the next Snowy Water Licence Review. See page 85.

To address issues associated with alterations in the flow regimes of the NSW Murray region, this strategy includes:

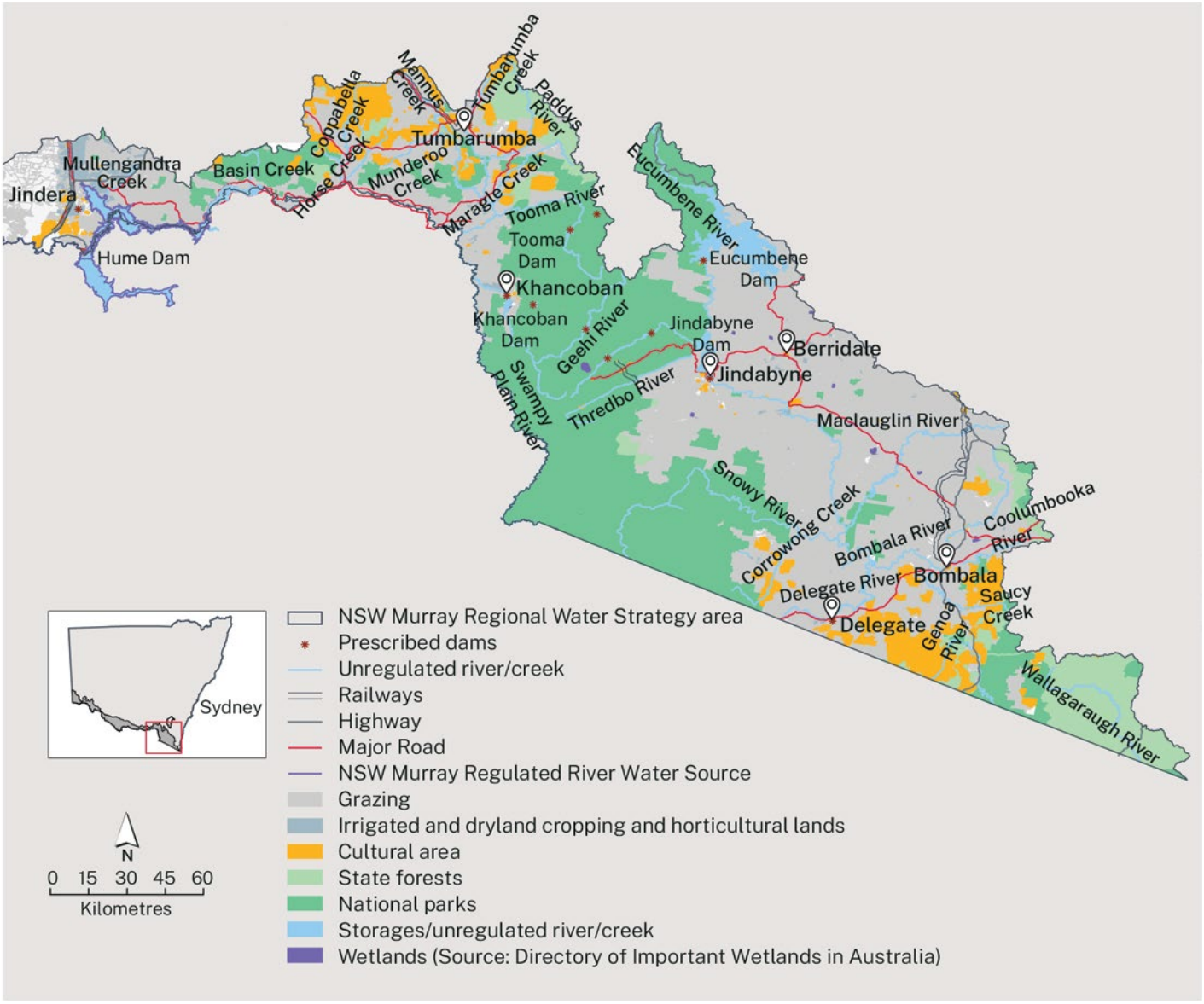
- Action 2.1: Rehabilitate ecologically and culturally important sites within the mid and lower catchment. See page 96.
- Action 2.2: Encourage partnerships with the irrigation sector for environmental water delivery to public and private lands. See page 98.
- Action 2.8: Seek agreement with the Australian Government to develop and implement the Reconnecting River Country Program in the NSW Murray region. See page 110.
- Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments. See page 111.
- Action 2.10: Improve the flow regime of the Snowy and montane rivers. See page 112.

Parts of the upper catchment are in poor condition

The Upper NSW Murray River catchment (Figure 16) covers over approximately 5,200 km^2 of land on the NSW side of the Murray River. The Snowy River catchment is also within the NSW Murray region and covers around 9,070 km^2.

Much of this area is pastoral rural land but there are also large areas considered to have a high degree of natural and cultural significance, including areas declared World Heritage Area and Wilderness such as Kosciuszko National Park. It is home to rare and threatened fish species such as Flathead galaxias, Southern pygmy perch, Purple-spotted gudgeon, Trout cod and Macquarie perch, and threatened species of frogs, birds and plants.[53]

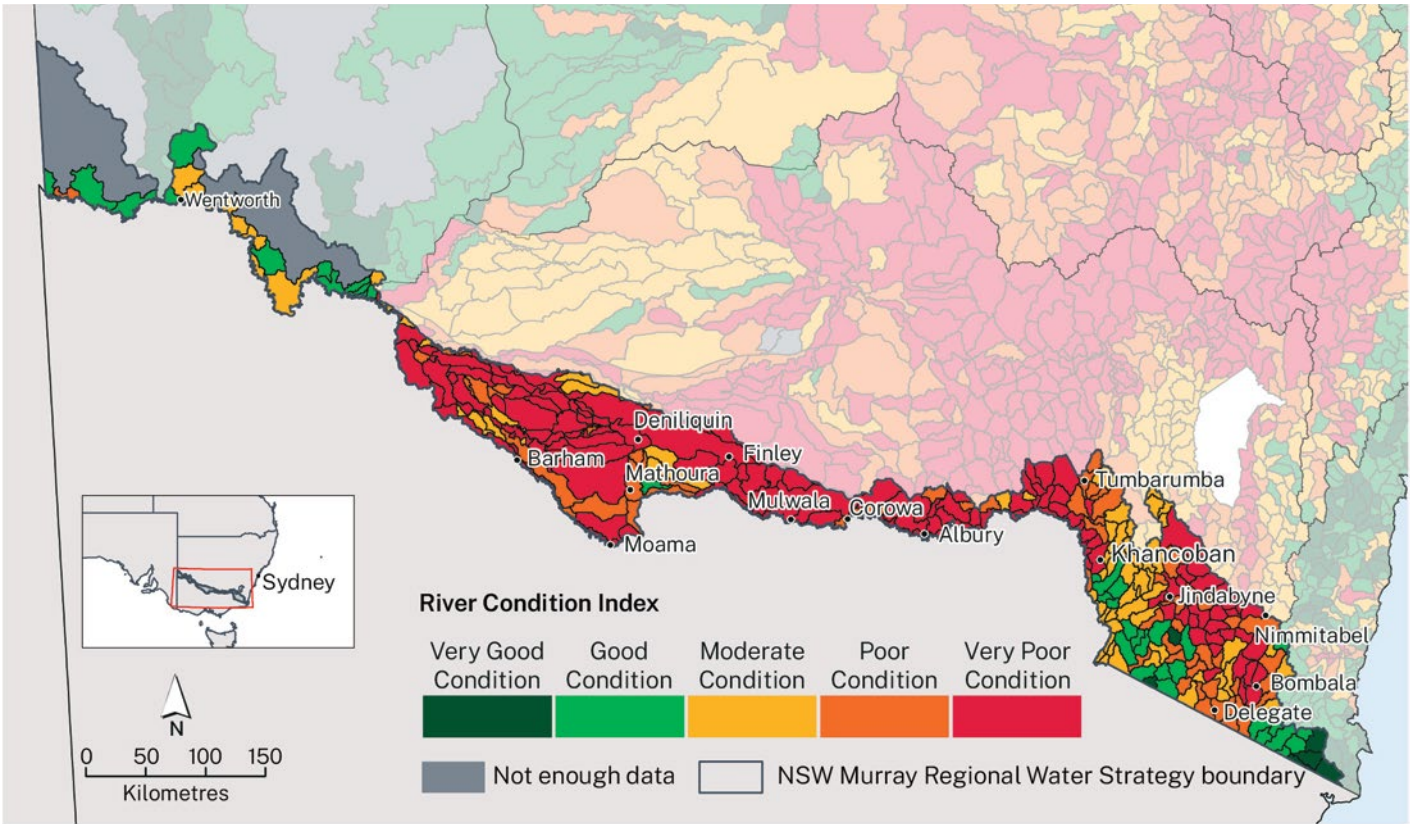
Figure 16. The Upper NSW Murray catchment



53. Available at: dpi.nsw.gov.au/fishing/threatened-species/what-current

Historical and current land and water management, including the development of the Snowy Mountains Scheme, has impacted the ecology of the Upper NSW Murray River and Snowy River catchments resulting in altered stream flows, increased sedimentation, weed infestations, poor biodiversity outcomes including declines in fish populations, and loss of aquatic and riparian habitats. Some areas are in very poor condition as assessed under the NSW River Condition Index (Figure 17).[54] This figure also highlights poor catchment health, right across the NSW Murray region.

Figure 17. River Condition Index for the NSW Murray region



54. More information about the NSW River Condition Index is available at: datasets.seed.nsw.gov.au/dataset/river-condition-index-rci

Restoring unregulated river flow patterns that better resemble the natural hydrological regime helps to reinstate critical processes, such as the transporting of organic matter, nutrient cycling, and habitat creation. These processes, when functioning properly, improve the overall ecological health of the river, and contribute to better water quality.

A significant cause of reduced flow in the Snowy River is due to the flow diversion created by Jindabyne Dam, an integral component of the Snowy-Murray Development of the Snowy Mountains Scheme. The dam led to massive reductions in flow, reducing the natural annual average flow to a trickle flow release.

In a partial recognition of this issue, in 2002 environmental flows were made available through the Snowy Water Initiative Outcomes Implementation Deed (SWIOID). However, the volumes available are limited to an average of 21% of mean annual flow. These reduced flow rates mean that the river cannot adequately flush sediments downstream, and large sand slugs, weed infestation and habitat simplification are all prevalent throughout the Snowy River, with a significant loss of biodiversity.

Under the Snowy Water Licence and the Snowy Water Initiative Outcomes Implementation Deed, current environmental flow rules for the Snowy River require monthly flow release schedules to be set a year in advance, and daily release schedules to be set before the start of each month, meaning it can be difficult to issue releases to respond to natural events or requirements. Further, allocations may only be used in the year they are provided, not strategically carried over into potentially drier future years. These inflexibilities further restrict the effectiveness of the available water to deliver environmental outcomes.

Intense bushfires also create catchment and river-based challenges because loose soil, ash, debris and nutrients wash into watercourses and cause serious impacts such as fish deaths and contamination of town water supplies. Over periods lasting up to and exceeding a century, there can be significant declines in run-off volumes as forests regrow, which reduce river flows. The 2019–2020 bushfire season burnt around 5.6 million ha within NSW, including over 450,000 ha across the Snowy Valleys and Snowy Monaro local government areas and led to declines in water quality and conditions for native fish and other aquatic animals.

To address catchment health issues for the Upper NSW Murray and Snowy rivers, the strategy includes:

- Action 3.3: Investigate innovative ways to improve run–off in water supply catchments. See page 119.
- Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments. See page 111.
- Action 2.10: Improve the flow regime of the Snowy and montane rivers. See page 112.

It could be more difficult to deliver water for the environment in the future

During dry periods, less water may be available to be released for the environment. In some instances, there may be limited opportunities to maintain critical environmental needs such as refuge river pools, core wetland areas and seed banks in soil. Similar to consumptive water users, dry conditions also reduce the reliability of water entitlements held by NSW and Commonwealth environmental water holders.

The NSW Regulated Murray River has a large volume of licenced environmental water with 421 GL in registered entitlements managed by the Commonwealth Environmental Water Holder and around 252 GL managed by NSW.[55]

These entitlements are managed for the benefit of the environment to deliver water to specific sites (such as wetlands) and support ecosystem functions.

In addition, there are the River Murray Increased Flows and Snowy River Increased Flows[56] and the Barmah–Millewa Forest Environmental Water Allocation.

Like any other licence holder, the amount of water available to the environment through held environmental water entitlements and environmental water allowances varies year to year depending on water availability in storages. This variability is considered as part of the annual planning process by environmental water managers.[57] Under a dry future climate scenario, as with all other water entitlement holders, a future with lower water availability would constrain efforts to achieve environmental watering objectives and outcomes.

To improve the way water for the environment is delivered in the NSW Murray region, the strategy includes:

- Action 2.1: Rehabilitate ecologically and culturally important sites within the mid and lower catchment. See page 96.
- Action 2.2: Encourage partnerships with the irrigation sector for environmental water delivery to public and private lands. See page 98.
- Action 2.8: Seek agreement with the Australian Government to develop and implement the Reconnecting River Country Program in the NSW Murray region. See page 110.
- Action 2.10: Improve the flow regime of the Snowy and montane rivers. See page 112.

55. NSW Murray Regulated River Water Source, held environmental water dashboard. Retrieved from: datasets.seed.nsw.gov.au/dataset/nsw-water-dashboards-held-environmental-water
56. River Murray Increased Flows and Snowy River Increased Flows are held environmental water entitlements, with water released from the Snowy Scheme for environmental purposes in the Murray and Snowy rivers.
57. The NSW and Commonwealth environmental water holders own and manage a total of 660 GL of water entitlement, which is 26% of total regulated NSW Murray River entitlement. The majority of this water is in general security entitlements.

Ecological communities are at risk

A number of ecological communities are at risk in the region.

Native fish are under stress from physical and operational barriers. The ability to sustain the native fish of the NSW Murray region is impaired by physical structures such as dams, weirs and floodplain infrastructure that do not have fishways and restrict the ability of native fish to move, to breed and find ideal habitat.

Native vegetation has declined in condition and extent due to a reduction in flood frequency and duration and an increase in land clearing. Groundwater-dependent ecosystems (GDEs) could be at risk if groundwater is increasingly extracted due to a drying climate or for other reasons and if there is reduced recharge of groundwater from surface water. High priority GDEs are located in the catchment from the east of Howlong to the west at the NSW–SA border.

A drier and more variable climate will increase the stress on ecological communities. Events such as intense bushfires can have serious effects. The 2019–20 bushfire had a severe effect on populations of the endangered Macquarie Perch from a loss of streamside vegetation that resulted in increased sediment loads and ash to wash into streams leading to loss of habitat and poor water quality (including low dissolved oxygen).

After long droughts followed by floods, hypoxic (low oxygen) blackwater events can often occur that cause the death of fish and other aquatic animals (see breakout box below).

Water releases from Hume Dam can display temperature decreases of 10 degrees or more in summer, which can extend more than 200 km downstream. Cold water pollution has a significant damaging impact on riverine ecological function, particularly in summer. An almost complete loss of historic populations of Murray cod, Trout cod, Macquarie perch and Freshwater catfish from Hume Dam to Yarrawonga Weir has been experienced from a range of impacts including cold water pollution. However, the impacts of cold water pollution are wider reaching, with cultural impacts and reduced swimming, boating, and recreational fishing opportunities that in turn impact on regional tourism. There is also the potential for reduced crop yields[58] as the cold water temperature suppresses seed germination and plant growth.

Every year, unscreened pumps in the NSW Murray region extract large numbers of native fish and other aquatic species such as crayfish and turtles. Adult fish, as well as juveniles, larvae and eggs, are diverted and isolated in irrigation channels.

Image courtesy of Jason King, NSW Department of Climate Change, Energy, the Environment and Water. River Red Gums, NSW.

58. Wierenga PJ and Hagan, R.M. 1966. *Effects of Irrigation on soil and crop*. Available at: californiaagriculture.org/article/112825-effects-of-cold-irrigation-water-on-soil-temperature-and-crop-growth

Hypoxic blackwater and fish deaths

Large-scale hypoxic blackwater events, such as those that occurred in 2011, 2016 and 2022 are driven by biological processes, but are exacerbated by water resource developments and potentially a changing climate. These events caused widespread fish and crustacean deaths across the southern Murray–Darling Basin. Fish deaths that are likely linked to hypoxic blackwater have been reported in the southern Basin and the Barwon–Darling since the late 1800s, so there is some evidence that such events have occurred prior to major water resource developments.[59]

Most large-scale hypoxic blackwater events happen after prolonged periods where floodplains have not been regularly inundated either due to prolonged dry periods, or due to water resource developments that restrict such inundation. This leads to extensive build-ups of organic material, such as leaf litter, which is then washed into the river during flood events – feeding a boom in microscopic organisms that consume the available oxygen. Temperature is a critical factor in hypoxic blackwater generation, as bacterial production increases with warmer temperatures. Another critical factor with hypoxia is that the oxygen carrying capacity of water physically decreases as water temperature increases, reducing available oxygen. This means that a warming climate is likely to increase the likelihood of these events.

WaterInsights data by WaterNSW[60] includes dissolved oxygen values for some river gauges in NSW which can give an indication of the likelihood of a hypoxic blackwater event.

All actions within 'Priority 2: Improve river and catchment health' contribute to improving outcomes for at-risk ecological communities.

Image courtesy of Destination NSW. Lake Hume Resort, Luke Hume Village.

59. More information on blackwater can be found at: water.dcceew.nsw.gov.au/our-work/allocations-and-availability/drought-floods-and-extreme-events/hypoxic-blackwater
60. WaterNSW data can be found at: realtimedata.waternsw.com.au/water.stm

Challenge 3: Addressing barriers to Aboriginal people's water rights

Water is an essential part of Aboriginal people's culture and heritage, but the current water management framework is not meeting the needs and aspirations of Aboriginal people.

There is limited understanding of the cultural significance of water to Aboriginal peoples

Aboriginal peoples have a profound spiritual, cultural and practical connection to water, viewing it as a sacred element that sustains the life blood of Aboriginal people, culture, Country and communities.

Waterways and catchments are intertwined with cultural identity, community health, and biodiversity. In partnership with Aboriginal people, we should work to protect and manage water as an intergenerational responsibility to ensure that Country inherits healthy ecosystems and abundant water resources for all future generations.

To address limitations in the understanding of the cultural significance of water for Aboriginal people in the NSW Murray region, this strategy includes Action 2.7: Support delivery of cultural outcomes and how cultural values are identified for Aboriginal people. See page 108.

Image courtesy of Destination NSW. Yindyamarra Sculpture Walk, Albury.

The current water management framework limits the ability of Aboriginal people to access water

While Aboriginal people can access rights to water through water use entitlements, the framework is complex and confusing and can be difficult to navigate. In addition, current water access rights may limit Aboriginal people's access to water for economic purposes and there are some remote Aboriginal communities that have limited access to clean drinking water.[61]

The current water management framework inhibits access to culturally significant areas and waterways and there is limited acknowledgement of the impact of current river operations on the environmental and cultural value of these assets.

Development of a policy framework about cultural flows is in its infancy in Australia.

Cultural flows are not provided for explicitly in the NSW *Water Management Act 2000*, relevant water sharing plans or releases from the Snowy Mountains Scheme. In recent years, environmental water managers have made efforts to achieve cultural and ecological co-benefits[62] and Aboriginal people continue to contribute important knowledge to inform the management of water for the environment in the NSW Murray region. However, these efforts are distinct from how Aboriginal communities envision cultural flows, where water is owned and managed by Aboriginal people and used as per the Cultural Flows definition in the Echuca Declaration.[63]

The costs associated with accessing water are also prohibitive. While some licence and annual fees are waived, there are costs associated with purchasing and maintaining related water infrastructure such as pumps and pipes. Although governments have, at times, set aside funding to help Aboriginal people invest in water entitlements, these commitments have often been 'in principle', and many are yet to be implemented. This lack of funding to manage and access water is compounded when land is under Aboriginal ownership and management.

To improve access to water for Aboriginal people in the NSW Murray region, this strategy includes:

- Action 1.4: Strengthen the role of Aboriginal people in water management. See page 86.
- Action 2.7: Support delivery of cultural outcomes and how cultural values are identified for Aboriginal people. See page 108.

61. Improved access to clean drinking water for remote Aboriginal communities is currently being addressed through the department's Aboriginal Communities Water and Sewerage Program. The Aboriginal communities in the region that are part of the Aboriginal Communities Water and Sewerage Program include: Brungle, Three Ways and Balranald Reserve Endeavour Drive.
62. Available at: environment.nsw.gov.au/topics/water/water-for-the-environment/murray-and-lower-darling/annual-environmental-water-priorities-2023-24
63. The National Cultural Flows Research Project is working to secure a future where Aboriginal peoples' 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. Further information is available at: www.culturalflows.com.au/

Restrictions exists with the Aboriginal cultural water access licensing framework

In NSW, Aboriginal people can access water to care for Country and to support the maintenance of cultural practices and customs by having an Aboriginal cultural-specific-purpose access licence.

In NSW, Aboriginal people can apply annually for an individual Aboriginal cultural water access licence.[64] If granted, this licence can provide up to 10 ML/ year of water for cultural purposes,[65] but it cannot be associated with commercial activities or provide direct economic benefit. Once the cultural project is completed, the entitlement is removed. The special purpose cultural access licence is cancelled once the purpose for which the licence was granted no longer exists. This makes ongoing cultural watering difficult and an onerous process for renewal.

No (high security) Aboriginal cultural water access licences have been granted to Aboriginal people since the Water Sharing Plan for the NSW Murray and Lower Darling Regulated Rivers Water Sources commenced on 1 July 2004. The Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016 is the only water sharing plan to have granted a high–security (Aboriginal cultural) access entitlement.

Some cultural assets in the NSW Murray region have been identified and assessed for water management strategies. Through the Aboriginal Waterways Assessment Program,[66] 2 sites have been assessed in the NSW Murray catchment: the Werai Forest by the Barapa Barapa and Wemba Wemba nations and the Millewa Forest by the Bangerang and Yorta Yorta nations. The Murray Lower Darling Long-Term Water Plan identifies water management strategies to maintain and improve the long-term health of the Werai Forest and other sites in the NSW Murray region. To nourish these important cultural values and assets, genuine and ongoing consultation with Aboriginal people is vital.

Feedback indicates there are challenges in the way water is accessed and managed in Werai Forest, despite having a cultural water management strategy. Costs associated with water infrastructure and insufficient training and resources, can limit the operation of this infrastructure and impact how and where water moves through a site.

Image courtesy of Destination NSW. Wagirra Trail and Yindyamarra Sculpture Walk, Albury.

64. In NSW, the Water Management (General) Regulation 2018 allows for applications to be made for any category of specific purpose access licence, subcategory Aboriginal Cultural, for Aboriginal cultural purposes. This ensures that applications can be made for an Aboriginal Cultural licence throughout NSW for both surface water and groundwater. These licences allow the take of water independent of Native Title rights.
65. Cultural purposes include drinking, food preparation, washing and watering domestic gardens, as well as for Aboriginal cultural uses such as manufacturing traditional artefacts, hunting, fishing, gathering, recreation and ceremonial purposes.
66. Murray Lower Darling Rivers Indigenous Nations. Un-dated. Using the Aboriginal Waterways Assessment Tool: A Handbook for practitioners. See: mldrin.org/what-we-do/aboriginal-waterways-assessment

Cultural water access licence provisions

The NSW Government recognises Aboriginal people's rights to water. We aim to embed water for Aboriginal people in the water planning and management regime in NSW to deliver cultural, spiritual, social, environmental and economic benefit to communities.

While there are provisions for accessing water for cultural purposes in NSW,[67] these do not currently meet the needs and obligations of Aboriginal people to care for Country or achieve the cultural water flows and water management aspirations set out in the 2007 Echuca Declaration.

The Aboriginal Water Program (AWP) is delivering initiatives to give greater recognition to Aboriginal people's water rights and interests, including clarifying the purposes for which cultural water can be used. Several other key pieces of work also provide the foundation for the way forward, including the National Cultural Flows Research Project.[68]

In early 2023, the Cultural Watering Plan Project[69] conducted an expression of interest process for a pilot program. A large number of applications were received, and 6 were selected to participate in the program. The AWP team has been working with these Aboriginal community groups across NSW to develop cultural watering plans for their communities. The plans address the significance of cultural water, explore options for water access and ownership, and establish monitoring mechanisms. The findings will be used to guide reviews of existing water policy and planning frameworks, and to bridge gaps in how we communicate with Aboriginal people.

During 2025, the department sought registrations of interest (ROI) from eligible Aboriginal legal entities for water access licences held by the Minister for Water. These access licences are more versatile than cultural water access licences because they can be used for any purpose, including agriculture, other commercial, cultural or environmental purposes.[70]

The NSW Government will keep working with Aboriginal people and organisations and apply the processes developed in A Pathway to Cultural Flows in Australia.[71]

67. More information about Cultural water access for Aboriginal people is available at: water.dcceew.nsw.gov.au/our-work/projects-and-programs/aboriginal-water-programs
68. Available at: culturalflows.com.au
69. Available at: water.dcceew.nsw.gov.au/cultural-watering-plans
70. More information on increasing Aboriginal ownership of water access licences is available at: water.dcceew.nsw.gov.au/our-work/projects-and-programs/nsw-aboriginal-water-strategy
71. Available at: mdba.gov.au/node/6339

There are limited opportunities for Aboriginal people to participate in water management

A historic lack of water entitlements held by Aboriginal people is a significant obstacle for representation in water management decisions that advance the cultural, economic and social needs of Aboriginal people.

Aboriginal people have raised concerns that water management in the region and across NSW is largely seen as an allocation problem between agriculture, towns and environment. This approach overlooks the interests, values, knowledge and rights of Aboriginal people and their cultural obligation to Country, including their understanding that waterways are living ecosystems that need to be cared for and protected.

There is concern from Aboriginal people that our understanding of the extent of cultural values and assets within the region is limited and needs to be better considered in water management decisions. There is also concern about limited understanding of how cultural obligations to care for land and water connect across communities and language groups, extending to downstream communities, throughout catchments and over connected surface and groundwater systems.

Increasingly, it is acknowledged that Aboriginal knowledge and experience needs to be recognised as an essential element for managing natural resources in Australia. However, significant gaps remain. Opportunities are still limited for Aboriginal people to co-manage activities or participate in water-related decision-making processes because:

- consultation timeframes and processes do not allow the time needed to adequately meet Aboriginal cultural governance processes. This erodes trust and prevents important relationships between Aboriginal people and water managers being established
- the complex set of state and federal laws and systems around water management is often not explained in a culturally appropriate manner
- there is a lack of resources and support for Aboriginal people and Aboriginal community groups to enable their engagement in water management processes
- monitoring, evaluation and reporting do not include Aboriginal input in design, implementation and assessment.

While governments are committed to improving engagement with Aboriginal people and communities, significant progress is still needed before it can be considered a mature, knowledge sharing partnership.

To increase the opportunities for Aboriginal people to participate in water management in the NSW Murray region this strategy includes Action 1.4: Strengthen the role of Aboriginal people in water management. See page 86.

The NSW Water Strategy[72] prioritises Aboriginal people's water rights

The NSW Government recognises systemic issues need to be addressed at a statewide level to better enable the exercise of Aboriginal people's rights and access to water. This is reflected in Priority 2 of the NSW Water Strategy: 'Recognise Aboriginal peoples' water rights and values and aims to increase access to and ownership of water for cultural and economic purposes.[73]

Actions being taken under the NSW Water Strategy are:

- 2.1: Strengthen the role of First Nations/Aboriginal People in water planning and management
- 2.2: Develop a statewide Aboriginal Water Strategy
- 2.3: Provide Aboriginal ownership of and access to water for cultural and economic purposes
- 2.4: Work with First Nations/Aboriginal People to improve shared water knowledge
- 2.5: Work with First Nations/Aboriginal People to maintain and preserve water-related cultural sites and landscapes.

NSW Aboriginal Water Strategy

The NSW Government has developed a NSW Aboriginal Water Strategy in collaboration with Aboriginal people. This initiative fulfills the commitment outlined in Priority 2 of the NSW Water Strategy: 'Recognise First Nations/Aboriginal People's rights and values and increase access to and ownership of water for cultural and economic purposes.'

The NSW Aboriginal Water Strategy empowers Aboriginal people to actively participate in water management and planning decisions, identify ways to enhance their water rights and reflect Aboriginal peoples' voice in terms of:

- culture
- health and wellbeing
- caring for Country
- meaningful engagement
- economic benefit
- shared cultural and environmental benefits.

The NSW Aboriginal Water Strategy captures the recommendations and diverse voices of Aboriginal communities heard through extensive consultations with Aboriginal peoples since 2019. Peak Aboriginal organisations and Regional Aboriginal Water Committees were engaged as an essential part of the process. Based on the continuous community feedback the NSW Aboriginal Water Strategy has guiding principles that form the basis for the next step in an ongoing two-way conversation with Aboriginal people and set the way forward to achieve long-term aspirations and Aboriginal outcomes in water management. This includes increasing water ownership and access for Aboriginal people.

The NSW Aboriginal Water Strategy also emphasises the importance of increasing water literacy among Aboriginal people. Education about water rights, policies, and management is crucial for driving reforms that will lead to improved cultural and economic outcomes for Aboriginal communities.

The NSW Aboriginal Water Strategy was finalised and published in 2025.

72. NSW Water Strategy available at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/nsw-water-strategy
73. More information about Priority 2 of the NSW Water Strategy is available at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/nsw-water-strategy/nsw-water-strategy/nsw-water-strategy-priority-2

Image courtesy of NSW Department of Climate Change, Energy, the Environment and Water. River Red Gums, NSW.

Challenge 4: Supporting existing and emerging industries and livelihoods

Agriculture, agribusiness and hydroelectricity are the major water-reliant industries in the NSW Murray region. The region's water resources also support indirect water users, including tourism and manufacturing. Patterns of land use are changing, and industries are expected to grow over the next 20 years. While there is potential for future development in high–value industries, a shortage of reliable water supplies may hinder this growth. A key challenge for the region is to support new and existing industries within the context of a variable and changing climate and fully committed water resources.

Australian Government water buybacks have impacts on regional communities reliant on irrigation

From 2008–2024, the Australian Government purchased water entitlements across the Murray–Darling Basin as part of 'bridging the gap' efforts to meet the requirements of the Basin Plan sustainable diversion limits (SDLs). Bridging-the-gap purchases have now been completed in the southern Basin.

The *Water Amendment (Restoring Our Rivers) Act 2023* that came into effect in December 2023 allows the Australian Government to use voluntary water purchases, or buybacks, to recover water towards the Basin Plan's 450 GL target of additional environmental water. This has led to the establishment of the Australian Government's Restoring Our Rivers Voluntary Water Purchase Program which is now underway.

While the water purchased is intended to enhance environmental outcomes and can provide indirect social and economic benefits through recreation, tourism, and ecosystem services,[74] there can be considerable negative social and economic impacts from buybacks on communities reliant on irrigation including:

- reduced irrigation use, which places strain on operation of irrigation schemes
- increased water prices in both the temporary and permanent water markets
- increased reliance on the temporary water market which increases the risk profile for irrigators.

The Australian Government is also implementing its $300 million Sustainable Communities Program to support communities and manage socio-economic impacts related to water recovery towards the 450 GL of additional environmental water. The funding is intended to support delivery costs and regional engagement to identify and develop community adjustment initiatives.

While the NSW Government supports implementation of the Basin Plan, it does not support buybacks. In response, we have developed the NSW Alternatives to Buybacks Plan, which shows how commitments in the Basin Plan can be delivered in a way that achieves good environmental outcomes while minimising the exposure of NSW communities to the impacts of broad scale water buybacks by the Australian Government.

To help avoid further buy-backs in the NSW Murray region, this strategy includes Action 3.5: Implement NSW's commitments in the NSW Alternatives to Buybacks Plan. See page 124.

74. Economic benefits associated with ecosystem services include groundwater recharge; water quality improvements for town water supplies, irrigation and stock and domestic use; flood mitigation; nutrient treatment and carbon storage.

Less reliable surface water may impact water reliant industries that are important to the regional economy

The NSW Murray region forms part of a region known as Australia's 'food bowl' with a reputation as one of Australia's premium agricultural areas due to its contribution to the country's agricultural production and economy. The diverse landscape, climate and transport links in the region support a wide range of agricultural industries that rely on the region's water resources.

Water use by annual crops in central and eastern NSW Murray region's local government areas varies significantly between wet and dry years. Comparatively, water use by permanent plantings has remained relatively constant, and there was an increase in irrigation area and volume from 2018 to 2019. Although total water use for industries is bound by the sustainable diversion limits, changes within and between industries – including the growth of permanent plantings in the western parts of the NSW Murray region – is altering the geographical distribution of water use in the catchment, trade patterns and seasonal water demand.[75]

Attracting new, high-value industries and supporting economic diversification is a strong focus for the NSW Murray region. Access to reliable water is important to achieving a more diverse employment and economic base.

The Inland Rail Project, upgrades to the Newell Highway and other initiatives will enable the region to leverage its position along nationally significant rail and road corridors, encouraging further industry development and job growth. The Snowy Mountains Special Activation Precinct will help stimulate economic growth and investments made by the NSW Government, while the Albury Regional Jobs Precinct will leverage the region's established industries to grow existing businesses and attract new businesses.

The new climate data and modelling highlights that, with the current rules and infrastructure under a dry future climate scenario, general security allocations may be significantly reduced compared to the historical climate scenario – both at the start of the irrigation season and end-of-year (Figure 18).

Reduced allocations at the beginning of the irrigation season would mean that irrigators would be less likely to plant annual crops. Combined with less water added to accounts throughout the year, this would likely constrain economic activity in the region.

However, the modelling indicates that end-of-season, high security allocations, perform well across all the modelled scenarios, including the dry future climate scenario. This means that, while there may be some delays in when allocations are added to accounts throughout the year, high security allocations could continue to perform well, indicating that reserves are sufficient (Figure 19).

Image courtesy of NSW Department of Climate Change, Energy, the Environment and Water. Irrigation of citrus, NSW.

75. NSW Department of Planning and Environment 2022, *Draft Murray Regional Water Strategy*, water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program/nsw-murray-regional-water-0

Figure 18. Impact of dry future climate scenario on the NSW Murray region's general security available water determinations for 1 July (top) and 30 June (bottom)

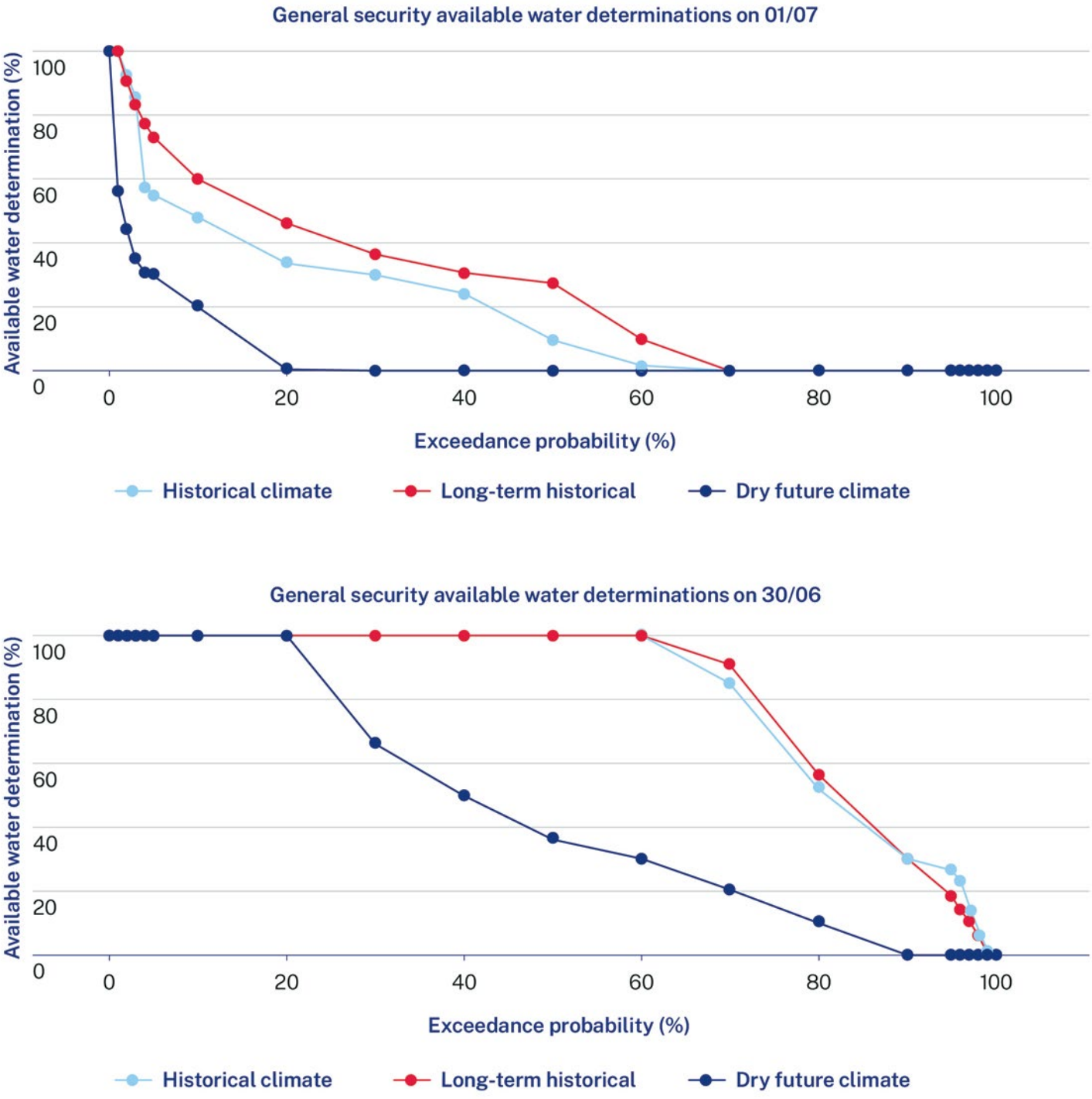
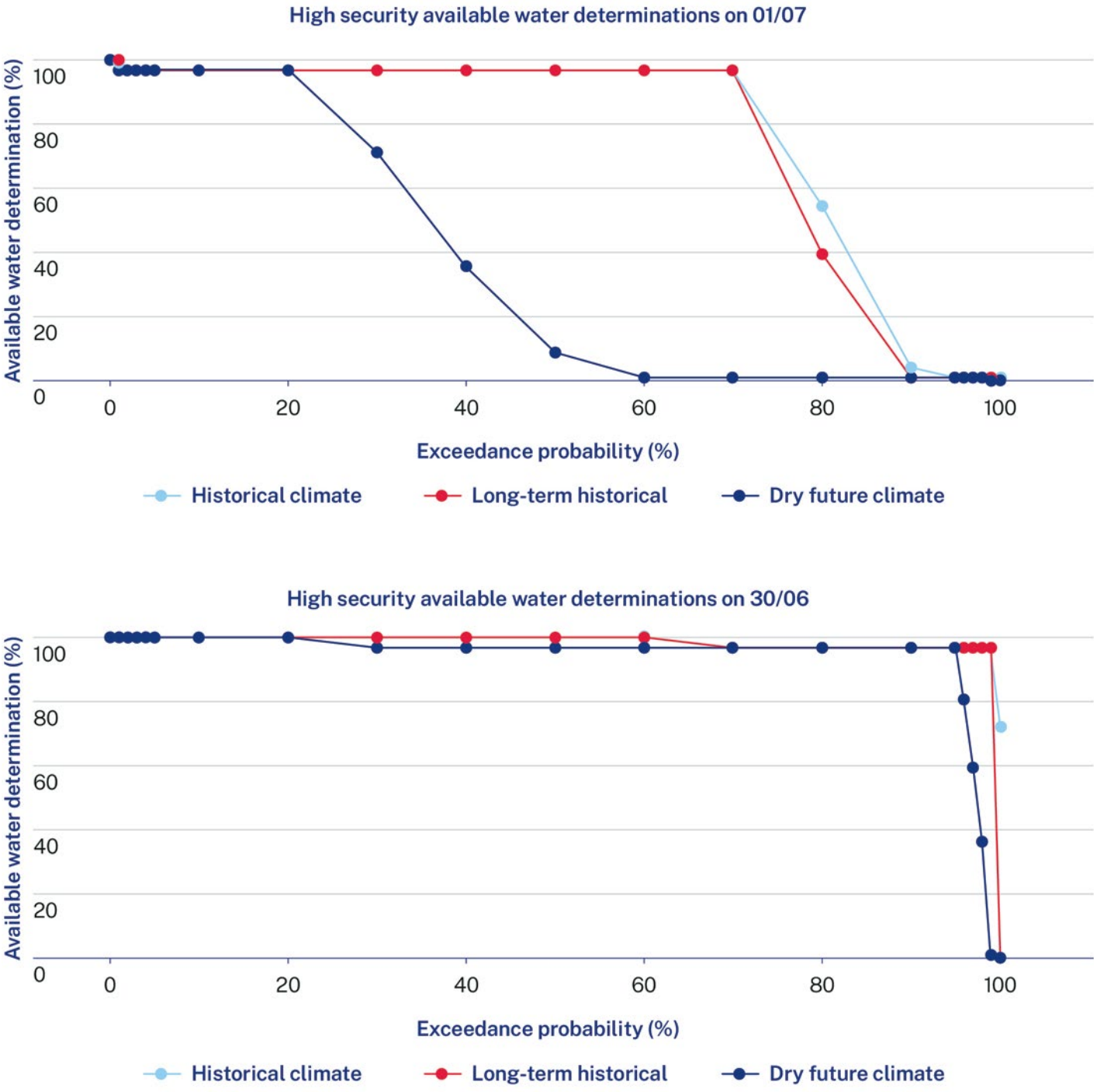


Figure 19. Impact of dry future climate scenario on the NSW Murray region's high security available water determinations for 1 July (top) and 30 June (bottom)



Despite the Murray River being one of the most reliable river systems in inland NSW, climate change has the potential to constrain industry and economic growth across the region. Based on these results, climate change may result in reduced water availability and increased uncertainty for the region's industries. Changes in temperature and seasonality have the potential to force changes to the type of crops that are suitable for the region. More extreme events, such as droughts, floods and bushfires, could cause large-scale economic and social losses for the agricultural sector and communities.

The Snowy Mountains Scheme, critically important for energy generation and regional water management, is not immune to the potential ramifications of climate change on its operations and yield.

A changing climate prompts the need to better understand the operation of the Snowy Water Licence provisions under different climate scenarios.

Limited understanding of future water availability and publicly available climate information can lead to poor investments, business decisions and drought and flood security planning. This can also constrain the uptake of opportunities from alternative water supplies.

A description of the climate scenarios and many other results about water availability are presented in the *NSW Murray and Murrumbidgee Regional Water Strategies: Climate and hydrological modelling report*.[76]

To address water reliability issues in the NSW Murray region, this strategy includes:

- Action 1.2: Improve strategic water management and decision-making frameworks by incorporating new climate and modelled data. See page 83.
- Action 1.5: Better integrate strategic land use and water planning. See page 87.
- Action 3.3: Investigate innovative ways to improve run-off in water supply catchments. See page 119.
- Action 3.6: Improve public access to climate information and water availability forecasts. See page 125.

76. The Department of Planning and Environment, *Climate and hydrological modelling: Murray and Murrumbidgee Regional Water Strategies*, available at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program/nsw-murray-regional-water-strategy

Crop vulnerability assessments

The impacts of climate change are likely to disrupt primary industries in many ways including changes to agricultural productivity, crop yields and pasture availability, as well as changes in the spread of pests, weeds and disease.

Understanding the extent of these changes and the associated vulnerability of primary industries is critical for managing risks and making sound adaptation decisions. At the same time, climate change may offer new opportunities for producers. Understanding the timing and nature of potential opportunities is essential for producers to prepare to maximise any benefit.

The Department of Primary Industries and Regional Development, under the NSW Climate Change Research Strategy,[77] is undertaking crop vulnerability assessments to address this issue. Through a consistently applied approach, with consultation and review by industry, the vulnerability assessment analyses potential climate change impacts and adaptation strategies for 28 commodities across cropping, extensive livestock, horticulture and viticulture, forestry and fisheries.

The project also analyses the impacts of climate change on 14 related biosecurity risks that are relevant to each sector.

The vulnerability assessment has 2 key objectives:

- improve the understanding of climate change risks and impacts
- provide evidence of the value of adaptation strategies to reduce the identified climate impacts.

The assessment applies a standard methodology across all commodities and with the related biosecurity risks. This enables comparisons between commodities across NSW and aims to inform strategic industry planning and policy.

The assessment is being conducted in 4 stages:[78]

- identifying industry needs for, and current activities in, climate change risk and adaptation
- reviewing previous climate change impact and adaptation research and current activities for each industry
- developing a vulnerability assessment to capture climate change exposure risk and sensitivity of key primary producers
- conducting spatial and economic analysis to evaluate climate risk and adaptation options for primary industries.

77. More information available at: www.dpi.nsw.gov.au/dpi/climate/about-dpi-climate/climate-change-research-strategy
78. More information can be found at: dpi.nsw.gov.au/dpi/climate/climate-vulnerability-assessment

There are gaps in our understanding of groundwater resources

Sustainable use of the region's groundwater sources (Figure 11) is critical to support towns, industries and the environment. During drought, reliance on groundwater can increase significantly to support the region's industries and communities.

In the NSW Murray region, there is a high reliance on alluvium water sources for irrigation, especially in the Lower Murray (deep) Groundwater Source. Historically, there have been declines in groundwater levels across the central part of alluvial groundwater sources (for example, around Deniliquin and Blighty of up to 8 m, and up to 4 m around Finley[79]), where the majority of extraction is occurring. Such declines in groundwater levels represent a risk to groundwater-dependent industries, particularly agricultural businesses with critical water demand requirements such as permanent plantings, and to groundwater dependent ecosystems and communities (Challenge 2: Improving the health and resilience of ecosystems). In the last 4 years, use of groundwater sources has decreased due to wet conditions and greater surface water availability.

During drought, demand for and pressure on the NSW Murray region's fully allocated alluvial groundwater sources (Figure 20) increase as groundwater is often used to supplement or replace surface water sources. Although knowledge of groundwater sources in the NSW Murray region has improved, understanding future risks to groundwater systems under different climate projections and population growth scenarios is vital to support industries, ecosystems and towns.

Figure 20. Average level of use and commitment (2015–2023) of alluvial aquifers in the NSW Murray region

79. Department of Industry 2019, *Appendix A: Murray Alluvium Water Resource Plan – Ground Water Resource Description*, water.dcceew.nsw.gov.au/our-work/plans-and-strategies/water-resource-plans/murray-alluvium-water-resource-plan

Groundwater knowledge is built over years from investigation, research, metering and monitoring bore data and groundwater models. But the limited number of monitoring sites, compared to those for surface water, and the inherent complexity of the subsurface environment mean that there are gaps in our knowledge of groundwater. Additionally, it is crucial to acknowledge that climate change impacts groundwater, adding to the inherent complexity of the subsurface environment and highlighting the need for enhanced monitoring, deeper knowledge, and precise quantification of groundwater recharge.

The NSW Government has invested in monitoring and understanding groundwater systems over many decades.[80] However, the status of these systems changes over time in response to changes in groundwater use and the climate. Groundwater levels fall and recover seasonally with annual pumping cycles and over multi-year periods when they decline in dry years and recover in wet years. Groundwater models can be used to assess the long-term (decadal and multidecadal) trends in aquifer behaviour, accounting for the impact of water extraction.

The models simulate the behaviour of aquifers over time, including recharge, contamination plumes, the movement of water and the take of water through bores and are needed for defining long-term sustainable levels of extraction for future reviews of water sharing plans. Continuing to invest in monitoring and updating groundwater system models needs to be a priority. The models are due to be modernised, extended and built at a higher resolution to better model the interaction between groundwater and surface water. There is currently a gap in funding for what we require to do this work.

There are also groundwater quality risks in the NSW Murray region. The Lower Murray Shallow Groundwater Source, notably saline in the western part, has had rising groundwater levels causing waterlogging and salinity in the past. There is potential for this to occur in future if not managed appropriately.

There are saline groundwater discharges in the lower part of the Billabong Creek from the Billabong Creek Alluvial Groundwater Source. This is managed by the Billabong Creek Salt Interception Scheme. Pollution from different land uses is an emerging threat to these systems and the ecosystems they support and better understanding of these changes and threats is needed to protect and manage the resource for the future.

Historically there have been salinity issues in the mid-Murray region due to land clearing and expansion in irrigation, most notably in the Blighty, Green Gully and Wakool areas. Implementation of the Murray Land and Water Management Plan, drainage infrastructure and improved irrigation methods have effectively addressed this issue.

However, expansion of irrigation in the Lower Murray, could be contributing to increased salinity discharge of groundwater to the Murray River. There are a number of salt-interception schemes in the Lower Murray in both NSW and VIC, which mitigate the salinity risk to downstream water users and communities when salinity levels exceed 600 EC (electrical conductivity).

Table 7 summarises challenges in each groundwater source and their related areas.

80. Read more about groundwater science undertaken by the NSW Government at: water.dcceew.nsw.gov.au/our-work/science-data-and-modelling/groundwater-management-and-science

Table 7. Challenge in each groundwater source in the NSW Murray region

Groundwater source	Challenges	Areas/towns affected/related
Upper Murray Groundwater Source	-	Hume Dam to Corowa
Lower Murray (deep) Groundwater Source	Increasing salinity	Deniliquin, Finley
Lower Murray Shallow Groundwater Source	Rising watertable and soil salinisation	Berriquin Irrigation District, Wakool
Billabong Creek Alluvial Groundwater Source	Saline groundwater discharge into Billabong Creek	Walla Walla, Walbundrie
Western Murray Porous Rock	Salinity issues	Southern border, Lake Victoria
Lachlan Fold Belt	Relatively limited with some areas of intense groundwater utilisation due to locally favourable groundwater availability and water quality. Presence of GDEs	

To address gaps in the understanding of groundwater resources in the NSW Murray region, this strategy includes:

- Action 1.1: Improve understanding and management of groundwater sources. See page 82.
- Action 2.5: Continue to expand and update groundwater data collection and modelling to improve groundwater knowledge in the NSW Murray region. See page 104.
- Action 3.2: Support groundwater use for towns and communities. See page 118.

Predicting and managing floods is difficult

Floods are a vital natural process that support the region's ecosystems, providing benefits such as groundwater recharge, lateral connections between rivers, wetlands and floodplains, nutrient and carbon exchanges, and breeding cues for wildlife. They also fill our dams. Floods are also responsible for the productive soils valued by landholders on the NSW Murray's floodplains.

Flooding in the NSW Murray region is often experienced when elevated or flooding flows are passing through Hume Dam and tributary inflows further downstream, either from NSW or VIC, and build upon those flows to exceed flood thresholds. The timing of convergence of all these flows is highly variable and responsive to many factors, which means that flooding in the NSW Murray region is difficult to predict.

Hume Dam provides a high degree of flood protection to downstream communities when the storage is low. About 70% of flood events in the upstream catchment have been stored in Hume Reservoir since 1979. However, the dam is intended to collect and store water for supply, and in wetter years when dam levels reach full capacity, there is very limited ability to mitigate flood events as the dam cannot store water above the Full Supply Level. Floodwaters entering from upstream pass through the storage with only limited reduction in flood peak heights. This can make it difficult to manage flood flows with potentially significant impacts to people and businesses, risks to safety and well-being, disruption of communities, damage to infrastructure, and causing major financial and economic losses. Land use planning and business decisions will always need to take flood risk and vulnerability into account.

To better address issues associated with flooding in the NSW Murray region, this strategy includes:

- Action 1.2: Improve strategic water management and decision-making frameworks by incorporating new climate and modelled data. See page 83.
- Action 2.4: Support development and implementation of the NSW Murray Floodplain Management Plan (FMP) and address floodplain structures. See page 102.

Drought risk mitigation planning roles and responsibilities

Local councils and various state agencies have responsibility for drought preparedness and planning.

Under the Regulatory and Assurance Framework for Local Water Utilities, local water utilities (LWUs) must demonstrate that their local strategic water planning addresses water security, including drought planning. The NSW Department of Climate Change, Energy, the Environment and Water supports local councils to undertake this strategic planning, including providing guidance to local water utilities.

Flood risk mitigation planning roles and responsibilities

The Murray–Darling Basin Authority and state governments manage major storages in the River Murray system, with the aim to ensure dam structures remain safe during floods. The department's Conservation Programs, Heritage and Regulation group is primarily responsible for providing flood risk management advice to government and supporting local councils to meet their flood risk management planning responsibilities for urban communities. These activities are undertaken in line with the NSW Flood Prone Land Policy and the Flood Risk Management Manual and its supporting toolkit and the Floodplain Management Program.

The department's Water group is responsible for the development, review and replacement of rural floodplain management plans under the NSW *Water Management Act 2000*. These plans coordinate development on declared floodplains by establishing management zones and setting clear and consistent rules and assessment criteria for each zone. The plans also identify and protect flood-dependent ecological and cultural assets and help identify risks to life and property from the effects of flooding. Work is underway to replace the historical floodplain management plans in the NSW Murray region with a single floodplain management plan and associated declared floodplain. The replacement floodplain management plan is anticipated to commence in July 2026.

The NSW Reconstruction Authority is currently developing a state disaster mitigation plan and supporting local councils to undertake local and regional disaster planning. The state disaster mitigation plan will:

- identify potential strategies and actions for reducing the impact of disasters
- assess and consider the impacts of climate change on disasters
- determine priority projects for regions to mitigate the impact of disasters.

The state disaster mitigation plan will also set priorities for the plan, disaster adaptation plans and strategic plans under the *Environmental Planning and Assessment Act 1979*.

Other disaster planning and response roles

Under the *State Emergency and Rescue Management Act 1989 and NSW State Emergency Service Act 1989*, the NSW State Emergency Service is the emergency management lead agency. Under the *NSW Reconstruction Authority Act 2022*, the NSW Reconstruction Authority is also responsible for reconstruction and recovery following disasters and other emergencies, including:

- facilitating, coordinating and directing the recovery, planning and rebuilding 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.

The department's Water group plays a support role during emergency incidents including drought and flooding, by providing technical assistance and advice regarding emergency water security options or damaged local water infrastructure.

Other state agencies administer various funding and support programs to assist councils with disaster planning, such as the Regional Drought Resilience Planning Program administered by Department of Primary Industries and Regional Development (DPIRD).

Image courtesy of iStock. Hume Lake, Albury.

A plan to secure water for the NSW Murray region

5

Image courtesy of Destination NSW. Murray River National Park, NSW.

The vision for the NSW Murray 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 challenges in the NSW Murray region, the NSW Murray Regional Water Strategy identifies 3 regional priorities and proposes actions for each priority.

The regional priorities are:

- Priority 1: Continue to improve water management
- Priority 2: Improve river and catchment health
- Priority 3: Support sustainable economies and communities.

These priorities and proposed actions aim to improve the NSW Murray region's readiness to adapt to a more variable climate and support the difficult decisions needed to deliver healthy, reliable and resilient water resources for the region's future.

Image courtesy of Destination NSW. River of Islands Mulwala, NSW.

Priority 1

Continue to improve water management

Effective water resource management in the NSW Murray region requires a holistic and integrated evidence-based approach, involving the cooperation of stakeholders, government bodies, and the community. Regular reviews and the flexibility to adjust management strategies to respond to evolving conditions are essential for long-term sustainability.

Continual improvement in management of water resources is required in the region to maintain ecosystem health, support agriculture and other industries, preserve cultural values, and to safeguard the well-being of communities that rely on the river.

Proposed actions under this priority focus on:

- continuing to incorporate the best available evidence and climate data into the water management framework
- improving the way water and land planning processes are integrated
- fostering collaboration with Aboriginal people.

The success of these actions will require working with stakeholders in the region and incorporating the best available science and operational knowledge.

What is already happening

The NSW Government is investing in several initiatives to improve the management of both surface water and groundwater.

The NSW Water Strategy includes actions to improve water management, such as Action 4.2: Review water allocation and water sharing in response to new climate information and Action 4.4: Better integrate land use planning and water management.

The NSW Aboriginal Water Strategy identifies a program of measures to deliver on Aboriginal people's water rights and interests in water management and was developed with Aboriginal people and communities.

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

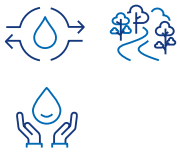
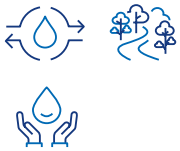
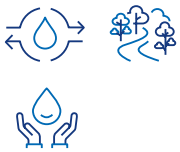
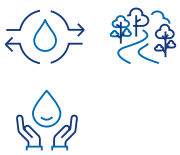
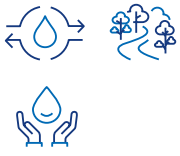
Challenges in the NSW Murray region

Balancing competing interests for water

Improving the health and resilience of ecosystems

Addressing barriers to Aboriginal people's water rights

Supporting existing and emerging industries and livelihoods

Action	Summary	Challenges addressed
Action 1.1: **Improve understanding and management of groundwater sources**	Improve water management by: • better understanding the water requirements of and potential risks to groundwater-dependent ecosystems • updating the approach to reviewing extraction limits • preparing a framework to act on declining groundwater levels • developing a regional water quality monitoring program.	
Action 1.2: **Improve strategic water management and decision-making frameworks by incorporating new climate and modelled data**	The water sharing plans covering the NSW Murray region are due for renewal in 2024, 2026 and 2030. This provides an opportunity for new climate data to be considered in the reviews of these plans. This will allow a review of the drought rules, and aspects of the surface water allocation and trading framework.	
Action 1.3: **Continue to build the climate evidence base for the next Snowy Water Licence Review**	A detailed review of this licence will commence in 2027. This provides the opportunity to include varying climate change scenarios into an agreed inter-jurisdictional model package that could be the main source for testing changes to the Snowy Water Licence, water management policy and operational rules relating to the Snowy Hydro Limited system.	
Action 1.4: **Strengthen the role of Aboriginal people in water management**	Support Aboriginal people's continued involvement in water management activities and decision making.	
Action 1.5: **Better integrate strategic land use and water planning**	Work across government to better integrate future strategic land use and water planning so that water resources can be considered upfront in future land use planning processes. This action would also consider projected population and industry growth trends and identify water-related gaps in the current land use planning framework in the NSW Murray region.	
Action 1.6: **Work with Basin Governments to participate in the review of the Commonwealth *Water Act 2007***	Under this action, NSW would participate in the Australian Government's review of the *Water Act 2007*.	

Action 1.1: Improve understanding and management of groundwater sources

Action outcomes:

- Improved understanding and management of groundwater resources.

Over the decades, the NSW Government has invested in improving understanding and management of groundwater systems.[81] However, these systems respond over time to changes in groundwater use and the impacts of climate change. There are also emerging risks to these systems and the ecosystems they support, such as pollution from different land uses.

These changes and risks need to be better understood to adapt groundwater management frameworks to protect and manage this valuable resource for the future. Continuing to invest in groundwater science and collaboratively increasing and sharing knowledge of groundwater sources and their dependent ecosystems is critical to future management of this important resource.

The priorities and actions outlined in the NSW Groundwater Strategy (2022) will support improved groundwater management in the NSW Murray region.

Reviewing and improving our groundwater policy and planning approaches across the state sets the foundation for future management approaches that recognise the unique challenges for groundwater management in the region.

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

The following table provides sub-actions to achieve this action.

Table 8. Sub-actions to achieve actions in Action 1.1: Improve understanding and management of groundwater sources

Sub-action
1.1.1 Review our approach to setting long-term average annual extraction limits in priority areas.
1.1.2 Develop a groundwater-level management framework and implementation guideline with a series of escalating management actions corresponding to stages of localised water-level decline. This is consistent with the NSW Groundwater Strategy.
1.1.3 Develop and implement guidance that clarifies the management rules for groundwater sources where the total entitlement shares are greater than the long-term average annual extraction limit.
1.1.4 Improve protection of groundwater dependant ecosystems and baseflows to streams in the NSW Murray region.
1.1.5 Progress the delivery of a NSW program to better understand groundwater quality and risks.

81. Read more about groundwater science undertaken by the NSW Government here: water.dcceew.nsw.gov.au/our-work/science-data-and-modelling/groundwater-management-and-science

Action 1.2: Improve strategic water management and decision-making frameworks by incorporating new climate and modelled data

Action outcomes:

- Updated new climate and modelled data incorporated into the review and update of water sharing plans.
- Water management rules in NSW better account for increasing climate variability to reduce the impact on water users.

Current water sharing arrangements are based on the last 120 to 125 years of recorded data. This limits the understanding of how vulnerable the region could be to the climate variability experienced prior to when records began, or to future extreme wet and dry events under climate change.

The development of new climate data and modelling allows the NSW Government to update regulatory frameworks to be more responsive to a range of current and future climate conditions.

Understanding of the drivers of our current climate has increased over recent years. There is the opportunity to incorporate this knowledge into the way water is managed. While the water allocations framework already provides adaptability to a varying climate this action seeks to make improvements to build upon this work to better address climate variability.

A key element is incorporating this information into the review of the region's water sharing plans to improve the way the system is managed. This action focusses on the refinement of current rules and the development of new rules to improve how the impacts of drought or 'wet' years are handled. This action also supports improvements in how water is shared, leading to greater certainty for water users.

The following table provides sub-actions to achieve this action.

Table 9. Sub-actions to achieve outcomes in Action 1.2: Improve strategic water management and decision-making frameworks by incorporating new climate and modelled data

Sub-action
1.2.1 Review and update water sharing plans for the NSW Murray region[82] using new climate data and information.
1.2.2 Review aspects of the surface water allocation framework to improve adaptability to climate variability for different water availability conditions.
1.2.2.a Investigate changes to minimum inflows in the water allocation framework.
1.2.2.b Investigate changes to discourage water over-ordering and cancelling orders at short notice.
1.2.2.c Investigate changes to better facilitate trade.
1.2.2.d Investigate changes to enhance understanding of future transmission and evaporation losses.
1.2.3 Explore alternative mechanisms such as conversion factors for water trades (for example, a study to quantify volumetric impacts of trading water downstream).
1.2.4 Continue to work with Murray–Darling Basin Authority (MDBA) on the Water Market Reform Roadmap recommendation to investigate impacts of carryovers.

82. The unregulated and regulated water sharing plans of the NSW Murray region are due for renewal in 2034 and 2026 respectively. This provides an opportunity to consider the new climate data in these reviews. The various groundwater water sharing plans covering the NSW Murray region are due for replacement in 2030 and the new climate data could be incorporated into these plans as well.

Converting licences from general security (GS) to high security (HS) entitlements

General security water licences make up around 67% of all licences in the regulated NSW Murray region. In dry years these licences receive lower allocations compared to high security licences.

In the development of the NSW Murray Regional Water Strategy, a shortlisted action was incorporated that proposed to further investigate converting 10% of general security entitlements to high security.[83] This action was shortlisted due to favourable results in several hydrological, economic and environmental assessments. Several benefits were expected including:

- an increase in the availability of high security (HS) entitlement to support recent and expected growth in permanent plantings
- a reduction of pressure on channel constraints in peak delivery periods in years of high allocations
- more opportunities for water entitlement holders to change their portfolio mix.

However, stakeholders highlighted strong concerns about a range of secondary impacts including:

- reliability impacts on general security (GS) entitlements, particularly during dry years
- additional pressure on Irrigation Infrastructure Operators conveyance licences during dry years
- potential impact on water charges arising from lower water sales
- water market distortions and likely secondary impacts on asset valuations
- financial gain where conversion factors are higher than the market price ratio of general to high security
- fairness in participation where demand for conversion exceeds capacity.

As a result, this option will not be considered further for the NSW Murray Regional Water Strategy.

Carryover of allocations traded onto general security accounts from high security

The practice of trading high security allocations into general security accounts for the purpose of carrying over allocations to the following water year is referred to as carryover parking. Stakeholders in the NSW Murray region see carryover parking as a loophole which impacts general security water entitlement reliability.

As part of the Water Market Reform Roadmap, Basin states and the MDBA are evaluating 'carryover parking' to better understand any material impacts on water entitlement holders, water markets and water management.[84] The NSW Government is working on improving the collection of carryover parking related data as a first step of the evaluation.

83. For detailed assessment results and stakeholder views visit: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program/nsw-murray-regional-water-0
84. Department of Climate Change, Energy, the Environment and Water, *Implementing the Water market reform roadmap: Progress report*, October 2023.

Action 1.3: Continue to build the climate evidence base for the next Snowy Water Licence Review

Action outcomes:

- Validated climate evidence base for the 2027 Snowy Water Licence Review.
- Ongoing climate evidence base support for the Snowy Water Licence Review.

River system models have been integrated as part of the development of the NSW Murray and Murrumbidgee regional water strategies and further refined through the Snowy Water Licence Review Implementation Program.

The work done to date is significant because it provides the first evidence-based climate tool to support decisions around the Snowy Water Licence.

However, for the licence review, the model requires further work to include varying climate change scenarios to understand the implications of a potentially drying climate.

Regulation of the Snowy Water Licence is legislated under the *Snowy Hydro Corporatisation Act 2002* and operated through the Snowy Water Inquiry Outcomes Implementation Deed (SWIOID) and licence. A review of the licence is undertaken every 10 years. A detailed review of the Snowy Water Licence is planned to commence in 2027.

The following table provides sub-actions to achieve this action.

Table 10. Sub-actions to achieve Action 1.3: Continue to build the climate evidence base for the next Snowy Water Licence Review

Sub-action
1.3.1 Establish formal inter-jurisdictional data-sharing agreements to: • facilitate the exchange of model input data, ensuring seamless collaboration for ongoing model refinements and climate evidence integration • agree on an approach to incorporate climate change into the modelling.
1.3.2 Further develop the models by integrating climate change scenarios that assess water availability impacts for both the environment and downstream users. Ensure models are validated against current and projected Snowy Scheme infrastructure.
1.3.3 Implement recommended actions from the 10-Year Snowy Water Licence Review, that are tested and developed using the new integrated modelling, where appropriate, to adapt the licence to changing climate conditions.
1.3.4 Consolidate a framework for inter-jurisdictional collaboration on data sharing and model refinement, ensuring the Snowy Water Licence review process has continuous access to updated climate data and model inputs.

Action 1.4: Strengthen the role of Aboriginal people in water management

Action outcomes:

- Consistent participation by Aboriginal people in NSW Government decision making about water management.
- Appropriate mechanisms are in place to support Aboriginal people to participate in water management.

This action will support 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 the NSW Murray Regional Water Strategy, Aboriginal people told us that engagement 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 (AWP) and the Aboriginal Water Strategy (published in 2025). The Aboriginal Water Program will continue to be implemented in the NSW Murray region and across the state. The NSW Aboriginal Water Strategy will be progressively implemented to ensure better outcomes for Aboriginal communities.

The following table provides sub-actions to achieve this action.

Table 11. Sub-actions to achieve Action 1.4: Strengthen the role of Aboriginal people in water management

Sub-action
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, with future actions to be guided by the NSW Aboriginal Water Strategy.
1.4.2 Continue the current NSW Regional Aboriginal Water Committee (RAWC) model of engagement through to at least the end of June 2026, and seek RAWC member views on preferences for a model beyond June 2026.
1.4.3 Explore how Aboriginal people want to be represented on the NSW Murray and Lower Darling Environmental Water Advisory Group (EWAG) and how their priorities may be represented in annual and long-term environmental water planning.
1.4.4 Continue to collaborate with Aboriginal people in a culturally appropriate way to understand and identify programs needed for their communities.
1.4.5 Provide training and support to NSW Murray and Lower Darling Environmental Water Advisory Group (EWAG) members to further develop their cultural competence and capacity.
1.4.6 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.

Action 1.5: Better integrate strategic land use and water planning

Action outcomes:

- Water resources are considered upfront in strategic land use planning processes.
- Strategic land use and water planning are integrated.

Water resources are not always considered upfront in broader strategic land use planning processes, leading to inefficiencies and missed opportunities. Poor coordination between land and water planning can negatively impact existing water users, the environment, and lead to population and industry growth in areas with limited water availability. This increases pressure on already stressed surface and groundwater resources.

During consultation we heard broad support for progressing this action, which has implications for both of urban and rural developments. There was also a suggestion to foster partnerships between government, stakeholders and communities, including inter-jurisdictional relationships to support better integration of these planning processes.

There are opportunities to better integrate water resource planning in strategic planning processes that will also help to more closely integrate future iterations of the regional (land use) plans (draft South-East and Tablelands, draft Far West, and Riverina Murray regional plans)[85] and future iterations of the regional water strategies.

The following table provides sub-actions to achieve this action.

Table 12. Sub-actions to achieve Action 1.5: Better integrate strategic land use and water planning

Sub-action
1.5.1 Assess the region's water demand considering population growth and regional development trends to identify shifts in water needs.
1.5.2 Evaluate potential flood risks by analysing new developments and changes in land use that could increase vulnerability to flooding.
1.5.3 Assess current land uses and development trends to identify potential sources of point and non-point pollution risks to the environment and waterways and propose updates to land use planning controls to mitigate these risks and protect water resources.
1.5.4 Improve access to information for developers and councils about water availability, water quality, and any associated risks to local water resources, waterways, and riparian corridors.
1.5.5 Continue to review and update local government and state government water and land use planning frameworks to ensure alignment. Including improved involvement of local water utilities and county councils in the planning approval process.
1.5.6 Conduct a quantitative assessment of long-term climate change and future drought impacts on irrigated permanent and annual crops in the NSW Murray region. This would include assessment of economic impacts on both primary and secondary industries.

85. For more information about the regional plans visit: www.planning.nsw.gov.au/plans-for-your-area/regional-plans

Note that the regional water strategies are not proposing to prohibit particular land uses in NSW regional areas. Land use planning will continue to be managed under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Land uses and the *Environmental Planning and Assessment Act 1979*

The main statute governing land use planning in NSW is the EP&A Act. Other relevant legislation that affects land use includes the *Local Government Act 1993*, *Crown Land Management Act 2016*, *Aboriginal Land Rights Act 1983* (ALR Act), *Mining Act 1992*, *Biodiversity Conservation Act 2016* (BC Act) and NSW *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 councils, while the NSW Government is responsible for ensuring that NSW's goals are achieved at the regional level, in partnership with councils.

In 2015, the EP&A Act was amended to give effect to the preparation of regional plans, set out what the plans need to address, and provide for their regular review.

Prior to the release of regional plans in 2017, there was no consistent regional scale framework for strategic planning. Since then, the strategic planning framework has been strengthened at the local level with the preparation of local strategic planning statements, which provide an opportunity for a council to set out the strategic vision for the future of the local government area. Each council in the NSW Murray region has a local strategic planning statement and a requirement to review the statement at regular intervals.

Action 1.6: Work with Basin Governments to participate in the review of the Commonwealth *Water Act 2007*

Action outcomes:

- Consideration of NSW issues and suggested amendments through participation in the Australian Government's statutory review of the *Water Act 2007*.

The *Water Act 2007* (the Act) primarily focuses on managing the Murray–Darling Basin's water resources. It aims to ensure sustainable water extraction, promote efficient water use, and protect the environment within the Basin. Section 235 of the Act requires the Commonwealth Minister to cause a review of the operation of the Act, and the extent to which its objects have been achieved, before the end of 2027.

Through participation in the review of the Act, NSW will work with Basin Governments to seek updates or amendments to simplify the legislative framework and to reflect contemporary understanding of the risks, challenges and opportunities for water management.

Table 13. Sub-actions to achieve Action 1.6: Work with Basin Governments to participate in the review of the Commonwealth *Water Act 2007*

Sub-action
1.6.1. Work with Basin Governments to participate in the review of the Commonwealth *Water Act 2007*.

Image courtesy of iStock. Murray River, NSW.

Priority 2

Improve river and catchment health

Improving river and catchment health brings a range of benefits. It enhances water availability by promoting groundwater recharge, attenuates floods, maintains base stream flows, promotes good water quality, reduces water treatment costs, increases crop yields and supports biodiversity, cultural and recreational values.

To improve catchment health our management systems and decision-making processes need to use a holistic, whole-of-catchment approach.

Actions proposed under this priority focus on:

- improving the ability to deliver environmental water
- adopting an integrated catchment management approach to address water quality challenges
- improving water resource health through better land management that considers Aboriginal knowledge and culture, to benefit users at local, whole-of-catchment and regional scale
- limiting or removing pressures and impacts directly related to water infrastructure.

What is already happening

The Murray–Lower Darling Long-Term Water Plan[86] was developed to describe flow regimes that are 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 NSW Murray region's riverine and floodplain environmental assets and the ecosystem functions they perform. The NSW Water Strategy includes a commitment to consider long-term water plans to protect and enhance ecological systems.

The Natural Resource Commission is currently undertaking an independent review of the Water Sharing Plan for the NSW Murray and Lower Darling Regulated Rivers by the end of the 2025–26 financial year. This review will help identify opportunities to improve water sharing provisions and associated outcomes.

The Water Quality Management Plan developed for the NSW Murray and Lower Darling Surface Water Resource Plan,[87] the Murray Alluvium Water Resource Plan,[88] NSW Murray–Darling Basin Fractured Rock Water Resource Plan[89] and the NSW Murray–Darling Porous Rock Water Resource Plan[90] aims to provide a framework to protect, enhance and restore water quality for the region.

The Protecting Our Places Grants Program[91] encourages and empowers Aboriginal communities to protect, conserve and restore landscapes and waterways that are important to them to achieve long-term beneficial outcomes for the environment.

Implementing recommendations from the first 10-Year Snowy Water Licence Review has involved developing an integrated water model of the Snowy, Murray and Murrumbidgee systems and exploring improvements to the delivery of environmental flows through the Snowy River Increased Flows Program.

The next Snowy Water Licence Review, due to commence in 2027, will focus on a range of administrative and technical issues, including exploring better ways to deliver environmental flows.

86. More information at: www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/murray-lower-darling
87. More information at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/water-resource-plans/nsw-murray-and-lower-darling-surface-water
88. More information at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/water-resource-plans/murray-alluvium-water-resource-plan
89. More information at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/water-resource-plans/nsw-murray-darling-basin-fractured-rock-water
90. More information at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/water-resource-plans/nsw-mdb-porous-rock-water-resource-plan
91. More information at: www.environment.nsw.gov.au/funding-and-support/nsw-environmental-trust/grants-available/protecting-our-places

The River Murray Joint Venture Program[92] includes programs and project management activities to meet the NSW Governments responsibilities under the Murray Darling Basin Agreement. Key activities include:

- The Basin Salinity Management Strategy 2030[93] is a program of coordinated salinity management focused on maintaining salinity within the Murray–Darling Basin at appropriate levels to protect economic, environmental, cultural and social values. As part of the strategy, NSW and joint venture partners from SA, VIC and the MDBA maintain a salinity accountability framework and continually invest in managing salinity and improving understanding of salinity risks.
- NSW and joint venture partners operate and maintain 3 Salt Interception Schemes at Mallee Cliffs, Buronga and Upper Darling to significantly reduce the input of saline groundwater into the river system. In addition, one state-owned scheme located adjacent to Billabong Creek (north of Albury) is operated and managed under this program of works.
- The Living Murray Indigenous Partnership Program[94] supports the involvement of Aboriginal people in planning and managing iconic sites along the Murray River.
- The River Works Program[95] includes local projects addressing erosion control and stream channel revegetation and activities by organisations such as local Landcare groups to remove riparian weeds removal, stream bank stabilisation and promoted 'waterway friendly' farming practices.

Recently, the *Water Amendment (Restoring Our Rivers) Act 2023* was passed. This provides increased funding and an extension of 2.5 years to complete delivery of several SDLAM projects.

The Australian Government committed $15.2 million to investigate and identify a safe, effective and integrated range of measures to control carp populations in Australia. $10.4 million was allocated to the Fisheries Research and Development Corporation to undertake a feasibility assessment, referred to as the National Carp Control Plan.

The NSW Water Strategy sets out actions under Priority 3 to improve river, floodplain and aquifer ecosystem health and system connectivity. These provide a strong foundation for actions taken in the NSW Murray 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 provides sector-wide guidance on future science, research and development.

The NSW Government and other local organisations are delivering programs that support the adoption of best practice land management by local landholders to improve productivity and reduce land and water degradation. These programs include:

- restoration of riparian habitat for targeted species
- irrigation audits
- guidelines for fertiliser application
- improved management of farm runoff and water quality
- adaptive farms for sustainable landscapes
- improved capacity to prepare and recover from droughts and bushfires
- community engagement and extension to consolidate and increase awareness of natural values
- control of weeds and pest animals.

92. More information at: water.dcceew.nsw.gov.au/our-work/water-infrastructure/regional-projects/river-murray-joint-programs
93. More information at: www.mdba.gov.au/publications-and-data/publications/basin-salinity-management-2030-strategies-and-reports
94. More information at: www.mdba.gov.au/climate-and-river-health/water-environment/living-murray/indigenous-partnership-program
95. More information at: www.dpie.nsw.gov.au/water/our-work/water-infrastructure-nsw/regional-projects/river-murray-joint-programs

Landcare groups and the Local Land Services are focusing on projects to improve river health and address riparian areas or land degradation, including:

- erosion intervention to protect waterways in the West Hume Landcare area through improving land management practices that will reduce the impacts of sedimentation
- Refreshing Rivers Program is a 10-year project to improve waterway health across the Murray–Riverina region by encouraging the adoption of river-friendly land management practices. This includes the development of Waterway Management Plans that are tied to social/cultural, environmental, and economic outcomes
- the NSW Murray Local Land Services NRM Core Services Project aims to improve the condition of wetlands and waterways by increasing community awareness of natural values, build landholders capacity to manage natural resources and improve resilience of significant aquatic species and ecosystems.

Extension services are also provided by the Natural Resource Access Regulator (NRAR) to help landholders, agricultural producers, irrigators and others understand water laws and their environmental responsibilities.

The NSW Government is investing $1.7 million over 2 years in the Integrated Catchment Management Work Program to develop a reform package for a new, enhanced integrated catchment management framework and governance model.

Image courtesy of Destination NSW. Lake Mulwala, NSW.

Challenges in the NSW Murray region

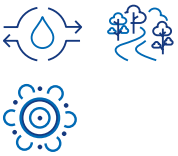
Balancing competing interests for water

Improving the health and resilience of ecosystems

Addressing barriers to Aboriginal people's water rights

Supporting existing and emerging industries and livelihoods

Action	Summary	Challenges addressed
Action 2.1: **Rehabilitate ecologically and culturally important sites within the mid and lower catchment**	This action aims to improve habitat for native plants and animals and improve water quality, river health and ecosystem resilience in the regulated areas of the NSW Murray region.	
Action 2.2: **Encourage partnership with the irrigation sector for environmental water delivery to public and private lands**	Governments, irrigation infrastructure operators, Aboriginal people and landholders working together through voluntary partnerships to deliver water for the environment to reach ecosystems on public and private lands.	
Action 2.3: **Mitigate the impact of infrastructure on native fish**	Progress work to seek the installation of fish passages at priority sites and build on existing government commitments to encourage and provide incentives for the installation of diversion screens at priority pumps sites. This action would also restore and restock degraded native fish habitats and explore solutions to address cold water pollution.	
Action 2.4: **Support development and implementation of the NSW Murray Floodplain Management Plan (FMP) and address floodplain structures**	Support the development of a valley-wide, connected floodplain management plan and address floodplain works and structures that adversely impact the environment and Aboriginal cultural assets and values.	
Action 2.5: **Continue to expand and update groundwater data collection and modelling to improve groundwater knowledge in the NSW Murray region**	Continue to improve groundwater system models that underpin water management planning in the NSW Murray region. This would include developing multidisciplinary models that incorporate socio-economic, physical and groundwater data.	
Action 2.6: **Adopt a catchment management approach to improve water quality in the NSW Murray region**	Explore reform options that could improve catchment management in NSW and consider these options for the NSW Murray region.	

Action	Summary	Challenges addressed
Action 2.7: **Support delivery of cultural outcomes and how cultural values are indentified for Aboriginal people**	Support Aboriginal organisations and communities to develop tailored projects for their communities. This action would 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. It would include a demonstration river reach, programs to engage Aboriginal youth in water and landscape management, and improved access to sites of cultural significance.	
Action 2.8: **Seek agreement with the Australian Government to develop and implement the Reconnecting River Country Program in the NSW Murray region**	Remove constraints to enable the flexible use of water for the environment to increase the frequency and extent that rivers connect to their wetlands and floodplains.	
Action 2.9: **Support ongoing river restoration in the Upper NSW Murray and Snowy catchments**	Develop and fund a collaborative and coordinated Snowy and Upper NSW Murray River catchment recovery program that integrates a range of river recovery actions. This would build on and enhance existing programs, as well as exploring improvements in environmental water management through the review of the Snowy Water Inquiry Outcomes Implementation Deed.	
Action 2.10: **Improve the flow regime of the Snowy and montane rivers**	This action would investigate a range of opportunities to restore a sustainable flow regime, with partner governments and stakeholders in the Snowy and montane rivers. This action includes scientific studies, infrastructure investments, water plan revisions, revisions to the Snowy Water Inquiry Outcomes Implementation Deed and temporary water restrictions to protect environmental flows.	

Action 2.1: Rehabilitate ecologically and culturally important sites within the mid and lower catchment

Action outcomes:

- Upgraded key water delivery infrastructure and enhanced water distribution at ecologically and culturally important sites, with better coordination of existing rehabilitation programs, integrating local Aboriginal knowledge, and collaborating with communities.
- Ecologically improved habitat quality and restored key culturally significant sites.

This action focuses on restoring important ecological and cultural sites in the mid and lower catchment of the NSW Murray region. It aims to improve riparian, wetland, and floodplain areas, enhancing habitats for native plants and animals and improving water quality across the river system.

The mid and Lower Murray catchments of the NSW Murray region contain ecologically and culturally important sites. The mid-Murray consists of expansive floodplains and anabranches including the Edward/Kolety–Wakool and Niemur rivers. This area is highly developed and contains some of the region's larger towns, including Albury. Many significant dryland and irrigated agricultural industries are in the mid-Murray. Delivery constraints in the mid-Murray River and an expansion of permanent plantings and environmental water use downstream means getting water to where it is needed is often difficult.

Improving river health not only supports biodiversity but also plays a crucial role in filtering and cleaning water, which directly benefits all water users by providing cleaner, safer water for communities. Additionally, healthier river systems sustain cultural practices and values crucial to local Aboriginal communities, while also enhancing recreational and tourism opportunities by creating vibrant natural environments that attract visitors and support local economies.

This action will complement previous environmental restoration initiatives and support ongoing and new initiatives, programs and projects within the mid and lower catchment areas.

The following table provides sub-actions to achieve this action.

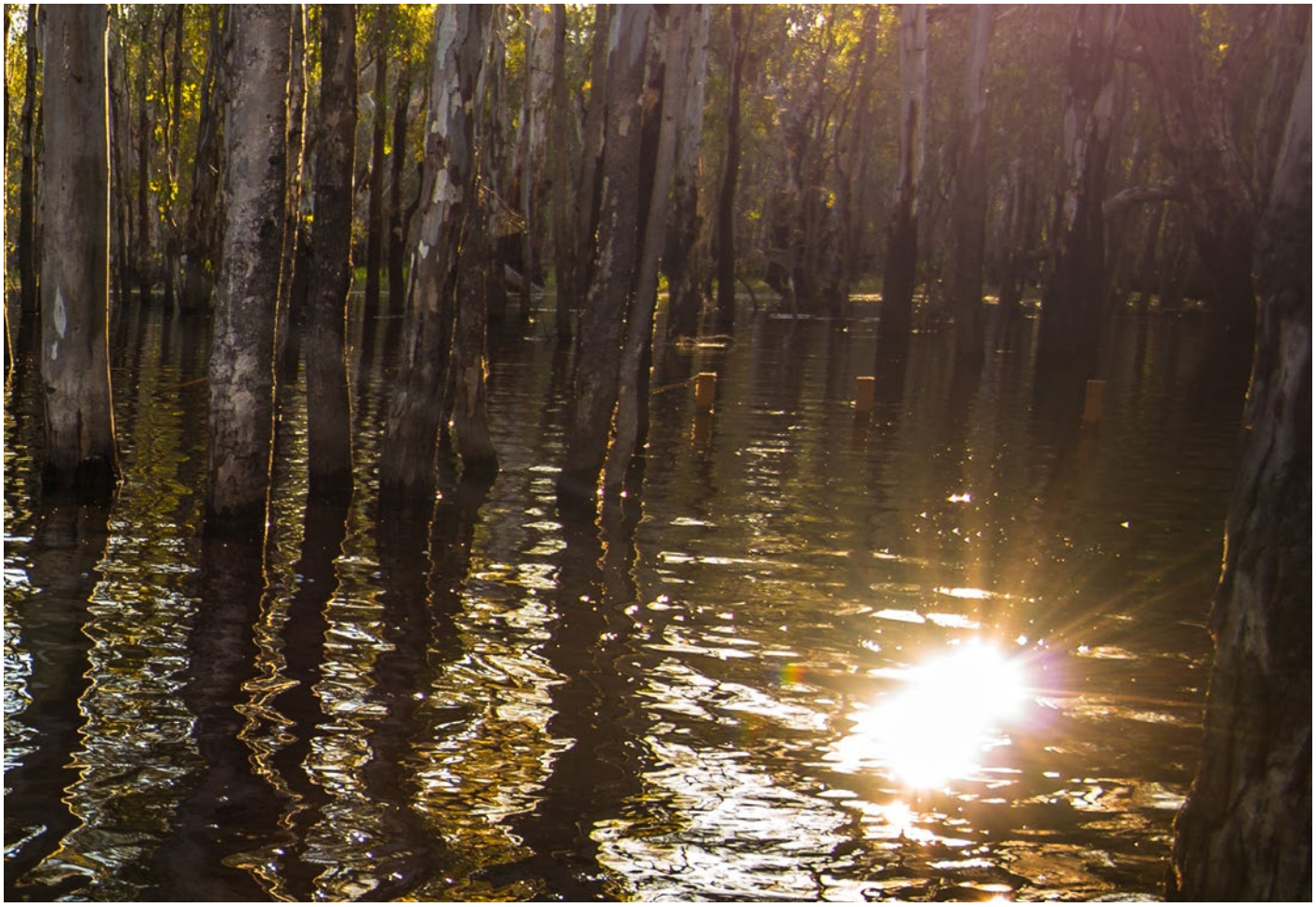


Image courtesy of Destination NSW. Murray River, Barmah National Park.

Table 14. Sub-actions to achieve Action 2.1: Rehabilitate ecologically and culturally important sites within the mid and lower catchment

Sub-action
2.1.1 Collaborate with local Aboriginal people and local communities to support new and existing initiatives to maintain and preserve water-related cultural sites and landscapes.
2.1.2 Improve monitoring of ecological outcomes in collaboration with Aboriginal communities.
2.1.3 Fund the management, such as water use and entitlement charges of the NSW-held environmental water portfolio from consolidated revenue, rather than having to rely on the sale of allocations to generate the required revenue.
2.1.4 Upgrade existing or install new water delivery infrastructure (such as channels, levees, regulators, escapes and pumps) to provide water to wetlands. For example: upgrading Werai and Millewa Forest regulators and restoring Merran, Waddy and St Helena creeks (including Lake Tooim connection).
2.1.5 Upgrade existing infrastructure that restricts or no longer supports flows to key sites (for example, road crossings, box culverts and bridges).[96]
2.1.6 Review the effectiveness of previous measures to manage native species and mitigate invasive species, such as carp, to inform more effective long-term actions.
2.1.7 Develop a better understanding of the tolerable ecological limits of the Barmah Choke and Edward/Kolety–Wakool system.
2.1.8 Support revegetation programs in priority sites that improve habitat and hold the water and soil together.

96. Some of this work would complement work proposed under the SDLAM Program.

Action 2.2: Encourage partnerships with the irrigation sector for environmental water delivery to public and private lands

Action outcomes:

- Established partnerships that facilitate the efficient delivery of water to environmental assets in locations where irrigation infrastructure can assist.
- Improved environmental outcomes that result in, better habitat quality and biodiversity, increased customer base for irrigation infrastructure operators, and reinforced community confidence in water management by actively involving landholders and community members in environmental stewardship.

This action proposes to target additional opportunities to deliver water to wetlands and other significant ecological and culturally important sites using irrigation networks, through voluntary partnerships between land holders, irrigation infrastructure operators, governments and local communities, including the integration of Aboriginal knowledge and cultural science.

Water for the environment is typically delivered to watercourses and wetlands situated on public lands such as nature reserves and national parks.

However, partnerships between the irrigation industry and environmental water managers have also enabled the delivery of water for the environment to private lands. For example, Murray Irrigation Limited has delivered over 205 GL of environmental water to wetlands, ephemeral creeks and rivers within its footprint since 2001.

In addition, Murray Irrigation has secured a $33.5 million Australian Government grant to fund an innovative environmental water initiative, Restoring Murray Waterways. This project aims to upgrade existing infrastructure within the Murray Irrigation channel network and on private land to deliver environmental water to creeks and wetlands in the Murray Irrigation Area that only receive water in times of extreme flooding.

NSW has worked with Murray Irrigation on expanding the Restoring Murray Waterways Project, with the original project and expansion supported as a new SDLAM Project by all Basin Governments. Conversations around funding for the expansion project are underway with the Australian Government, noting that for the project to be recognised by the MDBA under the SDLAM framework, it will need to be delivered by 31 December 2026.

Landholders and people within the community will be able to be actively involved in environmental management, creating a sense of ownership, collaboration and participation. This action aligns with the broader goals of improving environmental outcomes, enhancing biodiversity, and rebuilding community confidence in water management.

The following table provides sub-actions to achieve this action.

Table 15. Sub-actions to achieve Action 2.2: Encourage partnerships with the irrigation sector for environmental water delivery to public and private lands

Sub-action
2.2.1 Explore additional opportunities to deliver water to wetlands using irrigation networks through voluntary partnerships between land holders, irrigation infrastructure operators and governments.
2.2.2 Explore options to continue Action 2.2.1's voluntary partnerships between land holders, irrigation infrastructure operators and governments, in the long-term.
2.2.3 Progress the Restoring Murray Waterways Project as a new SDLAM measure, subject to suitable funding arrangements being agreed.

Action 2.3: Mitigate the impact of infrastructure on native fish

Action outcomes:

- Improved fish passage at priority sites and progressed NSW Diversion Screening Strategy, with enhanced aquatic ecosystem health and more sustainable native fish populations in the NSW Murray region.
- Significantly improved native fish population and aquatic ecosystem health, with restored fish habitats in key areas with emphasis on healthy water conditions.

This action focusses on mitigating the impact of infrastructure on native fish within the NSW Murray region.

Many species of native fish need to move freely within and between rivers and waterways to source food, avoid predators and find shelter, escape the impacts of drought, and seasonally spawn, migrate and recruit. Improving conditions for native fish will increase their resilience and the resilience of all aquatic communities. Water infrastructure such as dams, weirs and pumps are impacting this movement by creating physical barriers, removing and killing juvenile fish, and creating water conditions – for example, cold water – too far removed from a natural state.

Implementing the NSW Fish Passage Strategy

Priority 3 of the NSW Water Strategy includes an action to address threats to native fish through 3 statewide, catchment scale initiatives: implementing the NSW Fish Passage Strategy; addressing cold water pollution through interventions such as temperature monitoring and mitigation technology; and investing in fish-friendly water extraction technology at priority sites in each region.

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

Currently, native fish can only move freely through the NSW Murray region during high flows when water flows over weirs and other instream 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 NSW Murray region.[97]

The NSW Fish Passage Strategy outlined several priority sites for improving fish passage in the NSW Murray region. These include:

- Lake Victoria: Inlet Regulator, Control Regulator, Outlet Regulator
- Mildura Weir Lock 11
- Euston Weir Lock 15 (replacement of fish lock gates)
- Torrumbarry Weir
- Yarrawonga Weir
- Murray Anabranches.

97. More information at: www.dpi.nsw.gov.au/fishing/habitat/threats/barriers

Implement diversion screens at priority pumps

Since European settlement, the Basin has undergone significant ecological decline. Native fish populations have declined dramatically, at least 26 of the 46 native fish species found here are now listed as rare or threatened, and many ecological processes have been interrupted. A key impact of irrigation in the Basin is the entrainment, injury and/or death of tens of millions of native fish annually – estimated at 3.5 native fish per ML of water extracted.[98]

In NSW alone, over 4,500 water pumps are operated for irrigation. In the Murray River, one estimate has for just the large mid-Murray offtakes that up to 1.2 million less fish survive to fingerling stage each year – which is 1,000 times the number of fish stocked into that reach over a 5-year period.[97]

Modern fish-protection screens are automated, self-cleaning technologies that keep fish and debris in natural waterways and out of irrigation infrastructure. The screens work by reducing the velocity of water entering a pump intake, without reducing the volume of water that can be extracted. The technology is proven to work and is available for any type of water diversion, of any size. In NSW, 25 modern screens have been installed to date with 42 more with manufacture underway and scheduled to be installed by 2025.

Modern fish-protection screens can maximise the benefits of the Murray–Darling Basin Plan (the Basin Plan), by reallocating water from agriculture to the environment. The technology protects 90% of native fish that would otherwise be entrained, and effectively eliminates the impacts of debris on water infrastructure. The installation of screens reduces point-source mortality of native fish and helps stimulate widespread adoption of this best practice by irrigators, delivering significant and enduring ecological, economic, social and cultural benefits.

Restore priority habitats of threatened fish species

Reduced and degraded habitat for native fish in the NSW Murray region has led to many species becoming threatened or locally extinct. Restoring habitats can improve the resilience of native fish, which would lead to overall improvements in river function such as the restoration of complex food webs and enhanced water quality.

In some areas, native fish species are locally extinct. Once habitats have been restored, a conservation restocking program would be required for some species in some areas. Community groups and organisations (such as the Tri-State Murray NRM Regional Alliance[99]) are working together to build surrogate breeding populations of threatened fish species.

Progress the NSW commitment to the National Carp Control Plan

Carp are an introduced freshwater pest fish now widespread throughout most of NSW, particularly in the Murray–Darling Basin and other river systems within the NSW Murray region. In many areas they dominate the fish biomass at the expense of native species.

The reported impacts of carp include increased turbidity, algal blooms, riverbank damage and destruction of aquatic vegetation. Although domesticated koi carp are a popular ornamental fish in NSW (they are prohibited in all other states except Western Australia), wild carp are generally unpopular and have been the focus of considerable control efforts – by both governments and communities – for many decades.

Given the scale of the carp problem, the Australian Government is progressing a National Carp Control Plan (NCCP).[100] The NSW government is committed to support and progress the NCCP efforts to have a coordinated and targeted approach in order to maximise the environmental and community benefits that can be achieved from implementing the NCCP locally.

Progress cold water pollution mitigation

Cold water pollution has damaging impacts on riverine ecological function, particularly in summer when biological cues such as fish spawning are disrupted. Water releases from Hume Dam can result in temperature decreases of 10 degrees or more in summer, which can extend more than 200 km downstream. In the Murray River, there has been a loss of trout cod, Macquarie perch and freshwater catfish from Hume Dam to Yarrawonga Weir.[101]

While variable-level offtakes can be operated to reduce cold water pollution risks, in warmer months, the presence of potentially toxic surface algae often mean that it is not possible to use the variable-level offtake to take warmer surface water. As it is not currently possible to remove the risk of algal blooms in Hume Dam, additional actions to manage cold water pollution need to be taken. A cold water pollution options study for Hume Dam will be progressed as funding becomes available.

The following table provides sub-actions to achieve this action.

98. 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.
99. More information at: www.necma.vic.gov.au/Projects/Current-projects/tristate-murray
100. Information about the NCCP is available at: www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/pest-animals-and-weeds/national-carp-control-plan
101. More information on cold water pollution can be found at: water.dcceew.nsw.gov.au/our-work/science-data-and-modelling/surface-water-science

Table 16. Sub-actions to achieve Action 2.3: Mitigate the impact of infrastructure on native fish

Sub-action
2.3.1 Improve fish passage at priority sites as guided by the NSW Fish Passage Strategy, including any existing fish passage infrastructure in the catchment to ensure they meet biological and operational requirements.
2.3.2 Collaborate with local governments to investigate and apply basic best-practice solutions to mitigate impacts locally (e.g. implementation of fish friendly culverts), as funding and works allow.
2.3.3 Progress the development of a NSW Fish Diversion Screening Strategy.
2.3.4 Progress consultation with large-scale water users in NSW Murray region to incentivise the installation of appropriate screens.
2.3.5 In collaboration with existing initiatives, restore fish habitats in the following areas: • Mannus Creek • Hume-Yarrawonga reach • Yarrawonga-Tocumwal reach • Millewa Forest • Torrumbarry-Barham reach • Edward/Kolety-Wakool rivers • Murray-Murrumbidgee junction floodplain • Lower Murray, Frenchmans Creek/Lake Victoria floodplains.
2.3.6 Continue the NSW commitment to the National Carp Control Plan (NCCP), noting that the implementation of any NCCP actions is dependent on Australian Government investment.[102]
2.3.7 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.
2.3.8 Progress cold water pollution mitigation options and options assessments for Hume Dam.

102. Information about the NCCP is available at: www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/pest-animals-and-weeds/national-carp-control-plan

Action 2.4: Support development and implementation of the NSW Murray Floodplain Management Plan (FMP) and address floodplain structures

Action outcomes:

- Commence NSW Murray Floodplain Management Plan.
- Improved health of floodplains managed in accordance with the NSW Murray Floodplain Management Plan.

During the first public exhibition of the NSW Murray Regional Water Strategy stakeholders raised concerns about existing structures on floodplains in the NSW Murray region and their impact on the environment and Aboriginal cultural assets and values. We also heard concerns about the increased risk to life and property from existing and new structures on floodplains following the recent flooding in the region.

In 2021, the department's Water group completed a review under section 43 of the NSW *Water Management Act 2000* and is currently progressing the replacement of 5 localised floodplain management plans (FMPs) for the NSW Murray region with one valley-wide FMP and associated declared floodplain.[103]

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

The following table provides sub-actions to achieve this action. Implementation may require coordination with Action 2.8: Seek agreement with the Australian Government to develop and implement the Reconnecting River Country Program in the NSW Murray region on page 110.

Image courtesy of Vince Bucello, NSW Department of Climate Change, Energy, the Environment and Water. Reed Beds Swamp, NSW.

103. More information is available on the replacement floodplain management plans at: water.dcceew.nsw.gov.au/our-work/floodplain-management/floodplain-management-plans/southern-floodplain-management-plans

Table 17. Sub-actions to achieve Action 2.4: Support development and implementation of the NSW Murray Floodplain Management Plan (FMP) and address floodplain structures

Sub-action
2.4.1 Progress the NSW Murray 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.
2.4.2 Define an overall boundary for the floodplain and categorise the different areas within it into management zones.
2.4.3 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.
2.4.4 Undertake a comprehensive consultation process for the development of the NSW Murray Floodplain Management Plan incorporating local expertise, with formal public consultation and opportunities for property-scale feedback.
2.4.5. Establish an interagency working group to review the plan throughout each stage of development.
2.4.6. Work with NRAR and WaterNSW to bring unapproved structures on floodplains into compliance.
2.4.7. Consider options to accelerate the process of bringing unapproved or non-compliant structures on floodplains into compliance. This could include rolling out a program like the Improving Floodplain Connections Program[104] for the NSW Murray region.
2.4.8. Liaise with WaterNSW and MDBA to investigate operational releases from dams and re-regulating structures and include operational river constraints for floodplain risk management. (Note: This is not part of the development and implementation of the floodplain management plans).

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

Action 2.5: Continue to expand and update groundwater data collection and modelling to improve groundwater knowledge in the NSW Murray region

Action outcomes:

- Improved monitoring bore network, filling in data gaps to enhance our groundwater knowledge and update our groundwater models for the NSW Murray region.
- Improved and updated multidisciplinary models and developed approaches for future water management needs.

Strong feedback from stakeholders was received for improving and expanding our groundwater data collection in relation to the key groundwater sources around the NSW Murray region. This action focuses on progressing efforts to improve the monitoring network and to update the groundwater models. Continuing to improve these models as new data becomes available is particularly important for managing and sharing limited water resources and predicting and mitigating the impacts of increasingly variable and extreme conditions in the NSW Murray region.

This action aligns with the NSW Groundwater Strategic Priority 3: Improve groundwater information and knowledge, specifically with Action 3.3: Improve our understanding of groundwater resources and Action 3.4: Expand and target our groundwater data collection.[105]

The following table provides sub-actions to achieve this action.

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 and hydrogeological conceptual models, then 3D 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 conceptual and numerical models on a regular basis
- explore opportunities to develop multidisciplinary models that incorporate socio-economic and physical data, as well as groundwater extraction volume, level and quality data.

105. More information is available at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/nsw-groundwater-strategy

Table 18. Sub-actions to achieve Action 2.5 Continue to expand and update groundwater data collection and modelling to improve groundwater knowledge in the NSW Murray region

Sub-action
2.5.1 Undertake a review of the monitoring bore network to assess the suitability of the monitoring program.
2.5.2a Update, calibrate and peer review numerical groundwater models for the NSW Murray region by: • incorporating new information from upgraded and expanded monitoring system • incorporating uncertainty analysis.
2.5.2.b Update, calibrate and peer review numerical groundwater models for the NSW Murray region: • incorporate shifts in demand and changes in rainfall patterns that are likely driven by climate variability • incorporate new understanding on interconnectivity between surface water and groundwater.
2.5.3 Review and update the conceptualization of groundwater models in specific areas for the NSW Murray region (e.g. Sunraysia Project).
2.5.4 Develop multi-disciplinary models incorporating socio-economic and physical data, as well as groundwater volume, level and quality data.
2.5.5 Develop approaches to use models for future water management.

Action 2.6: Adopt a catchment management approach to improve water quality in the NSW Murray region

Action outcomes:

- Determine catchment management approach and actions for implementation to achieve integrated coordination of water planning, land use planning and natural resource management.
- Improved water quality outcomes for the NSW Murray region.

Current policy approaches for planning and managing water quality outcomes do not consider catchments as integrated systems, where upstream impacts, including land use, development, water extraction and pollution, can impact downstream water quality.

In addition, water quality governance in NSW is complex, with arrangements impacting the effectiveness and efficiency of water quality management and monitoring. It is challenging to identify consistent and cohesive water quality priorities between the many agencies that hold water quality functions. Sharing water quality information between agencies is also a challenge, which makes it hard to proactively manage water quality.

The NSW government is moving towards an integrated catchment management approach to drive improvements in water quality outcomes. Undertaking water quality management activities and policies on a catchment scale helps to consider the cumulative impacts of land-use and water management to protect waterway health and provides the best opportunity to apply the National Water Quality Management Strategy and encompass the catchment planning process. This ensures greater alignment with local community values and goals, accountability for implementation, and opportunities for learning through adaptive management.

Action 2.6 is based on the work undertaken through the NSW Water Quality Governance Roadmap and will complement the framework developed in Action 2.1: Rehabilitate ecologically and culturally important sites within the mid and lower catchment, Action 2.3: Mitigate the impact of infrastructure on native fish and Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments.

The following table provides sub-actions to achieve this action.

Table 19. Sub-actions to achieve Action 2.6: Adopt a catchment management approach to improve water quality in the NSW Murray region

Sub-action
2.6.1. Explore reform options under the Integrated Catchment Management Work Program that could improve catchment management in NSW.
2.6.2 Continue to develop the NSW Water Quality Monitoring Framework.
2.6.3 Consider the findings of the Integrated Catchment Management Work Program for the NSW Murray region.

Investing in catchment management and prioritising source water protection also helps to reduce water treatment costs

By implementing effective catchment management practices, the quality of the source water can be improved. This means that the water entering treatment plants is already of higher quality, requiring less intensive treatment. When source water is cleaner, it reduces the need for expensive and complex treatment processes, such as advanced filtration or chemical dosing, which can be energy-intensive and costly.

Catchment management focuses on preventing pollution at the source rather than relying solely on water treatment plants to remove contaminants. By addressing pollution sources, such as industrial discharges or agricultural run-off, early on, the need for costly remediation measures at water treatment plants is minimised. Prevention is generally more cost-effective than dealing with pollution after it has entered the water supply.

Water treatment plants are expensive to build and maintain. Effective catchment management can help preserve the lifespan and efficiency of treatment infrastructure by reducing the load on the systems. With cleaner source of water, the equipment and facilities at treatment plants are subject to less wear and tear resulting in reduced maintenance costs and increased longevity. By investing in catchment management and prioritising source water protection water treatment costs can be significantly reduced in the long-term.

Image courtesy of Vince Bucello, NSW Department of Climate Change, Energy, the Environment and Water.
Great Darling Anabranch near Wentworth.

Action 2.7: Support delivery of cultural outcomes and how cultural values are identified for Aboriginal people

Action outcomes:

- Improved understanding of how to maintain and preserve water related cultural sites and landscapes.
- Place-based initiatives and programs that deliver cultural outcomes for Aboriginal people.

The NSW Murray Regional Water 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 *National Agreement on Closing the Gap*[106] 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 2.7 would support Aboriginal organisations, and communities to build on or develop tailored projects for their communities. 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.

The following table provides sub-actions to achieve this action.

Table 20. Sub-actions to achieve Action 2.7: Support delivery of cultural outcomes and how cultural values are identified for Aboriginal people

Sub-action
2.7.1 Work with the NSW Coalition of Aboriginal Peak Organisations to: • develop a proposed NSW Closing the Gap water target • examine governance arrangements for Aboriginal water ownership and management outcomes.
2.7.2 Support Aboriginal communities to develop cultural watering plans. These plans help identify ways to increase Aboriginal access to water and support protection of cultural values.
2.7.3 Through the Reconnecting River Country Program, establish a cultural values monitoring program for sites benefited or impacted by relaxed constraints environmental water releases.
2.7.4 Work with Aboriginal partners to identify additional pathways to employment. This will involve developing fit-for-purpose programs that align with community values.
2.7.5 Co-design at least one project with Aboriginal people in the NSW Murray region that delivers cultural outcomes relevant to water, subject to available funding.
2.7.6 Develop and implement a test method for cultural flows, dependent on Monitoring Evaluation and reporting plans for water management.
2.7.7 Secure flows for and undertake rehabilitation and land restoration of important cultural sites, in the NSW Murray Region.
2.7.8 Develop a cultural watering program that understands the location and water needs of important cultural assets. This will involve working with the department, WaterNSW and environmental water holders to identify whether co-benefits could be achieved.

106. Available at: closingthegap.gov.au/national-agreement

Sub-action
2.7.9 Collaboratively design and pursue options, to improve access to culturally significant areas and waterways in the NSW Murray region, including those located on Crown reserves. This will also include an investigation of the benefits and constraints associated with setting up formal access arrangements between Aboriginal people and landholders or developing co-management arrangements for particular sites.
2.7.10 Develop a river restoration program, which incorporates cultural science and knowledge to rehabilitate Country along with Action 2.1: Rehabilitate ecologically and culturally important sites within the mid and lower catchment, Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments and Action 2.10: Improve the flow regime of the Snowy and montane rivers.

Incorporating Aboriginal knowledge and culture into catchment management

As custodians of Australia's land and water for tens of thousands of years, Aboriginal people have developed a rich spiritual connection to Country and have a large body of culture and knowledge.

A more holistic approach to improving catchment health involves working collaboratively with Aboriginal people, drawing on their knowledge and experience, and integrating their perspectives, approaches and values into water and catchment management frameworks.

We need to develop whole-of-system governance structures that are supported and understood by Aboriginal people and to give Aboriginal people direct input to water management decision making. We also need to provide Aboriginal people with opportunities to manage water using their culture and knowledge and to create improved economic opportunities and environmental outcomes. Restoring degraded spiritual and cultural sites is also an important act of reconciliation.

NSW's obligation under the Basin Plan with Aboriginal people

The NSW Government has obligations for the development of water resource plans under Chapter 10, Part 14 of the Basin Plan. These plans must identify Aboriginal people's objectives and desired outcomes for managing water resources in each region. A requirement under the Basin Plan is ensuring there is adequate consultation with Aboriginal people in developing water resource plans.

The objectives and outcomes as stated by the Aboriginal Nations in the NSW Murray water resource plans will be the basis for further initiatives focussed on considering and supporting Aboriginal people's objectives and outcomes in water resource management.

Action 2.8: Seek agreement with the Australian Government to develop and implement the Reconnecting River Country Program in the NSW Murray region

Action outcomes:

- Reconnecting River Country Program Murray Project progressed to final business case and commence delivery.
- Relaxed constraints resulting in greater flexibility to manage water for the environment.

The Reconnecting River Country Program is a key Murray–Darling Basin initiative essential to creating healthier functioning river systems in the Murray and Murrumbidgee valleys. Currently, rivers connect to wetlands and floodplains less often than is needed to maintain healthy ecosystems, due to river regulation and extraction. Water for the environment aims to restore the balance, however constraints restrict the effective use of this water contributing to the continual decline of the health of Country, including the species depending on these environments to survive.

A constraint is any physical, policy or operational barrier limiting the flow of water in river systems. There are a range of flow constraints in the Basin, such as:

- physical restrictions such as low-lying watercourse crossings, weirs and levees
- operational restrictions such as river operation rules and practices
- policy barriers such as existing legislation.

The program is proposing to relax constraints to enable the flexible and effective use of environmental water to increase the frequency and extent that rivers connect to their wetlands and floodplains. This is a critical step towards achieving the environmental objectives of the Murray–Darling Basin Plan and maximising the benefits of water already recovered from Basin communities.

By enabling greater flexibility in environmental flow delivery, the program will help create healthier river systems that support native vegetation, native fish, waterbirds, turtles, frogs and other wildlife. These improvements will also provide long-term benefits for local communities and the broader Basin, contributing to cultural, environmental, and economic resilience for future generations.

The program is at varying stages of development across the Murray and Murrumbidgee rivers. The Australian Government has announced an additional $274 million to fund this program until December 2026. Further Australian Government funding and Basin Plan continuation is required for full implementation of the program beyond December 2026.

As part of Action 2.8 engagement for the Reconnecting River Country Program Murray Project is paused, to enable the development and Basin state consideration of the Murray–Darling Basin Authority Constraints Relaxation Implementation Roadmap[107] published December 2024. NSW is working with Basin jurisdictions on next steps for a future project in the Murray. In the meantime, the NSW Government is progressing some activities in the NSW Murray region in preparation for a future Murray project.

The following table provides sub-actions to achieve this action.

Table 21. Sub-actions to achieve Action 2.8: Seek agreement with the Australian Government to develop and implement the Reconnecting River Country Program in the NSW Murray region

Sub-action
2.8.1 Deliver early works projects by December 2026, including upgrading ageing infrastructure in Werai Forest.
2.8.2 Continue to work with Murray–Darling Basin Authority and other Basin state governments to progress work on a Murray constraints project informed by the Constraints Relaxation Implementation Roadmap.
2.8.3 Progress technical studies in the Murray River system to inform a future final business case (up to 2026).
2.8.4 Confirm authorising environment to develop and deliver the Reconnecting River Country Program Murray Project.

107. More information is available at: www.mdba.gov.au/publications-and-data/publications/constraints-relaxation-implementation-roadmap

Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments

Action outcomes:

- A range of targeted activities are undertaken to restore habitats.
- Improved condition, complexity and connectivity of instream and riparian habitats.

Historical and current land and water management and pest species have impacted the ecology of the Upper NSW Murray River and Snowy River systems resulting in altered stream flows, increased rates of sedimentation, weed infestations, loss of fish numbers and species, and loss of aquatic habitats.

Action 2.9 would develop and fund a coordinated Snowy and Upper NSW Murray River catchment recovery program, collaboratively with stakeholder organisations, Aboriginal communities and other state/territory and federal government agencies.

The following table provides sub-actions to achieve this action.

These sub-actions will also be coordinated with the implementation of activities under:

- Action 2.6: Adopt a catchment management approach to improve water quality in the NSW Murray region
- Action 2.10: Improve the flow regime of the Snowy and montane rivers
- Action 3.3: Investigate innovative ways to improve run-off in water supply catchments.

Table 22. Sub-actions to achieve Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments

Sub-action
2.9.1 Continue supporting the existing community and government catchment management investments, programs and plans, such as the Upper Murray River Works Program.
2.9.2 Seek ongoing funding by the Australian Government and contributions of NSW Government funding towards catchment improvement activities.
2.9.3 Conserve threatened species through activities such as fish passage improvements aligned with Action 2.3: Mitigate the impact of infrastructure on native fish.
2.9.4 Manage weed infestations and control pest animals.
2.9.5 Undertake landscape function restoration and soil conservation activities in priority areas.

Action 2.10: Improve the flow regime of the Snowy and montane rivers

Action outcomes:

- With a wide range of stakeholders, identify and implement changes to the flow regime of the Snowy and montane rivers.
- Improvements to the health of the Snowy and montane rivers.

The combination of Snowy Scheme flow diversions and land use practices continue to produce several challenges in the Snowy and montane rivers, such as a poor and declining river health, compromised cultural values and endangered species.

Action 2.10 commits the NSW Government, with key partners, to making improvements to the environmental water delivery in the Snowy and montane rivers to improve river health. This action would be undertaken collaboratively with other governments, community organisations, Aboriginal communities and industry representatives to consider a wide range of needs from across the upper and regulated reaches of the NSW Murray region.

The sub-actions under this action will be coordinated with the implementation of activities under Action 2.7: Support delivery of cultural outcomes and how cultural values are identified for Aboriginal people and Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments.

The following table provides sub-actions to achieve this action.

Image courtesy of Destination NSW. Wakool River at Coonamit Bridge, Dilpurra.

Table 23. Sub-actions to achieve Action 2.10: Improve the flow regime of the Snowy and montane rivers

Sub-action
2.10.1 Seek opportunities to undertake studies to address key knowledge gaps concerning river health through: • seeking ongoing funding by the Australian Government and contributions of NSW-funding • cooperating with local research organisations, community and Aboriginal communities' groups.
2.10.2 Investigate operational improvements in environmental water management including: • introduction of carry-over allocations for Snowy River and Snowy Montane Rivers increased flows • improving flexibility to allow changes to be made to scheduled daily flow releases to respond to natural flow events or environmental requirements • allowing flow releases to have more natural variation within a 24-hour period rather than being held constant for that time • investigating investment in infrastructure improvements to montane river systems to allow more flexible management of releases • continuing to investigate using the Mowamba River for environmental releases • increasing annual volumes of water releases from Jindabyne Dam.
2.10.3 Revise the Murray-Lower Darling Long-Term Water Plan following any updates to the Snowy Water Licence.
2.10.4 Recommend amending water sharing plans to legislate protection of environmental water through the Snowy River, subject to the concurrence of the Minster for the Environment.
2.10.5 Seek funding for additional monitoring of river ecosystems to assess the effects of improved management under Action 2.9: Support ongoing river restoration in the Upper NSW Murray and Snowy catchments and Action 2.10: Improve the flow regime of the Snowy and montane rivers.

Priority 3

Support sustainable economies and communities

Regional cities and towns in the NSW Murray region face increasing risks to the security of their water supplies over the coming decades. Agriculture, energy generation and tourism will continue to be important to the region's economy into the future. 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 consider the likely reliability and security of future water supplies.

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

What is already happening

The NSW Government has developed the NSW Alternatives to Buybacks Plan to detail how we will deliver on existing and new projects to minimise impacts to NSW Basin communities and industries from large scale water buybacks. Further details are provided above (in the Alignment with the Basin Plan section). The Australian Government has made funding available through the Sustainable Communities Program for community adjustment to manage and mitigate negative social and economic impacts arising from water purchases towards the 450 GL water recovery target.

Funding of $3.9 million has been provided under Future Ready Communities 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 council works. The Future Ready Regions Strategy and Future Ready Communities Pilot Program includes a commitment to upgrade the Enhanced Drought Information System to provide farms with world-leading weather and climate data so they can make better business decisions, and to support councils to develop drought resilience plans.

Funding of $48 million has been provided for the Farms of the Future Program[108] to support on-farm connectivity and encourage farmers to adopt Agtech[109] to boost their productivity, water efficiency and drought preparedness.

Aboriginal water rights are being advanced, including setting a National target for water entitlements to be owned by Aboriginal people and organisations under the National Agreement on Closing the Gap. The state-wide NSW Aboriginal Water Strategy identifies measures to deliver on Aboriginal people's water rights and interests in water management.

The Primary Industries Climate Change Research Strategy is supporting projects that help primary industry sectors adapt to climate change.

The NSW Government has supported local councils in developing regional economic development strategies (REDS) based on the concept of a 'functional economic region'. The REDS provide a clear economic development strategy for the region. An update was completed for the NSW Murray region in 2023.[110]

Regional Plans across NSW were updated in 2023. These plans set a 20-year framework, vision and direction for strategic planning and land use to ensure regions continue to be vibrant places for people to live, work and visit.

108. Available at: dpi.nsw.gov.au/dpi/climate/farms-of-the-future
109. Available at: agtech.dpi.nsw.gov.au/?srsltid=AfmBOopxbywf8bBcATdUOGjlurBsnH_LwDpGWxjp4aDj6R-QQoD7MjAI
110. Available at: nsw.gov.au/regional-nsw/regional-economic-development-strategies

The NSW Government has developed region-specific information about drought management. The NSW Drought Hub provides resources to assist stakeholders to prepare and manage for drought.

The NSW Extreme Events Policy framework includes a staged approach and provides a range of measures for water managers to extend remaining supplies for critical needs as conditions deteriorate. As an extreme drought is prolonged, water managers will progressively introduce more stringent restrictions on access to water by different water users. The NSW Department of Climate Change, Energy, the Environment and Water's website has a summary of the types of actions that the department may take as the drought becomes more critical.[111]

The NSW Government Open Data Framework[112] recently published by the department 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.

Image courtesy of iStock. Township, Albury.

111. Available at: water.dcceew.nsw.gov.au/about-us/legislation-and-policies/extreme-events-policy
112. Available at: water.dcceew.nsw.gov.au/our-work/science-data-and-modelling/data/open-data-framework

Challenges in the NSW Murray region

Balancing competing interests for water

Improving the health and resilience of ecosystems

Addressing barriers to Aboriginal people's water rights

Supporting existing and emerging industries and livelihoods

Action	Summary	Challenges addressed
Action 3.1: **Develop and enable employment and business opportunities for Aboriginal people**	Support Aboriginal business development opportunities in the NSW Murray region, some of which may require access to water resources. This action would also investigate ways to expand water-related employment opportunities for Aboriginal people in the NSW Murray region.	
Action 3.2: **Support groundwater use for towns and communities**	This action focuses on enhancing groundwater security in the NSW Murray region that is crucial for towns and industries. It addresses varying quality and availability issues, especially during droughts. Strategies include monitoring contaminants, developing innovative salinity solutions and collaborating with councils to promote sustainable groundwater use and develop a policy for managed aquifer recharge.	
Action 3.3: **Investigate innovative ways to improve run-off in water supply catchments**	This action investigates strengthening bushfire management to preserve crucial run-off processes and water quality.	
Action 3.4: **Support towns and local water utilities to understand and manage their future water security risks**	Supports towns and local water utilities to manage future water security risks. This action involves risk analysis, upgrading water models, exploring alternative supply options, and promoting urban efficiency measures, including stormwater harvesting and smart metering. Various programs and collaborations would aim to enhance water system efficiency and conservation.	
Action 3.5: **Implement NSW's commitments in the NSW Alternatives to Buybacks Plan**	This action includes implementing the NSW Alternatives to Buybacks Plan, aiming to reduce water buybacks by the Australian Government by delivering existing projects and identifying new projects that can contribute to water recovery targets.	
Action 3.6: **Improve public access to climate information and water availability forecasts**	Improve existing platforms and products to provide information about water availability and climate change in a format tailored for water users and their business planning needs in the NSW Murray region.	

Action 3.1: Develop and enable employment and business opportunities for Aboriginal people

Action outcomes:

- Increased opportunities for meaningful career pathways for Aboriginal people through formal training and implementing learnings across the region.
- Improved employment and business opportunities for Aboriginal people in the NSW Murray region.

Action 3.1 focuses on supporting the development and growth of local water-related Aboriginal businesses, employment and training opportunities, and boosting the local economy by using existing water or accessing additional water in the NSW Murray region.

During our consultations, we heard about the need for economic development and business opportunities led by Aboriginal communities. Stakeholders strongly supported initiatives that create employment opportunities for Aboriginal people, especially youth. However, stakeholders emphasised that these roles should be community-based. Additionally, training opportunities for Aboriginal youth were highlighted as a key priority.

Action 3.1 will support Aboriginal people's business development opportunities in the NSW Murray region and will be led by the Department of Primary Industries and Regional Development. Other support is also available through NSW Department of Aboriginal Affairs, NSW Aboriginal Land Council and the National Indigenous Australians Agency.

The following table provides sub-actions to achieve this action.

Table 24. Sub-actions to achieve Action 3.1: Develop and enable employment and business opportunities for Aboriginal people

Sub-action
3.1.1 Continue to support development opportunities for Aboriginal businesses through a range of programs including the Regional Aboriginal Partnership Program.[113]
3.1.2 Support programs designed to enhance Aboriginal people's connection to Country and provide meaningful career pathways.
3.1.3 Through the Regional Aboriginal Partnership Program and Outcomes program team, work with Aboriginal organisations, businesses and individuals to strategically identify business opportunities or provide further support or scope for grant funding.

113. Available at: nsw.gov.au/grants-and-funding/regional-aboriginal-partnerships-program-round-2

Action 3.2: Support groundwater use for towns and communities

Action outcomes:

- Improved urban water planning for regional towns and cities using groundwater.
- Secured and sustainable groundwater use by regional towns and communities.

Groundwater is an important water source for towns, communities and industries across the NSW Murray region. During drought, groundwater use tends to increase as surface water becomes less available. Groundwater in the NSW Murray region is used for agricultural, industry, stock and domestic purposes and town water supply.

There are many groundwater bores in the Upper Murray Alluvium. Most groundwater bores are used for stock and domestic purposes. However, there are also bores used for irrigation that can extract moderate to high volumes of water each year. Groundwater from this source is also used as the main water supply for the township of Balldale.

There is heavy reliance on the Lower Murray Deep Alluvium for irrigation, particularly east of Wakool to Finley. The Billabong Creek Alluvium has a low level of use compared to the Upper Murray Alluvium and Lower Murray Deep Alluvium, and is mainly used for stock and domestic purposes, with some use for irrigation. The Billabong Creek Alluvium provides town water supplies for Walbundrie, Walla Walla, Culcairn and Holbrook.

Groundwater in some areas of the Lower Murray region is known to have elevated levels of salinity that limit or prevent its use. Opportunities for information sharing and developing affordable desalination and filtration technology will support the region to use groundwater more effectively and sustainably.

The sub-actions under this action are consistent with the NSW Groundwater Strategy.

The following table provides sub-actions to achieve this action.

Table 25. Sub-actions to achieve Action 3.2: Support groundwater use for towns and communities

Sub-action
3.2.1 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.
3.2.2 Work with local councils, state government agencies and other stakeholders in line with the Regulatory and Assurance Framework for Local Water Utilities 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 (quantity and quality) are sufficient to meet demand • the likelihood and consequences of shortfalls of groundwater • any issues around the groundwater licence application and approvals process.
3.2.3 Support assessing the feasibility of aquifer storage and recovery for towns and industry, such as the recharge capacity of sites for temporary storage of stormwater, river flow or recycled water.
3.2.4 Review the regulation of basic landholder stock and domestic rights.
3.2.5 Support development of innovative salinity solutions for groundwater communities and industry.

Action 3.3: Investigate innovative ways to improve run-off in water supply catchments

Action outcomes:

- Understanding of the feasibility of changes to bushfire management that target preservation and enhancement of rainfall run-off processes.

As highlighted above in Challenge: Balancing competing interests for water, intense bushfires in source catchments are having deleterious effects on the water quality and quantity of the region's water supplies.

New climate and modelling data (Figure 13) highlights that under the dry future climate scenario there could be a significant decrease in the inflow volume into the shared storages of the NSW Murray River system – particularly during the traditional dam filling period of winter/spring. In addition, our new climate data indicates that median stream flows in the Upper Murray and Snowy catchments would be lower and cease-to-flow events more prevalent under a dry future climate. This has implications for the unregulated systems in the Upper NSW Murray and inflows into the major dams of the regulated systems.

Bushfire management

A drying, more variable climate will also increase the severity of bushfires in the region, leading to significant changes to hydrological run-off processes. When intense fires occur in catchments such as the Snowy Mountains, they have profound impacts on water quality in the short-term and significant long-term impacts on catchment water yields. This is particularly the case for stands of mountain ash (Eucalyptus regnans).

The region's key watersheds[114] need to be better managed to avoid adverse fire regimes and associated water-quantity and water-quality impacts and to improve run-off. This action involves investigations by the NSW Government to better understand how bushfire management could be strengthened, with investment from the water sector, to preserve vitally important run-off processes. This would include investigating the feasibility of including rainfall run-off processes as a strategic bushfire management priority and identifying the associated fire management activities.

A key part of this would be to seek involvement from Traditional Owners from the Snowy Mountains to understand the potential for traditional knowledge and practices to be further incorporated into bushfire management.

The following table provides sub-actions to achieve this action.

Image courtesy of Destination NSW. Lake Mulwala, Mulwala.

114. A watershed is a land area that collects water from rain and snow and drains it into a body of water, like a river, lake, or stream.

Table 26. Sub-actions to achieve Action 3.3: Investigate innovative ways to improve run-off in water supply catchments

Sub-action
3.3.1 Explore new technologies to increase snowfall in the headwater catchment to improve run-off and inflows into the NSW Murray system.
3.3.2 Seek investment to strengthen bushfire management to preserve vital run-off processes.
3.3.3 Investigate the feasibility of including rainfall run-off processes as a strategic bushfire management priority and identifying the associated fire management activities.
3.3.4 Seek involvement from Traditional Owners in the Snowy Mountains region to incorporate traditional knowledge and practices into bushfire management.

Using Snowy Hydro infrastructure to store consumptive water

A feasibility study into commercial arrangements for storing or banking water in Snowy Hydro Limited infrastructure was completed in November 2022. The study included stakeholder engagement with irrigation organisations, the Australian Government and state agencies from VIC and SA. A risk assessment and examination of the key criteria required for commercial arrangements identified the following high risks and issues:

- administration needs
- potential impacts on SA storage rights
- Murray–Darling Basin Agreement for Victoria's share
- equitability of user access
- water for environment calculations committed under the River Murray Increased Flows (RMIF)
- the need to change multiple legislative instruments and relatively low level of interest of stakeholders.

As a result, this proposal is not being considered further.

Action 3.4: Support towns and local water utilities to understand and manage their future water security risks

Action outcomes:

- Evidence-based understanding by local water utilities of their water-security risks and strategic plans in place to manage these risks.
- Improved drought resilience of local councils.

This action will ensure that the NSW Government continues to support towns and local water utilities with water system planning, and to build skills and capacity for implementation. This support will focus on the department's new Regulatory and Assurance Framework for Local Water Utilities, which highlights key outcomes for understanding and addressing water security and water quality risks.

The Regulatory and Assurance Framework[115] sets the expectations the department has for local water utilities, including:

- establishing the outcomes required to meet customer needs and to manage key risks
- undertaking evidence-based strategic planning to meet these outcomes
- assessing the standard to which the outcomes are met.

The new framework encourages local water utilities to develop and apply sound water security criteria and service levels either through a traditional approach, an enduring supply approach, or another credible and robust approach.

The NSW Government aims to provide the right mix of tools to support local councils in the NSW Murray region to address their town water security challenges.

This includes assisting councils to explore options to reduce demands on surface and groundwater sources – for example, water use efficiency programs and accessing other water sources such as stormwater harvesting and purified recycled water. The department will provide guidance and support to local water utilities to help them undertake their strategic planning under the new framework. The department will also monitor this work to ensure it sufficiently manages the key risks.

Other actions in the NSW Murray Regional Water Strategy aim to improve river health and land management, in Priority 2 Improve river and catchment health. These actions will also benefit councils by improving access to high quality water for town water supplies.

The following table provides sub-actions to achieve this action.

115. More information on the Regulatory and Assurance Framework is available at: water.dcceew.nsw.gov.au/our-work/local-water-utilities/regulatory-and-assurance-framework

Table 27. Sub-actions to achieve Action 3.4: Support towns and local water utilities to understand and manage their future water security risks

Sub-action
3.4.1 Support councils and local water utilities with guidance to confirm the level of risk through town water security analyses using the new climate data.
3.4.2 Support councils and local water utilities to investigate options for town water security including: • capability to purchase or trade additional water entitlements • potential alternative supply options from groundwater • innovative water management options for towns and industry such as stormwater harvesting and use of recycled water by industry, within or near towns.
3.4.3 Investigate urban water efficiency measures including: • water restrictions to limit town water use during dry periods and prolong water supplies • installing rainwater tanks and grey water systems on houses and commercial buildings, and encouraging water-efficient appliances • reducing leakage from pipes • smart metering and pricing or tiered pricing.

Safe and Secure Water Program

The Safe and Secure Water Program, established in 2017, is managed by the department and co-funds vital water and sewerage projects across regional NSW. This co-funding assists non-metropolitan councils, local water utilities, county councils, water supply authorities and joint organisations to deliver projects that provide safe, secure and sustainable water and wastewater services to regional NSW.

In the Murray region, funded projects include strategic planning, investigations and upgrades to water and wastewater treatment plants with Albury City Council, Balranald Shire Council, Berrigan Shire Council, Federation Shire Council, Greater Hume Shire Council, Murray River Council, Edward River Council, Snowy Valleys and Wentworth Council.[116]

116. Available at: water.dcceew.nsw.gov.au/our-work/water-infrastructure/water-infrastructure-grants-and-funding/safe-and-secure-water-program

Town Water Risk Reduction Program

The NSW Government is collaborating with local water utilities and the wider sector on the Town Water Risk Reduction Program. This program is delivering a new approach to working together that enables local water utilities to access the capacity and capabilities of state government entities, including agencies and state-owned corporations, to manage risk and priorities in town water systems more strategically and effectively.

Several pilots have been initiated to trial new approaches to local water utility strategic planning. In the NSW Murray region, Balranald Council has been successful in becoming a participant in the program.

NSW Water Efficiency Program

The NSW Water Efficiency Program for urban areas is collaborating with key stakeholders to increase investment in water system efficiency, water conservation and demand management. This aims to 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. The need to focus on local water utilities' network leakage and water losses became apparent during the drought and has been reinforced during consultation with councils and the wider sector as part of the Town Water Risk Reduction Program. Several councils in the NSW Murray region have participated in the Regional Leakage Reduction Program, with Wentworth receiving grants for co-funded projects under this program.

Aboriginal Communities Water and Sewerage Program

The program provides ongoing leak repair and education projects to promote water-wise behaviour and demand-management measures within Aboriginal communities.

Smart Approved WaterMark – Smart Water Advice Program

The NSW Government and Smart Approved WaterMark are partnering with local water utilities and councils to provide subsidised subscriptions to the Smart Water Advice Program. Subscribers to Smart Water Advice receive water efficiency tips and advice, interactive tools and information to share with their communities.

Local water utility performance data

The NSW Government provides and maintains a public web-based database for NSW regional water utilities to annually report their water supply and sewerage data. Performance monitoring and benchmarking are required under the National Water Initiative and provide assurance to the NSW Government that the requirements of the NSW *Water Management Act 2000* are being met (i.e. each local water utility is performing satisfactorily).

Action 3.5: Implement NSW's commitments in the NSW Alternatives to Buybacks Plan

Action outcomes:

- Environmental outcomes achieved via SDLAM, and maximised recovery towards the 450 GL of additional environmental water through investment in infrastructure.
- Minimised risk to NSW Basin communities from water buybacks.

The NSW Government remains committed to delivering the Basin Plan in full, in partnership with the Australian Government and other Basin governments. However, this delivery must be done in a way that minimises socio-economic impacts and allows regional communities to prosper.

The purchase of water rights by the Australian Government (i.e. water buybacks), as a mechanism to meet the water recovery targets under the Basin Plan, has the potential to cause significant socio-economic impacts. This has been consistent feedback received from stakeholders throughout the southern parts of the Basin.

Analysis by the Australian Bureau of Agriculture and Resource Economics suggests that irrigation areas in the southern Basin, such as in the regulated NSW Murray and Murrumbidgee rivers, are likely to be more vulnerable to the impacts of water buybacks due to the reliance on surface water resources, the volume of entitlement in the area and the extent of irrigation infrastructure networks.[117]

To minimise the impacts on Basin communities and industries from large scale water buybacks by the Australian Government, this action involves the implementation of the commitments made by the NSW Government in the NSW Alternatives to Buybacks Plan[118] (the plan). The plan explains how we will deliver existing projects and bring forward new projects to contribute to water recovery in ways that have less socio-economic impacts.

The Alternatives to Buybacks Plan seeks to achieve 2 outcomes:

- maximise the environmental outcomes achieved via the Sustainable Diversion Limit Adjustment Mechanism (SDLAM) that accounts for 605 GL
- maximise recovery towards the 450 GL of additional environmental water from investment in infrastructure, projects and rules-based changes.

While the plan does not eliminate the prospect of water buybacks in NSW, it outlines the NSW Government's strategy to provide a tangible reduction in the volume of water required to be purchased by the Australian Government to meet recovery targets.

The following table provides sub-actions to achieve this action.

Table 28. Sub-actions to achieve Action 3.5: Implement NSW's commitments in the NSW Alternatives to Buybacks Plan

Sub-action
3.5.1 Deliver newly notified and existing SDLAM projects by December 2026 and efficiency projects by December 2027 to deliver environmental outcomes while minimising Australian Government water buybacks.

117. Available at: agriculture.gov.au/abares/research-topics/water/the-impacts-of-further-water-recovery
118. Available at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/nsw-alternatives-buybacks-plan

Action 3.6: Improve public access to climate information and water availability forecasts

Action outcomes:

- Climate data and information is shared and easily accessed by the public.
- Climate data and information is updated regularly 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, feedback was received that stakeholders are interested in the new climate datasets, and they want modelling information to be made publicly available so the data can be used by water users and communities to better prepare for future extreme events.

The following table provides sub-actions to achieve this action.

Image courtesy of Destination NSW. Thredbo, Snowy Mountains.

Table 29. Sub-actions to achieve Action 3.6: Improve public access to climate information and water availability forecasts

Sub-action
3.6.1 Update existing data and information for the Water Insights portal and information dashboards.
3.6.2 Continue to upload climate and flow data to the NSW Governments Sharing and Enabling Environmental Data (SEED) portal,[119] including user guidance.
3.6.3 Consult with stakeholders in the NSW Murray region to harness local knowledge and to identify opportunities for on-ground climate information to better understand the specific circumstances in the region.
3.6.4 Improve communication of the NSW Murray Regional Water Strategy climate datasets and climate risk modelling (e.g. by making more detailed information publicly available).
3.6.5 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.
3.6.6 Investigate options to build on or complement existing state and national climate-related information platforms and products to assist water users in the NSW Murray 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 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 they 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.

119. NSW Government, Sharing and Enabling Environmental Data in NSW, available at: seed.nsw.gov.au/

Collecting more data and better data

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

Climate risk data

The NSW Government has recently published the long-term data about climate variability risk that supports the regional water strategies. This is the first step in providing water users with better access to information on the future risks to water availability. The stochastic datasets for rainfall and potential evapotranspiration for the NSW Murray region and a number of other NSW Government's Sharing and Enabling Environmental Data portal (SEED).[120]

Non-urban water metering framework[121]

It is 5 years since new metering rules were put in place for non-urban water users. The majority of large commercial water users with irrigation pumps bigger than 500 mm have installed accurate, tamper-proof meters and telemetry.

A review of the non-urban metering framework in 2023/24 proposed key changes to ensure that water resources are being measured and managed fairly across the state and water users can comply with their licence obligations. Implementing the recommendations of the review aims to ensure that 95% of licenced water entitlement in NSW is measured, recorded and reported by December 2026.

Hydrometric Network Review[122]

NSW is undertaking a review of its hydrometric (river gauge) network. The review is looking at the coverage and data quality obtained from the existing hydrometric network and identifying ways to improve the 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 from the new stations will include stream levels, flow volumes and water quality.

These sites will enhance the network to better manage stream connectivity, compliance, environmental water release, and extreme events. The new stations will add more localised data, helping to better understand local conditions so we can 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[123] and the Bureau of Meteorology's Water Information Portal[124] and Water Data Online.[125]

120. More information available at: seed.nsw.gov.au
121. More information available at: water.dcceew.nsw.gov.au/our-work/non-urban-metering
122. Available at: water.dcceew.nsw.gov.au/our-work/science-data-and-modelling/data/hydrometric-network-review
123. Available at: waterinsights.waternsw.com.au/
124. Available at: bom.gov.au/water/
125. Available at: bom.gov.au/waterdata/

Implementing the NSW Murray Regional Water Strategy

6

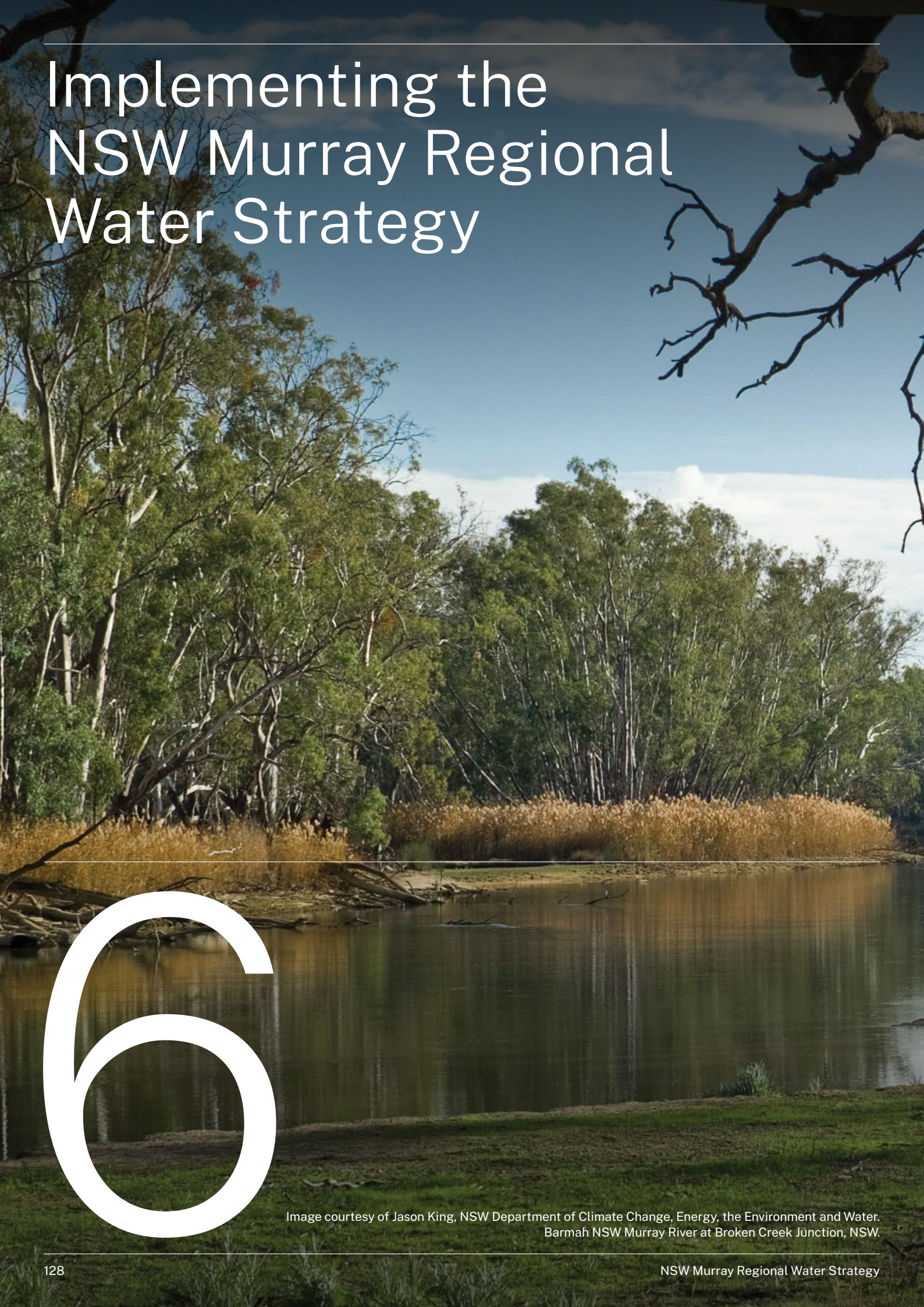


Image courtesy of Jason King, NSW Department of Climate Change, Energy, the Environment and Water.
Barmah NSW Murray River at Broken Creek Junction, NSW.

Getting our timing right

A critical feature of developing NSW Murray Regional Water Strategy was deciding which actions and investments are needed now, and which will be needed in the future. With a 20-year timeframe, the NSW Murray Regional Water 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 evolving circumstances.

The strategy has a separate implementation plan[126] that outlines the sub-actions which will be delivered in the first 5 years after the strategy is published. The implementation plan only focuses on sub-actions that are underway or planned (and funded) for delivery within 5 years by the 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 adapting.

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.

126. The implementation plan for the NSW Murry Regional Water Strategy is available at: water.dcceew.nsw.gov.au/our-work/plans-and-strategies/regional-water-strategies-program/nsw-murray-regional-water-strategy

Ongoing monitoring, adaptation and reporting

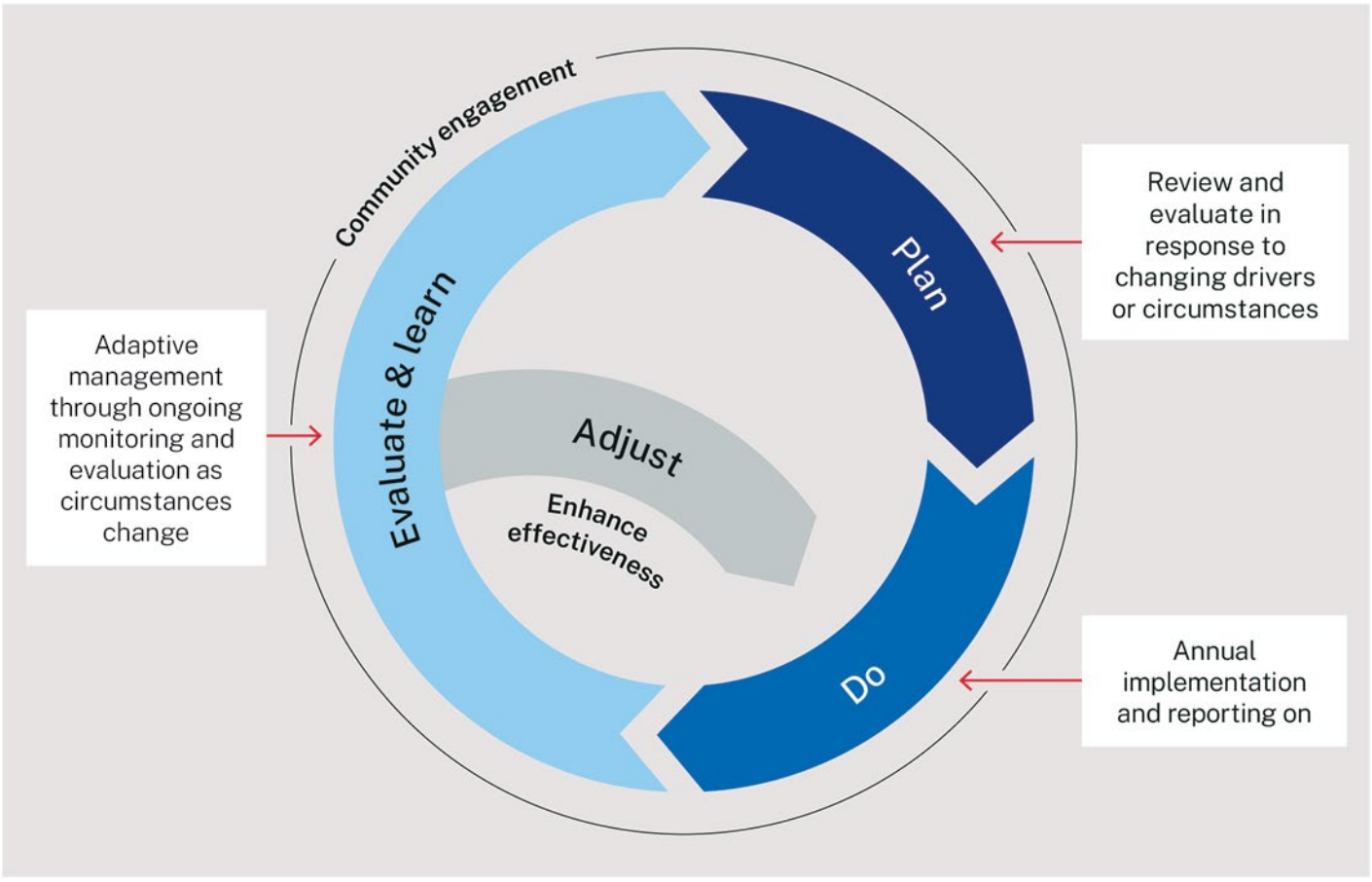
The NSW Murray Regional Water Strategy is designed to respond to changing circumstances. Ongoing monitoring and evaluation will be led by the department. Priorities for implementation may shift in response to funding availability, movements in population, climate cycles, economic conditions and other 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 the progress of water strategy implementation. The annual report is a way for the community to track progress and for the department to demonstrate which actions have been delivered, or are in progress, in that year.

Figure 21. Regional water strategy monitoring, evaluation and reporting process



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