Western Riverina
Regional Drought Resilience Plan

Griffith city council ...love the lifestyle...

LEETON SHIRE COUNCIL

Narrandera SHIRE COUNCIL

Murrumbidgee COUNCIL

Acknowledgement of Country

Griffith City Council, Leeton Shire Council, Murrumbidgee Council, and Narrandera Shire Council acknowledge the Traditional Custodians of the region's lands and waters, and pay our respect to Elders past and present.

We value the vital involvement of members of the primary production and broader communities of each council area to the formulation of this plan and extend our thanks to those who contributed.

This document was prepared for Griffith City, Leeton Shire, Murrumbidgee, and Narrandera Shire Councils by Meridian Urban.

This project is supported by Griffith City, Leeton Shire, Murrumbidgee, and Narrandera Shire Councils, through funding from the Australian Government's Future Drought Fund and NSW Government.

Contents

Glossary

Key terms used throughout this plan are defined below.

ADAPTATION	Adjustment or modification in natural and/or human systems in response to actual or expected shocks and stresses to moderate harm, reduce vulnerability and/or exploit beneficial opportunities.
ADAPTIVE CAPACITY	The ability of individuals and groups to adjust and respond to environmental and socio-economic changes.
ADAPTIVE GOVERNANCE	Coordinating iterative, flexible, and responsive interactions between systems when designing interventions and for their implementation and evaluation.
COPING CAPACITY	Communities that may be constrained in their capacity to use available resources to cope with adverse events and to prepare for, absorb and recover.
DROUGHT	Drought means acute water shortage. Drought is a prolonged, abnormally dry period when the amount of available water is insufficient to meet our normal use.
ECONOMIC RESILIENCE	The ability of the economy to absorb the economic impact of shocks and stressors without changing the economic status or outcomes.
ENVIRONMENTAL RESILIENCE	The ability of the natural environment to cope with a diverse range of shocks and stressors while maintaining natural processes and ecosystem services.
GOVERNANCE	Governance is the structures and processes by which individuals, groups and agencies in a society share power and make decisions. It can be formally institutionalised, or informal.
INTERVENTION OPTIONS	Alternative or complementary actions, projects, programs, policies, initiatives, and investments that are planned to bring about change in the system.
LOCAL KNOWLEDGE	Local knowledge and First Nations knowledge incorporates elements of lived experience within a landscape, bearing witness to the operation of systems. It includes aspects of people, landscape, culture – how people interact with surroundings and as part of communities and processes.
RESILIENCE	The ability of a system to absorb a disturbance and reorganise to maintain the existing functions, structure, and feedback. Also see general resilience, specified resilience, economic resilience, environmental resilience, and social resilience.
RISK	The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems.
SHOCK	Sudden, short-term events that threaten a city (or region). Examples include major storms, floods, bush fires, heatwaves, disease outbreaks, terrorism, and cyber-attacks'.
SOCIAL RESILIENCE	The ability of the human society to cope with a diverse range of shocks and stressors while maintaining existing social and community functions.
STRESSOR	An event that occurs gradually over a timeframe that causes an adverse effect, e.g. drought.
SYSTEMS	The interaction of processes, networks, and inter-dependencies across a complex 'whole'.
THEORY OF CHANGE	Refers to theories, causal mechanisms and assumptions that explain how and why outcomes and impacts will be achieved through use, implementation and production of proposed inputs, activities, and outputs.
TRENDS	Major global or regional influences that have driven change in the past and are expected to shape change into the future.
THRESHOLD	The point at which a change in a level or amount a controlling variable causes a system to shift to a qualitatively different regime. Also referred to as a tipping point.
TRANSFORM	The process of radically changing or building a new system with different structure, functions, feedback, and identity.
TRIGGER POINT	A pre-agreed situation or event, that when met, activates a management intervention. Trigger points are usually defined in the planning phase.

Introduction

This Regional Drought Resilience Plan is a collaboration between Griffith City, Leeton Shire, Murrumbidgee, and Narrandera Shire Councils, and their communities, working together to advance the region's resilience to the impacts of drought.

Drought is a recurring feature of the Australian landscape. While common experiences exist, the impacts and major pressures through drought varies across geographies, and across communities.

The Western Riverina region is dependent on the land, water and climatic conditions for prosperity. This highlights a need enhance drought resilience opportunities to position the region to respond to and recover from dry times. Sustainable and diverse economies, and connected communities that are responsive to drought signals, are the foundation to reduce vulnerability and mitigate potential impacts.

The Western Riverina is unique in its drought context. Whilst susceptible to periods of drought, the irrigation schemes of the region and regulation of the Murrumbidgee River set it apart from other parts of NSW. Water uncertainty in the region, as opposed to climatic events leading to drought, is a consequence of an interplay of factors. These factors, broadly grouped by climate, policy and operational infrastructure requirements, each have their own challenges but interact in combination across the drought cycle.

Within the region, vulnerabilities from drought are Within the region, future vulnerabilities to drought are indicated by downward trends in rainfall and soil moisture. Changes in the Snowy Mountains catchment area would also have effect given the flows received from the Alpine region. Across the community, challenges are voiced in the evolution of the complex water policy landscape which places its own pressures on the community. Under this broader context, the region retains a self-driven focus on harnessing co-operative community and economic opportunities. This plans seeks to build on the collective strengths and regional identity of the Western Riverina as a premier food bowl for Australia to take steps now to stem the impacts of future drought on our region.

The Regional Drought Resilience Plan program is one of five focus areas[1] of the Commonwealth Government's Future Drought Fund. The NSW Regional Drought Resilience Plan program is jointly funded through the Commonwealth Government's Future Drought Fund and the NSW Government, supporting local governments to work together regionally to plan for drought resilience proactively and pragmatically.

1 Other focus areas under the Future Drought Fund include farm business resilience, roll-out of the Drought Resilience Self-Assessment Tool, and better land management practices that support landscape resilience.

Drought resilience

'will ensure regional Australia can endure deeper, longer droughts, and recover from them sooner. This will help Australia's agricultural industries maintain national farm income, increase food security, and protect the regional jobs that rely on agriculture during the toughest years. Importantly, it will also increase the resilience of rural and regional communities and improve environmental outcomes'.

(CSIRO, 2022)

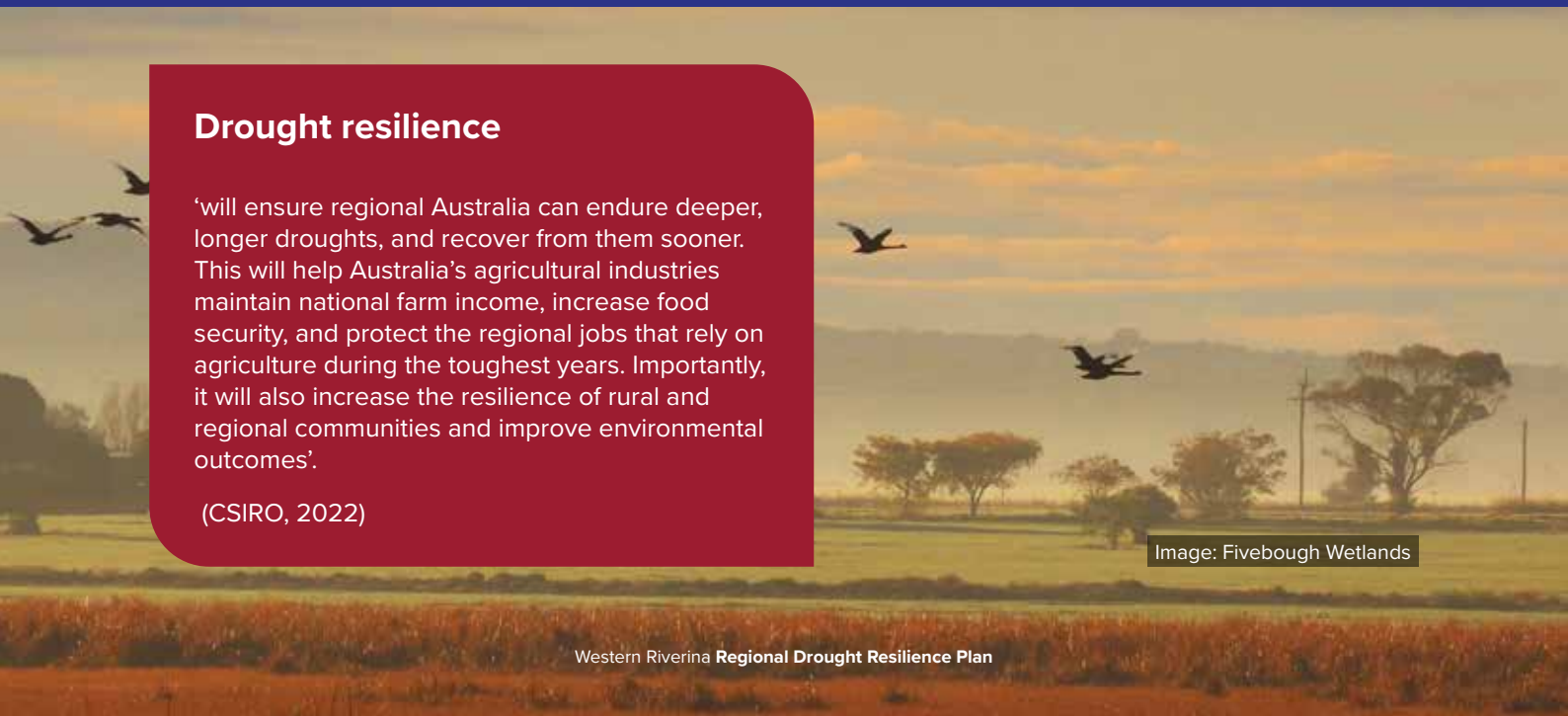


Image: Fivebough Wetlands

Western Riverina Regional Drought Resilience Plan Framework

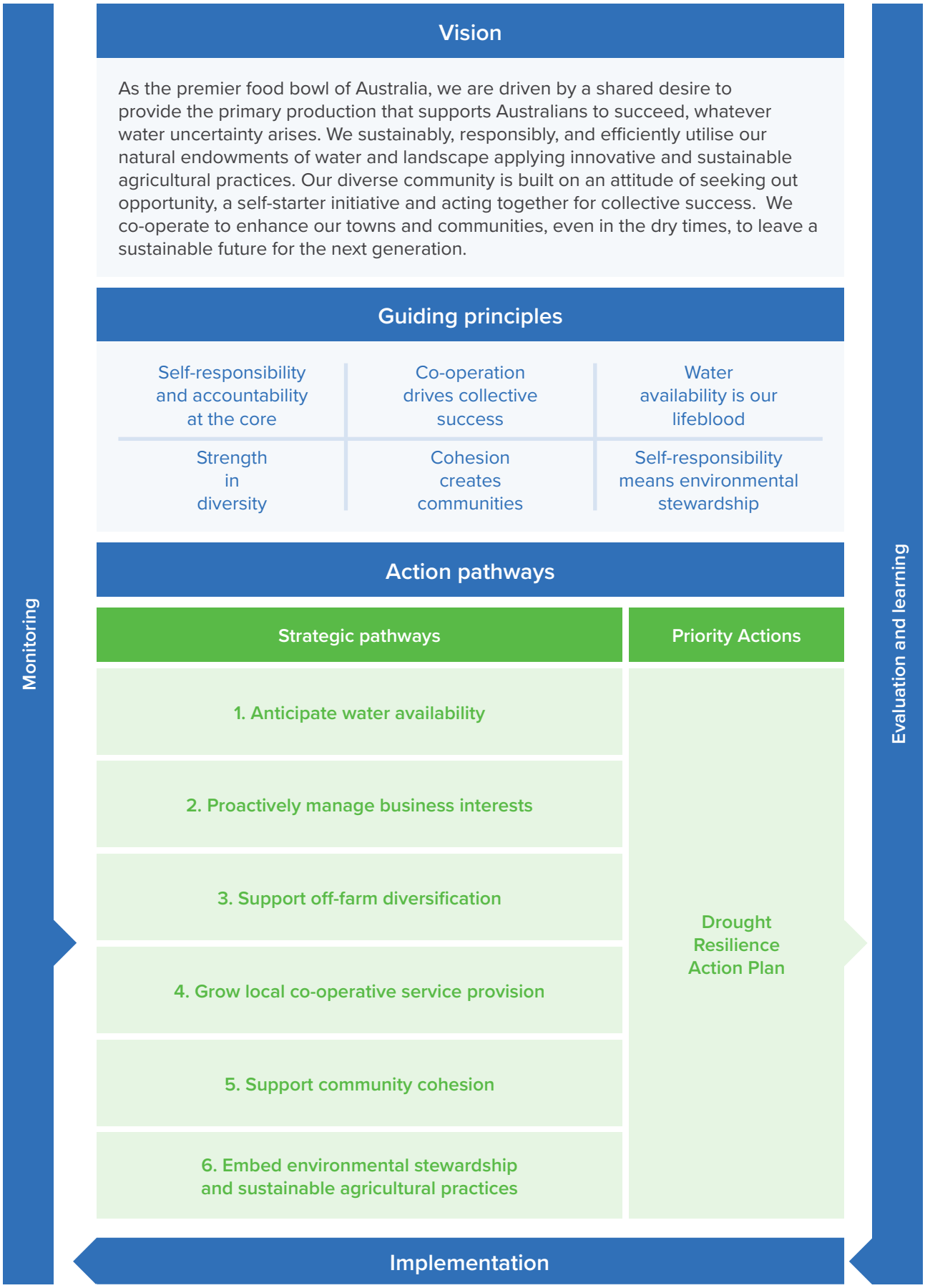


Figure 1 — Western Riverina Regional Drought Resilience Plan Framework

Purpose

The Western Riverina RDRP provides direction and options for how the community, business, industry networks, and local governments can adapt to strengthen drought resilience and transform for new opportunities.

The purpose of this plan is to:

- Increase understanding of the region's current and future drought resilience, considering the region's unique economic, environmental and social characteristics
- Recognise the interdependent nature of the local economy, community wellbeing, and environmental sustainability through the drought cycle and across business types
- Understand local signals and drought priorities in the community's voice and create stronger connectedness and greater social capital within communities
- Inform decisions based on a combination of local knowledge, and risk and resilience information
- Identify pathways and opportunities to improve regional drought resilience, mitigate risks and adapt to change
- Help Councils and regional organisations be in a stronger position to implement strategic actions and support partnerships that drive enhanced drought resilience
- Develop concrete actions to address and mitigate short-term and long-term drought impacts.

For the purposes of this plan, references to regional businesses include farms and agricultural business, contractors, suppliers, industry, retail and commercial services and references to community includes all townships, irrespective of size.

How does the plan help

The Western Riverina Regional Drought Resilience Plan combines drought history, climate analysis and local input to form a comprehensive understanding of the impacts of drought and to anticipate and prepare for the next drought cycle.

Whilst the future cannot necessarily be predicted, this plan addresses drought resilience by building in actions across the system where impacts are felt and across the drought cycles where interventions can be most effective. The plan consolidates on the range of existing programs and initiatives. It supports the ongoing collaboration between key actors who support the community through drought cycles.

The impacts of drought can be insidious with a slow onset but prolonged effects that reach across the community. It is important we understand the warning signals of drought and retain a focus on continuous preparedness.

How previous impacts of drought have manifested across community networks, local business and the natural environment provides a guidepost for where actions are needed. This plan supports a focus on outcomes through:

- Prevention of potential impacts
- Increased preparedness and resilience through recognition of signals
- What is needed in response
- What is needed for recovery.

This Regional Drought Resilience Plan supports collective and cooperative measures to prepare for drought in the face of changing and uncertain futures. This is done through several intervention approaches:

Absorb | **Adapt** | **Transform**

These areas of absorptive capacity, adaptive capacity and transformational capacity provide a view of the priorities identified by this plan relative to different components of the drought cycle, effort and/or costs associated. Some opportunities are short-term and more immediate, whilst others are more transformative in nature and require long-term effort to generate change.

This concept forms part of a resilience 'theory of change' model[2] which helps us to break down and consider the complex elements of drought resilience and the links across issues. This makes clear both how and why its impacts run so deep. This approach also helps to inform decision-making for enhanced resilience and adaptation as conditions and circumstances change over time.

This plan supports drought resilience in the Western Riverina through approach that will:

- Understand and recognise the triggers and impacts
- Build capacity to meet challenges
- Unite in community
- Use regional voices to advance strengths and opportunities

This Regional Drought Resilience Plan provides the framework for implementation and identifies practical ways the community and businesses of the region can prepare for and respond to drought impacts. Implementation funding is available from longer-term investment under the Commonwealth Government's Future Drought Fund, as well as other funding and grant assistance opportunities.

Implementation of actions contained in this plan is dependent on funding availability.

2 The drought resilience plan integrates the 'Resilience, Adaptation Pathways and Transformation Approach' (RAPTA) developed by CSIRO which provides a framework to map resilience interventions. For more information on RAPTA, visit https://research.csiro.au/eap/rapta/

Image: Visit Griffith

Vision and principles

Vision

As the premier food bowl of Australia, we are driven by a shared desire to provide the primary production that supports Australians to succeed, whatever water uncertainty arises. We sustainably, responsibly, and efficiently utilise our natural endowments of water and landscape applying innovative and sustainable agricultural practices. Our diverse community is built on an attitude of seeking out opportunity, a self-starter initiative and acting together for collective success. We co-operate to enhance our towns and communities, even in the dry times, to leave a sustainable future for the next generation.

Guiding principles

Self-responsibility and accountability at the core

People in this region are frank and honest. We are very good at what we do – whether running the local café or managing a multi-million dollar diversified agri-business portfolio. The sense of responsibility and personal accountability is strong – people need practical and realistic support to keep doing what they do well.

Co-operation drives collective success

Not many parts of Australia work under such successful co-operative approaches like this region. From the irrigation schemes to the mills and even local pubs, the co-operative business structure provides a trust-based way to transform communities by growing services and prosperity in other critical sectors – like aged care, housing, and even retail – so that local services can be retained in-community, owned by community.

Strength in diversity

Farmers in this region know how to build, manage and grow diversified on-farm operations – they have been doing it efficiently for generations. Transferring this culture of diversification into off-farm economic growth that supports manufacturing and value-added employment and prosperity is a clear opportunity.

Water availability is our lifeblood

The region is unique in the way it receives its natural endowment of water – receiving both in-region rainfall and irrigation waters from Australia's snow country via the Snowy Hydro scheme. This combination of water sources supports arguably Australia's most critical and diversified irrigated and dryland country. However, uncertainty exists for both sources of water, which create similar drought-like conditions through different causes.

Cohesion creates communities

The region embodies the Australian ideals of mateship. There are tight-knit communities in towns and districts across the region that band together in a crisis to help each other through. It's a clear and common foundation of what it takes to live successfully and sustainably.

Self-responsibility means environmental stewardship

There is an awareness of the precious nature of resources with which the community is entrusted. There is increasing recognition and practice in environmental restoration, regenerative agriculture, and care for Country that will pay great dividends as efforts increase.

Region snapshot

Information sourced from: ABS 2021 Census data, Regional Development Australia, and AgTrack - Agricultural and Land Use Dashboard

Population
47,589

Population aged 65+
20.6%
(17.7% NSW average)

First Nations population
8.5%
(3.4% NSW average)

REGIONAL ECONOMY*
23,752 jobs (2021)
Economy **$3.5b** (2020)
Local businesses **5,608** (2022)

UNEMPLOYMENT
Griffith: **3.0%**
Leeton: **3.8%**
Murrumbidgee: **2.9%**
Narrandera: **5.2%**

VOLUNTARY WORK
(organisations)
13.2% — 23.2%
(13.0% NSW Average)

Largest industries (by employment)

GRIFFITH
- Poultry Processing
- Wine / Alcoholic Beverage Manufacturing
- Hospitals

LEETON
- Secondary Education
- Meat Processing
- Grain Mill Product Manufacturing

MURRUMBIDGEE
- Other Grain Growing
- Grain-Sheep or Grain-Beef Cattle Faming
- Local Government Administration

NARRANDERA
- Grain growing, and Grain-Sheep or Grain-Beef Cattle farming
- Local Government Administration
- Meat Processing
- Aged Care Residential Services

LARGEST INDUSTRIES (gross value add)
- Agriculture
- Manufacturing
- Health and education
- Electricity and water supply

PRINCIPAL AGRICULTURAL COMMODITIES
- Broadacre cropping
- Fruit and nuts
- Livestock

ASSETS
- ✓ Western Riverina Intermodal Freight Terminal
- ✓ Griffith Medical Health Precinct
- ✓ Griffith Regional Airport
- ✓ Country Universities Centre
- ✓ Yanco Agricultural institute
- ✓ TAFE NSW campuses
- ✓ Narrandera Fisheries Centres

AREAS OF SIGNIFICANCE
- ✓ Murrumbidgee River and tributaries
- ✓ Billabong Creek
- ✓ Murrumbidgee Valley and Oolambeyan National Parks
- ✓ Fivebough and Tuckerbil Wetlands
- ✓ Recreational lakes

*Values include Carrathool Shire LGA

About the Western Riverina Region

The Western Riverina, as part of the broader Riverina Murray region, is known as Australia's 'food bowl'. It is built around premium agricultural areas, and long-standing agricultural industry strengths linked to secure water and complemented by beneficial climate conditions and versatile soils. The Western Riverina Regional Drought Resilience Plan covers the local government areas (LGA) of Griffith City, Murrumbidgee, Leeton Shire and Narrandera Shire.

Griffith is the largest regional city in the Western Riverina and is one of the three regional cities in the broader Riverina Murray region alongside Wagga Wagga and Albury. A number of smaller centres support Griffith in surrounding rural communities. Leeton is the second largest centre in the Western Riverina and Leeton Shire includes the towns of Whitton and Yanco. The shire is a strong driver of the broader regional strengths, in particular through the role it plays in value-add agriculture, including agricultural education and research.

Murrumbidgee Council contains the three townships of Coleambally, Darlington Point and Jerilderie. These centres account for over 90 percent of the LGA's population, and reflect strengths through food and fibre production, benefiting from the Murrumbidgee River, Billabong Creek and water supplied from the Murray River.

Narrandera Shire is located at the juncture of the Newell and Sturt Highways, representing a transition from the broad acre agricultural areas to the east to the highly productive Murrumbidgee Irrigation Area. Narrandera forms the main town and provides a concentration of services, supported by smaller communities in Barellan, Binya, Grong Grong, and a number of rural localities.

Across each LGA the strength in agriculture is linked through connection to water, a highly evolved local industry with value-add processing, and connection to major markets and major transport infrastructure. Key assets include the Murrumbidgee River, and flows received from the Alpine Region. The Western Riverina is home to the major irrigation schemes of the Murrumbidgee Irrigation Area, Coleambally Irrigation Area, and Murray Irrigation area, alongside other private irrigators. This irrigation network supports many farms and provides some of the nation's most important irrigation areas.

Building on agricultural strengths, educational and research institutes form key assets in the region. This is includes the Country Universities Centre, Yanco Agricultural Institute, and TAFE campuses across LGAs, with the largest TAFE campus in the Riverina located at Griffith. These educational facilities and major health facilities anchor services in the region and provide for a mixture of employment options.

The position of the region has influenced its economic development and agricultural strengths, capturing major freight corridors between capital cities, and evolving its own manufacturing and transport hubs. These form the basis of future growth ambitions, with further links to emerging activation precincts across the state.

The northern part of the region (north of Jerilderie) is within the Wiradjuri Nation, the largest territory at the time of European settlement. The Nation encompasses the Central West slopes and plains and extends from Coonabarabran to the north, hugging the Great Dividing Range south towards the Murray River in the south and out to western NSW. The Nation encompasses approximately one fifth of NSW. Wiradjuri people are known as 'people of three rivers', acknowledging the three rivers that are associated with their Country: the Wambuul (Macquarie River), Kalari (Lachlan River) and Murrumbidjeri (Murrumbidgee River).

Figure 2 — Map of the Western Riverina Region and local centres

Figure 3 — Approximate extent of the Wiradjuri Nation[3]

3 Griffith City Council, 2019, Griffith City Council Reconciliation Action Plan December 2019/December 2021, Available at https://www.griffith.nsw.gov.au/page.asp?f=RES-GWK-21-15-76.

Wiradjuri Nation

The Wiradjuri Nation is the largest traditional owner group in NSW known to have cared for the lands in the regions for at least 60,000 years. Colonisation drastically changed their way of life, leading to dispossession and cultural suppression.

The culture of the Wiradjuri people is closely linked to the land and waterways, and retains a strong belief that if we care for Country, it will care for us. There are several sites of significance to the Wiradjuri people in the area, including the Koonadan Aboriginal Place and the Fivebough and Tuckerbil Wetlands. Conservation practices are key to ensuring these sites continue to maintain an ecological balance.

Water has played a critical role in the lives of Aboriginal people, for survival in arid environments and for culture, spiritual connection to land and waters and identity. Water helped in defining language boundaries and ceremonial places, and also underpins many land management practices. Traditional Aboriginal water collection and storage practices have evolved for many centuries and continue into the present.

In collaboration with First Nations/ Aboriginal people, a state-wide Aboriginal Water Strategy is currently under development, building upon consultation over recent year. The plan will identify ways of increasing water rights and ensuring that First Nations people are empowered to contribute to water management and planning decisions.

People and community

The Western Riverina is attracting new agricultural ventures and business operators who are keen to trial innovative approaches. Across the region, the vibrancy of agricultural industry is shining.

At heart of this is a strong community co-operative style of approach to not only business, but community development. A drive to work together, and to share knowledge and benefits, is a key attribute behind some of the region's most successful economic and community ventures. Strong community identity and a sense of civic duty is foundational in this regard. It also informs the community's dedication to volunteering activities and organisations. Whilst volunteerism rates are in decline nationally, community dedication at the local-scale across the Western Riverina remains relatively strong.

Sport and recreation plays a major role in the wellbeing of people and communities in the region, displayed through the diverse range of sporting teams and sporting calendar. This goes beyond those that play, but to the broader community as avid spectators and volunteers who contribute to the local teams and the running, maintenance and administration of local venues and facilities. Other social interest groups also add to the vibrant tapestry of community spirit and provide important creative and social connections.

Green spaces, recreational and natural assets are therefore critical to community wellbeing. While maintaining water to these spaces during drought is challenging, it is also essential to underpin community cohesion and mental wellness at a broader scale. There are also significant visitor economy dividends associated with these assets, as well as the region's colonial heritage and lively arts and culture scene.

Image: Jerilderie Plains

Environment

The Western Riverina is part of the wider Riverina Bioregion which has high soil fertility and a generally abundant water supply. These aspects underly its primacy as a premier food-growing region.

The climate of the Riverina Bioregion is dry and semi-arid with hot summers and cool winters, and most rainfall occurring in winter months. Vegetation ranges from river red gums along river channels, to saltbush on the plains. National parks in the region include Murrumbidgee Valley and Oolambeyan National Parks. The region's natural assets include significant wetlands and swamps such as the Fivebough and Tuckerbil Wetlands. These areas provide important habitat for native fish, amphibians, birds, mammals and many other water dependent fauna. These areas are also of cultural heritage significance to the region's First Nations people.

Since European colonisation there has been substantial modification of the vegetation and landscape through pastoral activities, the use of ground and surface water resources, and the introduction of feral animals to the region including Carp in the river systems.

One of the most profound changes at a landscape scale was the construction and commencement of the Snowy Mountain Scheme (Snowy Scheme). The Snowy Scheme was designed to produce electrical energy. However, one of the key objectives of the Scheme was to mitigate the effects of drought on irrigated agriculture in NSW and Victoria by improving the security of water supply to farmers along the fertile Murray and Murrumbidgee Rivers.

Economy

Collectively, the Western Riverina economy supports approximately 23,752 jobs and its economic value is an estimated $3.5 billion[4] per year. The four key strengths of the region are in agriculture, manufacturing, utilities, and health and education

The high-quality agricultural lands support a long-held sector strength with significant value-add opportunities. The sector retains strong links to manufacturing, which also benefits from the linkages to large cities, distribution points of ports and airports, and links to freight and logistics hubs.

Economic assets exist through the major freight routes, freight railway lines, and links to the neighbouring regional city precincts in Albury and Wagga Wagga. The region's Western Riverina Intermodal Freight Terminal and urban industrial areas also proivde economic enablers.

Investment in the region continues with major projects planned and underway. Strengths which support the key industries are its access to water and irrigation systems, proximity to metropolitan markets, extensive road and rail infrastructure and emerging population-serving employment clusters.

Industry	Employment (2021)	Gross Value Add (2020)
Agriculture	3,926 jobs (16.5% share)	$583m
Manufacturing	3,827 jobs (16.3% share)	$526m
Health and education	4,405 jobs (18.5% share)	$390m
Electricity and water supply (including renewables)	382 jobs (1.6% share)	$144m

4 This includes Carrathool Shire in addition to Griffith City, Leeton Shire, Murrumbidgee, and Narrandera Shire

How this plan was prepared

The Western Riverina Regional Drought Resilience Plan was prepared through the valued contribution of a broad cross section of community members, stakeholders, local government, government services, community organisations, businesses and local producers. This engagement was supported by an evidence-based resilience assessment for the region.

Resilience Assessment

- research and literature
- strategy and policy reviews
- regional characteristics
- trends and projections for drought impacts; and
- drought resilience indicators assessment.

Stakeholder engagement

- online community and business surveys
- community, industry and government workshops
- community drop-in sessions
- targeted consultations, interviews and discussions with community, industry and services representatives.

The narrative, theme and actions within the plan are directed by the conversations across community engagement. The plan builds on existing strategies through the lens of drought resilience which supports development on the identified strategic pathways.

Image: Leeton Chill & Grill Festival

Strategic alignment – state, regional and local

Looking upwards, the regional drought resilience program provides strategic alignment with international scale goals including the United Nations Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction, alongside national-scale strategies and frameworks and state-level strategic instruments. This alignment demonstrates how working locally contributes to broader sustainability and resilience outcomes for NSW and Australia.

Key plans and strategies contributing to this alignment and the preparation of the Western Riverina Regional Drought Resilience Plan has included (but is not limited to):

- Murray-Darling Basin Plan
- Riverina Murray Regional Plan 2041
- Western Riverina Regional Economic Development Strategy (2023 update)
- Draft Murrumbidgee Regional Water Strategy
- Riverina and Murray Joint Organisation (RAMJO) strategies, plans and papers
- NSW Climate Change Adaptation Strategy
- NSW Government Department of Primary Industries Drought Hub
- Department of Regional NSW Drought Signals Dashboard
- Commonwealth Government's Drought Resilience Self-Assessment tool
- Council Integrated Planning and Reporting Framework documents.

A stakeholder-driven approach

The resilience assessment which underpins the RDRP built an understanding of local context and drought impacts around the economic, natural environment and social characteristics of the region. However, impacts are not felt in isolation but rather can compound and cascade. Community consultation was key to understanding how these interactions occur and build.

The engagement process centred on community workshops, drop-in sessions, targeted meetings and discussions, and an online survey to collate experiences, insights and views from a broad cross section of community members. We spoke with growers, livestock graziers, industry and community group representatives, business operators, First Nations organisations, subject matter specialists, service providers, local and state government agencies, elected representatives and more.

Discussion was had on what was needed into the future to better position the region collectively when the next time a dry period is upon us. This discussion focussed on actions and initiatives that were required in preparation for drought, the needs during drought and then into recovery.

Figure 4 — Engagement workshops held in-region

9 workshops across weeks in July and September 2024

Coleambally / Narrandera
Barellan / Leeton / Griffith

4 drop in sessions

Darlington Point / Jerilderie
Whitton / Griffith

Online survey

Community / Business owners and operators

72 survey responses

45+ workshop attendees

Engagement observations and insights

Key insights communicated through the stakeholder consultation process and informing the preparation of this plan include:

- Co-operative community approaches are strong and working well. This sets the region apart from other areas. There is a strong desire to work together for mutual benefit.
- Irrigation has stabilised the local economy over the past 50 years which has limited the impacts of drought on the region to an extent, though it is still felt.
- Mental health and wellbeing ahead of the next drought should be a key area of focus. Mental health support once drought has set in is welcomed, but it can be too late. Tools to support producers ahead of drought is a clear opportunity, as well as building broader community mental health literacy.
- Primary producers in the region benefit from opportunities to showcase their property management and production processes. People come from around the world to learn from Western Riverina producers.
- The Western Riverina plays a key role in broader food security matters, and as a key exporter for the nation. As key players in this system we want to see what is being planned at higher policy levels.
- State and Commonwealth Government services that support drought preparedness should be more actively promoted and marketed.
- An improved and shared understanding of how the water market operates is needed.
- To deal with reduced water availability, economic development needs to focus on non-water dependent jobs / industries. Government assistance is needed in diversifying the economy to reduce reliance on contribution from agricultural.
- The key is to act early when making decisions in the face of drought, which applies to on and off-farm businesses.
- The efficiency of government processes and systems places unnecessary stress on people. For example, registration of trucks (of which properties / businesses usually have many) which must be done in-person. Issues were also present with previous grant application process and timelines of such availability.
- Townships have good water allocations that provide opportunities for new businesses.
- Resilience is driven by efficiencies and strong self-accountability based upon business acumen, efficient management, innovation and sustainability.
- Business and property succession planning is critical.

Messages from the Community

Community views are strong on how the region builds its own resilience and how it contributes to the resilience of Australians more broadly. Key messages from the community, which are central to this plan include:

Our region was developed purposefully to provide food for Australians – and we take that legacy seriously by developing and innovating world class food production processes

We are a critical driver of the success of cities and towns of everyday lives of people all over Australia – our resilience drives Australia's resilience

Trust us to manage our own future, and help us to keep being as efficient as we can be

One size fits all approaches don't work – specialised and targeted support is critical

We need greater water certainty and availability

Centralisation of services doesn't meet community need – we need core services in community to support our prosperity

Regional enablers

To bolster the resilience to the effects of drought, the region's ability to capitalise on its community and economic development opportunities is reliant upon key enabling attributes. Beyond water, these include access to reliable energy networks, digital connectivity and transport infrastructure.

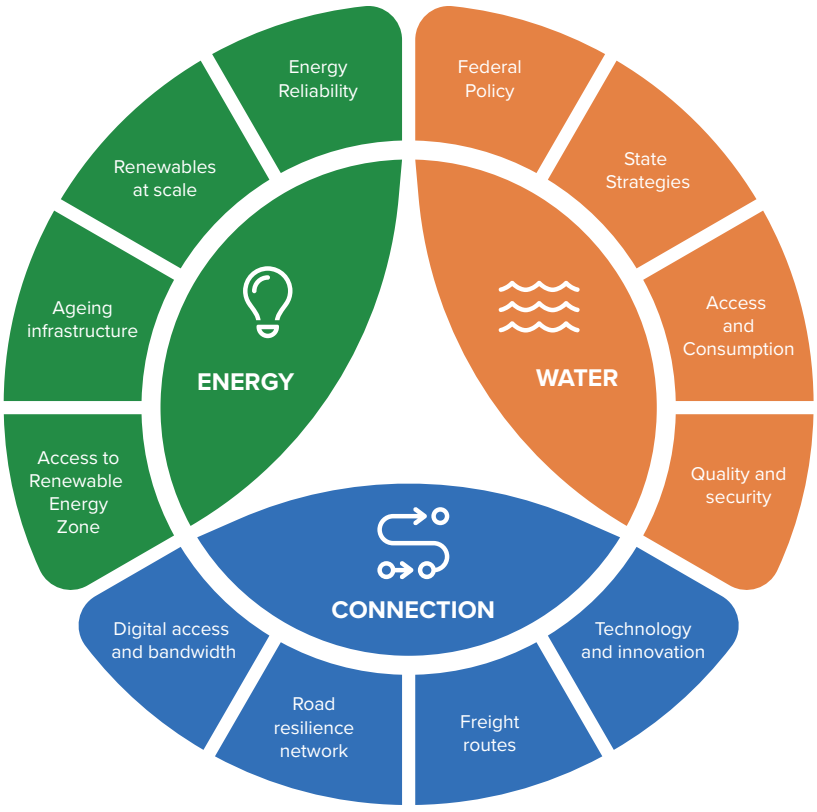


Figure 5 — Regional enabling priorities of the Western Riverina

How our region is impacted by drought

How the Western Riverina region is impacted by drought is closely aligned to its connection with water, which is the 'lifeblood' of the region.

Natural river systems

This is a unique part of Australia. The region derives the benefit of relatively modest in-region rainfall, but also the bounty of surface water from rain and snow precipitation from far away. The Murrumbidgee is sourced from high in the Australian Alps, winding its way across the south-west slopes of NSW and across the riverine plains to where it meets the Murray River. The Snowy Scheme was originally conceived as an irrigation scheme to draw the snowmelt from the Snowy Mountains west into the Murrumbidgee and Murray Rivers, before it also diversified into hydro-electric power generation.

The Murrumbidgee River connects centres and communities across the region and is the basis for productive agricultural lands, nationally important wetlands, and hydroelectricity further beyond the Western Riverina.

The Murrumbidgee catchment is part of the southern Basin of the Murray-Darling Basin, with this basin flowing into the Murray River. The Murray River system also influences the region, supplying water to south of Billabong Creek. This supports production in and around Jerilderie and the broader Murrumbidgee Council area.

Land uses are diverse across the Murrumbidgee Valley. A high proportion of land is used for dryland grazing and cereal-based cropping. The region supports the production of over 40 percent of NSW grapes and 50 percent of Australia's rice. Given the diversity of users, and the context to which it sits as part of the broader Murray-Darling Basin system, there are competing interests which provide the backdrop for a range of issues related to regional water planning and policy in the region.

The Snowy Scheme water makes its way through the Murrumbidgee Irrigation Area (MIA) via Blowering Dam and Burrinjuck Dam on the Murrumbidgee River. Blowering Dam stores water that has been released from storages further upstream in the Snowy-Tumut Development Section of the Snowy Scheme. Water releases from Blowering and Burrinjuck Dams are managed by NSW State Water, to provide for town water supply, irrigation and environmental use requirements. On the Murrumbidgee River, as at Gundagai, the Snowy Scheme contributes inflows of around 25 percent during average inflow years, but 60 percent during drought years. Water from the two storage dams flows down to Berembed Weir, a journey taking five days and a further two days to Gogeldrie Weir. From Berembed Weir, water moves into Bundidgerry storage and onto the Narrandera Regulator, which is the start of the system owned and maintained by Murrumbidgee Irrigation.

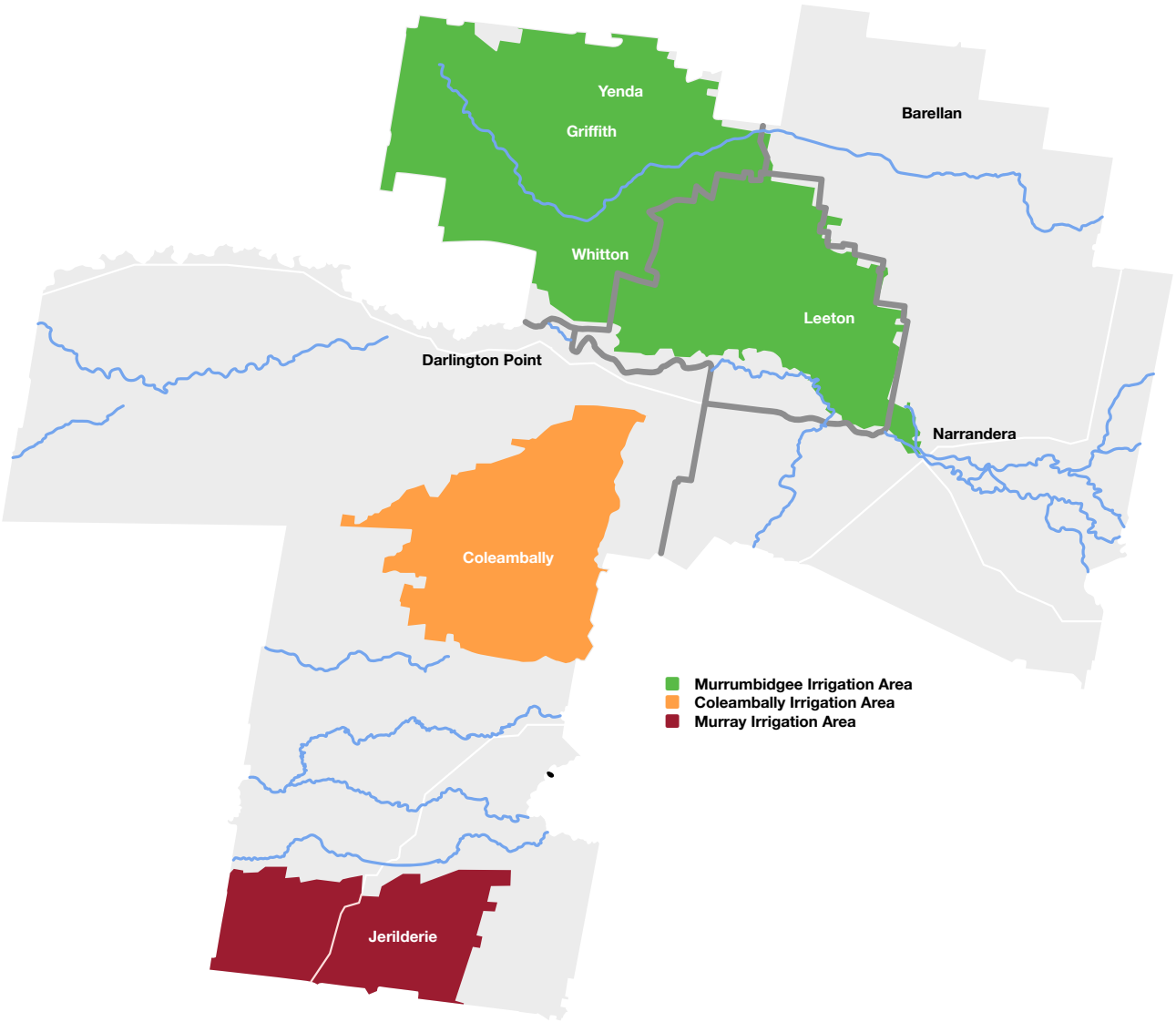
Image: Griffith Main Canal

Irrigation areas

The Murrumbidgee River acts as the natural delivery course for the major food producing areas of the MIA and the Coleambally Irrigation Area (CIA) via Blowering Dam (on the Tumut River, a tributary to the Murrumbidgee) and Burrinjuck Dams. These irrigation areas provide over one-quarter of all the fruit and vegetable production in NSW and are also one of Australia's largest exporters of bulk wine. The southern part of the region, south of Jerilderie and Billabong Creek, is serviced by Murray Irrigation which supplies to more than 740,000 hectares of farmland.

This access to water through the establishment of irrigation schemes, and other water sources, has supported the growth and scale of operations in the region both in agribusiness and associated manufacturing. Economic activity in the region, both historically and at present is strongly linked to the Murrumbidgee Irrigation Scheme, and the water infrastructure investment that support the modern-day irrigation network.

Figure 6 — Major irrigation areas in the Western Riverina



The region's different types of 'drought'

The Bureau of Meteorology notes that drought is a prolonged, abnormally dry period when the amount of available water is insufficient to meet our normal use. We typically think of drought as the absence of rainfall in a region given most other regions in Australia are predominantly dryland in nature.

'Water uncertainty' is a preferred term in the region rather than this traditional rainfall and climate-led view of drought. This uncertainty can come from a range of different mechanisms in this region which may occur singularly or in combination. Engagement highlighted three kinds of 'water uncertainty' for the region:

- 'Natural' drought – which is the climate-related drought experienced across Australia, and involves a deficit in the level of rainfall occurring in region.
- 'Human-made' drought – which is the lack of irrigation water due to government policy or out-of-region water availability.
- Operational constraints influences – which involves the asset-based constraints of scheme maintenance and operation, an more significantly, reliability of supply.

The effects of drought and any resilience initiative need to be aligned with responses to the broader context, including policy drivers and operational implications of changing rainfall patterns in the Snowy Mountains. These may result in less water availability or a reduction in the reliability of water supplies in the region. The interplay of these factors creates uncertainty in the water landscape for this region.

Whilst the irrigation schemes have stabilised local and regional economic activity, water shortage and drought impacts can still be felt across the community. Into the future, the impact of climate change on the Snowy Mountain region is also important to the Western Riverina given the reliance on elevated inflows in drier periods from the Snowy Scheme. This emphasises a need to plan ahead to alleviate potential future impacts.

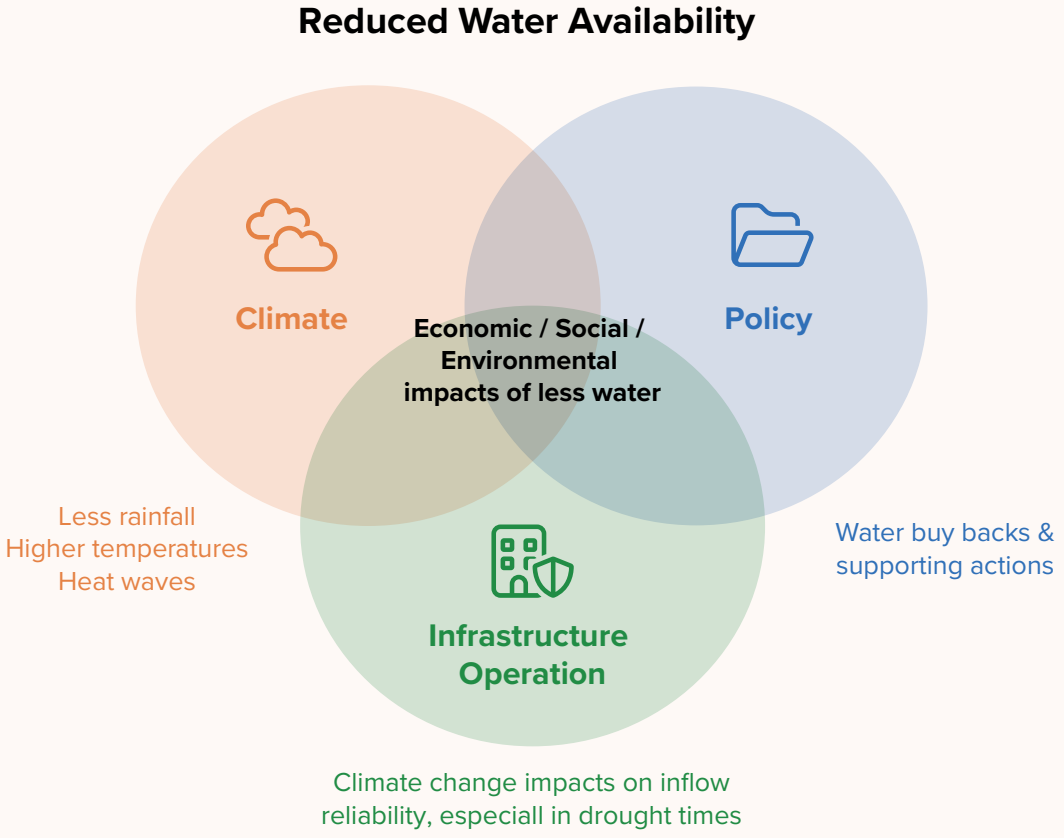


Figure 7 — Drivers of loss of water availability in the Western Riverina

Drought impacts

Regardless of how drought manifests, whether it is climatic, policy or operationally-related, the impacts are largely still the same. The impacts below were identified through consultation to inform the plan.

Environmental Impacts

- Loss of topsoil through groundcover loss and wind erosion
- Increased demand on alluvial ground water
- Reduced root zone soil moisture
- Water turbidity
- Pressure on the wetlands to support a wider variety and quantity of wildlife
- Low inflows into the water courses and higher evaporation rates impacting the health of flora and fauna
- Biosecurity and pest and weed outbreaks
- Vegetation dieback
- Increased potential for bushfire and grassfire, and dust storms
- Water and food availability for wildlife

People and Social Impacts

- Social isolation
- Increased mental and physical health issues
- Increased demand on community services
- Challenges in attracting and retaining workers
- Youth retention
- Maintenance of sports and recreational facilities
- Reduced ability to partake in sporting and recreation activities
- Household financial distress, and capacity to access local services
- Population decline and loss of skills
- Increased need for community group activity with less volunteers available
- Increased potential for conflict and reduced community cohesion
- Impacts on culture and cultural practices
- Infections and illness from water quality

Economic Impacts

- Reduction in water allocations
- Limited fodder and water availability for livestock
- Reduced discretionary spending in townships
- Water uncertainty creates loss of confidence in both commercial & residential property market
- Reduction in agricultural production, reduced yields
- Loss of or reduced farm income, balance sheet impacts and reduced borrowing capacity
- Maintaining cash flow and debt servicing
- Loss or reduction in on and off farm employment
- Increased fodder and water prices
- Changes in farm ownership models
- Halting of investment and capital projects on farms and directly associated businesses
- Research and innovation can stall
- Compounding effects of other natural events such as frosts

Impacts from external trends

- Changing water policy environments including water buy backs and allocation changes
- Housing pressure and availability of land in and around towns impacting housing supply for workers
- Costs of living and rising costs of farming inputs
- Demand from overseas markets is driving the need for sustainability and accreditation
- Changes to government service delivery models which centralise employment to larger centres and results in consequences for awareness of programs and support, and access to services
- Changes to farm structures, with an increase of corporate farm and the resultant impacts to local community service provision, population and local spend
- Limited telecommunications and electricity network reliability and coverage.

Cascading impacts of drought

The effects of drought are not isolated, they are interconnected across the social and economic systems in the region and broader pressures on the landscape. Given the significance of agriculture within the regional economy, impacts to the sector have broader flow on effects to downstream industries, supply chains, and the local businesses in town that rely on discretionary spending.

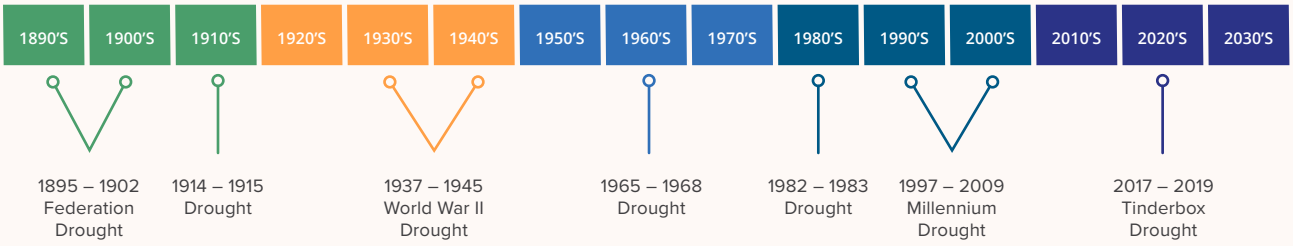
Many existing challenges within a regional area are made harder. Workforce attraction and retention can be an issue through drought. Where workers leave during drought, it can be difficult attracting these workers back which can be both timely and costly to business operations and can impede productivity in the recovery cycle.

As part of the development of this plan, it is essential to consider the relationship between drought impacts and their underlying causes, with a focus on addressing the root causes rather than merely responding to the resulting chain of symptoms. In this regard, the design and implementation of actions can address multiple challenges across the system.

Image: Banna Lane Festival Griffith - Artwork by Reubszz

Drought history

The impacts of drought can vary based on community, weather conditions, and the prevailing macro influences and trends of the time. Additionally, personal circumstances can vary significantly. Major droughts in Australian history have affected the Western Riverina region, characterised by periods of low rainfall.



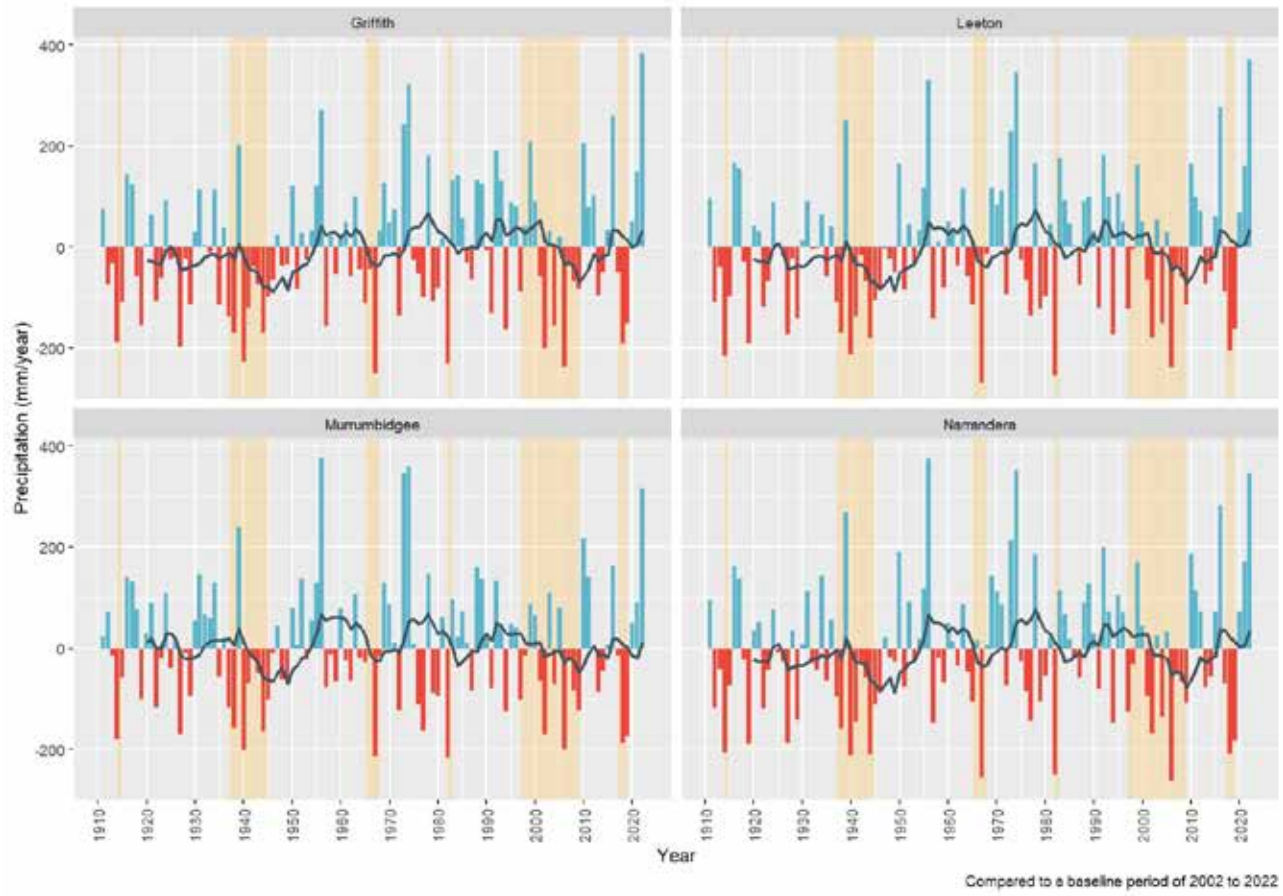


Figure 8 — Yearly mean precipitation anomaly by LGA

*Note that the data does not extend back to the Federation drought of 1890-1902

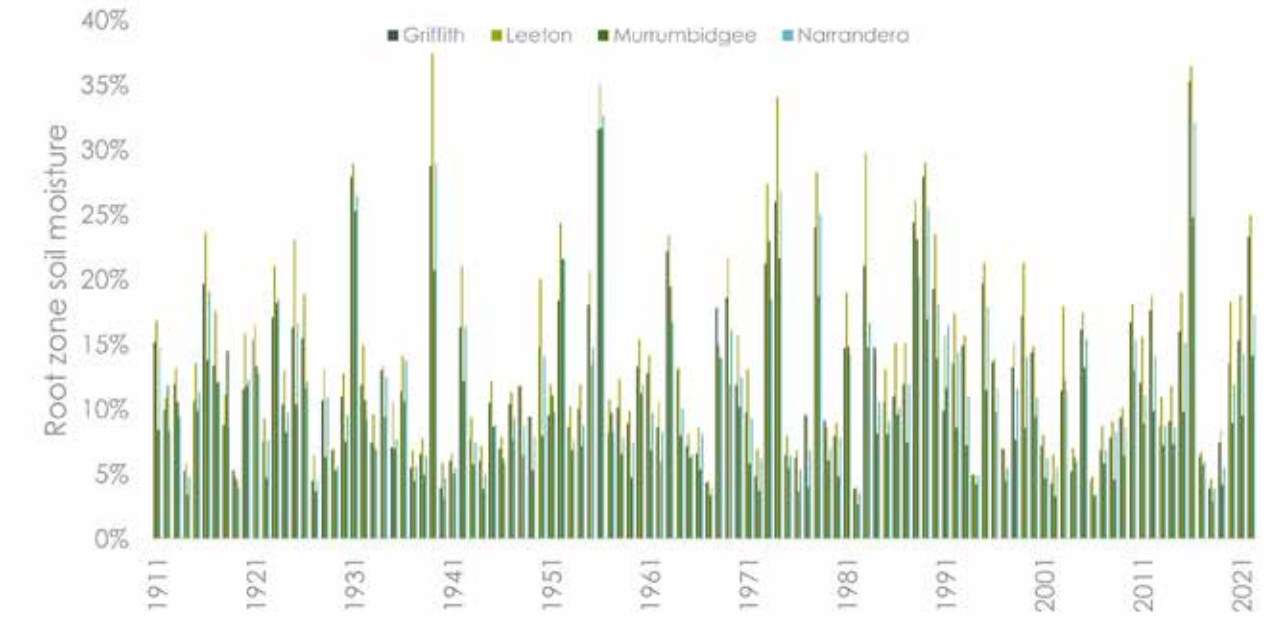


Figure 9 — Soil moisture across LGAs. Major historical droughts align with lower soil moisture levels

The region experiences some years of consistent rainfall, scattered with year-to-year fluctuations. The WWII Drought and Millenium Drought display some of the more protracted periods with notable impacts to soil moisture levels.

A comprehensive synthesis of historic drought climate data specific to the region is included at Appendix A. An analysis of this was undertaken as part of the Resilience Assessment reporting that informs this plan.

A focus on the 2017-2019 drought

During the 2017-2019 period, rainfall for much of Australia, in particular most of the Murray–Darling Basin, was substantially below average. The three years from January 2017 to December 2019 was the driest on record for any 36-month period starting January, when averaged across the Murray-Darling Basin and NSW. Average rainfall for the basin was over 100 millimetres lower than the second driest period (January 1965 to December 1967), and NSW received around 170 millimetres less rainfall than the next driest period, the Federation Drought (1900-1902).

A notable feature of the rainfall deficiencies of these three years is that they were concentrated in the cooler seasons. Both 2018 and 2019 were especially dry. The period was the driest and hottest on record for the basin as a whole. These record warm temperatures exacerbated dry conditions, at times rapidly drying soils in a matter of months. This led to periods in 2017 and 2019 that researchers have termed ‘flash drought’.

Image: Grain storage, Jerilderie

Future drought

The agricultural industry is a significant economic driver for the region. The high-quality agricultural lands support a long-held sector strength with significant value-add in industries of education and manufacturing. Because of this, it is important to consider the projected impact of future climate changes to better plan for potential increased rainfall uncertainty and its impacts of associated water policy.

The further in advance we plan, build awareness and put in place redundancy measures, the more options we will likely have available to address issues down the track.

Future climate scenarios

According to the Intergovernmental Panel on Climate Change (IPCC) reporting, under all emissions scenarios considered global surface temperature will continue to increase until at least the mid-century. Increasing temperatures and energy within the climate system are projected to result in widespread changes to weather and climate patterns, including drought and all elements of the water cycle.

The below section presents projections of drought and associated climate conditions which are assessed over two possible future climate scenarios using regional climate model ensembles. Projections are shown across the region using the reference period (1976-2005) and then two timescales 2050 (2036-2065) and 2070 (2056-2085). The IPCC's Representative Concentration Pathways (RCP) 4.5 and 8.5 are used. RCP 4.5 models mean global warming of between two to three degrees Celsius and is the most likely future scenario based on current climate commitments. RCP 8.5 is a mean global warming of four degrees Celsius or more. This is considered a worst-case scenario.

Current climate models do not account for global climate tipping points. This means that the effects of tipping points are typically not included in climate projections and impact assessments. Breaching global climate tipping points represents significant risks on top of the changes typically described in climate assessments. The effects of breaching certain tipping points may include abrupt changes to the El Niño Southern Oscillation, rainfall patterns, and rainfall variability that are not represented in climate model projections, on top of the main consequences of more rapid warming and sea-level rise.

While days above 35ºC and Forest Fire Danger Index (FFDI) are not direct indicators of drought, they describe weather conditions that often occur alongside drought or are exacerbated by drought.

Regional drought climate indicators:

- Generally decreasing trends in annual precipitation across the region, worsening into the far term
- Reduction in soil moisture levels across all scenarios modelled
- Increasing temperatures are likely to be the primary driver of increased frequency and severity of evapotranspiration and drought conditions
- Other climate and weather-driven events like heatwaves and bushfires / grass fire may compound broader impacts from drought events.

Below projections of these indices use an ensemble of CSIRO's Electricity Sector Climate Information (ESCI) datasets (days above 35°C and days above an FFDI of 25).[5]

Griffith City

		2050		2070	
Variable	Climate model reference period	RCP4.5	RCP8.5	RCP4.5	RCP8.5
Root soil moisture	15%#	↓ 0.019 mm^	↓ 0.019 mm^	↓ 0.013 mm^	↓ 0.026 mm^
Annual total precipitation	414 mm	↑ 1 mm	↓ 7 mm	0 mm	↓ 15 mm
Days above 35°C	31	49 ↑ 18	55 ↑ 24	Data unavailable	
Days with FFDI above 25	53	67 ↑ 14	74 ↑ 21		

Leeton

		2050		2070	
Variable	Climate model reference period	RCP4.5	RCP8.5	RCP4.5	RCP8.5
Root soil moisture	16%#	↓ 0.023 mm^	↓ 0.025 mm^	↓ 0.015 mm^	↓ 0.031 mm^
Annual total precipitation	422 mm	↓ 3 mm	↓ 10 mm	↓ 9 mm	↓ 19 mm
Days above 35°C	30	47 ↑ 17	53 ↑ 23	Data unavailable	
Days with FFDI above 25	51	64 ↑ 13	71 ↑ 20		

Murrumbidgee

		2050		2070	
Variable	Climate model reference period	RCP4.5	RCP8.5	RCP4.5	RCP8.5
Root soil moisture	12%#	↓ 0.015 mm^	↓ 0.013 mm^	↓ 0.007 mm^	↓ 0.021 mm^
Annual total precipitation	385 mm	↓ 6 mm	↓ 3 mm	↓ 4 mm	↓ 17 mm
Days above 35°C	30	47 ↑ 17	53 ↑ 23	Data unavailable	
Days with FFDI above 25	54	68 ↑ 14	74 ↑ 20		

Narrandera

		2050		2070	
Variable	Climate model reference period	RCP4.5	RCP8.5	RCP4.5	RCP8.5
Root soil moisture	14%#	↓ 0.019 mm ^	↓ 0.018 mm^	↓ 0.009 mm^	↓ 0.023 mm^
Annual total precipitation	436 mm	↓ 3 mm	↓ 9 mm	↓ 7 mm	↓ 18 mm
Days above 35°C	30	47 ↑ 17	53 ↑ 23	Data unavailable	
Days with FFDI above 25	48	62 ↑ 14	68 ↑ 20		

Mean water content as a percentage of capacity.
^ Change (mm/yr) in relative soil water content of the 1976-2005 reference period's relative soil water holding capacity.

5 CSIRO n.d., ESCI Climate Data, Department of Industry, Science, Energy and Resources. Available at: https://www.climatechangeinaustralia.gov.au/en/projects/esci/esci-climate-data/

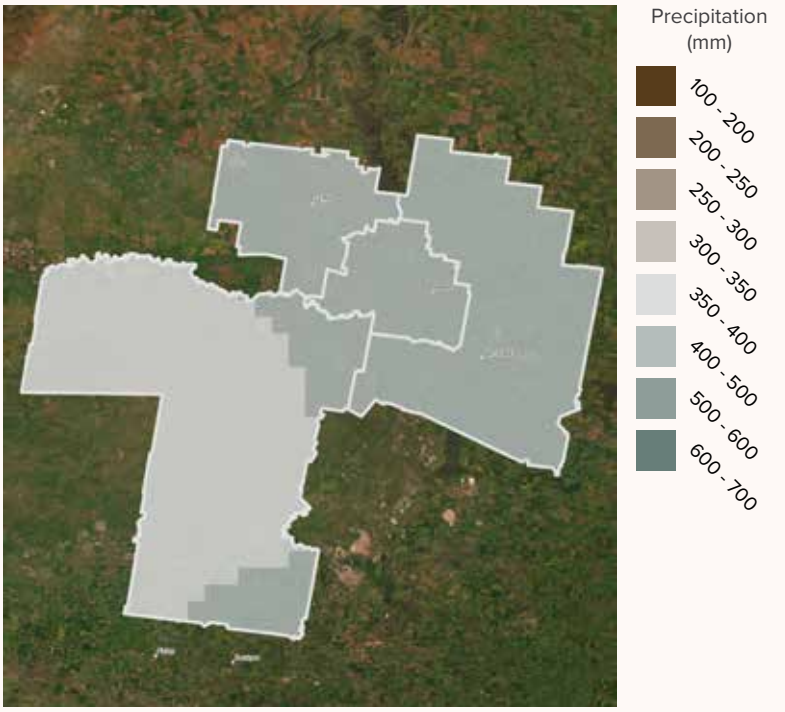
Annual precipitation

Considering the modelled scenarios for precipitation, all see either a minimal change or a reduction in annual total rainfall by 2050. Under the RCP4.5 scenario, this annual reduction lessens in severity in Murrumbidgee and Narrandera by 2070; but, grows in Griffith and Leeton.

Under the RCP8.5 scenario by 2070, the reduction in annual rainfall grows significantly across each LGA over the course of the two decades. This is notable for Murrumbidgee, as it has the lowest rainfall rate in the climate reference period and the most significant reduction from 2050 (-3mm) to 2070 (-17mm) under this scenario (Figure 12).

Figure 12 — Annual precipitation changes across the region.

Climate model reference period



2050 (RCP4.5)

2070 (RCP4.5)

Precipitation change (mm)

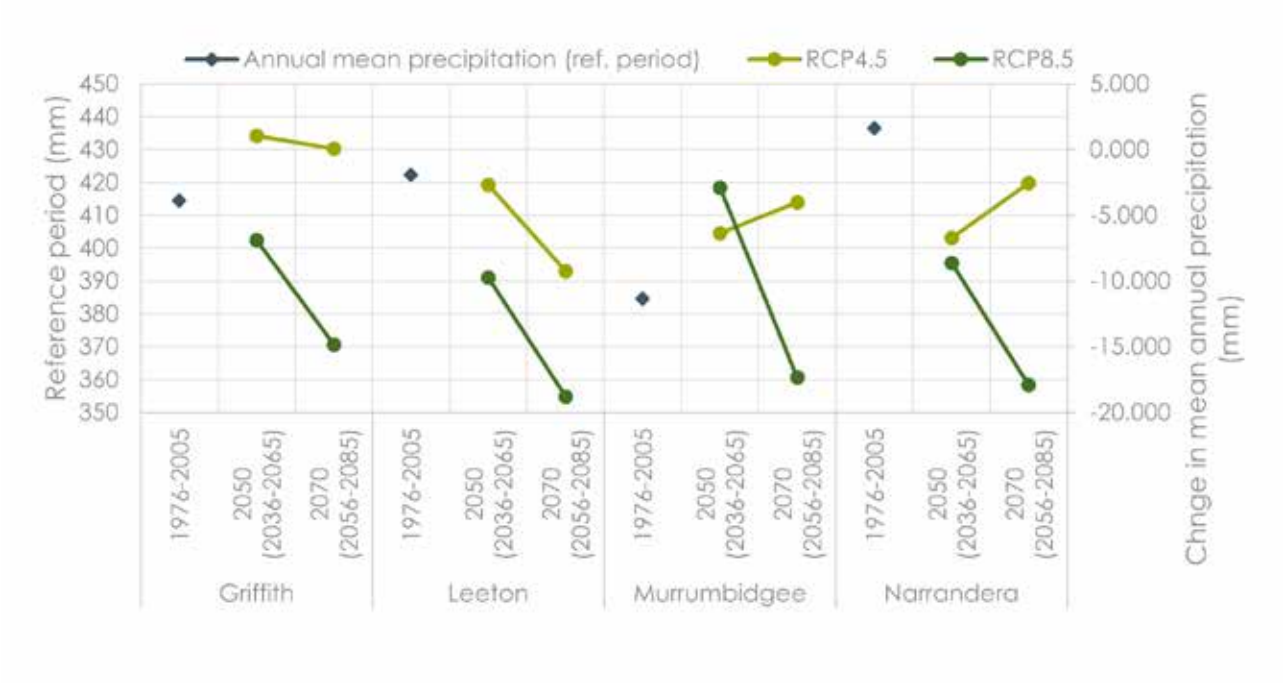
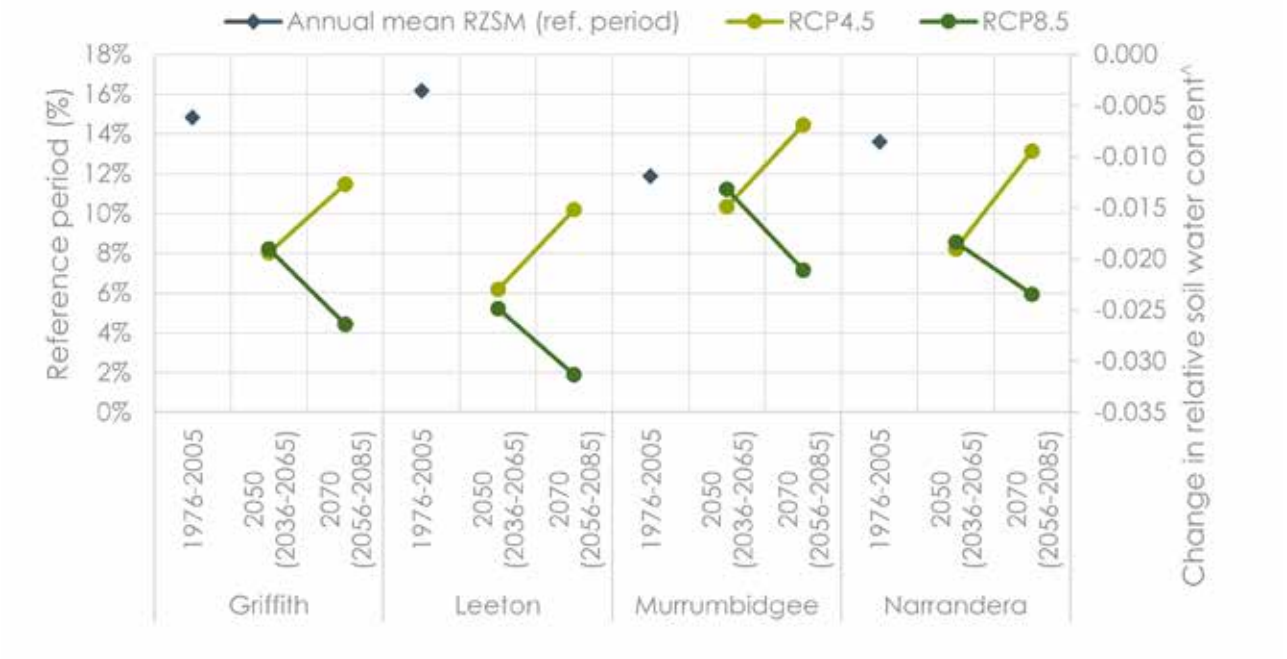


Figure 13 — Annual mean precipitation future climate projections, by LGA

Root zone soil moisture

Root zone soil moisture (RZSM) is presented as a percentage of total capacity during the baseline reference period and as a change of millimetres per year of the climate adjusted scenarios.



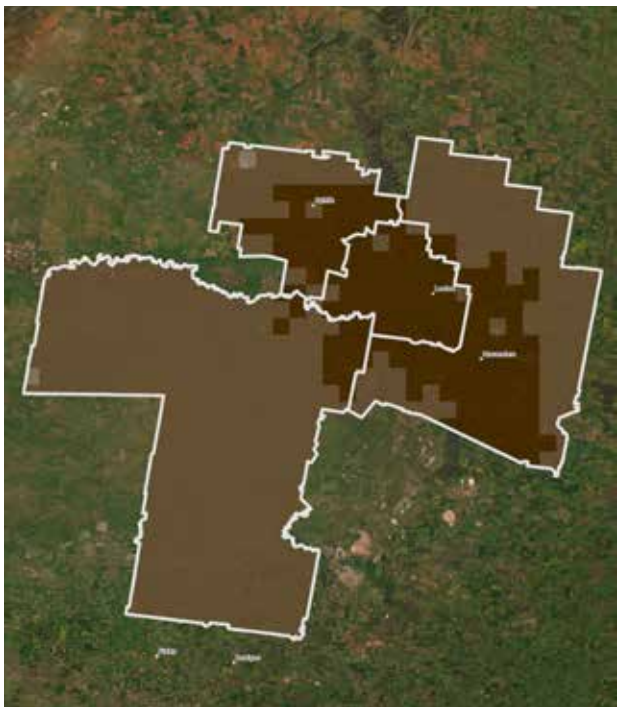
Root zone soil moisture

Under all four future scenarios modelled, each is set to see an annual reduction in root zone soil moisture. However, under the RCP4.5 scenarios, the reduction does lessen from 2050 to 2070. Under the RCP8.5 scenarios, the annual reduction increases to 2070 (Figure 14 — Root zone soil moisture future climate projections, by LGA). The reduction, both in 2050 and 2070, is most intense in Griffith and Leeton.

Figure 14 — Root zone soil moisture future climate projections, by LGA

Climate model reference period

2050 (RCP4.5)



2070 (RCP4.5)

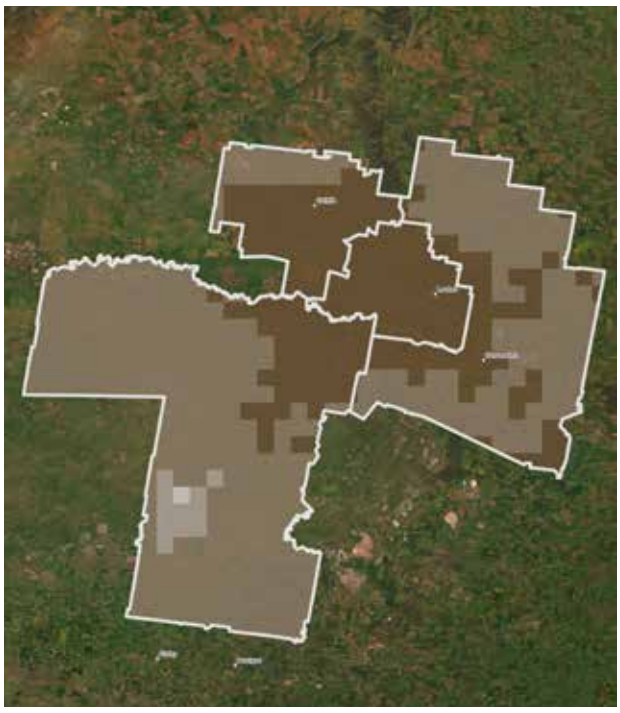


Figure 15 — Annual change in root zone soil moisture

What does the climate data tell us?

The region will continue to be susceptible to the impact of drought which can be protracted events, such as the Millennial drought, or relatively shorter time periods of high intensity.

Climate projections indicate an increase in drought risk, which worsens in the far-term under a higher emissions scenario.

Potential increases in frequency and severity of drought conditions will be largely driven by temperature, evapotranspiration and reduced soil moisture in the Western Riverina region.

Relevance of climate change in the neighbouring Alpine region

In addition to the climate projections for the Western Riverina region, climate change impacts in the Snowy Mountains (Alpine region) must also be considered given the reliance of inflows directed from the Snowy Scheme into the Murrumbidgee catchment. Over time, reduced snowpack, rainfall, changes to landform, erosion and runoff, and increased temperatures in the Snowy Mountains region is likely to have an impact on the Western Riverina.

The water from the Alps which flows through to the Basin and the irrigation schemes is of high significance, supporting ecosystem services of national economic, social and environmental importance. With the water held in high regard now, every gigalitre flowing from the Alps catchment to the Basin is likely to be more important in the future.

Climate projections for the NSW Alpine region indicate continued warming and drying – with winter temperatures increasing by more than 2°C in the far future and spring rainfall projected to decrease by 20 percent in the far future.

Through an increase in temperatures and changes to rainfall patterns, there are subsequent impacts to the quantity of both surface water and groundwater, with some projections showing that, across the Alpine region, there is likely to be a reduction in surface-water run-off in the future.

Climate change threats to the natural condition of the catchments may also impact high quality water delivery from the Alps. This includes water yield, water flow regimes and water quality.

Further investigation is needed to understand how the projected reduction in surface water run-off in the Alpine region, and other influencing processes on water yield and delivery within the Alps, interacts with the run-off generally received through the Murrumbidgee catchment. With the Murrumbidgee and Murray water catchments receiving inflows from the Snowy Scheme under the Snowy Water Licence, future reviews based on building a climate-based understanding will need to be considered.

Clear reliance is evident on the water quantity and quality from the Alpine region to other catchments, importantly the Murrumbidgee catchment, and broader considerations to the contribution it makes to agricultural production and other industries in the Basin.

Image: 'A Country Life' (Brett Collins)

Trends, stressors and shocks

To support preparedness and planning for drought we must also consider other trends, stressors and acute shocks, beyond the climate, that may amplify drought impacts into the future. These can influence our resilience to different conditions, circumstances and scenarios. It is also important in terms of governance arrangements and strategic priorities to ensure broader actions are cognisant of interaction with drought in our communities.

Economic

- Water policy and water allocation changes
- Cost of farming with rising inputs
- The state of the national economy, commodity prices, market volatility and interest rates
- Fuel prices and transport costs
- Positive impacts of strategic road connectivity on market access
- Major project investment decisions, both private and public
- Changing farm enterprise ownership models and their scale
- Energy access
- Transition to renewable energy sources

People and community

- Service availability, particularly health and community services
- Workforce shortages, and worker attraction and retention to regions
- Demographic shifts in population (ageing population and youth retention)
- Housing availability and new dwelling supply
- Costs of living pressures and local discretionary spending
- Urbanisation and population mobility trends

Environmental

- Widespread invasive species
- Feral animal numbers
- Land use conflicts, particularly on primary production areas
- Loss of riparian habitat
- Water management within the Murray-Darling Basin
- Water infrastructure projects and funding decisions
- Soil erosion
- Water licensing arrangements to improve environmental flows
- Climate change

Western Riverina in Australia's future drought context

At the national level, a consequence of the most recent drought (2017-2019) was increased pressure on Australia's food security. Grain was imported to feed stock and the nation. Similar imports in 2006-7, 2003-4, and 1994-5 correlate to the worst drought related cropping years in recent decades. Since this event in 2019, Australia's population has grown from 25.5 million to 27.2 million, with continued growth projected. This growth adds to the demand on available water and increases the pressures on food insecurity into the future. Any response to drought, particularly within the productive area of the Western Riverina, fits within the context of a strategic view of national food and water security. This would consider the potential scenarios of water availability, as well as the related potential biosecurity risks. Subsequent revisions of the Western Riverina Regional Drought Resilience Plan will monitor the development of a national policy response to this trend, and reflect community views to advocate more on this significant issue.

Our drought resilience

Drought resilience can be considered against three macro indicators, each with their own influencing factors. Considering how this plan can address all these factors ensures we can address all aspects of the system.

Economic resilience

Continuity
Employment
Diversity

Environmental resilience

Infrastructure and built assets
Natural processes
Land management

Social resilience

Personal wellbeing
Decision making capacity
Community wellbeing

A snapshot of vulnerability and resilience to drought

The Australian Bureau of Agricultural and Resource Economics and Sciences' (ABARES) has developed an index that ranks remote, rural or regional agriculturally dependent communities (at the LGA level) according to their potential to be adversely affected by drought.

The result is a snapshot based on drought exposure and drought sensitivity at the farm level (farm sensitivity), the reliance on employment in agricultural production industries (community sensitivity), the adaptive capacity of a LGA to drought based on economic diversity, and a final combination of the potential drought impact.

The data comprises data variables and indicators which have been combined and ranked. Scores are not necessarily representative of the magnitude of impact, rather it positions the sensitivity with respect to other LGAs assessed. There is a strong link to employment in agricultural production, particularly for community sensitivity which may not be representative of broader community sensitivity detailed throughout this plan.

Community Vulnerability and Resilience to Drought Index (measured from 0 [lowest] to 1 [highest])				
LGA	**Farm sensitivity**	**Community sensitivity**	**Economic diversity**	**Potential drought impact**
Griffith City	N/A*	0.30	0.53	0.20
Leeton Shire	N/A*	0.27	0.59	0.18
Murrumbidgee	0.76	0.58	0.16	0.90
Narrandera Shire	N/A*	0.32	0.47	0.22

* Insufficient data for broadacre farm samples in the region

The ABARES CVRDI scores indicate for the region:

- Some evidence of farm-based exposure, which is linked to both exposure to climate variability, and the effects that has on farm outcomes
- A low to moderate level of community dependence on agricultural activity in terms of employment
- Some demonstrated economic diversity highlighted by a strong regional centre offer, service industry and economic output
- A low to higher level of overall potential drought impact, particularly in Murrumbidgee noting it has a particularly strong agriculture sector with high value agriculture commodity output (while potential drought impact measures farm sensitivity and community sensitivity, whether there is lasting loss or harm depends on a community's adaptive capacity).

While the region is susceptible to future drought impacts, and this is more apparent for Murrumbidgee compared with other LGAs, its economic diversity supports a level of adaptive capacity in some areas of the region. Levels of community connection and social capital, along with diversified economic development opportunities, offer key opportunities to aid immediate as well as long-term drought resilience. Murrumbidgee's proximity to the regional centres of both Griffith and Albury potentially moderate drought vulnerability scoring through access to employment and services in relative proximity.

The above provides a snapshot of community vulnerability to drought, though a number of limitations are noted. As this plan details, impacts in the Western Riverina extend to broader pressures on water availability, and subsequent impacts to community and economic outputs.

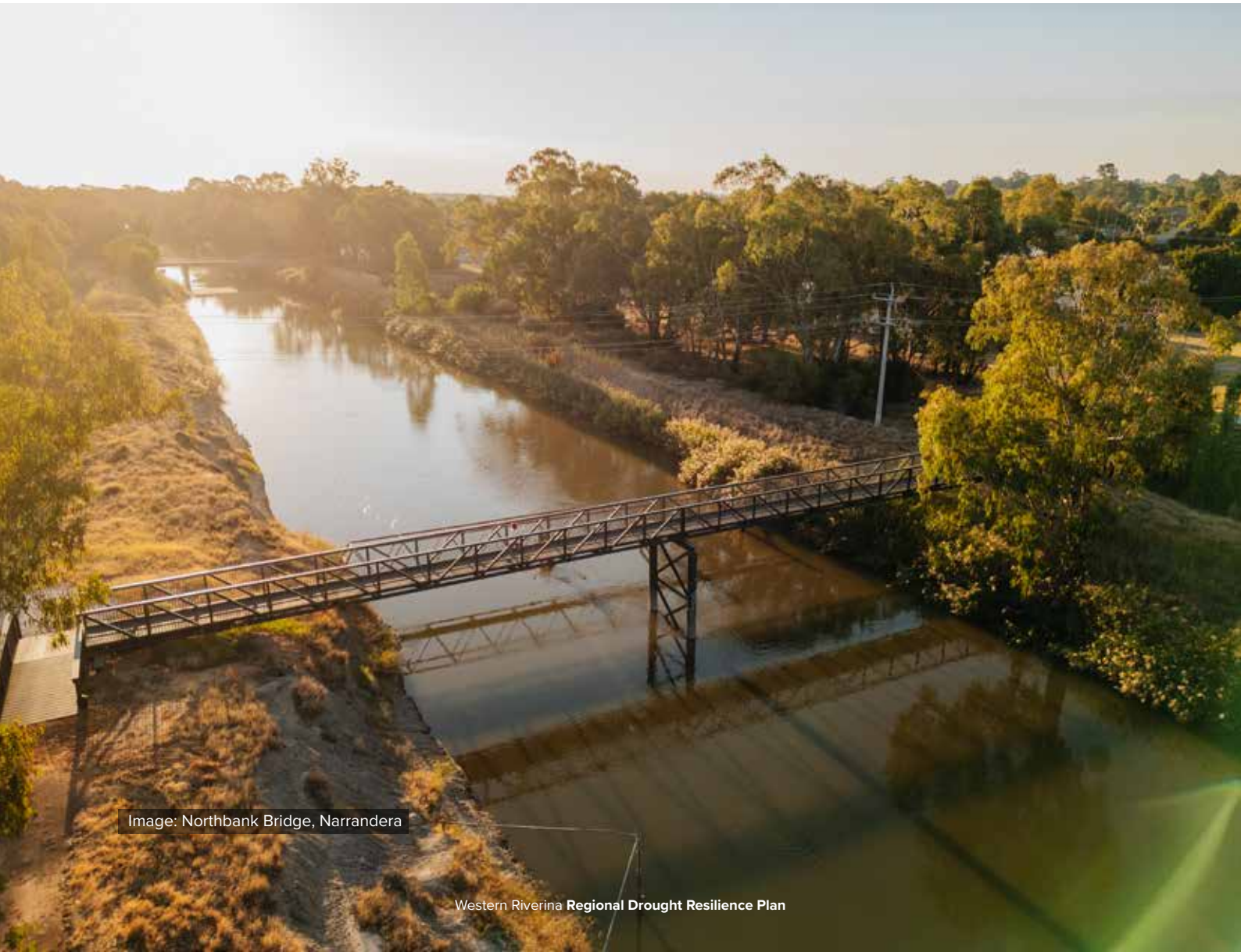


Image: Northbank Bridge, Narrandera

Drought action plan

The drought action plan for Western Riverina incorporates priorities for drought resilience across strategic pathways for action. The action plan provides:

- Details of specific actions against each pathway
- The alignment of the action to an implementation pathway
- Anticipated stakeholders

Timeframes are indicative and are dependent upon opportunities and timing for funding and other variables.

While Council is listed next to a number of actions, this is generally in anticipation of advocating and leading next steps of the action rather than sole responsibility in delivery. Many of these actions are of a scale or fall outside council operations and require funding and resourcing from other levels of government or input from industry.

A program logic approach was used to match the drought resilience needs illuminated by the engagement feedback with pragmatic actions. The degree to which the actions contribute to our movement along the resilience 'theory of change' journey is also detailed. This is about whether the actions 'absorb, adapt or transform' how we collectively prepare for and grow our resilience to drought effects. This scale also helps us to understand the level of effort and the timeframes associated with each action.

Pathways for change

This drought action plan establishes a framework to guide focus and efforts in response to community needs and community strengths highlighted through engagement. The action plan spans six strategic pathways, reflecting the three systems of drought resilience of community, economic, and environmental characteristics. These strategic pathways are:

- Anticipate water availability
- Proactively manage business interests
- Support off-farm diversification
- Grow local co-operative service provision
- Support community cohesion
- Embed environmental stewardship and sustainable agricultural practices

These pathways can be approached at different scales. This can be by different actors and through a range of mechanisms over time from transformative resilience actions at a large scale to proactive resilience actions by individuals and the more formal or common pathways.

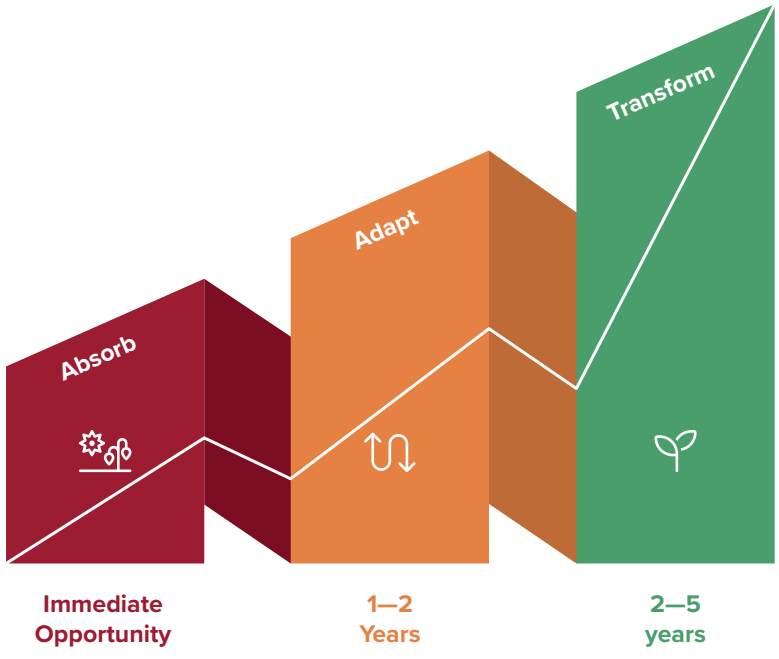


Figure 16 — Resilience theory of change

Pathway 1 – Anticipate water availability

The region's social and economic resilience is inextricably linked to water availability. Reducing the inherent uncertainties of water availability is critical to the ongoing sustainability of the region.

This is particularly the case with the evolution of the water market in NSW, whereby water allocations have been decoupled from land ownership. The ability to trade water unlocks an additional revenue stream for those farmers who hold those allocations, but it also creates challenges for those farmers who have to purchase both land and water allocations. In times of drought, they could be left with a farm (and its associated debt obligation) and having to purchase water temporarily at a high price due to reduced availability.

Key actions under this pathway to build resilience include:

- Increasing collective understanding of water market dynamics – including communicating the risks of temporary allocation purchases
- Improving water allocation forecasting
- Improving access to and awareness of climate forecasts for dryland farmers
- Considered and well-informed planning for water infrastructure programs and management

ID	SPECIFIC ACTION	IMPLEMENTATION PATHWAY	STAKEHOLDER(S)
1.1	Develop an agreed approach for drought fodder management/distribution with improved governance arrangements overseen by a local independent authority (e.g. using Stock Saleyard operations as a model)	**Adapt** to strengthen preparedness and ensure coordination of processes	Council
1.2	Councils to review town water supply restrictions policies and approaches to providing emergency water supplies, recognising the wellbeing benefits of towns being "green" even during dry times, and include water use efficiency approaches.	**Adapt** to strengthen preparedness and support common good outcomes	Council
1.3	Undertake an independent assessment of the Lake Coolah development proposal with consideration to multiple objectives including flood mitigation, wetland enhancement and water delivery system efficiency	**Transform** the long-term economic stability through catalyst projects	Council
1.4	Councils to review stormwater management and town sewerage discharge strategies and approaches to maximise opportunities for reuse of water resources	**Adapt** to strengthen preparedness through continuous improvements	Council
1.5	Work with International Commission on Irrigation and Drainage Australia and Irrigation Australia to promote the bench marking of irrigation scheme delivery efficiencies, and explore a "5 Star" approach – that will support regional marketing of agricultural products	**Adapt** to leverage existing strengths	Industry groups
1.6	Deliver continuing education / training program on the operation of water markets, with irrigators as the target audience	**Adapt** through increased local understanding of the system	Industry groups Irrigators
1.7	Work with the NSW Government to introduce training and programs for primary producers to further develop rainfall and weather intelligence using drought signals / indicators for use in conjunction with soil moisture and other weather data.	**Adapt** through improved processes to complement planning	Council State Government
1.8	Promote engagement with the One Basin CRC projects delivered through the Griffith Hub, and explore the possibility of a Centre of Irrigation Excellence building upon the existing Irrigation Research and Extension Committee model.	**Transform** through increased capacity and recognition of local strengths	Council

Pathway 2 – Proactively manage business interests

Strength of small business is a feature of the region whether it's fuel, cafes, hairdressers, mechanical or the local accountant. While drought generally impacts farmers first, the flow-on effects are felt across towns and communities through business impacts and in-turn, employment and expenditure.

Resilient, diverse and prepared businesses are better positioned to ride the peaks and troughs when they are planned for and anticipated. A range of pressures exist outside of drought times which requires strategic long term planning to address, while more agile initiatives provide interventions during drought, and are effective where planned for in advance. Priority action areas include:

- Support for businesses to adapt and prepare
- Ensuring the region has the right skills, and attracts new skills for confident business growth
- Ensure business has the information they need to operate effectively.

ID	SPECIFIC ACTION	IMPLEMENTATION PATHWAY	STAKEHOLDER(S)
2.1	Investigate the reintroduction of previous Services Australia farm exit program	**Adapt** to facilitate business transition	Council Services Australia (Federal Government)
2.2	Investigate potential to fund local application (using a co-operative approach) of the NSW Farmers' Federation "Ag Career Start" program	**Adapt** to strengthen preparedness and build local capacity	Council
2.3	Undertake a more detailed analysis of economic flows / benefits done by ABARES prior to the next drought (taking milling and downstream activities into account)	**Adapt** to strengthen preparedness through understanding of the system	Council
2.4	Undertake a review across all the local education service provider course and curriculum offerings to meet local agricultural industry and supply chain needs including opportunities for rural cadetships, apprenticeship advisors, and how to increase housing with a link to trade apprenticeships	**Transform** the long-term economic stability through catalyst projects	Council TAFE NSW Local education providers
2.5	Support small businesses with computer and internet training	**Absorb** immediate action to support community capacity	Council State Government
2.6	Promote the benefits of "lifestyle" driving the purpose of business / financial / succession planning, and promote the benefits and delivery of business plans e.g. for improved access to capital	**Adapt** to strengthen preparedness	Council
2.7	Promote drought assistance programs or financial subsidy programs to "supply chain" businesses when they are impacted by agricultural clients who are impacted by drought	**Adapt** to support endurance during drought	Council Business owners and operators
2.8	Engage a project officer to help local businesses (small to large) develop their own drought resilience plan - and facilitate access to grant funding from various agencies	**Adapt** to strengthen preparedness	Business owners and operators Council
2.9	Provide training to local providers on responding to tenders	**Absorb** immediate action to support local capacity	Council
2.10	Provide local support to Services NSW / Concierge service to provide opportunities for workers displaced by drought to get other local short-term work	**Adapt** to strengthen preparedness and mobilise workforce supply	Council State Government
2.11	Promote the need to broaden the rules for "backpacker" workers to attract more workers for agricultural related industries	**Transform** the long-term economic stability through catalyst projects and ensure workforce supply	Federal Government
2.12	Promote opportunities in alternate industries that suit available soils, water and climatic conditions.	**Transform** the long-term economic stability through catalyst projects	Council State Government
2.13	Review / update regional economic development strategies to include promotion of non-water based industries, agricultural industries that align with available soils and water, and others that take advantage of available products	**Transform** the long-term economic stability through catalyst projects and diversification of economy	Council State Government
2.14	Undertake regional internet/phone service audit for digital access, along with an energy access audit and advocate for improved connectivity	**Absorb** immediate action to inform advocacy of key barriers	Council
2.15	Advocate for improved consistency in funding for the Rural Financial Counselling Service to support local business operators to take proactive steps toward enhanced drought resilience	**Absorb** immediate action to provide continuity of services	Council
2.16	Develop a "Generation Ag Link" program modelled on the CSIRO program "Generation STEM Link"	**Adapt** to strengthen preparedness by building capacity and local industry understanding	Industry groups

Pathway 3 – Support off-farm diversification

The region boasts many economic development opportunities which over time will offer varied income and productivity opportunities. Some of these opportunities are truly transformative and offer long term prospects for change, growth and stability. As an agriculturally based economy, there is benefit in:

- Leveraging existing tourism assets as a major economic pillar
- Building the financial strength of all businesses regardless of sector or scale
- Diversifying the regional economy through manufacturing and value adding agriculture
- Keeping our towns active and attractive.

ID	SPECIFIC ACTION	IMPLEMENTATION PATHWAY	STAKEHOLDER(S)
3.1	Councils to have a strategy for future land release and development, potentially adopting a “cooperative model“ approach	**Absorb** immediate action to identify site potential	Council
3.2	Build on the Regional Arts Development Program - Regional Cultural Tourism report	**Absorb** immediate action to build existing work foundations	Regional Arts Network Council
3.3	Advocate for public service remote area benefits to attract and retain critical services and workforce	**Transform** the long-term economic stability through continuity of services	Council
3.4	Develop an Ag Industry focussed “Job Keeper” type program (taking principles from the Farm Household Allowance program delivered by Services Australia) for application during drought.	**Transform** the long-term economic stability through continuity of operations	Industry groups State Government
3.5	Promote agritourism and a viable diversification strategy	**Adapt** to strengthen preparedness through economic diversification	Council Tourism organisations
3.6	Promote value added manufacturing for existing and emerging agricultural commodities, such as almonds, grapes, citrus, sugar plum etc	**Adapt** to strengthen preparedness through economic diversification	Industry groups
3.7	Investigate a Geographic Indicator designation that would support sustainability accreditation for the Western Riverina agricultural industries	**Adapt** to leverage existing strengths	Industry groups
3.8	Develop public works / maintenance program of works e.g. town revitalisation, roadside clean-up / maintenance, farm clean outs to be done during drought	**Adapt** to inform preparedness through ready made actions with impact	Council
3.9	Schedule training during “down time” to upskill people in the agricultural industry	**Adapt** to strengthen preparedness	Farm business owners and operators
3.10	Outside of drought, promote availability of water in towns as an opportunity for new businesses – include in Economic Development strategies	**Adapt** to strengthen preparedness through economic diversification	Council
3.11	Promote National and State support for regionalisation strategies such as the Regional Development Australia “Country Change Riverina and Murray” strategy (to encourage movement from cities to regional areas)	**Transform** the long-term economic stability through continuity of services	Federal Government State Government
3.12	Facilitate affordable housing, fast track land development, explore community cooperative approach and private / public partnerships with Council	**Transform** the long-term economic stability through catalyst projects	Council State Government
3.13	Upskill and build capability of local providers in diverse business areas to allow them to compete in the tender and procurement process during drought that support broader business offers.	**Adapt** to strengthen preparedness through economic diversification	Council

Pathway 4 – Grow local co-operative service provision

The co-operative model of business and service provision in this region is truly unique. It is not found in many other parts of Australia at such a significant scale and could support the region's long-term resilience and prosperity. It is borne from a generational legacy of the collaboration needed to operate and maintain the complex irrigation schemes that thread through the landscape. Without co-operation, in this landscape, water availability would not exist.

Expanding this co-operative model beyond its irrigation roots is already evident, with pubs and rice mills already emerging to trade using this model of ownership and operation. Extending this model further into retail, grocery, aged care, and possibly even housing is arguably not too much of a stretch to achieve.

This pathway seeks to focus on this demonstrated strength of collaboration and cooperation in Western Riverina communities. This builds on these existing tangibles and non-tangible cultural assets to maintain baseline service provision for key sectors, and support social and community fabric and morale during drought times through enabling mechanisms that drive locally cooperative outcomes.

ID	SPECIFIC ACTION	IMPLEMENTATION PATHWAY	STAKEHOLDER(S)
4.1	Establish ongoing "Wellbeing Hubs" connecting community organisations to landholders, business and the community and develop action plans for priorities of each hub	**Transform** into the long term supporting continuity of services and community network capacity	Community organisations Council
4.2	Develop cooperative structure models for a range of situations along with guidelines to encourage people and corporations to co-invest in community services	**Transform** into the long-term supporting continuity of services and community network capacity	Community organisations
4.3	Promote programs, financial planning advice and funding available from providers including Services Australia	**Adapt** to broaden clarity and uptake of programs	Services Australia Council
4.4	Councils to consider the provision of more 'drop in' style community services to support locals especially in drought when costs can prohibit travel	**Absorb** to strengthen local access to support	Council
4.5	Link community-based investment in local infrastructure (e.g. ongoing social activities) with LGA programs including for social connectivity and for places of refuge linked to floods / bushfires etc.	**Adapt** immediate actions to support ongoing preparedness	Council
4.6	Undertake an audit of Council roads to identify priorities for an "Infrastructure Betterment" program to make access to farms more resilient to droughts, floods and other events	**Adapt** to direct future funding and support movement networks	Council Landowners

Pathway 5 – Support community cohesion

Cohesive and connected communities are a key ingredient to support drought resilience. Drought, as opposed to other hazards, can divide communities through isolation. Strong community connections are therefore critical in ensuring community care and wellbeing, looking out for mates and providing mutual relief.

This was a clear priority identified by the community through the plan engagement process. Community connection, participation and identity are already strengths of the Western Riverina and need to be maintained and bolstered.

This pathway seeks to build on the existing community strength of the Western Riverina region to support cohesiveness of the social fabric and morale during drought times by:

- Supporting strong social cohesion
- Attracting and retaining social and cultural events
- Maintaining an inclusive community.

ID	SPECIFIC ACTION	IMPLEMENTATION PATHWAY	STAKEHOLDER(S)
5.1	Include delivery of hard copy documents to households in communications strategies (where requested)	**Absorb** immediate action support accessibility	Council State Government
5.2	Advocate for additional subsidies during drought for youth sport and support similar initiatives such as “Active Farmers”	**Adapt** to utilise existing initiatives and programs	Council
5.3	Councils and community groups to drive / facilitate / promote volunteerism and develop a steering committee (or similar) to direct volunteer deployment in times of drought	**Adapt** to strengthen preparedness and capability to respond	Council Community groups
5.4	Develop written and visual history of the region (providing a way for intergenerational involvement and connection)	**Transform** into the long term through retaining regional identity	Council
5.5	Develop a list of groups and associations seeking volunteers, based on examples such as SES community actions teams – link to “Community Hub” Actions	**Adapt** to strengthen preparedness and capability to respond	Community groups
5.6	Council to promote and deliver free “Big Social” events	**Adapt** to strengthen preparedness and support role of community networks	Council Community organisation
5.7	Support existing and promote new “Food Festival” programs to show case locally grown products – invite celebrity chefs	**Adapt** the long-term economic stability through catalyst projects	Council Destination groups
5.8	Develop a local “Drought Self Help’’ kit (similar to Red Cross kit)	**Adapt** to strengthen preparedness	Council
5.9	Build on and expand the “Teach the Teachers” program relating to agricultural production and experiences of living in rural communities	**Adapt** to strengthen preparedness and connection to the region	Council Industry groups Schools
5.10	Support excursions from city schools to the region and continue to support “Boys to the Bush” program	**Adapt** to strengthen preparedness build understanding across region to urban areas	Council Community organisations Department of Education
5.11	Explore opportunities for mentor programs for both men and women, and promote existing programs focused on rural leadership and change makers	**Adapt** through capacity building of locals	Council Community organisations
5.12	Support delivery of drought resilience programs within schools	**Absorb** immediate action to strengthen preparedness	Schools
5.13	Continue to invest in the maintenance and enhancement of community facilities to support community cohesion during times of drought	**Absorb** immediate action to strengthen preparedness	Council
5.14	Work with Indigenous groups to “co-solve” water issues	**Transform** the long-term economic stability through catalyst projects	Council First Nations groups

Pathway 6 – Embed environmental stewardship and sustainable agricultural practices

The health of the landscape is integral to our economic and community wellbeing. Retaining soil moisture in the landscape and topsoil retention are clear drought impact reduction pursuits. Pest and weed management offer further opportunities to stem landscape degradation.

Areas for action include supporting land management and maintaining and enhancing biosecurity.

ID	SPECIFIC ACTION	IMPLEMENTATION PATHWAY	STAKEHOLDER(S)
6.1	Promote and support Landcare in providing opportunities for landholders to demonstrate the benefits derived from their business and land practices (including use of photo diaries)	**Adapt** to support resilient landscapes	Landcare
6.2	Support Landcare and associated programs and advocate for continuity of funding on programs that focus on climate ready revegetation and improving native seed supply	**Adapt** to support resilient landscapes	Landcare
6.3	Promote a policy for fixed riparian zone / corridors for reconstruction and restoration	**Adapt** the long-term economic stability through catalyst projects	Council
6.4	Support actions for on-going carp management within the region's waterways	**Absorb** immediate actions to support ongoing efforts	State government agencies
6.5	Advocate for and ensure understanding of the impacts of future reviews of the Snowy Water Licence	**Adapt** into long-term to maintain economic stability	Council Industry groups
6.6	Link Landcare with Regional Services Australia to identify funding opportunities for involvement in farm management professional development opportunities	**Adapt** the long-term economic stability through catalyst projects	Landcare
6.7	Promote the landscape and production benefits of sustainable and restorative agricultural practices and focus on driving buy-in through initiatives such as mapping of land use capability.	**Adapt** to support resilient landscapes	Industry groups Landcare
6.8	Work with First Nations peoples to bring First Nations ecological practice back to Country	**Transform** through actions building partnerships and resilient landscapes	First Nations groups
6.9	Support the establishment of Landcare groups across each of the council areas	**Adapt** to support resilient landscapes	Council Landcare
6.10	Develop a program to focus on improvements to road side revegetation for connected corridors	**Adapt** to support resilient landscapes	Council

Implementation

The Western Riverina Regional Drought Resilience Plan relies on collaborative implementation approaches involving a range of stakeholders.

The action plan for drought resilience spans the drought cycle and its interaction with the community, that is before, during and recovery from drought. The actions to implement cover levels of government, community and industry groups, service providers, not-for-profits, landowners, and local communities with actions that have effect at different points of the drought cycle. This includes short, medium and long term opportunities, and interventions that are strategic by strengthening preparedness or are agile and ready to be implemented when enduring drought.

Pathways implementation

The purpose of the action plan is to inform future drought funding and ongoing preparedness across the region. Stakeholders work together regionally to build drought resilience in the economy, environment and our communities, proactively and pragmatically.

The action plan has been drawn together through community expression, existing initiatives and background data. In developing this action plan, it is noted that:

- actions are purposefully listed with multiple stakeholders, and unspecified timeframes or funding to acknowledge that delivery is dependent on a range of variables
- implementation will occur through participation of all stakeholders over time as priorities, resources and funding arise
- as a regional plan, the actions are collective and collaborative
- roles and responsibilities are flexible, including for local governments. The plan is owned by the region. Any stakeholder can start an action that is within their capacity
- some actions are indeed underway by various stakeholders, the purpose of maintaining them in the action plan, is that the community has advised that the action is integral to drought resilience.

Stakeholder roles in implementation

DESCRIPTION
An **advocate** actively supports a position, action or policy. The task is outside the advocate's jurisdiction, capacity or resourcing and advocacy is required to engage with those parties with capacity to deliver. For example, telecommunications advocacy.
A **partner** joins others in a common cause or action where roles and responsibilities are shared across areas of expertise. Each partner brings an element to the action for joint delivery. For example, region-wide strategic initiatives.
A **lead** is in control of an action. The action may still involve partners or other roles, but the action is reliant upon a lead party due to their technical or other expertise. E.g. Health or counselling matters
An **owner** is the only party that can undertake or permit the action. E.g. local government as public asset owners
A **supporter** is united with others in the need or benefits of the action but potentially does not have a major role. The action is led or owned by others. E.g. A supporter may provide assistance in kind, technical advice or donations to action leaders
A stakeholder is anyone who has an interest in the project, program or action. Stakeholders will have varying degrees of involvement from owner to advocate and all points between.
A **deliverer** is responsible for implementation and outcomes of an action or funded program. e.g. Community agency delivering social aid programs.
A **funder** provides the funding arrangements. The party is not involved with scoping, executing or delivering the program but may require some outcome reporting or evidence. e.g. the government grant funding for a pest control program delivered by others.

Governance structure

Implementation of the regional drought resilience plan is to be driven by a collaborative and multi-disciplined drought resilience project control group (PCG). Membership will be broadened to provide an integrated and coordinated approach to drought resilience efforts.

This will enable the PCG to adopt agile approaches and shift priorities as needed depending on changing circumstances, and as opportunities arise. Despite this, all actions remain relevant in terms of maximising funding opportunities. This also allows expertise across the strategic pathways, and for partnerships to evolve as funding and priorities arise

A Chair of the PCG will be selected.

A PCG Terms of Reference is to be prepared for its membership to guide its function. The Terms of Reference could include:

- Role and purpose and connection to the RDRP
- Stakeholder and membership lists
- Meeting arrangements, (potentially quarterly) and responsibilities of attendees
- The circumstances of a quorum and decision making protocols
- The election or rotation of a chair person
- An action plan for the first 60 days or 12 months including delivery of the priority actions with the implementation funding; and
- A process for reflection and nominating next priority actions.

A Memorandum of Understanding may also be required.

PCG meetings should be held in different localities across the region over time.

Monitoring, evaluation and learning framework

The drought action plan incorporates a large suite of projects and actions, some offer immediate opportunity, some are medium-term items and others are longer-term transformational opportunities. Not all actions can be focused on or delivered at once. The 'absorb, adapt, transform' framework will guide the PCG in terms of its implementation and coordination of activities and funding pursuits, and will enable a flexible and agile approach as drought conditions change, guiding the focus.

Other stakeholders are able to use the plan to support funding and grant applications at any time, as desired. Opportunities for collaborative delivery partnerships, where two stakeholders may wish to provide similar projects, should be explored

This system will:

- Provide regular opportunities to define when conditions are changing locally; and
- Catalyse a change in focus to respond to the needs of the changing conditions.

This ensures a level of agility is adopted with regard to the implementation approach. Local governments may wish to apply more objective targets for immediate actions or further incorporate the outcomes of this plan into the local government reporting framework to ensure delivery.

As immediate efforts in response to the action plan are delivered, broader efforts across collaborators is guided in its approach, underpinned by this plan which enables stakeholders to work towards and contribute to regional drought resilience outcomes, including those at the local and property level.

The drought resilience action plan also requires that a 'lessons learned' posture is adopted, ensuring new information, knowledge, approaches and science is rolled into implementation delivery as a guiding principle. This will mean that over time, the drought resilience action plan may be adapted to reflect new learnings and the adjustment of intervention pathways as required. The PCG is responsible to conduct an annual lessons learned review, with changes to inform action moving forward.

The drought resilience action plan has been thoughtfully designed to not only guide collective effort and action but to enable adaptation through ongoing monitoring, evaluation and learning.

The Regional Drought Resilience Plan is a 10-year plan, to be reviewed after five years.

An annual monitoring program to inform adaptive learning is outlined below. Addendums to this plan can be made, to reflect these learnings over time and ensure the document maintains pace with changing circumstances and maturation of drought preparedness activities.

Tracking progress and reporting

Action-based project tracking against the drought resilience action plan, the principles and objectives of the plan should be undertaken on an annual basis. This tracking and reporting shall be the responsibility of the implementation PCG chair, unless otherwise delegated. Likewise, an annual evaluation process will be conducted by the PCG, guided by the evaluation questions that follow.

Image: Jerilderie Grain Storage and Handling

Key evaluation questions

These key evaluation questions are high level questions designed to frame the analysis of progress and performance of the Western Riverina Regional Drought Resilience Plan against the above framework. These key evaluation questions may help to structure annual tracking and reporting.

PROPERTY	EVALUATION
Effectiveness and Outcomes	What have been the outcomes (intended, unintended, positive and negative) of the plan implementation process and progress?
	To what extent has progress contributed to or furthered the principles and objectives of the regional drought resilience plan?
	Has the plan been used for or otherwise supported successful funding and grant applications?
	To what extent have stakeholders outside the PCG responded to the plan's content?
	Have any barriers or challenges been identified throughout the implementation of plan, and what solutions to address these have been identified?
Drought resilience maturation	To what extent has efforts in implementing the plan contributed to: › Creating stronger connectedness and greater social capital within communities, contributing to well-being and security? › Empowering communities and businesses to implement activities that improve their resilience to drought? › Supporting more primary producers and land managers to adopt whole-of-system approaches to natural resource management to improve the natural resource base, for long-term productivity and landscape health?
Stakeholder engagement	In what ways are the PCG and other stakeholders collaborating and collectively contributing to efforts outlined by the action plan?
	In what ways has the plan provided inclusive involvement across sectors, disciplines and communities?
	In what ways has the plan been able to support individual stakeholder goals, objectives and aspirations with regard to drought resilience?

The reporting may be undertaken using a range of tools to capture experiences and perspectives from across the PCG, allied stakeholders as well as the communities of Griffith City, Leeton Shire, Murrumbidgee and Narrandera Shire more broadly. These tools may include:

- Meetings and event data capture
- Targeted meeting / interviews with stakeholders
- Survey data
- Case studies and data from the PCG
- Media, including social media; and
- Funding and grant applications.

Achieving the plan's outcomes

A further opportunity for the PCG to measure the contribution to or achievement of the plan's outcomes is by using local data to assess specific outcomes. The data sources or indicators will need to be selected by the PCG and can provide insights as to how the plan is tracking against the resilience theory of change. Outcomes include (but are not limited to):

STRATEGIC PATHWAYS	OUTCOMES
Anticipate water availability	**1** Community infrastructure is resilient and helps to reduce disruptions
	2 Capacity to make informed decisions through local knowledge, access to data, intelligence and innovate tools is increased
Proactively manage business interests	**3** Agricultural productivity in the region is sustained
	4 Increased capacity to meet local procurement demands and local employment
Support off-farm diversification	**5** Employment loss is avoided or minimised, ensuring livelihood are maintained
	6 Reduced decline of gross regional product relative to: › Non-drought periods › Previous drought periods › Other regions in NSW, Victoria and South Australia
Grow local co-operative service provision	**7** Community partnerships are strengthened through program delivery
	8 Services are retained in the region, and offered in local centres
Support community cohesion	**9** Capacity and capability of community groups is strengthened
	10 Mental health services are available and are accessible
Embed environmental stewardship and sustainable agricultural practices	**11** Environmental degradation of landscapes and waterways is reduced throughout and emerging from drought
	12 Increase in activities relating to environmental restoration

Learning

Regular (annual) monitoring provides the ability for reflection and learning. The progress tracking and reporting methodology, using key evaluation questions, will present specific insights in terms of those opportunities to build in 'lessons learned' through engagement across stakeholders with a role in drought resilience. These lessons should, on an annual basis, be contemplated with regard to the drought action plan to determine any relevant updates, new insights, intelligence and technologies that can be integrated to ensure the action plan keeps pace with a growing drought resilience maturation across systems and sectors.

This process will ensure the action plan remains a 'live document' that appropriately supports and services the needs of all stakeholders and importantly, those of the Western Riverina communities in preparation for, endurance of, and recovery from drought.

Concepts to guide adaptive learning as part of plan implementation are included at Appendix B. These items will help navigate maturation of this plan over time.

Appexdix A — Drought history

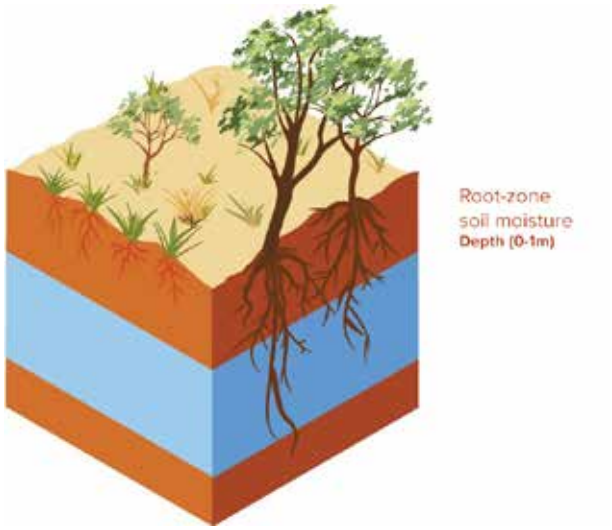
Precipitation and root zone soil moisture are considered as indicators of drought according to the Bureau of Meteorology's Australian Water Resources Assessment Landscape (AWRA-L) service. Root zone soil moisture is a calculation of the upper and lower soil layers in the AWRA-L, which represents the water-holding capacity of the top one metre of soil. Root zone soil moisture and precipitation rates are each useful indicators of future drought potential.

Locally, some of the most impactful periods of drought include the late 1910s, the World War II drought, 1967, 1982 to 1983, 2006 and and the 2017-2019 drought.

Some of the continent's most impactful droughts in recent recorded history have affected the region. Here, we consider the significant drought periods identified by the Bureau of Meteorology:

- 1914 to 1915
- 1937 to 1945 (World War II drought)
- 1965 to 1968
- 1982 to 1983
- 1997 to 2009 (Millennium drought)
- 2017 to 2019

Below, we consider these droughts and the changes in conditions against a present-day baseline of 2002 to 2022*.



(Source BoM, 2024)

Image: Irrigation channel Leeton Shire (David Single)

1914-1915

Nationally, this drought was short but notable, primarily due to the failure of national wheat crop. This drought was driven by a strong El Nino, with drought conditions first becoming evident in 1914. Rains improved in 1916 but began to decrease again over the subsequent years (1918 and 1919).

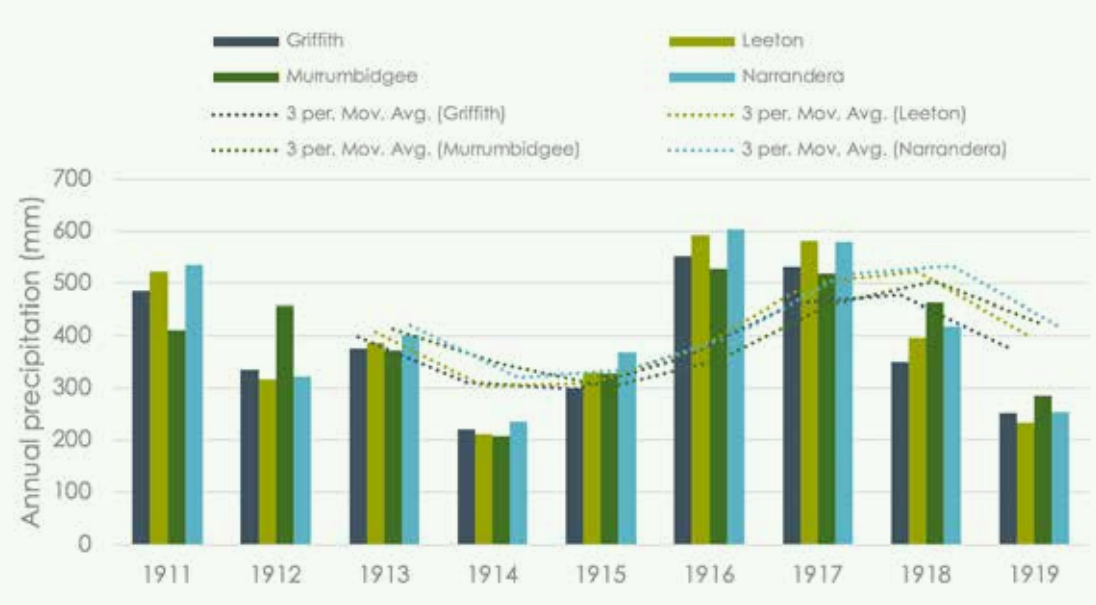
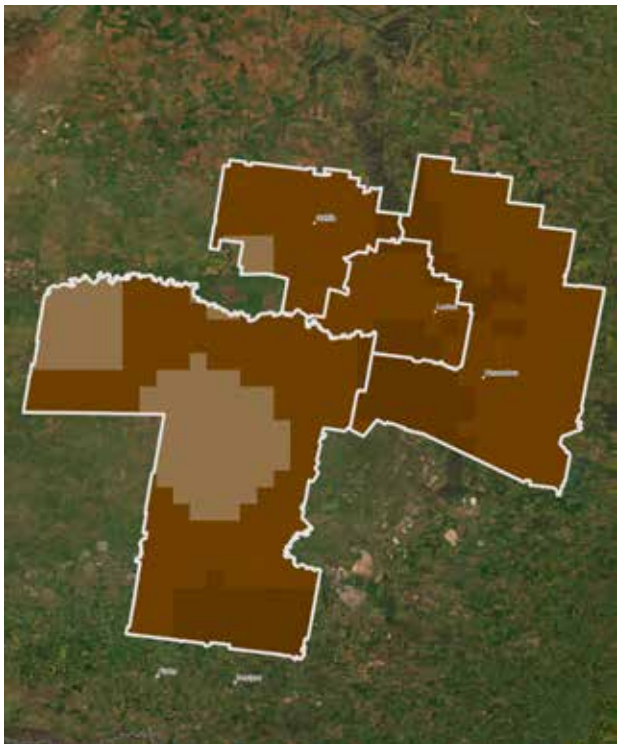


Figure 17 — Yearly precipitation (absolute), by LGA (1910 to 1918)

Precipitation (mm)



Precipitation, change during drought period (mm)

Soil moisture (mm/yr)

Historical change, root zone soil moisture (mm/year)

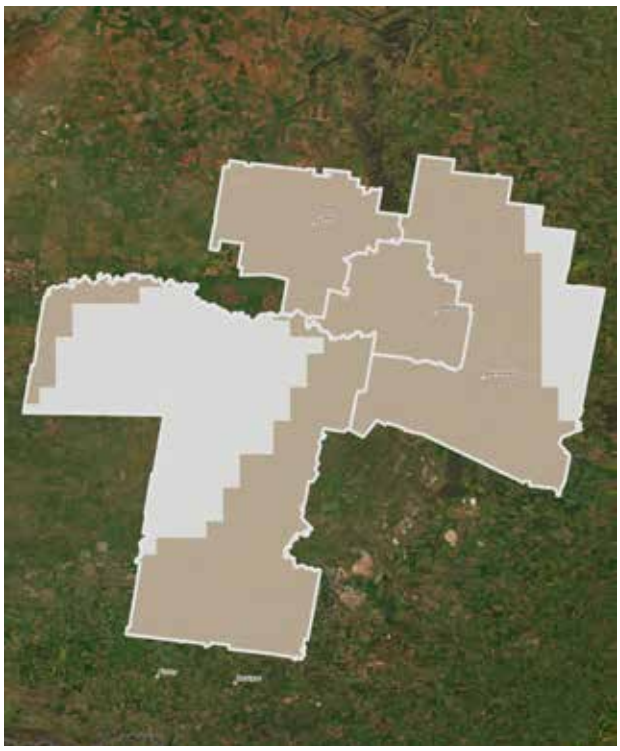
Figure 18 — Changes in conditions during drought against a present-day baseline of 2002 to 2022

1937 to 1945 (World War II drought)

This drought period was characterised by several breaks (1939 and 1942-1943), but significant periods of dryness. Rainfall rates were lower in 1937-1938 and 1940-1941. For the Western Riverina, 1940 was the most notable year, with extremely low rainfall totals across the entire region.

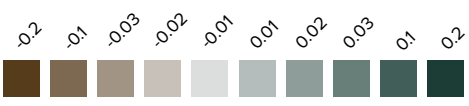
Figure 19 — Yearly precipitation (absolute), by LGA (1934 to 1948)

Precipitation (mm)



Precipitation, change during drought period (mm)

Soil moisture (mm/yr)



Historical change, root zone soil moisture (mm/year)

Figure 20 — Changes in conditions during drought against a present-day baseline of 2002 to 2022

1965 to 1968

The 1960s was generally dry across the continent. Drought developed in 1964 in northern New South Wales and had extended across most of the country by the following year. This was evident across the region, with lower rates of rainfall and soil moisture across much of the region. 1967 was the most severe year, with annual rainfall rates across each LGA below 200 mm.

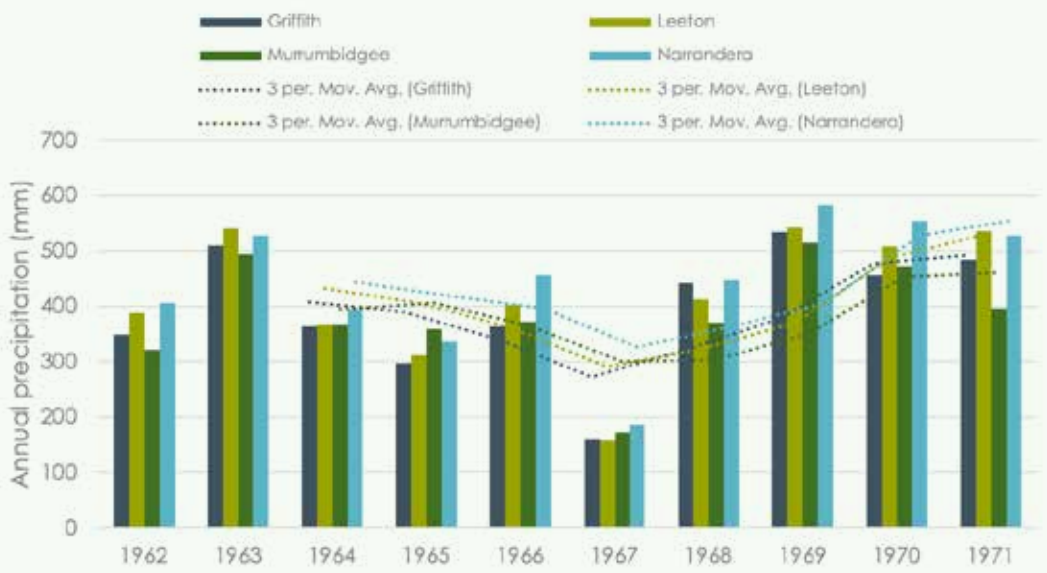


Figure 21: Yearly precipitation (absolute), by LGA (1962 to 1971)

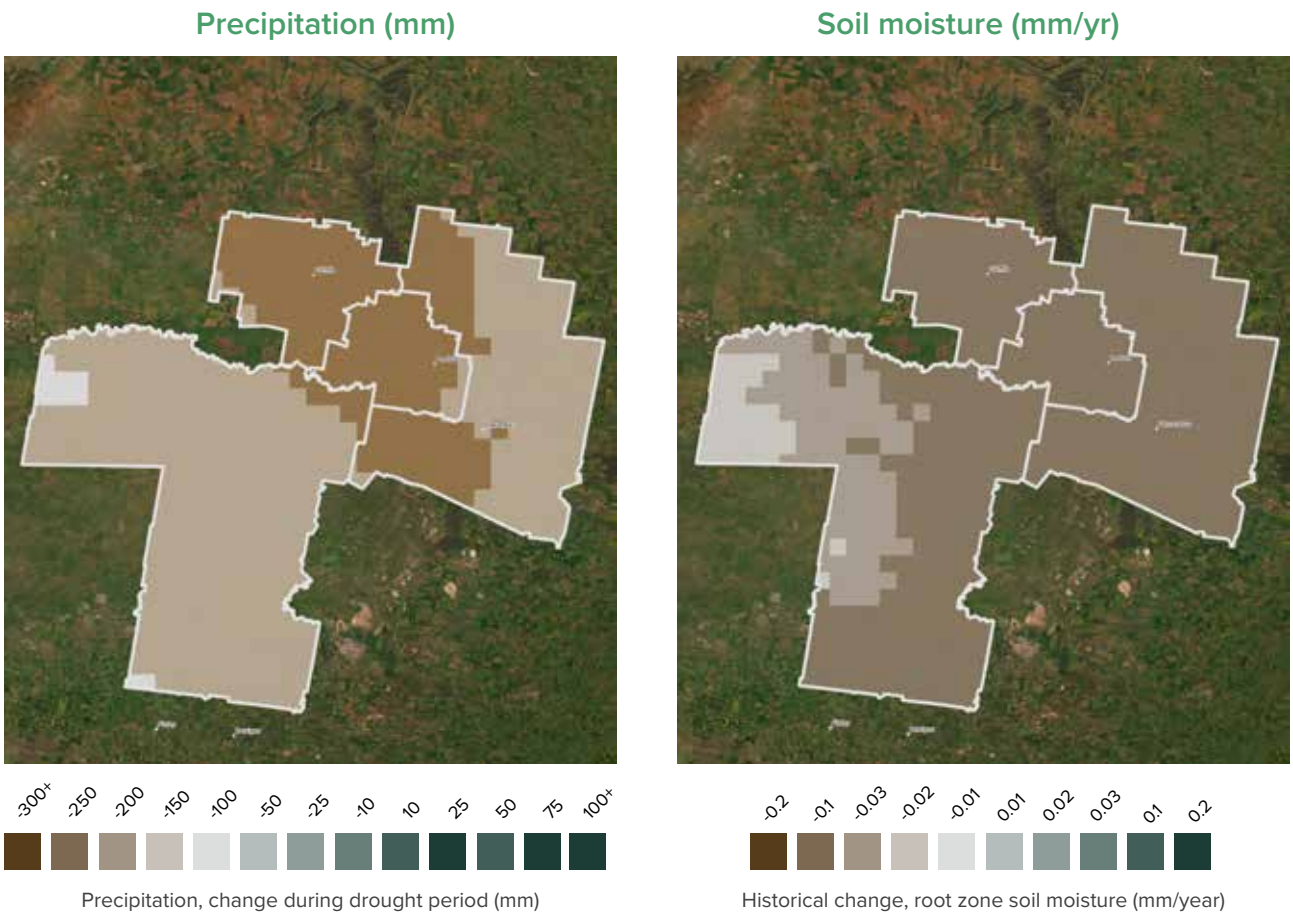


Figure 22: Changes in conditions during drought against a present-day baseline of 2002 to 2022

1982-1983

Despite being only one year long this was one of Australia's most severe droughts in the 20th century. A very strong El Nino led to these drought conditions. The region experienced widespread dryness.

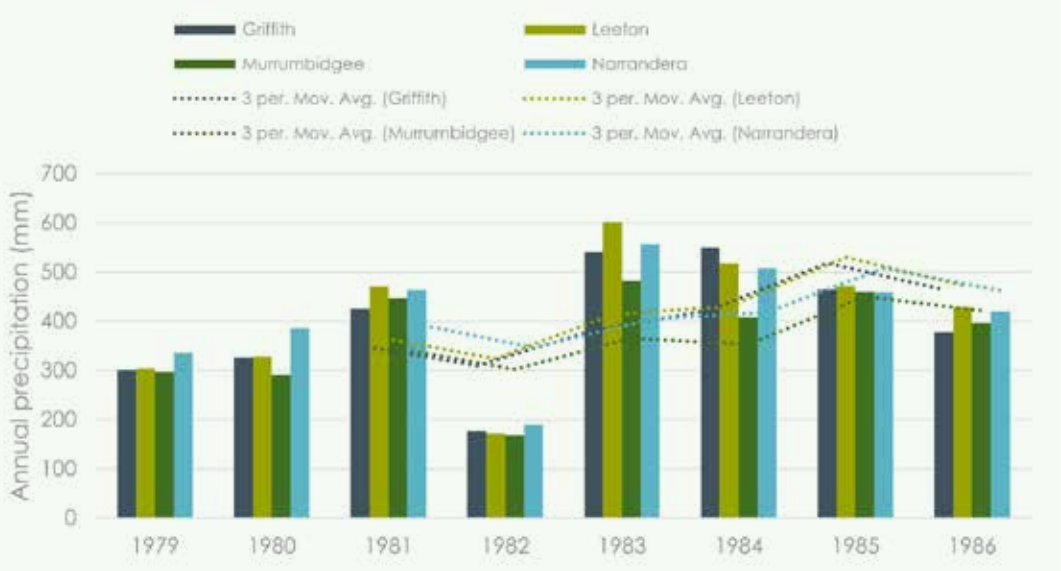
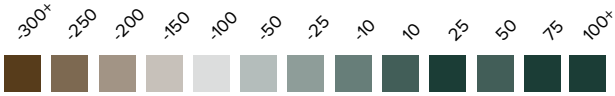


Figure 23: Yearly precipitation (absolute), by LGA (1979 to 1986)

Precipitation (mm)



Precipitation, change during drought period (mm)

Soil moisture (mm/yr)

Historical change, root zone soil moisture (mm/year)

Figure 24 — Changes in conditions during drought against a present-day baseline of 2002 to 2022

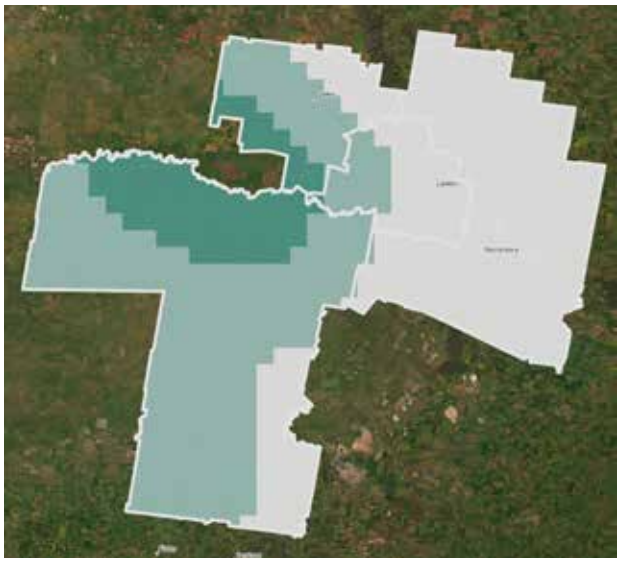
1997 – 2009 (Millennium drought)

The Millennium drought was a long-lasting period of dryness, most severe in densely populated areas of the south-east and south-west of the country. For the Western Riverina region, the beginning of this period was relatively unimpactful, as from lower levels in 1997, based on rainfall and soil moisture figures. It is not until 2001 when there is a dry spell into 2005, and then a severe dry year in 2006.

Editor's note: The maps below show significant rainfall and higher soil moisture over this period, despite it being identified as a drought. This discrepancy is likely due to the reference period used to produce these maps (2002 – 2022) and that there was significant dryness in the latter half of that period. This result is then compounded by the short-lasting periods of rainfall decline during this long drought period (1997 – 2009). Therefore, leading to the appearance of increased rainfall and soil moisture compared to the reference period.

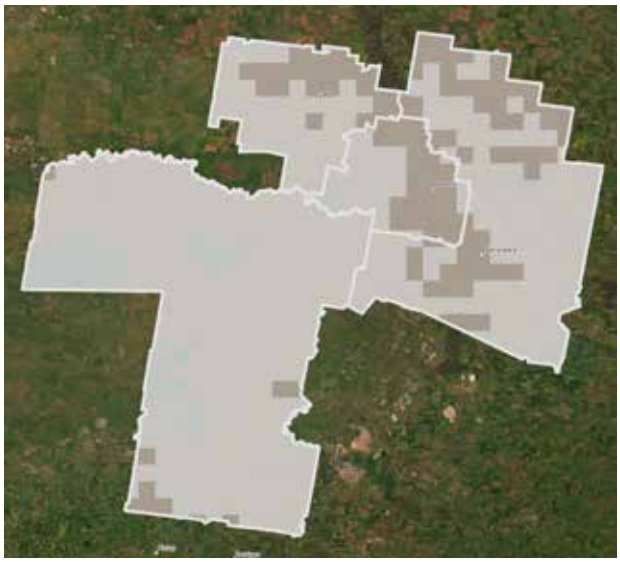
Figure 25: Yearly precipitation (absolute), by LGA (1994 to 2012)

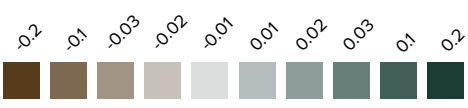
Precipitation (mm)



Precipitation, change during drought period (mm)

Soil moisture (mm/yr)





Historical change, root zone soil moisture (mm/year)

Figure 26: Changes in conditions during drought against a present-day baseline of 2002 to 2022

2017-2019

Following a wet 2016, dry conditions returned in 2017 across south and eastern Australia. This was a sustained multi-year period of dryness, unprecedented in recorded history. A strong Indian Ocean Dipole was a significant contributor to dry conditions the second half of 2019, leading into significant 2019/2020 bushfire season. The region was similar affected during this period, with widespread low rainfall and low soil moisture.

Figure 27 — Yearly precipitation (absolute), by LGA (2014 to 2022)

Precipitation (mm)

Soil moisture (mm/yr)

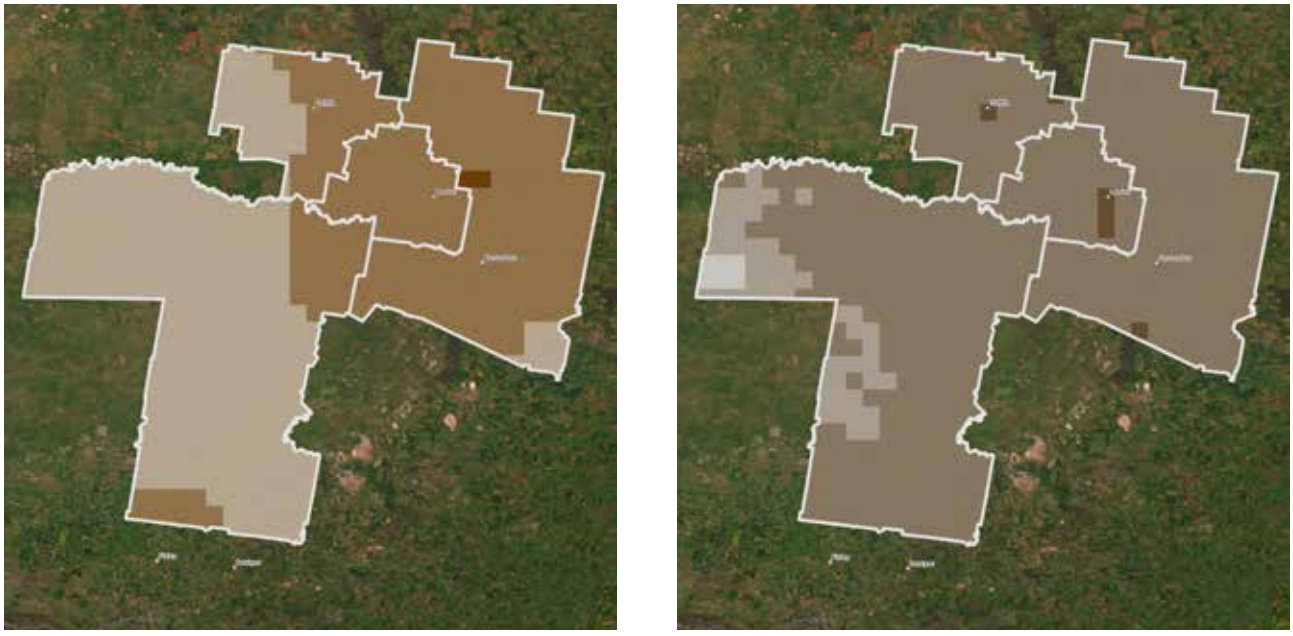


Figure 28 — Changes in conditions during drought against a present-day baseline of 2002 to 2022

Appendix B – Concepts to guide adaptive learning

As part of learning processes through the implementation, this appendix provides key considerations to guide further iterations and amendments to this RDRP.As drought resilience processes mature, the ability for further robust adaptation pathways to be implemented will emerge.

The table below captures specific items identified for integration as part of future plan iterations.

NO.	ASPECT OF CONSIDERATION
	Expansion of drought resilience relative to diverse stakeholder groups
1	Expand on what drought means to different segments of the region's community and industries, and adaptation pathways to 'maintain, modify or transform' to grow drought resilience. As implementation of this foundational RDRP occurs, and monitoring, evaluation and learning processes are undertaken, opportunity will arise to advance the concepts of resilience theory, and make more clear how the adaptation pathways are continuously improving and escalating to underpin drought resilience maturation.
2	Continue to engage with diverse community and industry groups to advance implementation of the plan. Future plan updates could capitalise on the community's desire to be engaged and involved in the plan's delivery by acknowledging the role that key knowledge holders could play. Stakeholder engagement could be expanded to include direct participation of different drought vulnerable groups including gauging their capacity to participate and how best to engage with them moving forward. This information could be used to better target vulnerable residents and ensure adequate supports are in place to involve different community segments.
	Expansion of resilience adaptation pathways
3	Use diverse quantitative and empirical evidence on the potential impact of the interaction of historical and projected drought with key economic and social variables over time, such as demographic changes, shifts in the diversity of businesses, and livelihoods and employment opportunities for different community segments, in emergent versus declining types of industries, and in labour mobility among different industry and sectors.
4	Further develop the theory of change to aligns the plan's objectives and actions towards reaching its intended outcomes, including the degree to which the proposed actions contribute to adaptation and transformation.
5	Expand on the interrelationships between economic, social and environmental factors across existing and updated documents, plans and strategies, and describe how these relationships influence potential cascading impacts of drought.

NO.	ASPECT OF CONSIDERATION
	Expansion of resilience adaptation pathways (cont)
6	Future plan updates could profile drought impacts for those non-agricultural sectors identified as key sectors in the community, such as mining, renewable energy, health care and social assistance and tourism sectors. Such a profile could include an exploration of how these sectors can build resilience or drive transformation through learning, preparedness and planning.
7	Future plan updates could develop a suite of plausible future scenarios through a participatory process and based on climate, drought and other drivers of change. The development of future scenarios could consider how trends, shocks or stresses (including drought) will interact with and likely affect the region's economic, social and environmental characteristics, and the implications for diverse stakeholder groups. This exercise will also assist these stakeholders to explore and identify actions and pathways that assist with building resilience under different plausible future scenarios.
	Resilience action planning
8	Establish resilience indicators for each of the plan's 'priority areas', using baseline observations drawn from the MEL process within the initial years of plan implementation.
9	Future updates could provide more information to substantiate the assumed mechanisms by which its actions can be achieved, and to what extent they align with the broader objectives and outcomes of the plan.
	Implementation
10	As implementation advances, expand the implementation content of the plan with respect to its governance arrangements and the function / operation of the PCG.
11	As partnership arrangements and relationships are built through this foundational plan, more information could be built on the main purpose of each collaboration setting clear intent and requirements, alongside specific measures. This can provide greater structure to partnerships, which may be a focus under each pathway. The types of partnerships and activities sought may influence these reporting arrangements. Review of partnership may be ongoing to ensure appropriate representation of groups, including First Nations communities and non-farming populations.
12	Future plan updates could provide more explicit descriptions of what external support is required for successful implementation.
13	Future updates to the plan may provide further detail on the sequencing of actions, as these are prioritised and refined and as funding becomes clearer.

NO.	ASPECT OF CONSIDERATION
	Monitoring, evaluation and learning framework
14	Further develop structured approaches to capturing lessons from performance measures, linked with monitoring in addition to lessons from annual evaluations currently identified in the MEL. Integrate lessons learned from the plan's existing evaluation questions back into the plan's actions. Continue to enhance and mature the plan's MEL processes over time as the plan transitions from foundational into a performance posture.
15	Further develop performance indicators tied to actions in the plan's MEL plan. This will improve accountability by showing the degree to which proposed priorities and actions contribute to the plan's articulated vision and outcomes. This could include using quantitative and empirical evidence for key economic and social variables over time. This could include evidence that helps to track demographic shifts, changes in the diversity of businesses, livelihoods and employment opportunities for different community segments in emergent versus declining types of industries. It could further include evidence of labour mobility among different industry and sectors in order to assess actions focused on economic diversification.
	Resilience assessment
16	Ensure future iterations of the plan are qualified by a review of the Resilience Assessment components to identify key circumstantial changes which have occurred.
17	Continue to build upon and refine the program logic approach embedded within the Resilience Assessment that supported the development of the current plan, into a well-developed theory of change that provides a detailed and explicit causal mechanisms and valid assumptions by which the plan, through its implementation, will deliver the desired outcomes and impact.

Griffith city council ...love the lifestyle...

LEETON SHIRE COUNCIL

Narrandera SHIRE COUNCIL

Murrumbidgee COUNCIL