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Draft Regional Water Strategy

NSW Murray

Discussion Paper: Draft regional challenges

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Acknowledging First Nations people

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

Today, they practice the oldest living culture on earth.

The NSW Government acknowledges the First Nations people/Traditional Owners from the NSW Murray region 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 First Nations people with essential links to their history and help them to maintain and practice their traditional culture and lifestyle.

We recognise the Traditional Owners were the first managers of Country and by incorporating their culture and knowledge into management of water in the region is a significant step for closing the gap.

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

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

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

We acknowledge that further work is required under this regional water strategy to inform how we care for Country and ensure First Nations People/Traditional Owners hold a strong voice in shaping the future for Indigenous/Aboriginal and non-Aboriginal communities.

Artwork: Image courtesy of Nikita Ridgeway.

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Snapshot

The Murray region



110,000
population



40,400
km²



Major regional centres:
Albury, Deniliquin, Corowa,
Moama and Jindabyne



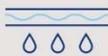
First Nations:

Bangerang, Barkandji, Barapa Barapa, Maljangapa, Maraura, Mutthi Mutthi, Ngiyampaa, Nyeri Nyeri, Tati Tati, Wadi Wadi, Wemba Wemba, Weki Weki, Wiradjuri, Yorta Yorta, Ngarigu, Walgalu and Bidhawal



Major river systems:

Murray, Edward/Kolety-Wakool, Snowy and Swampy Plains rivers
Plus a number of unregulated rivers and creeks



Main groundwater systems:

Upper and lower Murray Alluviums, Kanmantoo Fold Belt, Lachlan Fold Belt, Murray-Darling Basin Porous Rock and Oaklands Basin



Smaller regional towns:

Tumbarumba, Tocumwal, Wentworth, Howlong, Finley, Mulwala, Buronga, Bombala, Dalgety, Delegate and Berridale



Connections:

Snowy Scheme, Victoria, South Australia and the Murrumbidgee and lower Darling regions



Major water storages:

Dartmouth Dam (situated in Victoria) with a storage capacity of 3,856 GL

Hume Dam (situated on the NSW-Victorian border) with a storage capacity of 3,005 GL

Menindee Lakes (situated on the Darling River) with a storage capacity of 1,731 GL

Lake Victoria (situated in south-western NSW close to the South Australian border), with a storage capacity of 677 GL

Additional dams in the Snowy Scheme



Key environmental assets:

Millewa Forest, Werai Forest, Blue Lake and Koondrook-Perricoota Forest (Ramsar sites), NSW portion of the Chowilla Floodplain, Murray and Snowy rivers and Kosciuszko National Park

Approximately 159 plant and animal species listed as threatened, vulnerable, endangered, critically endangered or presumed extinct



Major investments:

Snowy Mountains Special Activation Precinct, Albury Regional Job Precinct and Inland Rail Project



Gross Value Added (2020-21):

\$10 billion

Key sectors and engine industries:

Agriculture, manufacturing, health care and tourism

Purpose of this discussion paper

Secure, reliable and resilient water sources are critical to regional communities in NSW. They contribute to the appeal and prosperity of rural areas, regional towns and cities. They create cultural connections to Country and support community well-being. Water in the right places at the right times is also vital for healthy regional landscapes and sustainable ecosystems. Changing water demand, increased climate variability and shifting community expectations mean we need to plan and invest in improved long-term regional water security.

The NSW Government is developing a suite of regional water strategies that bring together the best and latest climate evidence with a wide range of tools and solutions to plan and manage each region's water needs over the next 20 years and beyond.

The first draft of the NSW Murray Regional Water Strategy, which identified all the challenges and opportunities in region, was released in April 2022, along with a long list of options to address those challenges¹.

Since public consultation on the draft strategy, we have taken on board what we heard and undertaken additional baseline hydrological modelling based on the new climate data. We have used this information to further refine the challenges for the region.

In response to stakeholders wanting to be more involved in the development of the regional water strategy, and being prevented from doing so with the current flood situation, we are releasing this discussion paper which presents the outcomes of this work.

Clearly identifying the key challenges for the region is an important first step in helping assess what tools and solutions are needed to manage the water needs of the NSW Murray region over the next 20 years and beyond.

We are planning a second round of consultation in mid-2023 on a shortlist of actions to address the key challenges, prior to finalising the strategy.

¹ The draft Murray Regional Water Strategy and long list of options can be viewed at: www.dpie.nsw.gov.au/murray-regional-water-strategy

You can find additional background information on stakeholder feedback in the draft NSW Murray and Murrumbidgee Regional Water Strategies What We Heard report².

You can find information on the climate and hydrological modelling that underpin the draft NSW Murray Regional Water Strategy in the Climate and Hydrological modelling: draft NSW Murray and Murrumbidgee Regional Water Strategies³ report.

The regional water strategies cannot provide a comprehensive 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.

Improvements to flood risk mitigation are being considered through the 2022 NSW Flood Inquiry. The inquiry report and the NSW Government response can be found at: www.nsw.gov.au/nsw-government/projects-and-initiatives/floodinquiry

Although a comprehensive response to flooding is outside the scope of the regional water strategies, the strategies can play a supporting role for local councils in the region to make targeted flood management improvements.

References to flooding in the strategies are in the context of providing state and local decision-makers with technical advice to support holistic flood management taking place through other channels. This advice can assist councils with the best evidence base to help meet these challenges.

² The Department of Planning and Environment, Draft NSW Murray and Murrumbidgee Regional Water Strategies What We Heard report available at www.dpie.nsw.gov.au/murray-regional-water-strategy

³ The Department of Planning and Environment, Murray and Murrumbidgee Regional Water Strategies: Climate and hydrological modelling available at www.dpie.nsw.gov.au/murray-regional-water-strategy

Why we are developing regional water strategies

Across NSW, valuable and essential water resources are under pressure. A more variable climate, changes in industries, and population growth mean we face difficult decisions and choices about how to manage water efficiently and sustainably while balancing different demands for the resource. The regional water strategy process identifies these risks and seeks to understand how we can best be prepared for future uncertainties and challenges.

In addition to understanding and managing future pressures, there are opportunities to consider the role water resources will play in growing the regions, improving liveability and ensuring each region remains a great place to live, work, play and visit. The NSW Government's strategic investments in special activation precincts, regional job precincts, renewable energy zones, hydroelectricity and other actions identified through regional economic development strategies are critical to realising this vision. However, all these activities rely on access to water.

The regional water strategies program is helping to provide the evidence-base needed to support existing investments and identify new opportunities to sustain successful regional industries into the future.

The regional water strategies will include a wide range of tools and solutions to help us better use, share, store and deliver water to smooth the highs and lows of water availability and change how we manage water into the future.

Objectives of regional water strategies

Each regional water strategy will identify the key challenges that impact on our ability to achieve the 5 regional water strategy objectives (Figure 1). The final strategies will set out a long-term 'roadmap' that addresses the key challenges and work towards meeting at least one regional water strategy objective.

Figure 1. Regional water strategy objectives



How regional water strategies fit with other NSW water strategies

The NSW Water Strategy, together with the regional water strategies and metropolitan water strategies that underpin it, will form the strategic planning framework for water management in NSW. The NSW Water Strategy (2021) was developed in parallel with the draft regional water strategies. The NSW Water Strategy guides the strategic, state-level actions and the regional water strategies will prioritise how those state-wide actions, as well as other region-specific, place-based solutions, should be staged and implemented in each region.

As part of delivering the NSW Water Strategy, the NSW Government will deliver other state-wide strategies including:

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

The NSW Water Strategy and the draft NSW Murray Regional Water Strategy also complement other whole-of-government strategies, including the 20-Year Economic Vision for Regional NSW and accompanying Future Ready Regions Strategy and the updated State Infrastructure Strategy 2022–2042.

The draft NSW Murray Regional Water Strategy also seeks to align its actions and recommendations with the goals and directions set out in relevant regional plans,⁴ support the growth and development enabled through the Inland Rail Project, Albury Regional Jobs Precinct, and Snowy Mountains Special Activation Precinct.

The regional water strategy will be cognisant of further developments resulting from existing government commitments to develop water-related infrastructure business cases in the NSW Murray region and other NSW Government initiatives, programs and studies that are under development, including the review of the regional economic development strategies, the development of the Riverina Murray Regional Plan 2041, the South East and Tablelands Regional Plan 2041, the Housing 2041 – NSW Housing Strategy, the NSW Electricity Strategy and the Barmah Millewa Feasibility Study.

By providing a coordinated approach to support the range of transformational NSW Government policies recently introduced, we will proactively build resilience in regional communities, adopt a place-based framework that is adaptive to changing circumstances and enable government and regional communities to work together to ensure the NSW Murray region is a great place to live, work, and visit.

⁴ The Murray Regional Water Strategy and Murrumbidgee Regional Water Strategy area's overlaps with the boundaries of the Far West Regional Plan, the Riverina-Murray Regional Plan and the South-East and Tablelands Regional Plan.

Regional water strategies are backed by new climate data

To improve our strategic forward planning, new ground-breaking climate datasets have been developed for the Regional Water Strategy program. These datasets provide us with a more comprehensive understanding of the climate variability in the NSW Murray region beyond the recorded historical data.

To support the development of the draft NSW Murray Regional Water Strategy, we are using the recorded dataset as well as two plausible climate scenarios to test their respective implications for regional water resources:

- **Historical climate:** data from rainfall and evaporation records collected by Australian Government meteorological records over the past 130 years.
- **Long-term historical climate:** 10,000 years of stochastic-generated climate data developed using paleo climatic information from the University of Adelaide, Australia
- **Dry future climate:** applying the NSW and Australian Regional Climate Modelling (NARCLiM) climate projections for 2060–2079 compared to the baseline period of 1990–2009 to define a dry future climate scenario.

The dry future climate change scenario⁵ is the SRES A2 which represents a high carbon emissions scenario, and thus results in higher projected climate change impacts on the region⁶. This is not a forecast of how climate change is expected to eventuate, but it is one possible future outcome.

While these climate change scenarios may not eventuate, they help us to highlight key water challenges we may need to focus on in the future, over a range of wet and dry sequences. In addition, they will be used to test the comparative benefit or impact of options across a range of climate scenarios⁷.

While using this climate change dataset is appropriate for developing a regional water strategy with a 20-year horizon, it is not fit-for-purpose for operational and water sharing plan decisions, such as, available water determinations (allocation announcements); annual permitted take calculations and sustainable diversion limit compliance. Further work will be undertaken by the department to examine how climate information can be incorporated into shorter term decision-making.

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

⁵ The scenario uses the regionally downscaled factors from the NARCLiM 1.0 Project to adjust the long-term past climate scenario rainfall and evapotranspiration data. Further information on NARCLiM 1.0 Project is available on the NSW Government, AdaptNSW website: www.climatechange.environment.nsw.gov.au/climate-projections-used-adaptnsw

⁶ The SRES A2 assumes a 2C warming over the regional water strategy planning horizon.

⁷ For further details about the new climate data and modelling, please refer to www.dpie.nsw.gov.au/water/plans-and-programs/regional-water-strategies/climate-data-and-modelling.

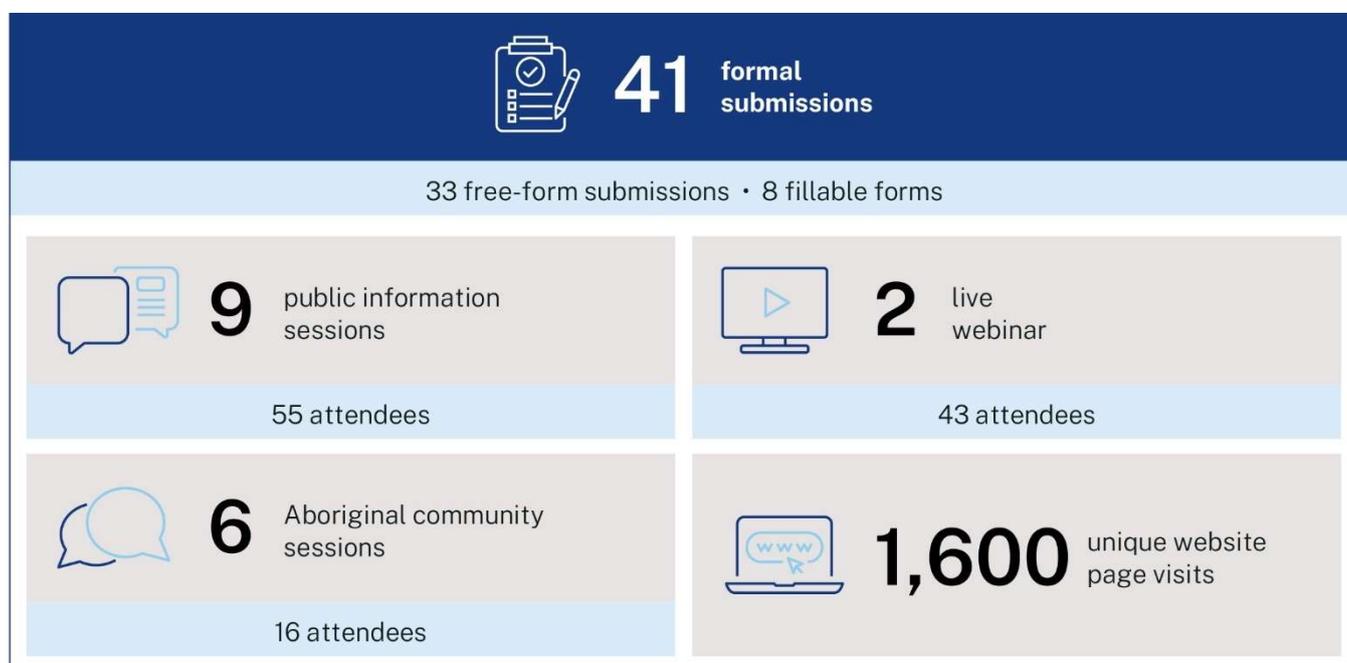
What we have heard so far

Developing an effective and lasting regional water strategy requires input from Aboriginal people, landholders, community members, local councils, and industry and environmental groups.

To guide the development of the draft NSW Murray Regional Water Strategy, targeted consultation was held with local councils and representatives from Aboriginal communities. Unfortunately, due to the COVID-19 pandemic, the targeted consultation with Aboriginal communities was not as extensive as intended.

Following this targeted consultation, the draft Murray Regional Water Strategy and long-list of options were placed on public exhibition from 11 April to 22 May 2022. A broad engagement program with the general public, stakeholder groups and local government supported this process and included online webinars and face-to-face public information sessions (Figure 2). This consultation was held jointly with consultation on the draft Murrumbidgee Regional Water Strategy.

Figure 2. Stakeholder engagement during the first public exhibition period, April-May 2022



Similar feedback was received for the Murrumbidgee and NSW Murray regions, and given the connectivity across the two regions, a combined What We Heard report⁸ has been prepared.

There was general support for the development of a regional water strategy for the NSW Murray region, but concerns were raised about insufficient consultation with some stakeholders, and it was argued that development of the strategy should not proceed without hydrological modelling results. We also heard the next phase of the draft NSW Murray Regional Water Strategy development should be accompanied by an open, transparent and broad-scale consultation process to ensure that all stakeholder voices are heard, and that a broad cross-section of the community is represented in the discussion. In response we have published this discussion paper to ensure we articulate the key challenges in the region.

The key insights we heard during our most recent consultation with landholders, local councils, Aboriginal communities, stakeholders and the general public are provided in Figure 3 below.

Figure 3. Key insights from consultation on the draft NSW Murray Regional Water Strategy

Feedback theme	Feedback summary
Climate and modelling	<ul style="list-style-type: none"> • Concerns about the ‘worst-case scenario’ approach to modelling, which many considered unreasonable and unlikely to eventuate. The data, information and modelling used to inform the strategies should consider both wet and dry future conditions, not just dry. • Support for making data, information and modelling publicly available to aid transparency and inform people’s understanding of how it had been applied to the strategies, preferably prior to the strategies being finalised. • Concern at using projected climate change impacts with a timeframe that differs to the planning horizon/timeframe of the strategies.
Water security, availability and use	<ul style="list-style-type: none"> • Further investigation into the trends impacting reliability of water licences was suggested as a way of understanding the extent of the issue and identify drivers and options to address. • Support for options and actions aimed at developing a better understanding of people’s behaviours and assumptions around water availability and use. • Concerns about the impacts of a changing and variable climate on the environment, water sources, water availability, water quality, ecological degradation, water sharing and water users. • Stakeholder concerns also reflect the need to meet forecast population growth requirements in the region.

⁸ Department of Planning and Environment 2022, Draft Murray and Murrumbidgee Regional Water Strategies What We Heard Report, available via: www.dpie.nsw.gov.au/murray-regional-water-strategy

Feedback theme	Feedback summary
Environmental health, ecosystems and water quality	<ul style="list-style-type: none"> • Support for the commitment made by government to protect and support environmental values. Feedback highlighted the importance of undertaking stakeholder engagement and supporting stakeholder partnerships in progressing these options. • Support for initiatives aimed at addressing the impacts of a changing and variable climate on issues such as water quality and availability as well as local ecosystems. • Noted the importance of ensuring that regional water strategies clearly align with and relate to other key water plans, policies and initiatives. • Bushfire and flooding impacts were noted as contributors to poor water quality and traditional burning methods of catchments should be considered to help solve water quality issues. • Suggestion that environmental water delivery rules, practices and programs be reviewed as part of the regional water strategy, and that the ecological targets and objectives of the Murray-Lower Darling Long Term Water Plan be incorporated into the regional water strategy.
Improving water-related opportunities for Aboriginal people	<ul style="list-style-type: none"> • Significant support for improving opportunities for Aboriginal people to be more involved in water related matters, including regional land and water management issues, access to water entitlements, recognising and respecting Aboriginal cultural and spiritual ties and connection to Country, and acknowledging the cultural significance of water. • There needs to be more consultation with Aboriginal stakeholders and communities to capture Aboriginal cultural perspectives and incorporate local knowledge into the draft strategy and options
Land and water management planning	<ul style="list-style-type: none"> • The inter-connectedness of the NSW Murray and Murrumbidgee regions is key to water management. • There were strong calls for improvements to inter-jurisdictional water sharing and management, noting the complexity of interstate agreements and rules impacting both the NSW Murray and Murrumbidgee regions, including suggestions for mechanisms such as inter-jurisdictional working groups to support better outcomes. Support for developing a better understanding of the impacts of land use change and population growth on water resource.
Strategy development and implementation	<ul style="list-style-type: none"> • Need to ensure that regional water strategies align with government commitments and other water management plans, policy, reform and legislation. • Further consultation with the general community and stakeholders about how the draft strategies will be developed and finalised is important, as is culturally appropriate engagement with Aboriginal stakeholders and communities.

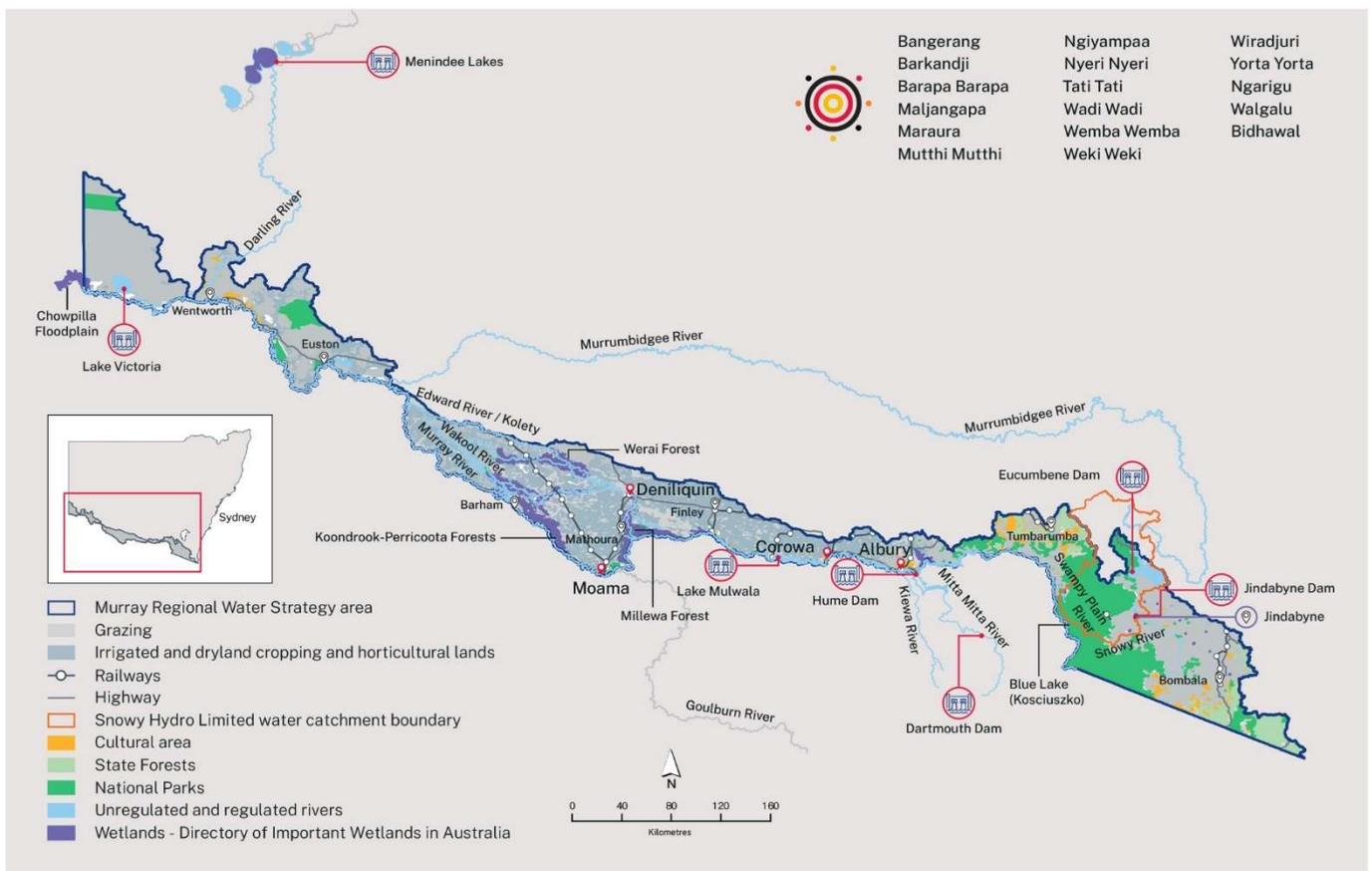
Feedback theme	Feedback summary
Connectivity between regions – southern connected Basin	<ul style="list-style-type: none">• It is important to consider improving connectivity between adjoining regions.• It may not be possible to improve connectivity when the Lower Darling River dries up naturally from time to time.

About the NSW Murray region

The NSW Murray region runs along the southern border of NSW from the Snowy River valley and includes stunning natural landscapes that vary from mountainous terrain in the east to open plans in the west.

The NSW Murray Regional Water Strategy region (Figure 4) region is home to many vibrant towns and communities; productive agricultural and agribusiness industries; nationally important and culturally significant wetlands; alpine glacial lakes, including lakes Albina, Cootapatamba, and the Ramsar site of Blue Lake and Hedley Tarn; and near-natural alpine wetlands in the Kosciuszko National Park. The region is also home to the Koondrook, Werai, and Millewa forests, which are the 3 subsites of the NSW Central Murray Forests Ramsar site.

Figure 4. Map of the NSW Murray Regional Water Strategy region



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

The NSW Murray region is part of the broader southern connected Basin, linked hydrologically and through water management arrangements to the Darling and Murrumbidgee rivers and by extension, to Victoria, Queensland and South Australia. The region also receives inflows from the Snowy Scheme under the Snowy River Licence.

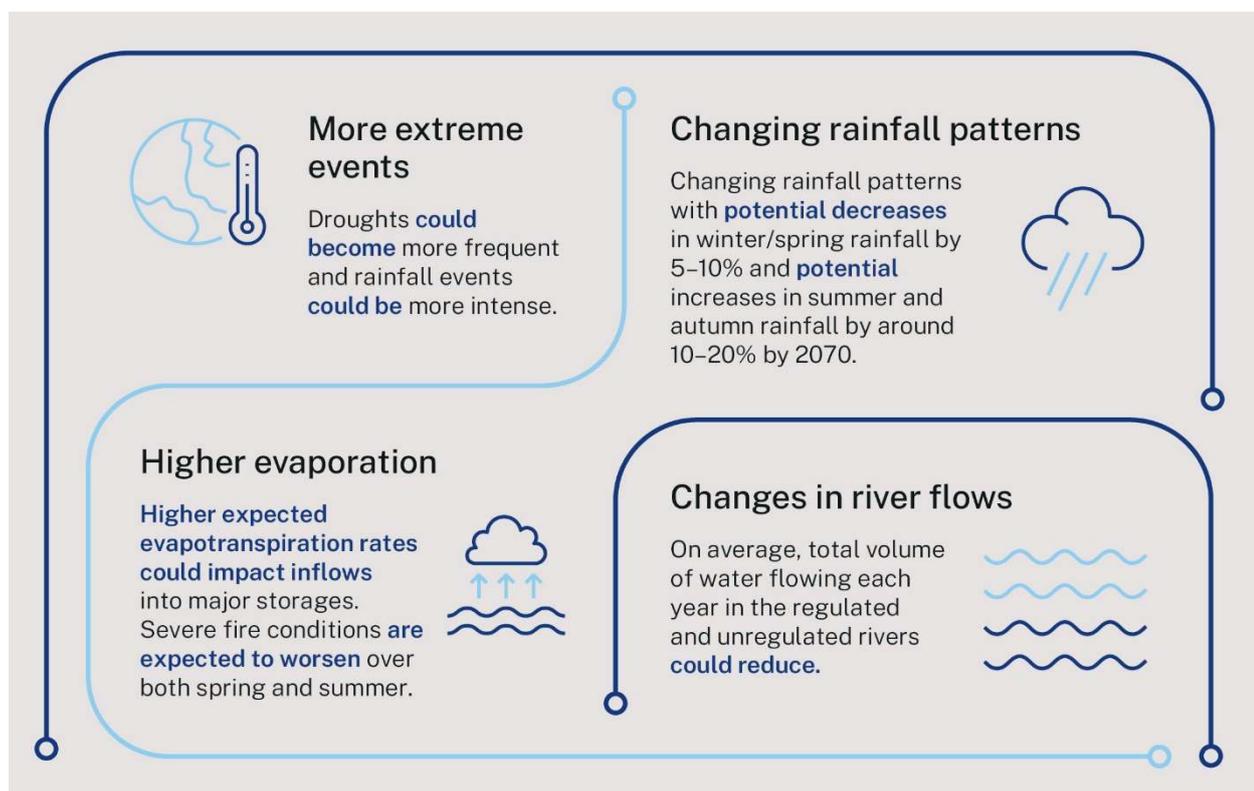
The NSW Murray region has access to surface water and good quality groundwater for towns, recreational use, cultural and environmental needs, and industry. Groundwater is an important water source for towns, industries and the environment in the NSW Murray region.

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

We do not know for certain what the future climate in the NSW Murray region will look like. However, our analysis of different climate scenarios shows there could be changing rainfall patterns; higher minimum and maximum temperatures; more hot days; fewer cold nights; more severe fire weather days; reduced or increased groundwater recharge, depending on location; and decreased snowfall and snowmelt (Figure 5).

We need to plan for these uncertainties and continue to refine our understanding of the climate-related risks in the NSW Murray region to ensure people, the environment and industries can thrive in the future.

Figure 5. What the future climate could look like in the NSW Murray region



Key challenges for the NSW Murray region

Our vision for the NSW Murray region, is to support the delivery of healthy, reliable and resilient water resources that will sustain a liveable and prosperous region.

Like other regions across Australia, the NSW Murray region will likely face a more variable and changing climate in the future. We need to prepare now for the transition to a scenario where we may have more variable and potentially less water available. We also need to set actions in motion to make smarter decisions about our water use and management armed with better knowledge and information to protect our the most critical water needs.

The draft NSW Murray Regional Water Strategy provides an opportunity to develop a long-term strategic plan so that communities, the environment and industries can be better prepared for a future changing climate. This long-term strategy will help keep the NSW Murray region an attractive place to live, work and visit.

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

- Challenge 1: Resilient water supplies for regional centres, towns and communities in a changing climate
- Challenge 2: Improving the health and resilience of aquatic and floodplain ecosystems
- Challenge 3: Addressing barriers to Aboriginal water rights and access
- Challenge 4: Supporting agriculture and emerging industries.

Addressing these challenges will help us meet the vision and objectives we have set for the regional water strategy.

Challenge 1: Ensuring resilient water supplies for regional centres, towns and communities in a changing climate

Population growth in strategic regional locations and changing climatic conditions are placing the region's water resources under pressure. There is a growing awareness that regional NSW needs to not only build its capacity to respond and recover from water-related shocks and stresses but also change its relationship with water to create an environment for the region to thrive.

Impact of climate change on water availability for towns and communities

Many of the towns in the NSW Murray region rely exclusively on surface water flows for town water supply. As a result of the highly variable climate conditions, local water utilities across the region have invested in infrastructure and water entitlements to secure town water supplies and continue to do so. In recent years, this investment has been informed by integrated water cycle management planning, and, from 1 July 2022, will continue to be guided by local water utility strategic planning under the Regulatory and Assurance Framework for Local Water Utilities⁹.

Our new modelling and climate data suggests that the risk of surface water supply shortfalls¹⁰ for towns reliant on surface water for town water supply in the NSW Murray region are already significant¹¹. Additionally, the models show that the probability of these shortfalls will vary across the region.¹²

For example, under the long-term historical climate scenario:

- Albury has a 2% annual probability of experiencing up to 30 days per year where at least 25% of daily demand cannot be met
- Tumbarumba has a 2% annual probability of experiencing up to 15 days where at least 75% of unrestricted daily demand cannot be met.¹³

Which, under the dry future climate, increases to:

- 85-day shortfall event where at least 25% of the unrestricted daily demands cannot be met for Albury (2% likelihood)
- 84-day shortfall event where at least 75% of the unrestricted daily demands cannot be met for Tumbarumba (2% likelihood).

⁹ www.industry.nsw.gov.au/water/water-utilities/best-practice-mgmt/iwcm

¹⁰ A shortfall is 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%).

¹¹ A 25% shortfall below unrestricted demands start to have significant implications to water dependent businesses and social amenity as councils start to introduce water restrictions to conserve water for critical human needs.

¹² For results, refer to Climate and hydrological modelling: Draft Murray and Murrumbidgee Regional Water Strategies report available at www.dpie.nsw.gov.au/murray-regional-water-strategy

¹³ NOTE: This is an assessment of surface water and does not include water that may be available from Tumbarumba's groundwater supply.

In addition, town water supplies to Corowa, Deniliquin and Murray Shire Council (Murray Shire) show shortfalls of greater than 10% of unrestricted daily demand across all the modelled scenarios, approximately doubling in duration under the dry future climate scenario.

Bombala is also modelled to experience shortfalls under the dry future climate scenario.

Locations with higher population growth, for example Albury, will further increase these shortfalls if per capita water demand remains the same.

The results of our modelling, coupled with the implications of projected population growth and the local water utility licence entitlements held by each council, will have varying implications for councils and local water utilities in the region and we will be working with them to understand what the information means for their local area. Consideration of our new climate modelling data and future water availability risk will be important to understand shortfall risks and assess performance of regional water strategy options.

Growing regional centres are placing pressures on supplies

Significant population growth of regional centres and towns is expected over the next 20 years which will increase town water supply demands (Table 1). These centres include Albury City, Murray River Council towns and Greater Hume Shire, some of which have been modelled as already experiencing town surface water supply shortfalls with current population levels, for example Albury.

Table 1. Forecast population growth for local government areas within the NSW Murray region

Local Government Area	2021 population	2041 population	Percentage increase
Albury	55,670	76,341	37%
Berrigan	8,768	9,897	13%
Federation	12,594	13,299	6%
Murray River	12,426	15,456	24%
Snowy Monaro	21,035	23,845	13%
Greater Hume	10,883	13,459	24%

Source: NSW 2022 Common Planning Assumptions data available at: www.planningportal.nsw.gov.au/populations

Under the dry future climate scenario with 2061 demand estimates:

- for Albury there is a 10% likelihood of a 91-day shortfall event where at least 25%¹⁴ of the unrestricted daily demands cannot be met. This is more than double the shortfall based on current demands.
- for Murray River Council, the likelihood of a shortfall where at least 25% of unrestricted demand could not be met for 5 - 10 days increases from 1% under the long-term historical climate to 10% under the dry future climate scenario.

¹⁴ A 25% shortfall below unrestricted demands start to have significant implications to water dependent businesses and social amenity as councils start to introduce water restrictions to conserve water for critical human needs.

Stakeholders also reflect the need to meet forecast growth requirements in the region.

Land use can present water quality challenges for local water utilities

Water supplies to the towns of Jindabyne, Bombala and Delegate¹⁵ are affected by turbidity during floods and high river flows, resulting in a constrained ability to treat water and temporary boil-water alerts issued for residents. More intense storms due to climate change, and increased likelihood of bushfires, will increase town water quality risks in the future. Councils and the NSW Government are preparing for this by investing in upgrades to water treatment facilities.

Local water utilities have highlighted concerns that wastewater discharges, from intensive agricultural production and poor catchment health, reduce the quality of raw water supplies and create significant challenges for supplying clean water to towns. Stakeholder feedback has also highlighted a need to improve coordination of legislation and regulations for inter-related issues such as land management and water quality.

Town water supplies along the Murray River are periodically impacted by blue-green algal blooms which result in toxins in raw water supplies that need to be removed and the added biomass of the algae can clog filtration systems, reducing their output.

¹⁵ These three towns are included in the Snowy River catchment and this catchment is included in the strategy area because of the strong hydrological linkages created because of the Snowy Scheme.

Challenge 2: Improving the health and resilience of aquatic and floodplain ecosystems

Development has affected ecosystem health in the NSW Murray region and connected valleys contributing to changes in flow variability, water quantity and water quality. The challenge is to protect and enhance the region's water-dependent ecosystems by using water effectively during wet and dry periods.

The NSW Murray region is renowned for its natural riverine features and assets including a range of upland and lowland rivers, nationally and internationally recognised wetlands, lakes, extensive river red gum forests, and a diverse range of native and threatened plants and animals. These riverine features exist across the entire length of the region and are critical to sustain the health of the river system to ensure continued cultural values of these assets are maintained now and into the future.

The river system, floodplains, aquifers and wetlands of the NSW Murray region provide habitat for many water-dependent species including waterbirds, frogs and native fish, and including endangered and vulnerable native species such as the Southern Bell Frog and the Murray Cod. There are also important areas of river red gum, blackbox, lignum and non-woody vegetation.

Throughout the catchment, vegetation has declined in condition and extent due to a reduction in flood frequency and duration and an increase in land clearing.¹⁶ Targeted delivery of environmental water to key areas during dry to moderate water availability is important to maintain their current extent and to improve their condition over the longer-term.

Altered flows are affecting ecosystem health

Water infrastructure, river regulation and water extraction have influenced flow variability and the distribution of water throughout the catchment. Despite extensive water reform initiatives to address flows and 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 Murray River is very different to predevelopment conditions with the degree and type of hydrological change varying within the catchment. The construction and operation of Hume and Dartmouth dams and other infrastructure have resulted in:

- declines in medium and high-flow frequencies
- change to the seasonality of flows
- lower, regulated flow patterns being more common with a sizable loss in natural flow variability, reduced inundation of wetlands, and decreased long-term average flows.

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

¹⁶ NSW Office of Environment and Heritage. 2020. Murray-Lower Darling Long-Term Water Plan Part A: Murray-Lower Darling catchment

River flows could be much less with a dry future climate

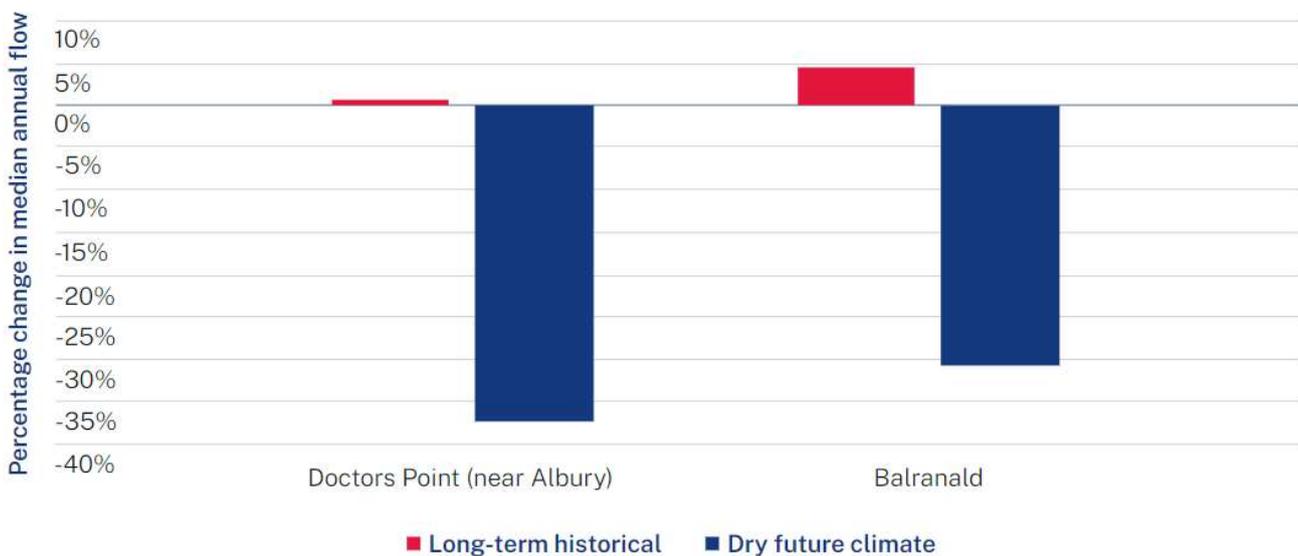
Generally, there has been declining rainfall, snowfall and changing seasonal conditions coupled with increasing temperatures and evaporation reducing inflows in the region’s water storages. This trend is expected to continue. Furthermore, the seasonality of precipitation is changing with lower rainfall in winter and spring, and higher rainfall in summer and autumn. Higher temperatures are also having an impact on snowfall and snowmelt, which are a key supply of water in the catchment. This presents a long-term risk to river, wetland and floodplain health, making it more difficult to manage our landscapes and ecosystems and the human activities that depend on and benefit from them. For example, with greater extremes of both long droughts and large, intermittent floods, the phenomenon of hypoxic blackwater could worsen.

Our modelling¹⁷ estimated that under a dry climate future there could be significant decreases in flows compared to those seen under the historical climate (Figure 6). The modelling found that:

- a 38% decrease in median daily flows at Doctors Point near Albury, and
- a 31% decrease in median daily flows at Balranald on the Murrumbidgee River near its confluence with the Murray River.

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

Figure 6. Effect of long-term climate scenarios on the NSW share of median daily flows in the NSW Murray River at Doctors Point, and in the Murrumbidgee River at Balranald near the confluence with the Murray River¹⁸



¹⁷ The Department of Planning and Environment, Murray and Murrumbidgee Regional Water Strategies: Climate and hydrological modelling available at www.dpie.nsw.gov.au/murray-regional-water-strategy

¹⁸ NSW shares 50% of the flow with Victoria at Doctor’s Point and owns 100% of Murrumbidgee outflows (measured at Balranald)

Restoring healthy flow regimes in the NSW Murray region

Since 2004, through water sharing plans, the Murray-Darling Basin Plan (Basin Plan) and other initiatives, the NSW Government and other Basin governments have introduced an environmental flow regime which is managed through a combination of planned and held environmental water sources, and environmental-watering works to enhance floodplain inundation at key environmental sites informed by a long-term water plan¹⁹.

Initiatives such as the Reconnecting River Country Program aim to improve wetland and floodplain connectivity through relaxing system constraints to enable flexible and efficient use of existing water for the environment. This program has recently prepared Strategic Business Cases for the Australian Government and has commenced the detailed flow option investigation stage to understand through working with stakeholders, the benefits, impacts and proposed mitigation measures associated with the options under consideration.

Initiatives to address flows and improve water for the environment

Reconnecting River Country Program

The Reconnecting River Country Program²⁰ aims to improve wetland and floodplain connectivity by striking a balance between economic, social, cultural and environmental outcomes across southern NSW.

The program focuses on relaxing or removing some of the constraints or physical barriers impacting the delivery of water for the environment in the:

- Murray River from Hume to Yarrawonga and Yarrawonga to Wakool
- Murrumbidgee River

The program is part of the Sustainable Diversion Limit Adjustment Mechanism (SDLAM) which aims to achieve improved environmental outcomes using existing water for the environment.

¹⁹ Department of Planning, Industry and Environment, 2020. Murray-Lower Darling Long Term Water Plan.: Part A Murray-Lower Darling catchment

²⁰More information on the Reconnecting River Country Program is available at: www.dpie.nsw.gov.au/water/water-infrastructure-nsw/sdlam/reconnecting-river-country-program

Initiatives to address flows and improve water for the environment

Snowy Water Licence Review

The construction of the Snowy Scheme caused a significant decline in the health of the Snowy River. In response the Snowy Water Inquiry was held in 1998 and resulted in environmental flow rules that would see more water and higher flows delivered to the Snowy River from a new outlet at Jindabyne Dam. These environmental flows have resulted in improved health and condition of the Snowy River.

Every ten years, the Snowy Water Licence is subject to reviews under the *Snowy Hydro Corporatisation Act 1997*, with the first review being completed in 2018 and the next scheduled to commence in 2027. These reviews focus on a range of administrative and technical issues including exploring better ways to deliver environmental flows. Actions from the review are being investigated and are due for completion in December 2023. The timeframe has been extended to enable the use of integrated modelling to provide rigorous analysis to inform any potential changes to the licence.

It could become more difficult to meet environmental water needs

The NSW and Commonwealth environmental water holders own and manage a total of 660 GL of water entitlement in the NSW Murray region which is 26% of total regulated NSW Murray River entitlement. This environmental water is held in the following categories:

- 485 GL as general security
- 100 GL as supplementary
- 50 GL as conveyance, and
- 25 GL as high security²¹.

Just 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 by 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 and, in some instances, limited opportunities to maintain critical environmental needs such as refuge river pools, core wetland areas and seed banks in the soil. Ongoing dry conditions would also reduce the reliability of these licences.

We heard concerns from stakeholders about the effects of a changing and variable climate on the environment, water sources, water availability, water quality, ecological degradation, water sharing and water users. There is considerable support for initiatives that address the impacts of a changing

²¹ Figures are for 2020 and 2021. See NSW Department of Planning and Environment, 2022. General Purpose Water Accounting Report 2020–21: NSW Murray. www.industry.nsw.gov.au/water/allocations-availability/water-accounting/gpwar

and variable climate, particularly in relation to water quality, water availability and protection of local ecosystems.

Sustained high flows and unseasonal inundation of Millewa Forest

During years with moderate to high water availability, a combination of regulated water deliveries and constrained channel capacity result in sustained, elevated water levels that can cause unseasonal flooding and erosion of Millewa Forest.

Through the Barmah Millewa Feasibility Study²², Basin governments are working to reinstate the delivery capacity of water across the Barmah Choke²³ on the NSW Murray River, while protecting the health and cultural integrity of the river.

Ecological communities are at risk

Threatened and high value ecological communities

Throughout the catchment, native vegetation has declined in condition and extent due to a reduction in flood frequency and duration and an increase in land clearing.²⁴ Targeted delivery of environmental water to key areas during dry to moderate water availability is important to maintain their current extent and to improve their condition over the longer-term.

Groundwater-dependent ecosystems (GDEs) are ecosystems that have their species composition and natural ecological processes determined to some extent by the availability of groundwater. GDEs are at risk where they are highly connected if groundwater becomes increasingly extracted due to a drying climate or other reasons and if there is reduced recharge. GDEs are mapped as part of the water sharing plan process and those ecosystems of high conservation value (high-priority GDEs) are protected by rules in the relevant plans. For the NSW Murray these are the Water Sharing Plan for the Murray Alluvial Groundwater Sources 2020, the Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Source 2020 and the Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Source 2020. As shown in the GDE maps in these plans, high priority GDEs are located in the catchment from the east of Howlong to the west at the NSW-South Australia border. Mapping of GDEs is regularly reviewed and included in new or revised water sharing plans leading to greater protection of GDEs.

A drier and more variable climate will increase the stress on ecological communities. Events such as intense bushfires can have serious effects. For example, populations of the endangered Macquarie Perch were severely affected by the 2019-20 black summer bushfires when a loss of streamside vegetation caused increased sediment loads and ash to wash into streams, rapidly resulting in loss of habitat and poor water quality including low dissolved oxygen.

²² See: www.mdba.gov.au/publications/mdba-reports/barmah-millewa-feasibility-study

²³ The Barmah Choke is a narrow section of the River Murray that runs through the Barmah-Millewa Forest and includes the Tocumwal Choke, the Barmah Choke and the Edward Choke (www.mdba.gov.au/water-management/water-markets-trade/barmah-choke)

²⁴ Department of Planning, Industry and Environment, 2020. Murray-Lower Darling Long Term Water Plan.: Part A Murray-Lower Darling catchment

Native fish remain 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.

In addition, water releases from Hume Dam can display temperature decreases of 10 C or more in summer that extend more than 200 km downstream. Cold water pollution has significant damaging impacts on riverine ecological function, particularly in summer when biological cues for fish spawning are disrupted. The Murray River from Hume Dam to Yarrawonga Weir is impacted by cold-water pollution with an almost complete loss of historic populations of Murray Cod, Trout Cod, Macquarie Perch and Freshwater Catfish.

Every year, large numbers of native fish are extracted from rivers by unscreened pumps in the NSW Murray region. Adult fish as well as juveniles, larvae and eggs are extracted by pumps and diverted into irrigation channels, along with debris such as sticks and leaves. This impacts the sustainability of native fish populations and can also cause damage to irrigation infrastructure.

Installation of screens at pump sites and diversion regulators can reduce fish losses by over 90%, helping more fish survive to maturity and boosting fish numbers. The protection extends to other aquatic species such as crayfish and turtles. Screening infrastructure also improves pump operation, water delivery and extraction efficiency for asset owners through fewer blockages caused by debris.

Aquatic species remain under stress from water quality risks such as hypoxic blackwater

There are programs to improve the conditions for native fish throughout the NSW Murray region²⁵ however some efforts are impeded by occasional hypoxic (low oxygen) blackwater events. These events occur when accumulated dead leaves and other plant matter decompose in waterways, drawing oxygen from the water which causes the death of fish and other aquatic animals. These events are more pronounced after long droughts followed by flooding which washes the build-up of organic matter into the rivers. We heard from stakeholders concerned about other water quality issues such as salinity, elevated nutrient levels, blue-green algae and cold-water pollution.

We also had feedback suggesting additional water allocations be assigned to protected areas for more effective ecosystem conservation. Some stakeholders suggested that the ecological targets and objectives of the Murray-Lower Darling Long Term Water Plan²⁶ be incorporated into the regional water strategy. We are mindful of the considerable amount of information contained in this plan and how this information can be used in the regional water strategy.

²⁵ MDBA 2020. The Native Fish Recovery Strategy www.mdba.gov.au/publications/governance/native-fish-recovery-strategy. See also: NSW DPI Improving fish habitats www.dpi.nsw.gov.au/fishing/habitat/rehabilitating/habitats

²⁶ Murray-Lower Darling Long Term Water Plan www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/murray-lower-darling

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

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.

Limited understanding of the cultural significance of water to Aboriginal people

There is a limited understanding and acknowledgement of the spiritual connection Aboriginal people have to healthy waterways and important cultural sites. 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 sites.

As the first managers and carers of this natural resource, Aboriginal people have rights and a moral obligation to care for water under their law and customs. These obligations connect across communities and connected surface water and groundwater systems.

There is a lack of understanding of the key cultural sites in the region

There is concern from Aboriginal people that our understanding of the extent of culturally significant sites within the region is limited and needs to be better considered in water management decisions.

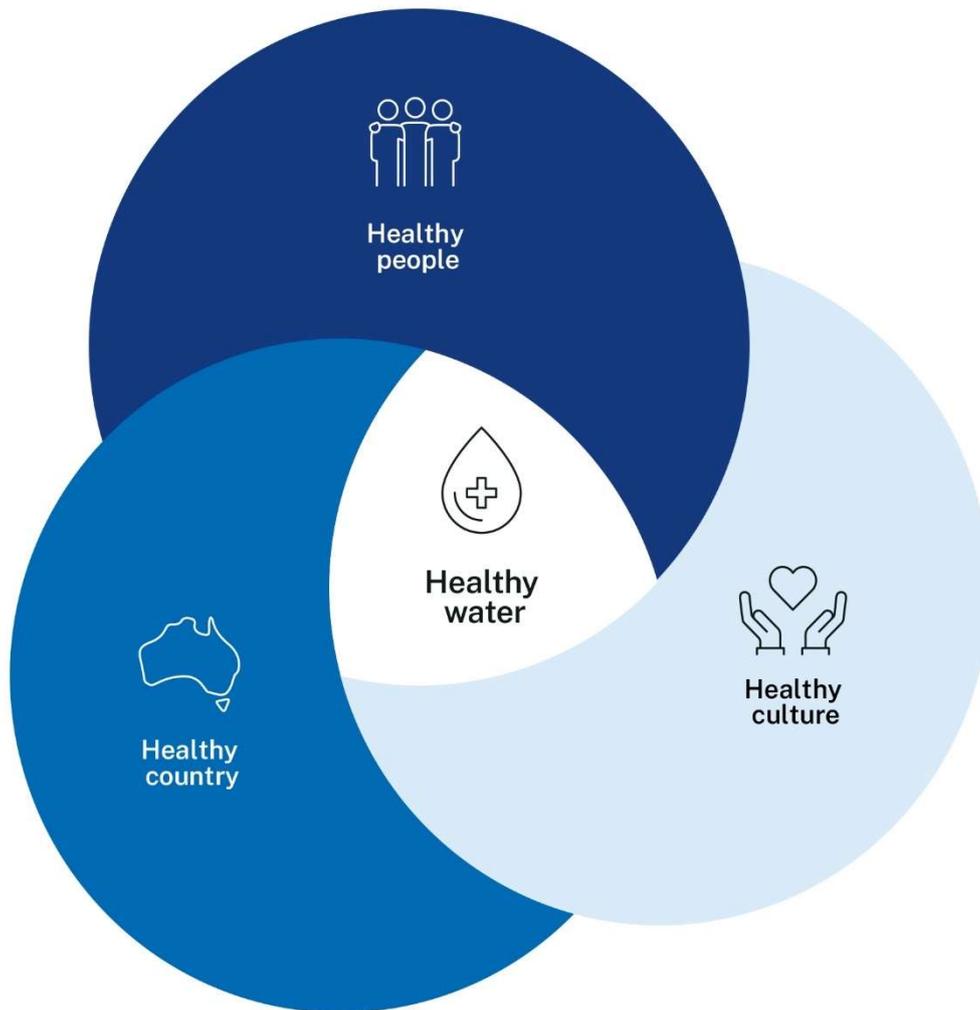
Some culturally significant sites in the Murray region have been identified and assessed for water management strategies. Through the Aboriginal Waterways Assessment Program²⁷, two sites have been assessed in the NSW Murray catchment: the Werai Forest by the Barapa Barapa and Wemba Wemba nations and the Millewa Forest by the Bangerang and Yorta Yorta nations. The Murray-Lower Darling Long-Term Water Plan identifies water management strategies that aim to maintain and improve the long-term health of the Werai Forest and other sites in the NSW Murray region. To nourish these important sites, it is acknowledged that genuine and ongoing consultation with Aboriginal people is vital.

Healthy waterways and environmental assets are critical for connection to Country

Aboriginal people rely on the health of water and their waterways for wellbeing and continued practice of cultural traditions. If a site dries up or has ongoing poor water quality, the traditional story or mean of a site can be lost. When the cultural and spiritual values of water are sustained by providing water that is sufficient in both quantity and quality, then many other components of Aboriginal life will be healthy (Figure 7).

²⁷ Murray Lower Darling Rivers Indigenous Nations. Un-dated. Using the Aboriginal Waterways Assessment Tool: A handbook for practitioners. See www.mldrin.org.au/what-we-do/aboriginal-waterways-assessment/

Figure 7. Australian Aboriginal people's view of the relationship between water, environment, culture and people



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

A significant number of cultural sites in the NSW Murray region are on floodplains and many cultural activities focus on floodplain areas. Development on floodplains, such as levees, have altered the passage of flow and resulted in some cultural assets that are disconnected from main waterways.

Current water management framework may limit the ability of Aboriginal people to access water for economic, cultural and basic human needs

While Aboriginal people can currently access rights to water through water use entitlements, the framework is complex, 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 water²⁸.

The costs associated with accessing water are also prohibitive. While there are some fees waived on purchasing licences and annual fees²⁹, 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 are yet to be implemented.

There are restrictions with Aboriginal cultural water access licences

In NSW, Aboriginal people can apply for an individual Aboriginal cultural water access licence.³⁰ If granted, this licence can provide up to 10 ML/year for cultural purposes³¹, but it cannot be associated with commercial activities or provide direct or indirect economic benefit. Since the Water Sharing Plan for the NSW Murray and Lower Darling Regulated Rivers Water Sources commenced on 1 July 2004, no (high security) Aboriginal cultural water access licences have been granted to Aboriginal people. The Water Sharing Plan for the Murrumbidgee Regulated River Source 2016 is the only water sharing plan to have granted a high security (Aboriginal cultural) access entitlement.

To help remove institutional constraints to better access to water for Aboriginal people, some stakeholders have indicated support for the use of Aboriginal cultural water access licences for economic activity. Feedback from other stakeholders expressed concern that these licences should not be allowed for an economic gain if water availability for third parties was impacted.

Cultural flows are not explicitly provided for

The development of a policy framework for cultural flows is in its infancy in Australia and they are not explicitly provided for in the *Water Management Act 2000* (NSW) or relevant water sharing plans. The Murray and Lower Darling Indigenous Nations Echuca Declaration, 2007, defines cultural flows as: 'water entitlements that are legally and beneficially owned by the Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, natural, environmental, social and economic conditions of those Nations.' These cultural flows, as defined in the Echuca Declaration, do not currently exist in the NSW Murray region.

In recent years, environmental water managers have made efforts to achieve cultural and ecological co-benefits³² and Aboriginal people continue to contribute important knowledge to inform the management of water for the environment in the Murray region. However, these efforts are distinct

²⁸ Improved access to clean drinking water for remote Aboriginal communities 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: Namatjira / New Merinee, Wamba Wamba, Cummeragunja

²⁹ For example, the Aboriginal Cultural Water Access Licence attracts no application fee or entitlement and usage fees

³⁰ 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, in both surface water and groundwater. These licences allow the take of water independent of Native Title rights.

³¹ 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

³² More information can be found at: www.environment.nsw.gov.au/topics/water/water-for-the-environment/murray-and-lower-darling/annual-environmental-water-priorities

from how Aboriginal communities envision cultural flows where water is owned and managed by Aboriginal People and used as per the Echuca Declaration.³³

Limited opportunities for Aboriginal people to participate in water management

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, and overlook the interest, values, knowledge and rights of Aboriginal people and their cultural obligation to Country,³⁴ including the understanding that waterways are living ecosystems that need to be cared for and protected.

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

Aboriginal people in the region have always been deeply connected to water and this relationship is essential to culture, community, connection to Country and health and well-being. Cultural obligations to care for land and water connect across communities and language groups, extending to downstream communities, throughout catchments and over connected surface water and groundwater systems.

Increasingly, it has been acknowledged that Aboriginal knowledge and experience needs to be recognised as an essential element to managing natural resources in Australia. However, significant gaps remain, and 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 to be established.
- the complex set of state and federal laws and systems around water management that is often not explained in a culturally appropriate manner.
- there are 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.

³³ The national cultural flows research project is working to secure a future where First Nations' water allocations are embedded within Australia's water planning and management regimes, to deliver cultural, spiritual and social benefits as well as environmental and economic benefits, to Aboriginal communities in the Murrumbidgee-Darling Basin and beyond. Further information is available at: www.culturalflows.com.au

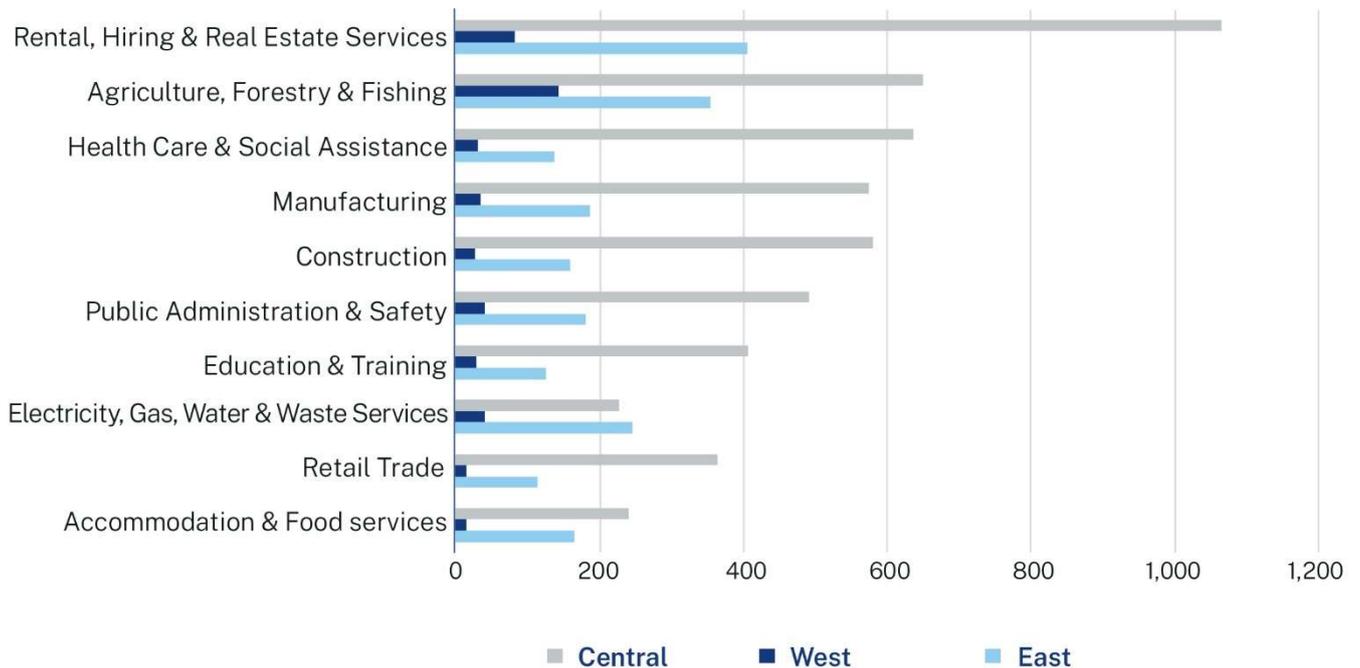
³⁴ Jackson, S., Woods, R. and Hooper, F., 2021. Empowering First Nations in the governance and management of the Murray–Darling Basin. In Murray-Darling Basin, Australia (pp. 313-338). Elsevier.

Challenge 4: Supporting agriculture and emerging industries

Over the next 20 years, agriculture and agribusiness will continue to be key economic drivers for the region, however opportunities for other existing and new industries, such as tourism, manufacturing, hydro-electricity, freight and logistics are emerging. A dry future climate could reduce water availability for new and existing industries and lead to adverse economic and social impacts. Our challenge is to support sustainable industries in the context of a variable and changing climate.

The NSW Murray region has diverse economy, reflecting its varied landscape and climate, which contributed over \$10 billion in 2020/21 in terms of gross value added to the state’s economy (Figure 8). The region’s water resources and waterways, directly and indirectly underpin key economic drivers of the region including agriculture, particularly irrigated agriculture, downstream agribusinesses, hydroelectricity and tourism for areas such as the Snowy Mountains and along the Murray River. The sustainable management of water resources will be critical for economic prosperity of the region.

Figure 8. Gross value added for key sectors of LGAs spanning the NSW Murray region³⁵



³⁵ Source: REMPLAN 2022, REMPLAN Economy: Custom data. Available at www.rempln.com.au/economy. Note: Due to the regional boundaries under which industry information is collected and reported, information that covers different local government areas located or partially located within the boundaries defined by the Murray Regional Water Strategy is presented. Given some of these local government areas cross over into other regional water strategy regions, there will be overlapping figures presented in the Murray Regional Water Strategy and in other strategies, such as the Murrumbidgee Regional Water Strategy and Western Regional Water Strategy. ‘East’ refers to the Snowy Valley and Snowy Monaro local government areas, which are partially in the Murray Regional Water Strategy.

The mix of industry and crops in the region is changing. Horticulture is expanding, tourism is increasing and value-added agricultural industries are expected to grow over the next 20 years. Changes in water use and water demand locations are occurring as a result. Improving our understanding of these trends and underlying drivers will allow for improved water management planning for the regions that will support future economic prosperity.

The importance of agriculture for the NSW Murray region

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 large contribution to the country's agricultural production. In 2020/21, the agricultural sector including downstream value-added manufacturing and services³⁶ contributed over \$1.2 billion to regional output in terms of gross value added. In 2016 the agricultural sector including downstream value-added manufacturing and services directly employed over 9,100 people, which is approximately 14% of total employment across the NSW Murray region.³⁷

Given this significance, the NSW Government is committed to supporting agriculture in the region in the long-term.

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. Major agricultural enterprises include mixed farms growing rice, winter crops and pastures for livestock production and dairying in the mid-Murray region, citrus in the south-west and other horticultural crops including grapes, fruit and nuts in the Mid- to Lower Murray. Cattle and sheep grazing occurs across the Snowy Genoa area. Other agricultural industries throughout the region are grains, table grapes and viticulture. Cotton has historically not been a major crop within the region; however, production in recent years has increased, and there is growing interest given the potential higher returns compared to more traditional seasonal crops such as rice.

Improve our understanding of climate variability to support agriculture and other water dependent industries

Climate change may result in reduced water availability and increased uncertainty for the region's industries (particularly agriculture) that are highly water dependent. More extreme weather events, such as droughts and floods, can cause large-scale economic and social losses for the agricultural sector and rural communities. Changes in temperature and seasonality may also force changes to the type of crops that are suitable for the region. These impacts have the potential to constrain industry and economic growth across the region. However, it should be noted that the NSW Murray River is one of the most reliable river systems in inland NSW.

Strategy region; 'Central' refers to the Albury, Berrigan, Edward River, Federation, Greater Hume and Murray River local government areas; and 'West' refers to the Balranald and Wentworth local government areas. Gross value-added figures are categorised using the Australian and New Zealand Standard Industrial Classifications.

³⁶ Total of 'Livestock, grains & other agriculture', 'Agriculture, forestry & fishing support services', 'Beverage product manufacturing' & 'Food product manufacturing'.

³⁷ REMPLAN 2022, REMPLAN Economy: Custom data. See www.rempln.com.au/economy.

Historically, water management decisions were made based on the last 130 years of climate records. Our new climate modelling, the last drought and recent flood events have demonstrated that the past is not necessarily a good indicator of the future, and the last 130 years of data could be inadequate for projections of future water availability.

A limited understanding of future water availability and publicly available climate information can lead to poor investments, business decisions, drought and flood security planning, as well as a loss of opportunities to invest in alternative water supplies. During public consultation we heard that stakeholders are interested in the new climate datasets and modelling. However, they were also concerned the modelling was overly conservative about the climate in the future, and there was a need to consider opportunities and challenges under all climate scenarios rather than just modelling dry scenarios.

Improve the sharing and delivery of water resources in the Murray system

The NSW Murray forms part of the southern connected Basin (Figure 9). During earlier consultations with stakeholders, we heard that optimising water availability to meet the current and future needs of irrigated agriculture, is a challenge. Stakeholders stated a need to better use existing infrastructure and explore new infrastructure and policy options to improve water security and improve delivery.

Managing water across regions in the southern connected Basin is complex, with the Murray-Darling Basin Agreement (the Agreement) governing water sharing between NSW, Victoria and South Australia, as well as rules for releases from the Snowy Scheme. The last substantive change to the Agreement occurred in 1970 against a backdrop of different water user needs, climate and water resource development conditions and management arrangements, compared to that of today.

Figure 9. Schematic of the southern connected Basin



Figure notes: MDBA = Murray-Darling Basin Authority

Stakeholders also highlighted the significant social and economic impacts experienced by the regions as a result of buy-backs of water for the environment, under the Basin Plan, and requested an investigation into the impacts on NSW communities and industries.

Connectivity between the Lower Darling and Lower NSW Murray catchments

The Lower Darling catchment is one of several that play a critical role in providing water to the Lower NSW Murray River. We have heard from many stakeholders that it is important to consider improving connectivity between adjoining regions. We have also heard that it may not be possible to improve connectivity when the Lower Darling River dries up naturally from time to time.

The NSW Government is reviewing whether rules should be amended to improve the flows of water between catchments at certain times. Importantly, this review needs to consider whether we have the tools to deliver the intended outcomes without significant adverse impacts. This work is being covered through a more coordinated, system-scale approach as part of the Western Regional Water Strategy.

Although not part of the NSW Murray Regional Water Strategy area, the Menindee Lakes system (which is part of the Western Regional Water Strategy area) is an important storage for the NSW Murray River system that is used to meet consumptive and environmental demands in the NSW

Murray and Lower Darling rivers. The draft Western Regional Water Strategy³⁸ has proposed three options (30, 50 and 52) which may impact on water availability in the NSW Murray River. The hydrological, economic and environmental assessment of these options will be conducted as part of the Western Regional Water Strategy.

Delivery constraints in the mid-NSW Murray create challenges for management of the system

An increase in water use downstream of the Barmah Choke means getting water to where it is needed is often difficult, and there is the potential for future supply shortfalls. Daily delivery rates from Hume Dam have had to be reduced because the capacity of the Barmah Choke has fallen progressively over the past 3 decades from 11,500 ML/day in the 1980s to 9,200 ML/day in 2019.

Through the Barmah Millewa Feasibility Study, Basin governments are working to investigate and assess options for reinstating the delivery capacity of water across Barmah Choke on the Murray River, and other alternatives, while protecting the health and cultural integrity of the river. Six options have been identified and a decision is expected in early 2023 as to which suite of options will proceed.

The challenges associated with managing the NSW Murray River system are likely to be exacerbated by future climate change, such as changing rainfall and snowfall patterns, increased evapotranspiration, longer dry periods and more intense floods.

Inundation of low-lying agricultural lands

In recent years, increased flows from flooding events, dam releases to manage large volumes of inflows, environmental releases, river operations and flooding events, have inundated low lying areas including private lands. Landholders have indicated that at times, more than 30% of their productive land can become unusable or inaccessible due to inundation and many people have expressed concern about the impact on productivity and livelihoods.

Stakeholders have expressed concern that sometimes they find themselves managing their farming operations on a day-to-day basis depending on the flows of the adjoining river. As a result, stakeholders are calling for more opportunities to be consulted in water management practices that impact their ability to manage and maintain the productivity and sustainability of their land and, if impacted, are seeking some form of compensation.

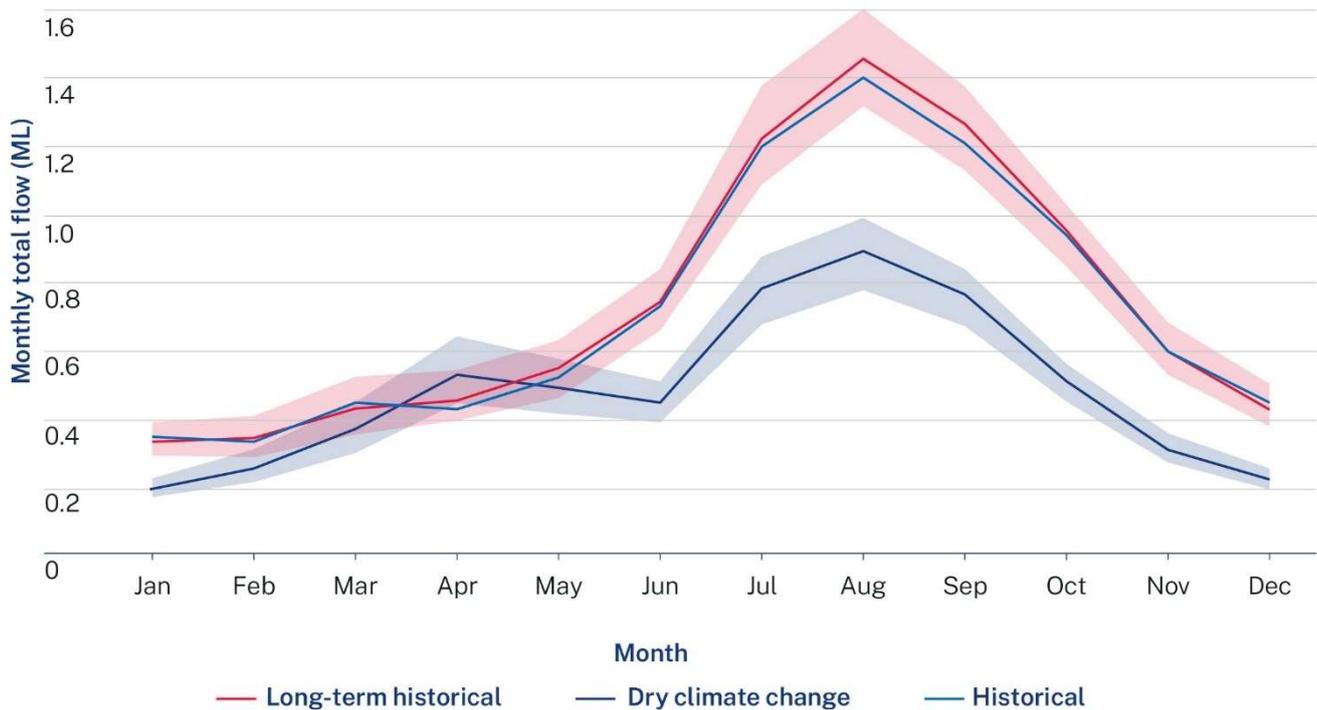
Balancing the needs of landholders to use and access their land with fluctuating flow regimes and inundation will require ongoing consultation and collaboration.

Water availability could be significantly reduced under a dry climate future

The new climate data and modelling highlights that under the dry future climate scenario (Figure 10) there could be a significant decrease in the amount of inflow into the NSW share of the Murray system.

³⁸ More information is available at: www.dpie.nsw.gov.au/western-regional-water-strategy

Figure 10. Impact of climate scenarios on seasonal inflows into the NSW share of the Murray system storages (combined)



In addition, as discussed in the draft Murray Regional Water Strategy³⁹, it was evident that there has been a reduction in average general security water allocations since about the year 2000. The new climate data and modelling (Figure 11), which is based on a range of plausible future climate scenarios, also highlights several significant trends for general security water entitlements:

- Under a repeat of the conditions experienced under the long-term historical climate scenario, opening yearly allocations may be higher than experienced under the historical climate scenario. However, under the dry future climate scenario, opening allocations would be significantly reduced compared to the other two scenarios.
- End-of-year allocations are shown to be somewhat similar across both the historical climate and long-term historical climate scenarios, but again, significantly reduced under the ‘dry future’ climate scenario.

For high security entitlements, opening allocations perform similarly across both the long-term historical climate and historical climate scenarios, but are significantly reduced under the dry future climate scenario. End-of-year allocations are similar for all three scenarios, albeit slightly reduced under the dry future climate change.

³⁹ NSW Department of Planning and Environment 2022, Draft Murray Regional Water Strategy, www.dpie.nsw.gov.au/murray-regional-water-strategy

A description of the climate scenarios and these and other results are presented in the Climate and hydrological modelling: Draft Murray and Murrumbidgee Regional Water Strategies report.⁴⁰

Figure 11. Impact of dry future climate scenario on NSW Murray general security available water determinations for 1 July (left) and 30 June (right)⁴¹

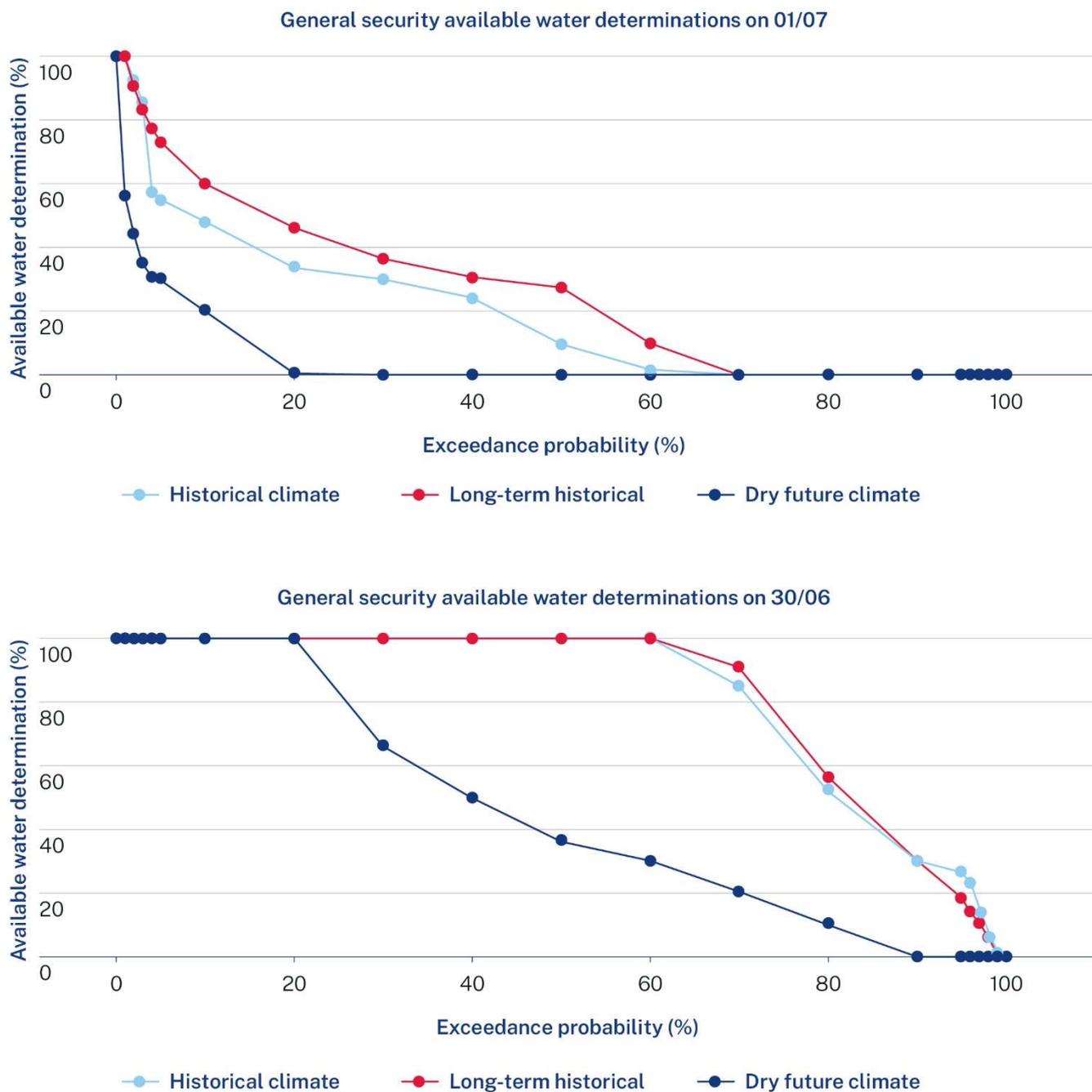


Figure notes: these results do not include carryover. To interpret these figures – the higher a point is (on a line), the higher the allocation level is, while the further a point is (on a line) to the right of the graph the more likely that level of allocation is. AWD = available water determination; GS = general security

⁴⁰ The Department of Planning and Environment, Climate and hydrological modelling: Murray and Murrumbidgee Regional Water Strategies available at www.dpie.nsw.gov.au/murray-regional-water-strategy

⁴¹ Note that these results do not include carryover

These results highlight that we need to explore a range of ways to improve water availability for water entitlement holders, considering opportunities and challenges afforded under both wet and dry years, and maintaining water use levels within sustainable diversion limits.

Changes in land use impact the use of water resources

The draft Riverina Murray Regional Plan 2041⁴² highlighted that access to water is critical for some land uses, but it 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. Misalignment between regional planning, economic development and catchment boundaries may create challenges to integrating regional planning priorities with supporting water resource management. The lack of integration makes consultation and collaboration across governments crucial.

The NSW Murray region has a diverse economy, reflecting its varied landscape and climate, with transport links and a strong network of interconnected centres. Its strategic location and infrastructure make it a significant contributor to the NSW economy. Government investments including the Inland Rail Project, the Albury Regional Jobs Precinct and the Snowy Mountains Special Activation Precinct will further leverage the region's competitive advantages of the NSW Murray region that will support industry development and job growth. This development may influence water-use patterns and intensify competition for available water resources.

Regional areas are becoming increasingly attractive places to work and live, with the ability to work remotely and access more affordable housing. For example, the 2022 NSW population projections estimate significant growth in the Albury local government area, with a 37% increase in population expected over the next 20 years.⁴³ In this context, regional housing will be a key focus in future years, which will also require further consideration of the implications on future water demand.

In the NSW Murray region, surface water resources and alluvial groundwater sources are fully allocated, and extraction limits guide how much water is permitted to be extracted. This will result in challenges for existing and new industries should they require additional water to meet current and future requirements.

- 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.

There are opportunities to reform the trade system to be more efficient, based on the recommendations of the Water market reform roadmap⁴⁴ that was developed in response to the Australian Competition and Consumer Commission's Murray–Darling Basin water markets inquiry.

Stakeholders raised and supported the need to develop a better understanding of people's behaviours and assumptions around water availability and use, including investigating existing

⁴² NSW Department of Planning and Environment, Draft Riverina Murray Regional Plan 2041, www.planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/Riverina-Murray

⁴³ <https://pp.planningportal.nsw.gov.au/populations>

⁴⁴ Quinlivan, D 2022, Water market reform: final roadmap report, available at: www.dcceew.gov.au/water/policy/markets/reform

water management rules and behaviours that may potentially underpin underuse. This issue requires further analysis. A working group on the use of water in the NSW Southern Murray-Darling Basin consisting of industry stakeholders, NSW and Commonwealth government agencies has been established, which will explore the issue of potential underuse.

There are gaps in our understanding of groundwater resources, an important water source for the agricultural sector during dry times

Groundwater is an important water source for some towns, industries and the environment across the region. During drought, reliance on groundwater can increase significantly to support the region's industries, particularly agriculture, and some town water needs.

Sustainable use of the region's groundwater sources is critical to support some existing towns, industries and the environment, and to support future economic prosperity. Robust data and information, as well as new groundwater infrastructure and technologies, and active and efficient groundwater markets could support industries in the context of a more variable and changing climate. Concurrently, enhancing our understanding of the interaction between surface water and groundwater across these regions will improve the management of these resources.

Under future climate change, lower surface water availability could further increase reliance on groundwater sources. Increased reliance on groundwater, particularly in areas of large, concentrated extraction could cause declines in groundwater levels, and may reduce future groundwater access by industries and constrain economic growth. In the NSW Murray region, there is a high reliance on the Lower Murray Deep Alluvium Water Source for irrigation, and there have been large declines in the groundwater level around Deniliquin and Finley⁴⁵. Such declines in groundwater levels represents a risk to water-dependent industries, particularly for agricultural businesses with inflexible water demand requirements such as permanent plantings.

Groundwater quality impacts the availability of supplies and its potential productive uses. Declining groundwater quality can affect all water users of the affected groundwater source. As mentioned, several risks to groundwater quality are present including salinity issues in the lower NSW Murray River alluvial ground water sources.

⁴⁵ Department of Industry 2019, Appendix A: Murray Alluvium Water Resource Plan — Ground Water Resource Description. See www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/drafts/murray-alluvium

What we are already doing to support regional economic growth

The NSW Government's \$48 million expanded Farms of the Future program, which will support on-farm connectivity and encourage farmers to adopt agtech⁴⁶ to boost productivity, including water efficiency and drought preparedness. In early 2023, a grants program will be delivered to help farmers purchase agtech devices and applications.

The Future Ready Regions Strategy⁴⁷ includes a commitment to upgrade the Enhanced Drought Information System to provide farmers with world-leading weather and climate data so they can make better business decisions.

The 20-Year Economic Vision for Regional NSW⁴⁸ is the NSW Government's plan to drive sustainable, long-term economic growth in regional NSW. It is the roadmap to unlock significant economic potential in regional NSW.

The NSW Government has assisted local councils to develop 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 and are currently under review.

The Department of Planning and Environment is undertaking a feasibility assessment for a policy framework for the potential for water users to enter commercial arrangements with Snowy Hydro Limited.

⁴⁶ Agtech is the collective term for the tools and technologies – sensors, farm management software, imagery and smart farm equipment – that enables best practice agriculture.

⁴⁷ NSW Government 2021, Future Ready Regions: Supporting drought resilient communities and economies, available at: www.nsw.gov.au/regional-nsw/future-ready-regions

⁴⁸ NSW Government 2021, A 20-Year Economic Vision for Regional NSW, available at: www.nsw.gov.au/a-20-year-economic-vision-for-regional-nsw-refresh

What happens next

This discussion paper outlines the key regional challenges to ensure we are focusing on the most important issues. We will then identify which options should progress to more detailed hydrological modelling and economic and environmental analysis. This will help us identify a suite of actions to address the key challenges.

We will present this analysis and proposed shortlisted actions in a second public consultation paper and to engage with the public to ensure we have the optimal mix of actions.

After the second round of public engagement, we will work to finalise the NSW Murray Regional Water Strategy and develop an implementation plan.

Figure 12. Process to develop the NSW Murray Regional Water Strategy

