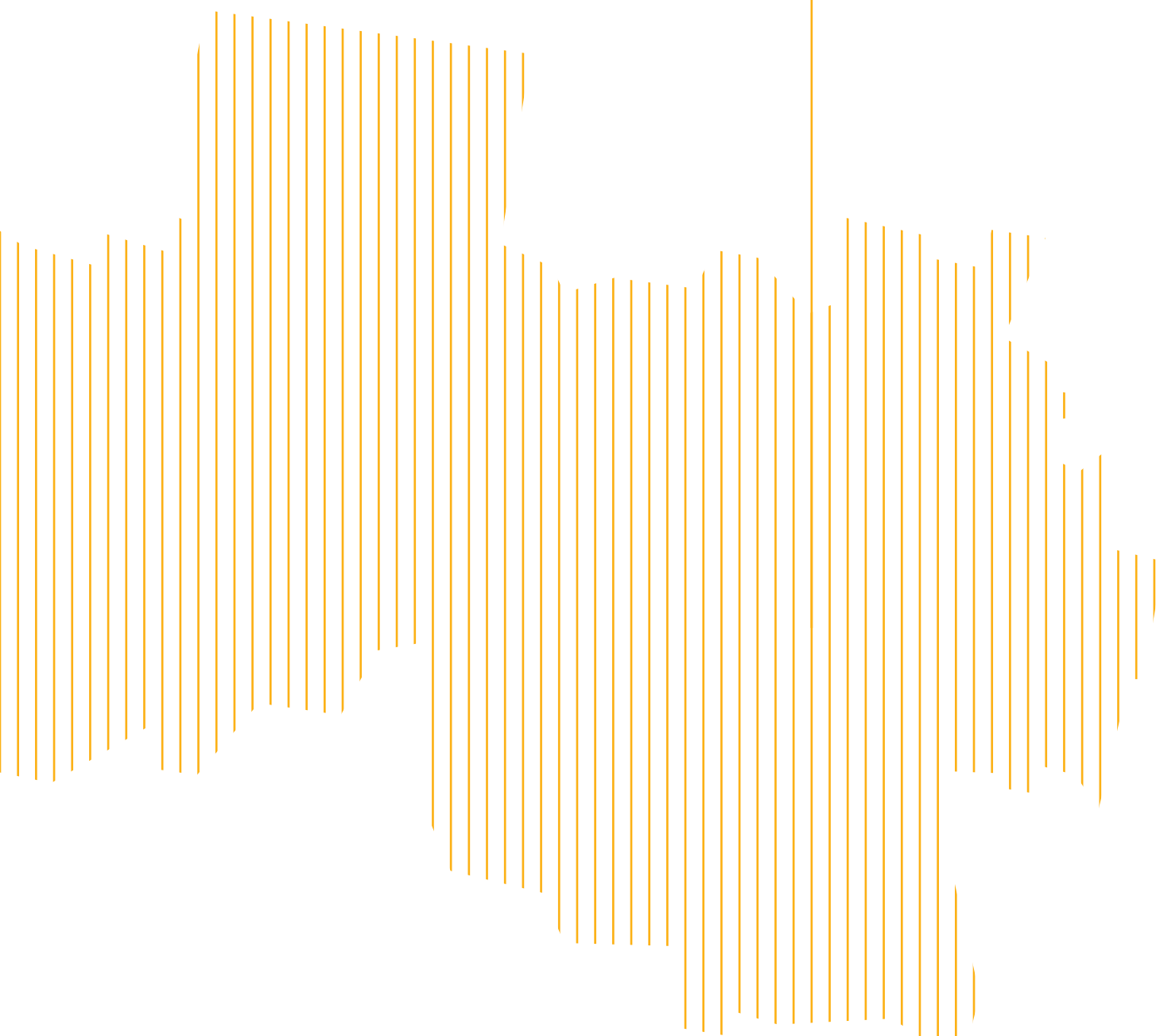


# **CENTRAL HIGHLANDS** DROUGHT RESILIENCE PLAN



## Acknowledgement of Country

We Acknowledge the Wadawurrung People, Dja Dja Wurrung, Wurundjeri Woi Wurrung, Wotjobaluk and Eastern Maar Peoples as the Traditional Owners of the land, water, and sky. We pay our respects to their Elders of the Past, Present and those Emerging. We Acknowledge the Wadawurrung People and the connection they share with our Lands and Waters and pay our respects to all First Nation Peoples.

We acknowledge that Aboriginal self-determination is a human right enshrined in the United Nations Declaration on the Rights of Indigenous Peoples, and we are committed to working towards social, economic, and cultural equity for Aboriginal Victorians.

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## Preface

Drought causes significant financial, social and environmental impact on people, communities and the region. Communities in the Central Highlands region are committed to taking steps now to ensure well considered strategies are in place to prepare for and manage through future dry periods.

The Central Highlands Drought Resilience Plan (the Plan) is one of nine regional drought plans developed in Victoria under the Regional Drought Resilience Planning (RDRP) Program, which forms part of Future Drought Fund. The RDRP Program is supporting the development of regional drought resilience plans throughout Australia over the years 2021 to 2025.

The \$5 billion Future Drought Fund invests in a wide range of drought resilience initiatives to help Australian farms and communities prepare for the impacts of drought. These are implemented through a suite of programs under four focus areas:

- Better climate information
- Better planning
- Better practices
- Better prepared communities

The RDRP program is included under 'better planning'. Regional drought resilience includes elements that cover all focal areas. The Central Highlands Drought Resilience Plan therefore bridges all Future Drought Fund categories and identifies actions the community proposed to build drought resilience.

This Plan aims to empower and enable communities to collectively identify and address their needs to be better prepared for and able to manage future dry seasonal conditions and droughts. The Plan informs future investments and actions towards regional drought resilience through clearly identified actions, grouped into themes, that are supported by the regional community to achieve the overall outcome.

This Plan is founded on historic and recent experiences of drought within the region as well as relevant existing regional strategies, programs and activities that aim to manage, mitigate or adapt to a drier climate. Nine regional Plans have been developed for Victoria. All nine Plans were developed using a consistent methodology across Victoria:

- **Drought impact analysis** to understand the prevalence, severity and frequency of past, present and future drought impacts
- **Stakeholder engagement** to identify and collate issues and develop actions to build drought resilience.







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# Collaboration

The Plan is the culmination of a co-design process led by the Central Highlands Regional Reference Group with wider community engagement sought through stakeholder interviews and the open online platform, Engage Victoria. Members of the Regional Reference Group and other stakeholders were drawn from a broad range of

organisations and sectors within the region that have responsibilities for, or interests in agriculture, water, liveability, regional and local communities, and regional development. Consultation with a broad range of regional stakeholders was critical to the development and aggregation of themes and actions that will achieve the overall vision for the region.

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## Organisational members of the Reference Group:

Agriculture Victoria	Federation University Australia
Artisan Producers in Hepburn Shire	Golden Plains Shire Council
Australian Red Cross Society	Hepburn Shire Council
Central Highland Water	Moorabool Shire Council
Central Highlands Regional Partnership	North Central CMA
City of Ballarat	Pyrenees Grape Growers and Winemakers Association
Commerce Ballarat	Pyrenees Shire Council
Committee for Ballarat	Regional Development Victoria (RDV)
Corangamite Catchment Management Authority (CMA)	Rural City of Ararat
Department of Energy, Environment and Climate Action (DEECA)	Rural Financial Counselling Service
Dept Families, Fairness and Housing (DFFH)	Victorian Farmers Federation (VFF)
Dja Dja Wurrung Clans Aboriginal Corporation (Djaara)	Victorian Fisheries Authority (VFA)
	Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC)

Development of the Plan was facilitated by Agriculture Victoria and jointly funded by the Victorian and Commonwealth Government under the Future Drought Fund.



## Summary

The long-term objectives of the Plan are to build regional, community and individual resilience to drought through recognising risks, mitigating risks, strengthening preparedness, and recognising opportunities for change that will improve the economic, environmental and social opportunities in the Central Highlands region.

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A list of actions was developed and agreed by the Reference Group for the Central Highlands Plan. The actions were grouped in themes and contribute to specific outcomes that together build regional drought resilience.

The key themes that emerged through the Plan's development process are:

- Collaboration, coordination, networking
- People and communities
- Farm enterprises
- Industry, businesses, and agencies
- Infrastructure
- Landscapes
- Education and learning

The set of outcomes for building regional drought resilience cover the broad areas of people, environment and economic development. Achieving these outcomes through the underlying action lists will make the Central Highlands stronger through preparation, response and recovery of drought impacts. The outcomes in this Plan are:

- Sectors, institutions and individuals working together in a holistic, whole picture, approach to maximise the regional, community and individual resilience to climate shocks.
- Communities and people in the Central Highlands have social resilience to drought events. Communities remain vibrant and have the ability to bounce back from droughts. Individuals maintain physical and mental wellbeing and have access to formal and informal support systems.

- Farms and other agriculture related businesses are financially sound and contribute to a strong economy that is well prepared for and more resilient to the effects of future droughts. Jobs on farms and in the agricultural sector are attractive, accessible and reliable, especially to youth. The agricultural sector is productive and integrated in the regional landscape.
- Industry, business and agencies are prepared for the impact of drought on people, the environment and the economy. Preparedness supports resilience within industry, businesses and agencies by ensuring contingency plans are in place and resources are available.
- Central Highlands has an infrastructure network that supports water access reliability and security, a (renewable) energy infrastructure that is distributed and supports peak demand in droughts, and a digital network that allows remote access to services and peer-support to increase drought resilience.
- A landscape that is diverse, healthy and resilient and adaptive to drought. An environment that supports nature, people, communities and industry through climate shocks.
- A community that is aware of the impacts of drought, has the knowledge to prepare, respond and recover from drought, and has the ability to build stronger resilience to droughts.





# INTRODUCTION

Drought is a recurring feature in the Australian landscape, and has been for thousands of years. However, the impacts of climate change are increasing the frequency and severity of drought. The Australian and Victorian Governments have partnered to support regional areas to ensure they are better prepared to manage and build resilience to future droughts, with an increasing focus on adaption and change. The Commonwealth Drought Response, Resilience and Preparedness Program's vision is to have farm businesses and rural communities that are prepared for, and capable of managing, drought in pursuit of a prosperous and sustainable future.

This Central Highlands Drought Resilience Plan (the Plan) seeks to facilitate a cohesive and coordinated approach to building community drought resilience. The Plan includes a collectively agreed approach that aims to build:

- economic resilience for an innovative and profitable agricultural sector
- environmental resilience for sustainable and improved functioning of landscapes
- social resilience for resourceful and adaptable communities

Given the amount of existing work related to drought and water management in the region, one of the main objectives of the Plan is to align, strengthen and coordinate existing drought-related strategies, plans, actions and aspirations to increase overall drought resilience in the region.

The Plan was developed through engagement with regional organisational stakeholders and local community groups. The Plan aligns with Victorian and Commonwealth government principles and approaches to drought preparedness and response. The Plan supports communities of the





Photo: Central Highlands Water

Central Highlands region to be better prepared and be more responsive to future drought events. Regional Drought Resilience Plans leverage regional strengths and address vulnerabilities in the region's ability to prosper during dry seasons and droughts.

Agriculture Victoria coordinated the development of the Plan, with extensive guidance by a Reference Group consisting of Traditional Owners and representatives from community organisations, industry and government. The Reference Group members and their affiliated organisations guided drought resilience thinking and ensured that the Plan can respond to change through adaptive planning and community engagement processes. The Reference Group held workshop-style meetings to guide the plan content and develop actions. The Group also provided access to local reports, regional priorities, organisational strategies and

ensured coordination of place-based strategies. Other regional stakeholders were also consulted to inform development of the Plan and the action framework of this Plan was shared on the Engage Victoria digital platform for feedback from the broader community.

A strong focus of the Plan is agriculture and allied industries; however, the initial workshop highlighted that there is a strong interconnection in Central Highlands between urban, peri-urban and rural communities. Consequently, this Plan considers the broad need for the regional community, environment and economy to be resilient to drought.



## Regional Vision

Central Highlands communities are prepared to manage and mitigate detrimental impacts of future droughts on the regional economy, communities, and environment.

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## Mission

Central Highlands communities have the skills and resources to manage and mitigate the impacts of drought within this region by actively supporting local and regional agreed actions to absorb extreme weather events and gradual climatic changes, adaptation, modification, transition, transformation.



Photo: David Marland

## Regional principles and drivers of change

The Central Highlands Plan to build drought resilience is based on a set of guiding principles. The principles guide the actions for the Central Highlands and include:

- Self-reliance and risk mitigation: drought is not an exceptional circumstance, but a risk to be managed along with other business threats. Primary producers and other small businesses mitigate the impacts of drought by understanding and reducing risk and impacts.
- Encourage preparedness: investment should focus on encouraging preparedness in good years and support community connectedness and wellbeing in times of drought.
- Collaboration and co-design: drought preparedness programs should be co-designed with Local Government Authorities and other relevant stakeholders to ensure they effectively address local community priorities.
- Improved decision-making: business skills and improved access to timely drought-related information is essential to support evidence-based decision-making for businesses and communities.
- Integration: Foster collaboration between organisations to deliver timely, place-based, integrated services which simplifies processes for, and access by, users and reduces stress.
- Leadership and community networks: Central Highlands has a strong record of collaboration and community leadership. Drought programs should be designed and delivered in partnership with established networks and Traditional Owners/First Peoples.
- Traditional Owner Self-Determination: Work with Traditional Owners to provide opportunities for them to be involved in, and have their self-determined goals reflected in, implementation of drought preparedness and resilience activities.

The Central Highlands is a region in constant flux and development. Drivers of change identified for the region include:

- Next generation of farmers have higher education levels and greater environmental awareness
- Big farms are getting larger in dryland areas, as well in irrigated areas around Daylesford, Ballarat and Waubra
- A change towards more corporate farms
- Emergence of new industries, such as solar and wind farms
- Increased needs for off-farm income and increased opportunity and requirement for diversification on farm
- Vertical integration with direct-to-consumer communication and marketing as alternative supply chains
- More lifestyle and hobby farms with an influx of new population
- Expansion of the major urban centres





# A SNAPSHOT OF THE CENTRAL HIGHLANDS

For the purpose of this Plan, the Central Highlands region of Victoria is defined by the six Local Government Authorities (LGAs) that constitute Central Highlands Regional Partnership. The LGAs are: Rural City of Ararat, Pyrenees Shire Council, City of Ballarat, Golden Plains Shire Council, Hepburn Shire Council and Moorabool Shire Council.

The region overlays an intersection of several traditional lands and distinct environments that is reflected in the areas managed by four Catchment Management Authorities (CMAs), four water authorities that are in the region and recognised Traditional Owners.

## Environment

Most land use in the region is agricultural, however, there are a sizeable number of parks, forests and natural reserves, some of which are jointly managed by Traditional Owners and the State Government. Parks that are widely recognised are: Grampians (Gariwerd) National Park (part thereof), Langi-Ghiran State Park, Ararat Hills Regional Park, Enfield State Park, Brisbane Ranges National Park, Wombat State Forest, Mount Buangor State Park and Lerderderg State Park. The parks are a haven for biodiversity and serve as a recreational and cultural asset to the regional community and visitors.

The northern part of the region is within the Murray-Darling Basin; below the Great Dividing Range there are several river catchments that drain to Victoria's coast. Parts of the Avoca, Barwon, Campaspe, Glenelg, Hopkins, Loddon, Maribyrnong, Moorabool, Werribee and Wimmera-Avon river catchments, and the Lake Corangamite catchment are within the region. There are

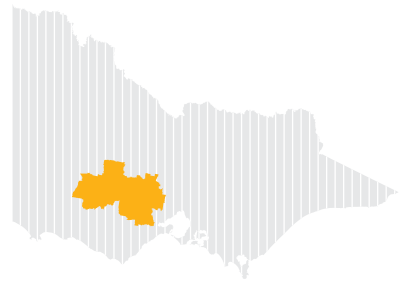
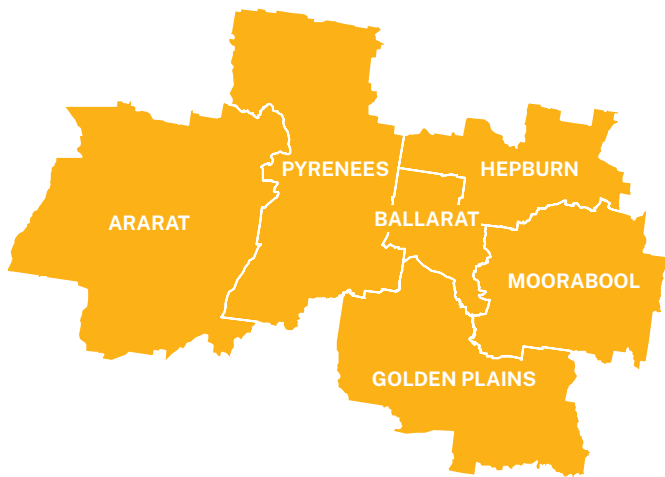
numerous wetlands and wetland complexes throughout the region that support the natural environment. Several larger lakes are important recreational and tourism assets, including Lake Wendouree, Lake Learmonth, Lake Beaufort, Lake Burrumbeet and Lake Calembeen. As with land management, Traditional Owners play a significant role in managing water and catchments in the region under the Water for Victoria Plan; a plan containing 69 actions for better water management in the State.

## Climate trends

Central Highlands has a relatively reliable high rainfall and cool summers compared with much of western Victoria. Climate modelling indicates that the region is likely to experience changes, with conditions anticipated to include:

- increased maximum and minimum temperatures
- more days over 35°C (from around 5 days up to 9–17 days each year)
- harsher fire weather and longer fire seasons
- less days with temperatures under 0°C (from 9–20 days down to 2–11 days each year)
- continued variability of rainfall with an overall decline in winter and spring of 24%–31%
- greater intensity of extreme rainfall events

These climate scenarios will have implications for agriculture in the region. However, overall, the agricultural sector in Central Highlands appears to be resilient, with a biophysical environment that will enable the sector to adapt through practical and attainable actions, and possibly take advantage of new opportunities.



POPULATION  
(2020)

POPULATION GROWTH  
(2011–20)

GROSS REGIONAL PRODUCT  
(2020)

\$10.2  
billion

18.1%

207,300

Source: Central Highlands Regional  
Economic Development Strategy (2022)



## Communities

The region covers the traditional lands of the Eastern Maar, Wadawurrung, Dja Dja Wurrung and Wurundjeri Peoples and the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagulk Nations, as well as other Traditional Owner groups in Victoria who are yet to receive formal recognition. The Traditional Owners have lived, worked, and cared for their Country and its resources for many thousands of years. Today, Traditional Owners, with the whole community, care for Country through plans such as Paleert Tjaara Dja “Healthy Country Plan” by Wadawurrung Traditional Owners Aboriginal Corporation, “Dhelkunya Dja (Healing Country) Country Plan” by Dja Dja Wurrung Clans Aboriginal Corporation and the “Country Plan: Growing what is Good” by the Wotjobaluk Nations.

The region is experiencing high rates of population growth particularly in the peri-urban areas and in the townships with closer proximity to Melbourne. Population growth is resulting in an increased urban footprint in the region as agricultural areas are re-classified as urban growth areas. Regional population is projected to grow by over 25% in 15 years mainly in the City of Ballarat, Moorabool Shire and Golden Plains Shire.

Major population centres in the region are the regional cities of Ballarat and Ararat and the townships of Bacchus Marsh, Ballan, Bannockburn, Daylesford and Beaufort, Avoca and Creswick.

Demand for water in these population centres and rural communities is being managed through regional and local water management plans and strategies.

These growing communities access a diversity of water sources depending on location and local infrastructure. These include dams managed by water authorities, storm water, ground water, private dams and the Murray-Darling Basin.

Groundwater is used directly by farmers, other industries or as a water supply redundancy option for some rural communities. The groundwater in the region is generally highly saline and therefore has limited usability on crops and in domestic supply. However, potato growing regions between Waubra and Ballan have access to low salinity groundwater.

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## Industry and employment trends

Movement of people into the region's urban centres align to the region's main industries for employment and economic activity: healthcare, retail, construction, education/training, and manufacturing. These diverse industries are supported by the regional workforce having higher levels of education than most regional areas of Victoria and local access to four universities.

In addition to the region's growing urban economic diversity, it remains a major food producer for Victoria with a broad range of agricultural commodities, farm sizes, farm types and farming communities. Major agricultural commodities of note include chicken meat, sheep meat, grains and eggs. Other commodities in the region are beef production, horticulture and dairy. The region is recognised as a grape, wine and beverage producing area and is known for niche produce

such as organic meats and vegetables, goat meat and cheeses and various herbs. Production of these high-value commodities also encourages visitation to the region through agri-tourism.

The majority of the area in the Central Highlands is classified as grazing and dryland cropping. The region contains several nature conservation areas. Small areas of irrigated pastures, horticulture and cropping are identified in the Pyrenees (Waubra), Ballarat (Tourello, Ascot, Blowhard), Hepburn and Moorabool (Millbrook, Bungaree, Wallace, Gordon) LGAs.

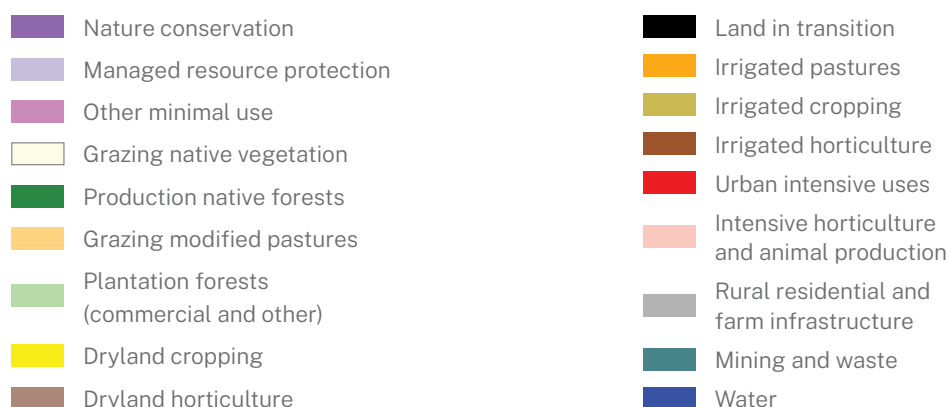
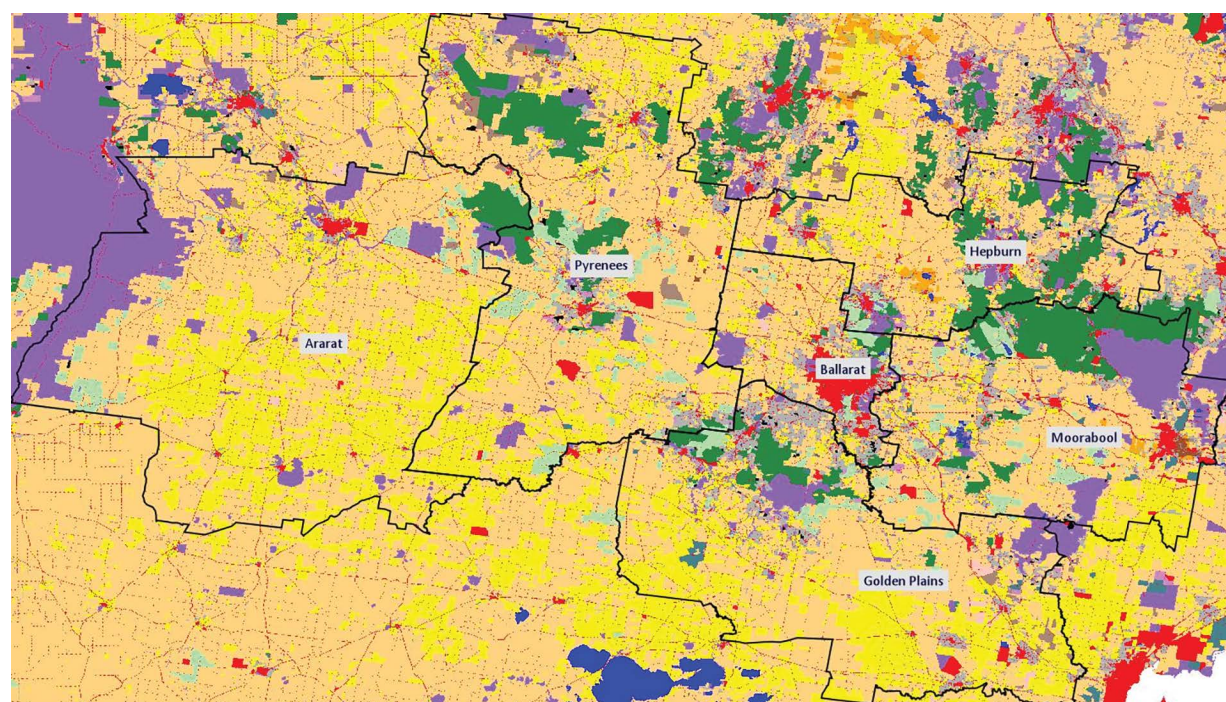
Most of the broadacre farms in the region are dryland, however irrigation is an important resource for potato production north of Ballarat and horticultural crop production around Bacchus Marsh for commodities such as turf, salad vegetables and pome fruits (apples, pears, etc.).

Water is also used on farm for livestock and agricultural activities such as crop protection, and as a product in itself with the mineral waters in Hepburn Shire and Bungaree bottled or used in the local visitor economy.

Overall, the agricultural sector in the region makes a significant direct economic contribution through production (Gross Value Production: \$1.4 billion in 2020/21) and accounts for about 4.5% of the region's employment with the western municipalities continuing to be more dependent on agriculture than the eastern municipalities.

In addition to on-farm production, the Central Highlands is home to some well recognised food processors, agricultural equipment manufacturers, abattoirs, meat processors and an agri-tourism industry. Exports of agricultural produce (including forestry and fishing) along with food product manufacturing was valued at \$695.9 million in 2020. Development of these types of industries is supported by State and Local Governments allocating land for new industrial developments, for instance Ballarat West Employment Zone (BWEZ), the Golden Plains Food Precinct, and the Parwan Employment Precinct (Moorabool Shire).

**Catchment Scale Land Use of the Central Highlands**  
(ABARES 2021)







## Drought impacts in the region

Many definitions of drought exist, generally depending on what indicators are used to describe it. Meteorological drought relates to the lack of rainfall, at least below expected rainfall. Hydrological drought relates to the lack of runoff, measured by river and creek flow volumes, a lack of groundwater availability, and a lack of water storage in catchments. Agricultural drought can be defined by reduced productivity on-farm resulting from a lack of water. Other definitions include institutional drought, where decisions on water allocation have induced a water shortage, economic drought, which is defined by an economic downturn resulting from a lack of water availability. Green droughts exist where limited rainfall shows the appearance of green paddocks, but insufficient water is available for agricultural crop production.

Definitions of drought are important because they help define the issues to be addressed. For this Plan no single definition will be used, since the Plan aims to build regional resilience to drought. Every individual, business, organisation and community will have their own unique drought experience. For example, the impact of drought is felt differently in broadacre cropping than in livestock farming and the health care sector requires a different approach to the educational sector to cope with drought.

Droughts also pose a key threat for Traditional Owners, impacting the health of Country, and affecting their rights and responsibilities in caring for Country. For Traditional Owners and Aboriginal Victorians, caring for Country extends beyond physical landscapes and involves the natural





Photo: Golden Plains Shire Council

waters, animals and resources and how they influence and impact each other. Healing Country in the wake of drought events is essential to ensuring positive health and wellbeing outcomes for Aboriginal Victorians.

It is important to note that duration and intensity of drought have an impact on how resilient a community can be. While on-farm drought management can be effective for a seasonal drought, it may be less effective for a 5-year drought. A meteorological drought with 'only' low rainfall may have less impact than a hydrological drought combined with heatwaves, dust storms and fires.

In the development of this Plan organisations and individuals came together to discuss drought and chart a course for a smarter, more resilient future.

The Plan was not developed to deal with an emergency, or an acute drought. It was developed to assist the Central Highlands community to proactively prepare for drought. The Plan proposes actions that individuals, communities, industry and government can take to be better prepared for future droughts.

A partnership approach will be needed with Traditional Owners to support their self-determined goals and aspirations. This is in line with the Government's policy and legal commitments, including the Victorian Aboriginal Affairs Framework and the Department of Energy, Environment and Climate Action's *Pupangarli Marnmarnepu 'Owning Our Future' 2020–2025* self-determination reform strategy.







## Resilience in the region

For the purpose of this Plan, drought resilience in the Central Highlands is described as communities that can adapt, modify and transform their practices, knowledge and attitude to overcome climatic adversity or the 'new normal' that is a drier climate.

This definition informs intended outcomes and actions with an understanding that resilience to climatic challenges and uncertainties is an opportunity to strengthen communities rather than just being able to maintain systems, processes and culture.

There is no one-size-fits-all route to becoming a resilient community. However, certain community characteristics are known to contribute to resilience. These characteristics have been used to build the suite of outcomes and actions documented in the Plan.

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### Resilient regions have:

- common vision and goals
  - cooperative and interconnected leadership and governance
  - strong connections and relationships through formal and informal networks
  - genuine collaboration
- 

### Resilient communities have:

- local leadership and initiative
- governance that embraces change
- willingness to work together in the pursuit of common goals
- drive for self-responsibility
- a willingness to be adaptable and learn lessons from change
- the skills needed to anticipate issues and effectively manage risk
- foresight to consider different perspectives and options to solve complex problems



Photo: David Marland



# THEMES, OUTCOMES AND ACTIONS FOR A DROUGHT RESILIENT COMMUNITY



The themes and outcomes were designed and agreed by the Reference Group that represented the regional community. Themes are used to provide the broad areas of interest to the regional stakeholders related to building drought resilience. The outcome for each theme reflects the overall goal for a set of actions that have a common purpose, beneficiary or instigator.

The actions listed under each theme should not be seen in isolation. Each action is designed to create a coordinated impact that drives this region towards its overall vision of being prepared to manage and mitigate detrimental impacts of future

droughts. Some actions are the responsibility of an individual agency or organisation, however, most actions will require a collaborative approach by several organisations, businesses and community groups or members.

The outcomes and actions in the Plan draw on the local experiences of people who live in the community as well as the relevant sections of existing plans and strategies that drive the actions and priorities of the organisational members of the Reference Group.

The seven themes for the RDRP in the Central Highlands are:

- Collaboration, coordination, networking
- People and communities
- Farm enterprises
- Industry, businesses, and agencies
- Infrastructure
- Landscapes
- Education and learning







## Theme 1

# COLLABORATION, COORDINATION, NETWORKING



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The Central Highlands is part of the upper catchment, with water running into the Murray Darling basin in the north, and to the coastal regions in the south. The supply, allocation and management of water is an important aspect of the region's drought resilience strengthening. Being in the upper catchment does not necessarily result in sufficient water supply, and water can be imported into the region through the Goldfields Superpipe to augment domestic water for Ballarat. With the many organisations and agencies responsible for water allocation, delivery and

demand management, as well as a broad and diverse number of water users, collaboration, coordination and networking is essential for the region.

Existing forums on water management can be used to prepare for drought event responses, but also to transform towards a more drought resilient region. The same applies to participative development of water strategies in the Central Highlands, where long-term drought resilience building can be included in the discussion and planning.

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### **Outcome:**

Sectors, institutions and individuals working together in a holistic, whole picture, approach to maximise the regional, community and individual resilience to climate shocks.



## Actions

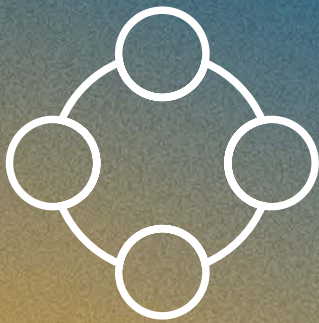
- 1.1 Review relevant regional and urban water strategies and drought response plans and share key information with the region
- 1.2 Communicate and support region-specific actions in the Sustainable Water Strategies
- 1.3 Promote Sustainable Water Strategy actions related to water sharing with the environment and Traditional Owners
- 1.4 Support the Central Highlands Integrated Water Management Forum
- 1.5 Partner and collaborate with Traditional Owner groups (Registered Aboriginal Parties and non-Registered Aboriginal Parties) in the Central Highlands to co-design activities that continue to care for Country in ways that uphold their Cultural values
- 1.6 Continue consultation with regional industry groups including horticulture and viticulture
- 1.7 Continue collaboration between organisations on large-scale, multi-agency projects that improve water security and drought resilience





## Theme 2

# PEOPLE AND COMMUNITIES



Regional drought resilience cannot be achieved by organisations and agencies alone. Residents and communities in the region have responsibilities in resilience building and strengthening. The actions in this Plan are intended to guide how the region can move forward. Grassroots initiatives are strongly encouraged, and existing community led processes are welcomed. Community groups can provide leadership to transform the region towards climate adaptation and drought resilience. A holistic approach to drought resilience is needed, and can be adopted through a “Connection to

Country” approach. Adapting to a “new normal”, under expected future climate conditions, will be required. To address mental health during droughts, green spaces and maintaining ovals for recreational activities have been identified as important. This requires pre-drought planning and prioritisation. Connectedness has proven important for people during Covid isolations, similar to isolation felt by households and businesses during previous droughts. Accessible and stable communication infrastructure (phone, text and internet) have been shown to alleviate the stresses of physical isolation.

### **Outcome:**

Communities and people in the Central Highlands have social resilience to drought events. Communities remain vibrant and have the ability to bounce back from droughts. Individuals maintain physical and mental wellbeing and have access to formal and informal support systems.



## Actions

- 2.1 Engage and empower community groups to build drought resilience
- 2.2 Engage the community in drought resilience planning
- 2.3 Ensure resilience building focuses on communities as well as individuals
- 2.4 Empower and strengthen the 'Connection to Country' approach for people and landscapes
- 2.5 Adopt, communicate and facilitate participation in "new normal" thinking
- 2.6 Review priorities of water use during droughts to support mental health in communities
- 2.7 Create and maintain green and recreational spaces
- 2.8 Promote the installation and use of rainwater tanks in urban and rural dwellings
- 2.9 Engage with telecom providers to optimise digital access and digital literacy in the region
- 2.10 Map and share what actions exist in the area of digital connectivity



Photo: Golden Plains Shire Council



## Theme 3

# FARM ENTERPRISES



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Farming businesses are impacted by drought in many ways. Crop yields, livestock and other farm related productivities decline, resulting in financial impacts. Additional stresses and uncertainties affect personal health and farming families.

Building and strengthening drought resilience focuses on being prepared for these impacts. Actions that can be undertaken include suitable infrastructure, optimised financial management, and maintaining a healthy, long-term farming system.

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### **Outcome:**

Farms and other agriculture related businesses are financially sound and contribute to a strong economy that is well prepared for, and more resilient to, the effects of future droughts. Jobs on farms and in the agricultural sector are attractive, accessible and reliable, especially to youth. The agricultural sector is productive and integrated in the regional landscape.

## Actions

- |      |   |
|------|---|
| 3.1  | Review and improve on-farm water management, including the options for pressurised water conveyance   |
| 3.2  | Address impacts of climate change and water security for farming enterprises through infrastructure development supported by existing water strategies                                    |
| 3.3  | Review incentives for farm infrastructure investments   |
| 3.4  | Review and improve on-farm infrastructure to build drought resilience (livestock, water, transport)   |
| 3.5  | Review existing farming practices through a drought lens and adjust as appropriate  |
| 3.6  | Ensure farm business plans include drought and climate shock preparedness   |
| 3.7  | Strengthen financial management incorporating seasonally fluctuating income and expenses  |
| 3.8  | Explore opportunities for income diversification  |
| 3.9  | Investigate opportunities for crop diversification, either to reduce risk of mono-culture income, or to apply risk-spreading by using multiple varieties with different weather responses |
| 3.10 | Improve soil health to increase water infiltration and retention, resulting in improved crop productivity   |
| 3.11 | Consider opportunities for regenerative farming practices as a long-term strategy to improve soil health and mitigate climate shocks  |
| 3.12 | Balance livestock management between climatic conditions, land carrying capacity and market opportunity   |
| 3.13 | Improve data collection and data-based decision making through applying digital technologies and methodologies  |
| 3.14 | Compile and use commodity-specific data, knowledge and information to maximise the information available for decision-making during droughts  |
| 3.15 | Promote the re-use and recycling of water on-farm   |



## Theme 4

# INDUSTRY, BUSINESSES, AND AGENCIES



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In addition to farm enterprises, other local industries, businesses and agencies are impacted by drought and have a role to play in making the Central Highlands region more drought resilient. This impacts essential, social and financial services, and the performance of rural

economies at several scales. Resilience building actions include the availability of communication, collaboration and support networks for businesses and agencies, and having individual business plans that include drought preparedness.

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### **Outcome:**

Industry, business and agencies are prepared for the impact of drought on people, the environment and the economy. Preparedness supports resilience within industry, businesses and agencies by ensuring contingency plans are in place and resources are available.



## Actions

- 4.1 Consider the actions in existing industry, business and agency plans and strategies through a drought resilience lens
- 4.2 Promote efficient water use and irrigation systems in cities and urban industry
- 4.3 Investigate the use of incentives for improved water delivery systems
- 4.4 Identify water as a key tool to support mental health in communities
- 4.5 Explore the use of diverse water sources to provide reliable water supply during droughts
- 4.6 Promote innovative water usage by manufacturers
- 4.7 Support opportunities to use 'waste' water
- 4.8 Identify agencies, industries and businesses that have impact on agricultural sector resilience building and include them in collaboration and networking forums



Photo: David Marland



## Theme 5

# INFRASTRUCTURE



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Hardware, the built environment, can have a supportive role in better management, operation and preparation for droughts. Thus, infrastructure supports the resilience building efforts in

the Central Highlands. This includes water infrastructure, but also communication networks, and infrastructure required to support a growing population.

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### **Outcome:**

Central Highlands has an infrastructure network that supports water access reliability and security, a (renewable) energy infrastructure that is distributed and supports peak demand in droughts, and a digital network that allows remote access to services and peer-support to increase drought resilience.



## Actions

- 5.1 Address impacts of climate change and regional population growth on water demand in townships through infrastructure development supported by existing water strategies
- 5.2 Promote good on-farm infrastructure to allow 'best management practices' for a variety of agricultural production systems
- 5.3 Strengthen and expand water pipelines where possible to reduce evaporative losses and improve delivery control and reliability
- 5.4 Expand infrastructure to support water re-use, recycled water and stormwater use
- 5.5 Highlight and expand tourism assets to promote alternative sources of income during climate shocks
- 5.6 Support the implementation of drought response plans for urban water supplies and recycled water system
- 5.7 Review opportunities for alternative use of existing water infrastructure
- 5.8 Adapt and improve infrastructure to accommodate population and economic growth
- 5.9 Review infrastructure requirements to ensure acceptable water quality can be delivered under a variety of seasonal conditions
- 5.10 Create a business case and promote the Southern Wimmera and Northeast – Pyrenees Rural Water Supply pipeline
- 5.11 Continue completion of the East Grampians Rural pipeline



Photo: Golden Plains Shire Council



## Theme 6

# LANDSCAPES



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Natural and human-supported landscapes are impacted by droughts. Resilient landscapes include those that have a diverse natural vegetation, contains drought resilient species,

and can recover from droughts. Landscape management can improve this resilience through shrub and tree planting, controlled cultural burning, and bushfire prevention.

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### **Outcome:**

A landscape that is diverse, healthy and resilient and adaptive to drought. An environment that supports nature, people, communities and industry through climate shocks.



## Actions

- 6.1 Advocate for high priority actions contained in current management plans for lakes and waterways within the region
- 6.2 Maximise water quality across the landscape zones following Catchment Management Authority (CMA) strategies
- 6.3 Communicate and support region-specific actions in CMA plans and strategies
- 6.4 Ensure biodiversity is maintained, strengthened, and supported, especially in relation to climate shocks
- 6.5 Support landscape design for climate proofing
- 6.6 Improve sustainable land and water management practices through collaboration and partnership with Traditional Owners and First Peoples, in line with Government's legal and policy obligations



Photo: Golden Plains Shire Council



## Theme 7

# EDUCATION AND LEARNING



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One of the principles of resilience building is to encourage learning. Learning is encouraged through many of the activities described previously. In addition, the Central Highlands region has many formal education opportunities,

including university and vocational training. Drought experience and resilience could be included in specialised curricula, contributing to drought resilience building in the region.

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### **Outcome:**

A community that is aware of the impacts of drought, has the knowledge to prepare, respond and recover from drought, and has the ability to build stronger resilience to droughts.



## Actions

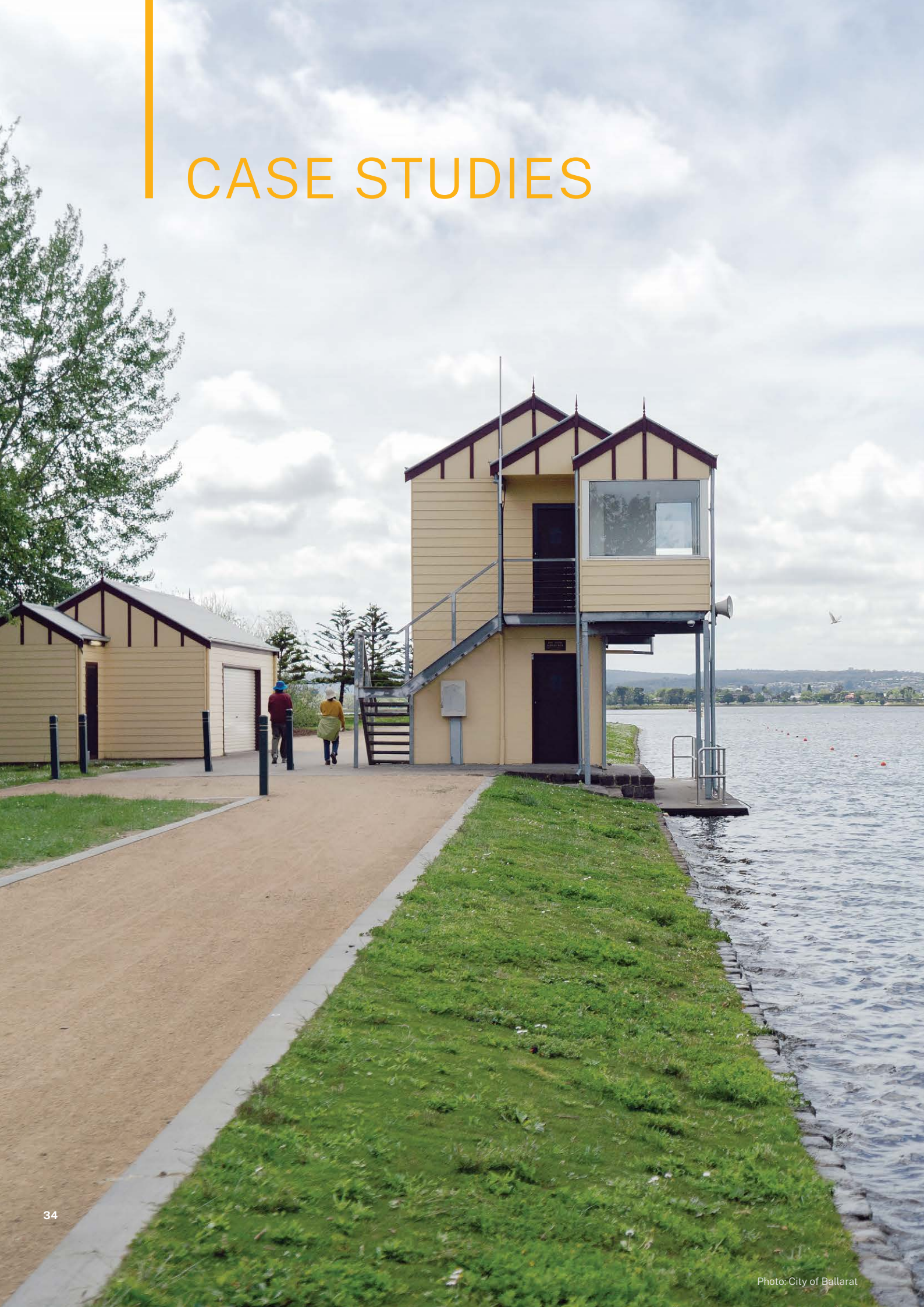
- 7.1 Promote community learning from past experiences, improved fact-based knowledge and insights, and proven actions to build drought resilience
- 7.2 Expand water-wise education in the context of drought, water saving opportunities, and impact of water savings on environment, economy and people
- 7.3 Strengthen community messaging about current conditions, expected future conditions, and opportunities for collective drought resilience building
- 7.4 Proactively communicate region-specific elements from policies and strategies applicable to the Central Highlands
- 7.5 Develop and use communication products that explain the roles and responsibilities for water management by different agencies (e.g. river water, rural and urban water, irrigation water)
- 7.6 Identify, in partnership with Traditional Owners, opportunities to use traditional knowledge, and culturally appropriate tools to heal and care for Country



Photo: Tracey McRae



# CASE STUDIES





## Lake Wendouree

Lake Wendouree was turned from a swamp into a shallow lake in the 1860's. It provides recreational services, is a source for irrigation water and has an important role for wildlife in the area. The canoe and rowing events of the 1956 Olympics were held on Lake Wendouree. Due to its shallow depth, droughts have reduced the surface area of the lake, at times only a dry lake bed remaining, most recently in 2006.

Although rainfall aided in recovering the lake, additional measures were taken to avoid the lake from completely drying again. This included diverting 'Paul's Drain' from the outfall of Paul's Wetland in the suburb of Wendouree and delivering it to Lake Wendouree via a 1.7km pipe, implemented by the City of Ballarat in 2006. Additional harvested stormwater diversions were created from Redan Wetland and the Ring Road in later years. Direct stormwater recharges the lake

from the North Gardens wetland and Wendouree Parade. Central Highlands Water supplies Class A recycled water from the Ballarat North Treatment Plant to Lake Wendouree to help maintain water levels in the lake.

In 2017, the City of Ballarat and Urban Initiative developed the Lake Wendouree Master Plan. It describes plans to maintain water levels and water quality, supporting recreation on and around the lake by maintaining and constructing infrastructure like bicycle paths and public toilets, diversifying the surrounding biodiversity through additional tree and shrub planting, and maintaining and improving access to the lake.

Having multiple sources of water to maintain the lake will ensure that, even in drought, visitors and residents can enjoy the water, wildlife has a refuge, and biodiversity remains supported.

### Paddle your canoe

It's a great day out at off-site water activities. The banks of the lake are sandy and there is no mud to be found. Three groups are formed and rotate between canoeing, volleyball and cricket.

One Scout was even game enough to go for a dip! You wouldn't catch me IN the water but it still looked like fun ON the water. The biggest problem has been kids un-prepared, they end up going home wet! If you go canoeing please remember a change of clothes!

- Michelle Bowler  
Right: Raft Chief WILLIAM WELLS on Lake Wendouree



the Jamboree

gardens. Besides that use, however, we submit that the swamp that is, or lake that will be, should be rendered available without delay for boating. Ballarat ought not to be compelled to go ten or twelve miles out of town to do its aquatic pleasure, nor ought the town to be deprived of the great attraction which a sheet of water, such as the Wendouree might be made, would be both to townsfolk and visitors.

The conversion of the Wendouree Swamp into Lake Wendouree, is another healthy and not very unpopular topic of discussion. Whether or not we are to have a Steam Navigation Company, there is little doubt that the suggestion made in this journal two or three years ago will have to be acted upon in some way. We suggested that in order to bring the Botanic Gardens within a proper distance of the town a steamer should be placed in the Swamp, and now that a large supply of water has been obtained, over and above that possessed in the Wendouree, the time seems to have come for something being done to give the public easier access to their gardens. Besides that use, however, we submit that the swamp that is, or lake that will be, should be rendered available without delay for boating. Ballarat ought not to be compelled to go ten or twelve miles out of town to do its aquatic pleasure, nor ought the town to be deprived of the great attraction which a sheet of water, such as the Wendouree might be made, would be both to townsfolk and visitors. As a means of useful and healthful recreation, as a short cut to the otherwise too-far-off Botanic Reserve, and as an ornament to the town, the Lake Wendouree should be made to serve the public uses in the way we have indicated, and we are persuaded that the Water Commission will do a good public service by considering how best the object can be accomplished without unnecessary delay. We would not have the thing rushed, but done without loss of time, as it surely may be done without loss of either water or revenue.



## Irrigation efficiency: Turning water into wine

Jillian Henderson and winemaker Peter Bicknell own and operate their vineyard and winery 'Bigibila' in the foothills of the Pyrenees Ranges on Dja Dja Wurrung Country. The 12.5 hectare vineyard enjoys near perfect growing conditions with warm dry days and cool clear nights. The vines are tended using sustainable farming practices that include using large volumes of animal manure and ground limestone instead of artificial fertilisers. The cornerstone of the business is production of four grape varieties that are processed on site into wines and sold direct from the vineyard.

Water is limited at the 60 hectare property. Farms and households in the area are not connected to a piped water supply and ground water under the property is too saline to be used for irrigation. In addition, the whole agribusiness is in the Murray Darling Basin catchment which places limits on water harvesting and water transfer between landholders. The vineyard, winery and other aspects of the business are therefore reliant on direct rainfall and the limited rainwater stored in

existing dams within their property. Limitations to water capture and water storage coupled with their experience of dry seasons make many seasons a challenge but has also led to drought resilience being an inherent part of their business success.

The vineyard has four different varieties, Shiraz, Cabernet Sauvignon, Cabernet Franc and Merlot. The diversity of varieties helps accommodate the different seasonal conditions experienced each year. The vines are watered using highly efficient drip irrigation, unlike the overhead irrigation commonly used throughout the district 15–20 years ago. Grape yields are higher in some years than others depending on seasonal conditions including rainfall. However, Peter and Jillian buffer the seasonal variations by selling wines from several years production through their cellar door and through their online marketplace. Further, diversification of the business into agritourism and innovative sales techniques supports the whole agribusiness through the drier seasons.



Photo: Bigibila Wines



## Caring for Country

The Wadawurrung Traditional Owners Aboriginal Corporation has a Whole of Country approach to drought resilience building. Drought is listed as a threat to several building blocks that underpin the Wadawurrung objectives and metrics in the Paleert Tjaara Dja Plan. Wadawurrung Peoples are innately connected to Country and rely on its health to protect our people and Culture. Without healthy Country, there can't be healthy people. Our waterways are the lifeblood of Country and through the Central and Gippsland Sustainable Water Strategy (Department of Environment, Land, Water and Planning, 2022) water is being reallocated to Wadawurrung for their self-determined needs. Additional environmental entitlement is also being allocated to provide flows to our significant waterways protecting the biocultural landscapes and strengthening their drought resilience. Water may also be used for native revegetation projects being delivered by our natural resource management team in collaboration with other agencies and partners.

In addition to revegetation, cultural burning regimes are applied to activate dormant seed banks. Wadawurrung works on cultural burning implementation with Corangamite CMA, private landholders and other agencies. Cultural burning regimes are applied to heal and rehabilitate cultural landscapes by activating dormant seed banks and managing weed biomass. For certain native vegetation species, seeds require the right fire to activate and grow into shrubs and trees. Diverse vegetation, native and adjusted to the climatic conditions of the Central Highlands, strengthens the environmental resilience to droughts. Healthy vegetation increases rainfall infiltration rates into the soil, thus increasing water availability for further vegetation development and growth. On the steeper slopes, vegetative cover reduces erosion caused by excessive runoff during heavy rain events, while during droughts, healthy vegetation reduces the risk of wind induced soil erosion. With this combined approach, the Caring for Country team not only improves the landscape for average years, but also strengthens its ability to remain healthy during droughts, and bounce back when the rains return.

Photo: Golden Plains Shire Council





## Green-Blue Infrastructure

Green-Blue Infrastructure (GBI) is an approach to integrate nature into urban landscapes. Green-Blue Infrastructure intends to make cities ‘nature positive’, for example through managing stormwater runoff using natural or constructed wetlands, ensuring healthy urban catchments, and using permeable pavements. Trees and green areas reduce the urban heat effect, green corridors provide habitat for wildlife, and provide spaces for people to relax. An increased integration, and co-design of urban and Green-Blue Infrastructure contributes to a strengthened drought resilience through increasing short-term water availability, reducing urban heat during heatwaves, and providing green spaces to relieve or lighten stress.

While the benefits of Green-Blue Infrastructure can be easily listed, achieving and implementing this approach requires multiple considerations. The Grampians region has developed a guide for small towns to support the decision making. It provides an insight into the added value of GBI and breaks down the process to reach the objectives. Stakeholder engagement, corporate planning and community-led planning are processes that help to maximise the benefits of GBI. Statutory and infrastructure planning provide the tools to enable implementation of GBI, and infrastructure design and procurement, and its operation and maintenance ensures that the infrastructure can be supported in construction and operation.

The Central Highlands Strategic Directions Statement (DELWP, 2018) recognises the activities leading to implementation of the GBI, and adds that many towns and localities in the region act as community hubs, tourism centres and regional attractions; functions that benefit from this approach.

The “Greening Ballarat – A Green Blue City Action Plan” project is highlighted. The City of Ballarat has a target for 40% tree canopy cover for the city which outlines its ambition. Other councils in the region have similar plans and recognise greening as a key strategy to underpin economic activity and wellbeing outcomes. One action of the Strategic Directions Statement is to provide seed funding for collaborative planning with the shires in the Central Highlands to define Green Blue Infrastructure activities. The Statement envisions opportunities in small towns including:

- Urban water alternative supply schemes for ovals, parks and local industry
- Street tree and urban greening projects supported by water
- Urban waterway restoration and improvement
- Water-sensitive urban design and stormwater management projects
- Planning controls and policies to influence developments in greenfield and infill areas.



Photo: Katherine Howard, Emerge Associates



## Natte Yallock

The Natte Yallock area is used mainly for cropping and grazing of improved pastures. Most of the soils are well suited to agriculture, however, gilgai clays with their adverse physical characteristics are challenging. Terraces have been formed at several levels and dominate the landscape, resulting in a variety of soils, among which red calcareous sodic duplex soils are the most widespread.

Anthony and Sam Streeter are wool and prime lamb producers in the Natte Yallock region of the Pyrenees Shire. The Streeter's farm of approximately 1000 hectares has about 1500 sheep comprising a mix of breeding merino ewes and wethers. The annual rainfall averages between 420mm to 500mm. Temperatures are less than 10°C

during the winter months. The rainfall is less than evapotranspiration from September to April.

To support a resilient livestock farming system, the Streeter's share-crop for the purpose of growing hay and grain to complement established perennial pastures. Importantly, the supplementary feed provides a feed reserve to build resilience into the farming system for when drier months and seasons occur. Further strategies adopted for droughts include making early decisions to reduce livestock numbers, establishing stock containment areas, and focusing on water security via careful management of water levels on the farm. The farm is fortunate to have a spring fed dam which becomes a critical asset during the worst of droughts.

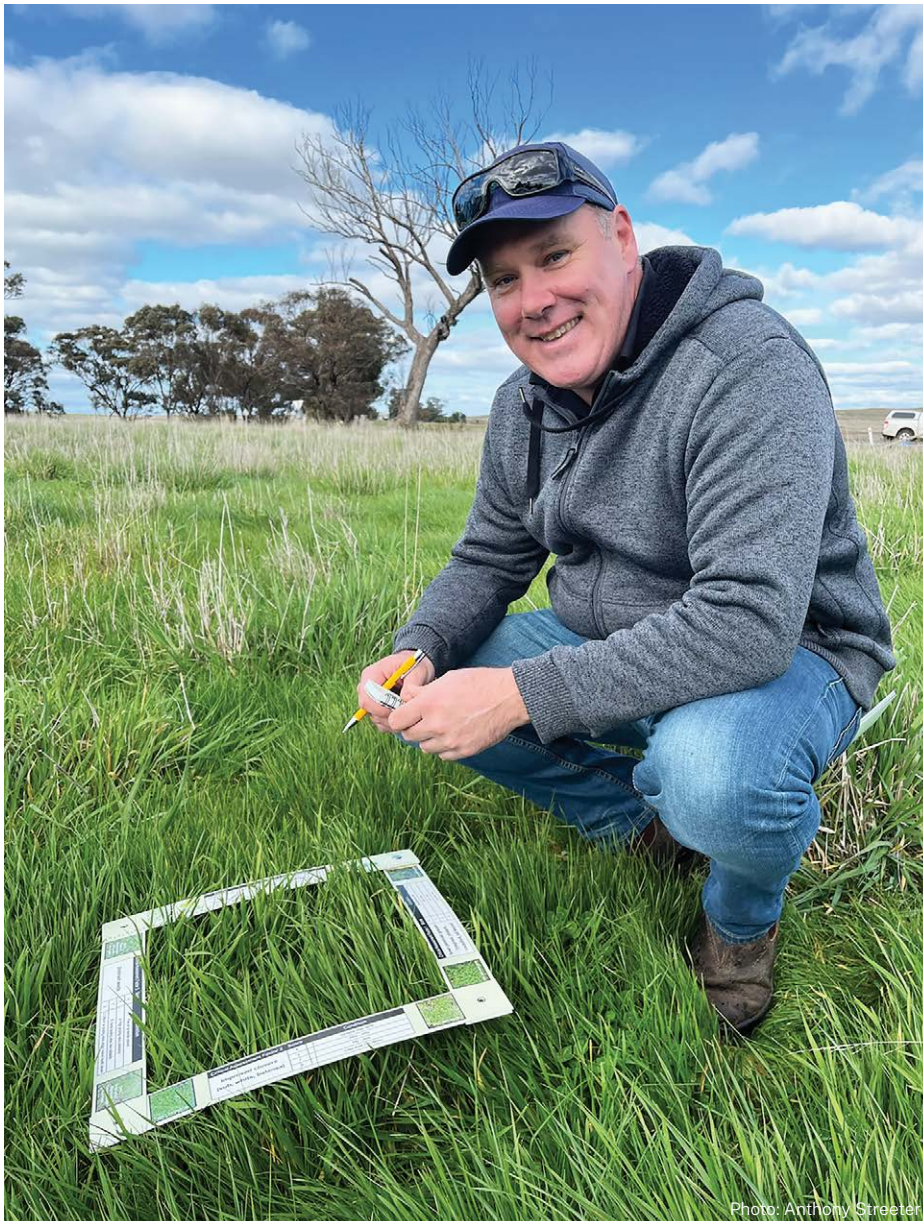


Photo: Anthony Streeter







# NEXT STEPS FOR THE CENTRAL HIGHLANDS

This Plan identifies and communicates the actions and outcomes needed for communities, businesses and people in the region to be resilient to future droughts and the gradual change to a drier climate.

A handful of actions in the Plan can be implemented by individual entities. However, most actions, related outcomes and the regional vision will only be realised through concerted and continuous collaboration that is driven by communities and organisations within this region. The communities and organisations within the region therefore have a critical role in implementing this Plan.

Some actions in the Plan will need regional stakeholders to reach out for broader cooperation or collaboration with other governments, agencies, statutory bodies, non-profit organisations, and the private sector.

Partnerships with Traditional Owners/First Peoples of the Central Highlands region will ensure their unique rights and responsibilities, and self-determined goals and aspirations for Country, are reflected during implementation of Plan actions.

The actions in this Plan represent a point in time. As economic, social and environment conditions change, the community will need to adapt the actions in this Plan and introduce new actions to maintain the path towards the desired outcomes and vision for the region.

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## **This Plan provides the pathway for the region to move towards drought resilience with:**

- an understanding of the regional impacts of drought
- a common regional vision and common goals
- desired outcomes and actions agreed by the community
- a common picture of how existing and new investments are related to each other
- a basis for developing new actions and programs to achieve the regional vision
- a framework to monitor progress towards building resilience to future droughts

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## **Next steps to support implementation of the Plan include:**

- identifying a lead organisation to oversee and coordinate the delivery of activities that align with the region's Plan
- establishing a fit-for-purpose Advisory Group to guide delivery and ensure regional representation
- detailing priority actions, budgets and timelines
- monitoring and evaluation
- reviewing the progress of the Plan and making necessary updates



# MONITORING, EVALUATION AND LEARNING

The collaborative effort and shared expertise used to prepare the Plan is the important first step in building drought resilience in the Central Highlands. Work was done by the region to articulate the actions needed to achieve desired regional outcomes. The next step is for the actions and activities identified in the Plan to be implemented, evaluated and adapted as needed to achieve the longer-term outcomes for drought resilience.

Monitoring, evaluation and learning (MEL) is a key element of the Regional Drought Resilience Planning program. Program objectives, outcomes and measures of success are clearly articulated at all levels of program delivery (national, state and regional) and are over a range of short, medium and long timeframes.

## Pathway of program delivery through discovery, engagement, development, implementation and evaluation





## Measuring success

The outcomes identified in this Plan are community and region wide, and dependent on the fourth step of implementation identified in the pathway of program delivery. Given the long-term outcomes of the Plan, the framework below outlines how progress toward success will be measured.

## Management and reporting

The organisation awarded as the lead organisation to coordinate delivery of the Plan will work with Agriculture Victoria to provide up-to-date data and information to support program implementation and planning. Monitoring and reporting will enable: key learnings to be identified, effective reporting, and adaptive program management.

A range of assessment tools may be used to indicate progress including, but not limited to, surveys, case studies, stakeholder interviews and engagement data analysis. Data and information will be collected at various intervals across implementation planning, and during and after activities are implemented.

## Assumptions underpinning success of the Plan

Measuring success and reporting on progress toward regionally specific outcomes is dependent on several key assumptions.

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### Key assumptions affecting short-term outcomes (1–2 years)

- Regional stakeholders have the capacity and capability to participate in strategic planning
- Regional stakeholders are willing to cooperate with each other for regional planning
- Program design is sufficient to give regional stakeholders opportunities to identify and communicate regional drought resilience needs
- Regional communities are motivated to take ownership of completed plans and actively seek to implement them
- There are sufficient learnings to continuously improve program implementation

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### Key assumptions affecting medium-term outcomes (2–4 years)

- Supporting regional stakeholders through program implementation will result in change in practice in the Central Highlands
- There are sufficient opportunities and funding for the region to implement elements of the Plan
- Plans contain implementable activities to build drought resilience
- The Central Highlands Plan Coordinator and regional stakeholders continue to review and implement the Plan

## MEL Framework

Key regional themes and outcomes are matched with relevant Future Drought Fund (the Fund) strategic priorities, regional progress measures (2–4 years) and indicators.

The Framework is aligned to existing MEL plans at the Program and Fund level to ensure consistency and to ensure the data collection tools provide information across a range of learning and reporting requirements.



## MEL Framework for the Central Highlands

FDF <sup>1</sup> Strategic priority	Progress measures (2–4 years)	Indicators
<b>Collaboration, coordination and networking</b> Sectors, institutions and individuals working together in a holistic, whole picture, approach to maximise the regional, community and individual resilience to climate shocks.		
<b>Social resilience for resourceful and adaptable communities</b>	Improved collaboration and coordination between governments, industry, community, Traditional Owners and primary producers. Communities are communicating regional drought resilience needs and priorities to inform investment. Communities are coming together to prepare for and respond to drought. Plan actions and opportunities are incorporated into other strategic planning across the region.	Implementation/planning groups and networks function well together. Communities have an improved understanding of drought resilience specific to their region. Stakeholders are working together to plan and deliver actions across the region.
<b>People and communities</b> Communities and people in the Central Highlands have social resilience to drought events. Communities remain vibrant and have the ability to bounce back from droughts. Individuals maintain physical and mental wellbeing and have access to formal and informal support systems.		
<b>Social resilience for resourceful and adaptable communities</b>	Communities are learning and building capability, capacity, expertise, and sharing innovative ways to build social resilience. Community preparedness to drought has increased. Community awareness of and access to support systems and services has increased. Traditional Owners are engaged in regional drought preparedness activities, and those activities reflect Traditional Owners' priorities	Communities are using their knowledge to plan for drought resilience. Leaders in the region are more confident to implement strategic actions. Stakeholders are working together to plan and deliver actions across the region. Traditional Owners are increasingly involved in drought programs and activities.
<b>Farm enterprises</b> Farms and other agriculture related businesses are financially sound and contribute to a strong economy that is well prepared for, and more resilient to, the effects of future droughts. Jobs on farms and in the agricultural sector are attractive, accessible and reliable, especially to youth. The agricultural sector is productive and integrated in the regional landscape.		
<b>Economic resilience for an innovative and profitable communities</b> <b>Environmental resilience for sustainable and improved functioning of our natural landscapes</b>	Primary producers are better able to identify business risk and make timely decisions. New technologies and practices are being adopted to better prepare primary producers and agricultural businesses for drought.	Farmers are learning about and implementing new business strategies and practices. Farmers and agricultural industries have an improved understanding of drought resilience specific to their region.



FDF <sup>1</sup> Strategic priority	Progress measures (2–4 years)	Indicators
<b>Industry, business and agencies</b> Industry, business and agencies are prepared for the impact of drought on people, the environment and the economy. Preparedness supports resilience within industry, businesses and agencies by ensuring contingency plans are in place and resources are available.		
<b>Social resilience for resourceful and adaptable communities</b> <b>Environmental resilience for sustainable and improved functioning of our natural landscapes</b> <b>Economic resilience for an innovative and profitable agricultural sector</b>	Impacts of drought on the economic, environmental and social parts of the region are known and prepared for. Innovative pathways and opportunities for water usage in the region are being actioned.	Increased community understanding of the region's current and future drought resilience, considering the region's unique economic, environmental and social characteristics. Innovative pathways and opportunities for water usage in the region are identified.
<b>Infrastructure</b> Central Highlands has an infrastructure network that supports water access reliability and security, a (renewable) energy infrastructure that is distributed and supports peak demand in droughts, and a digital network that allows remote access to services and peer-support to increase drought resilience.		
<b>Social resilience for resourceful and adaptable communities</b> <b>Economic resilience for an innovative and profitable agricultural sector</b>	Innovative pathways and opportunities for water availability and reliability in the region are being actioned. New technologies and digital systems are being adopted to support primary producers and communities to adapt. Organisations and corporations responsible for infrastructure have drought plans.	Best practice approaches are being used to identify opportunities to build drought resilience in the region. Stakeholders are learning about and implementing new technologies.
<b>Landscapes</b> A landscape that is diverse, healthy and resilient and adaptive to drought. An environment that supports nature, people, communities and industry through climate shocks.		
<b>Environmental resilience for sustainable and improved functioning of our natural landscapes</b>	Managing natural resource to build resilience to climate shocks is improving across region.	Partnerships, networks and organisations are working together to manage natural resources. Stakeholders have increased understanding of natural resource management to build drought resilience.
<b>Education and learning</b> A community that is aware of the impacts of drought, has the knowledge to prepare, respond and recover from drought, and has the ability to build stronger resilience to droughts.		
<b>Social resilience for resourceful and adaptable communities</b>	Communities are communicating regional drought resilience needs and priorities to inform investment. Regions are monitoring their resilience to drought in accordance with the Plan.	Increased community understanding of the region's current and future drought resilience, considering the region's unique economic, environmental and social characteristics. Communities are using their knowledge to plan for drought resilience.



## Appendix 1

# Drought resilience insights from the Central Highlands

### Influx of residents

The Central Highlands region has large urban centres and many rural communities. The region has a considerable influx of new residents, strengthened by many moving away from Melbourne throughout the COVID-19 pandemic. Lifestyle and hobby farms have increased with regional population growth. Several of these new residents have not been in the area during previous droughts and may be less prepared for future droughts than long-term residents.

### Water storage

From a farm perspective, an increase in water storage, either through dams or groundwater banking, is considered an option to improve the drought resilience of the business. As part of water catchments, increased storage in one location may impact water availability at other locations. Water managers at federal, state, regional and catchment level have developed strategies and management plans balancing water availability with water demand.

### Grassroots initiatives

Feedback gathered via the Engage Victoria platform emphasised that the Central Highlands Drought Resilience Plan should encourage regional initiatives, without government regulations taking over from communities.

The Regional Drought Resilience Plan is designed to promote bottom-up, community and region-led approaches, and encourage regionally relevant actions to support building the region's resilience to the next drought periods. This Plan aims to enable regional initiatives with government support – where it is beneficial. Building resilience to drought requires collaboration between many actors and across sectors - hence actions listed in this Plan have a broad range of owners and implementers.

Once the Regional Drought Resilience Plan is developed, an organisation from the region will become the Coordinator of the Plan and will support the implementation of actions noted, working collaboratively with regional partners and funders, including the Australian and Victorian Governments.

A Regional Drought Resilience Plan will never be finalised. Building resilience is a continuous effort which requires adjustments and flexibility to changing conditions over time.

### Drought and climate change

While this Plan focuses on building and strengthening regional drought resilience, feedback through the Engage Victoria platform emphasised drought is one of a range of climate hazards, and that frosts, floods, heatwaves and other changes are forecast to occur. This Drought Resilience Plan builds upon, and includes plans and strategies developed for the Central Highlands in the context of climate change. These on-going climate change adaptation and mitigation processes have been included in this Plan where appropriate.

### Farm management

Building drought resilience in farming systems requires a long-term approach. While there are short-term actions that help to reduce the impact of the next drought on crop and livestock management, finances and mental and physical health, these impacts will occur in every subsequent drought. Feedback through the Engage Victoria platform included suggestions for transformative agricultural systems, for example through the promotion of regenerative agriculture. Upskilling service providers to understand the implications of variability, volatility and shocks to the biophysical and financial performance of farming systems will be essential.



## Food security

Depending on the intensity and duration of drought, food security in the region can be impacted. Food security is not only related to local production, but is also dependent on regional, national and international trade, logistics and availability. For regional drought resilience, through a food security lens, focus on drought resilient local production systems, crop diversification, livestock management according to carrying capacity of drought impacted grazing properties, and regional business resilience are important.

## Information and knowledge

Data collection and monitoring were identified as important tools to determine drought impacts, temporary drought solutions, and management of drought impacted areas. Monitoring of regional water resources, soil moisture at farm level and livestock movements and efficiencies through industry-based GPS linked apps are examples where data collection and analysis can aid in drought resilience building.

## Awareness

Awareness of individuals, communities, agencies and businesses has been identified as important for drought resilience building in the Central Highlands. Awareness of existing plans and strategies on water management, climate change, physical and digital infrastructure and resilience building are themes emerging from feedback. Awareness raising is not only important for plans that organisations and agencies create, but also for responsibilities that individuals and communities have.

## Water savings

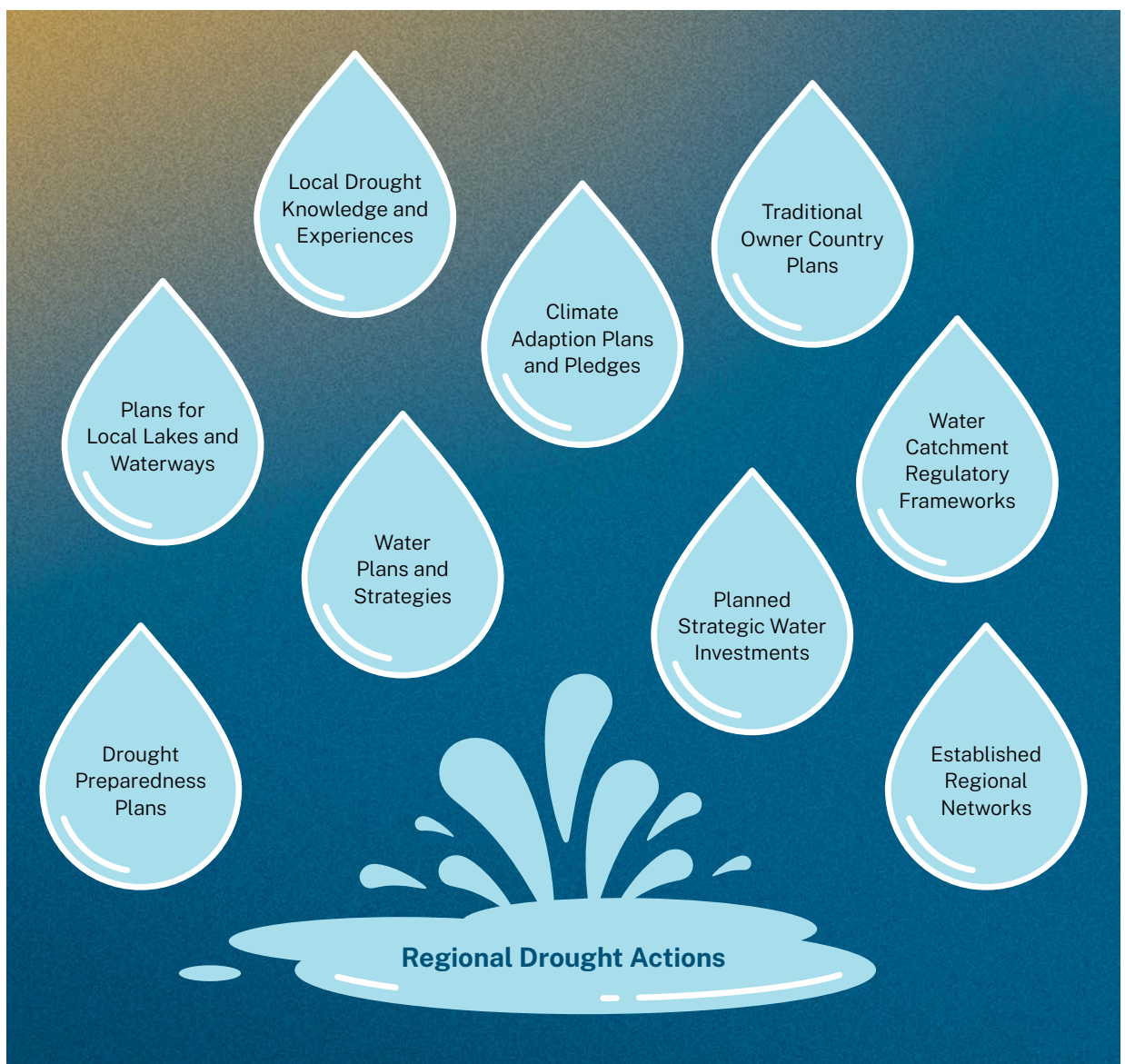
A large part of the discussions related to the Drought Resilience Plan in the Central Highlands have focused on water management. A broad range of water savings options were suggested, including reduction of evaporation from water surfaces like farm dams, improved water use efficiencies on farm and in landscaping and improved urban water delivery systems. Discussions also focused on reduced water use, through improved awareness on limited water resources and the use of water restrictions. Although water in urban settings has an important role in maintaining green spaces, recreation and cooling areas, suggestions for water efficient urban features were suggested, like splash pads instead of water features.



## Appendix 2

### Existing actions and strategies in the Central Highlands

Several region-specific actions, plans and strategies exist for the Central Highlands. The review in this appendix does not attempt to be a complete overview. However, a select number of documents are reviewed to support the thematic framework and actions listed in the main part of the drought resilience plan for the Central Highlands. The reviews in this appendix are ordered by year of publication, with the most recent documents listed first.





**Djaara (Dja Dja Wurrung Clans Aboriginal Corporation), 2023. Turning ‘wrong way’ climate ‘right way’ – Dja Dja Wurrung Climate Change Strategy 2023–2034**

The Climate Change Strategy published by Djaara assesses the actions required to reverse negative climate impacts on Djaara Country. It includes a comprehensive review of existing plans and strategies that come together in the Climate Change Strategy. The strategy focuses on 6 themes, Country, Fire, Water, Trees, Peoples and Sky Country. The strategy includes indicators of success and stresses the need for integration of cultural heritage and joint management practises. The strategy also includes the need to work together, and identifies partners.

**Djaara (Dja Dja Wurrung Clans Aboriginal Corporation), 2023. Dhelkunyangu Gatjin — Working together to heal water. Djaara Gatjin Strategy**

A water economy has evolved that is worth billions of dollars annually, produces food and fibre for Australia and the world, provides drinking water and underpins local and regional communities. This water system is governed by the State resulting in water on Djandak — Djaara’s water — being fully allocated to water users. Djaara are excluded from participating and benefiting in these water arrangements. Djaara knowledge is not central to informing sustainable water management. Djaara currently own very little water resources and have very little say on how the water is managed on Djandak.

The Strategy outlines three key outcomes which have been summarised here:

- 1** Make decisions for Gatjin; To meet obligations to heal and manage Djandak and enjoy traditional rights, Djaara Culture and Lore must be at the heart of water policy, planning and management.
- 2** Secure a growing share of water rights and entitlements; Increased water entitlement is some restitution of stolen water rights, enables the determination for the best use of water for cultural purposes, and allows direct involvement in the water economy.
- 3** A Djaara Gatjin Authority; A Djaara water authority is required to manage water and water interests and acknowledges that neighbouring mobs have authority for water on their Country.

**Department of Environment, Land, Water and Planning, Victoria State, 2022. Central and Gippsland Region Sustainable Water Strategy**

The role of the Central and Gippsland Region Sustainable Water Strategy (the Strategy) is to secure the region’s long-term water supplies to protect jobs, farms, ecosystems, communities, and the cultural values of Traditional Owners in the region. The Central and Gippsland Region covers the waterways and catchments south of the Great Divide down to the coast – from the Otways to Mallacoota. This Strategy is needed to help us prepare for the region’s water future. With forecast drier conditions and a growing population, the region’s water supplies will need to double in the next 50 years. The Strategy supports investment in water efficiency for homes, businesses and farms and increasing the region’s water supplies over the next 50 years. Key actions include:

**4.3b** Securing additional water for Geelong and the Moorabool Yulluk (Moorabool River) transfer a long-term average equivalent of 3 gegalitres per year of Barwon Water’s Lal Lal bulk entitlement 15 and 0.7 gegalitres per year of Barwon Water’s Upper East Moorabool bulk entitlement in the Bostock Reservoir to the Wadawurrung and to the Victorian Environmental Water Holder by 2025.

**4.4** Determine how water returned to the Moorabool Yulluk (Moorabool River) will be shared between Wadawurrung and the environment.

**Central Highlands Water, 2022. Drought Preparedness Plan**

This Plan focuses on short-term actions to prepare for drought and describes four major focus areas:

- 1** Monitoring program; All aspects important to service delivery are monitored by Central Highlands Water, including surface water storage and flow, groundwater extraction, and weather data including rain and evaporation values.
- 2** A set of drought response actions; Integrated Water Resources Management – overall improvement of water management through recycling and using alternative water resources for specific uses. Demand management actions like community awareness, permanent water saving rules and water restrictions, as well as improved operation and water losses reductions. On the supply side, the supply yield and associated



levels of service are set out. The Plan notes that the ability to re-prioritize supply to essential human requirements should not be relied on as a drought response action, and is only for short-term emergency operation.

**3** System augmentation triggers; Indicators that trigger the planning of expansion of infrastructure and operations to supply sufficient water in areas of growth or where demand is shifting. Central Highlands Water notes that they have access to the water market via the Goldfields pipeline for Ballarat and this provides much opportunity to purchase additional water entitlements. Similarly many of the groundwater supplied systems could be effectively augmented by purchase of additional groundwater licence. The plan also notes that water quality and water volumes are closely related, and that additional treatment of water could provide additional water resources for domestic use.

**4** Post-drought actions; Focusing on evaluation and implementing lessons learned during a drought.

Actions and responses for specific geographical locations in the regions are outlined in this Plan's appendices. A subsequent Urban Water Strategy focuses on long-term planning. A third annual report, Water Outlooks, provides a statistical analysis of how the system might track under various climatic scenarios in the years ahead.

#### **Adapt Grampians, 2021. Grampians Region Climate Adaptation Strategy 2021–2025**

The Grampians Climate Adaptation Strategy identifies opportunities and barriers around several themes: agriculture, biodiversity, economy, fire, health and wellbeing, heat, storms and flooding, and water. It identifies actions already underway, and the lead agencies on those actions. Goals are defined for each of the themes, linked to outcomes and indicators. The goals are defined as: Our regional responses to climate change are coordinated, resourced and evidence-based; Our Region's biodiversity and natural ecosystems are protected and resilient; The Grampians economy is sustainable and climate-ready; Regional farming is well-adapted to the changing climate; Our built environment is more resistant to weather extremes; Individuals and communities proactively reduce their climate-related risk; Our vulnerable people are supported to adapt to climate change.

#### **Golden Plains, Central Goldfields, Pyrenees and Morabool Shires, Central Highlands Water, and the Department of Water, Environment and Planning, 2021. Green Blue Infrastructure Guide – A guide for small towns in Victoria's Central Highlands Region**

'Green' infrastructure refers to living vegetation such as gardens, nature strips, trees, parks and green open spaces. 'Blue' infrastructure are the assets associated with managing stormwater, such as gutters, pits, pipes and drains, ponds, wetland and waterways. Green-blue infrastructure (GBI) is a term designed to help explain that these green and blue infrastructure assets are as critical to a town's liveability and resilience as are roads, buildings and carparks. GBI techniques aim to protect and enhance a town's natural assets, combined with better retention, treatment and use of rainwater where it falls. By improving the way urban stormwater is conveyed, stored and used it can make the most of the water that falls in a town. The combination of green and blue infrastructure provides the space to retain stormwater close to where it falls and use it to irrigate the living assets valued for liveability while improving downstream water quality. This in turn supports strengthening drought resilience.

Techniques of GBI can be applied at four scales: lot, streetscape, precinct and township. At the lot scale, these techniques include gardens, green roofs, green walls, water tanks and raingardens. At the streetscape scale, techniques include nature strips, footpaths, roadside raingardens, street trees and swales, shallow channels that convey and treat stormwater. Techniques at the precinct scale include parks, green links, open drains, wetlands, detention basins and sport grounds. The township scale techniques include urban forests, expansive open spaces, waterways and lakes.

Social, environmental and economic benefits include improving township amenities and liveability, reducing urban heat for cooler streets, and contributing to improved community physical and mental health. GBI also enhances urban and aquatic biodiversity, increases tree canopy and decreases air pollution, and increases stormwater and rainwater infiltration and improves soil water retention. The economic benefits include an improved township entrance to make it attractive for visitors, better and more significant use of open spaces, and increased use of alternative water, freeing up domestic water.



### **Corangamite CMA, 2021. Corangamite Regional Catchment Strategy 2021–2027**

The Corangamite Regional Catchment Strategy (RCS) is a high level blueprint for catchment health. It provides a strategic, integrated framework for natural resource management in the Corangamite Catchment Management Authority's region of Victoria. Climate change presents the greatest long-term challenge for the Corangamite region. The future climate of the region is expected to be hotter and drier than today with a higher frequency of extreme weather events such as bushfires and floods.

Drivers of change in the Corangamite area include increase in urbanisation, especially around major centres such as Geelong and Ballarat. Areas that were previously used for primary production are utilised for urban and peri-urban settlements. Demand for coastal real estate has also placed a heavy burden on our marine and coastal areas. The need for water has increased as the population of the region continues to grow. For agriculture across the region, emerging trends include fewer farmers, enterprise changes, smaller properties, less income from agriculture, older farmers. More than 70% of land in the region is privately owned, presenting significant challenges in engaging with landowners and managers. There is concern about the viability of rural communities with socio-economic issues related to an ageing population, the loss of important services and reduced employment opportunities becoming more relevant.

The strategy uses several themes. Under water, it provides outcomes for waterways, wetlands, estuaries and groundwater. For biodiversity, the strategy identifies native vegetation and habitats and native fauna. Land includes sections on land use changes, soil health and sustainable agriculture. Communities, coast and marine environments are the remaining themes.

### **Wadawurrung Traditional Owners Aboriginal Corporation, 2019. Paleert Tjaara Dja – Let's make Country good together 2020–2030. Wadawurrung Country Plan**

In 2019, the Wadawurrung Traditional Owners Aboriginal Corporation published a Country Plan to articulate how Country needs to be cared for and managed over the decade from 2020 to 20230. The Plan includes collaboration goals with federal, state and local government and other key stakeholders to ensure a sustainable Wadawurrung managed investment in Country.

The Plan describes the history of the Wadawurrung Peoples and the interlinkages with neighbouring Traditional Owner groups, especially those that are linked in similar languages, creation stories and cultural ceremonies and events (Kulin Nations). The Vision of the Plan is that all people work together to make Wadawurrung Country and Culture strong.

Wadawurrung Country covers approximately 1 million hectares, of which 20% is Crown land, and 80% freehold. The area contains an interconnected cultural landscape with several culturally significant places. The landscape varies from hill ranges to grassland plains, coastal forests, heathlands and ocean. Changes of the landscape are driven by agricultural land use, urban land use, population expansion, increasing pressure on natural resources; water, land, introduction of pests. These add to the difficulties of Country management.

The Plan presents 18 strategies supporting three themes: Taking care of Country and waters; Us supporting us – Cultural Strengthening and Strengthening the Wadawurrung Corporation. It describes nine building blocks, or values, including amongst these waterways, native animals, cultural sites and places and enterprise and employment. It includes 16 threats to these values, including drought, sea level rise, rising sea temperatures, bushfires, water extraction and lack of coordination between land managers. In sections describing each building block, a value of the current state is presented. A goal is defined on how that state can be improved or maintained, and indicators are listed how the strategic goals can be evaluated. The Plan continuous with an analysis of how the different threats impact the building blocks.



Drought was specifically listed as a threat to the building blocks. The summary threat rating for drought is “high”, like 11 other threats. Five of the threats have been identified as “very high”, and include urban development, lack of coordination, lack of recognition, sea level rise and water extraction. Drought is identified to have three “high” impacts on specific building blocks, namely the Wadawurrung cultural sites and places, Wadawurrung culture and Peoples, and Bushtucker, medicines and resources. Medium impact of drought is listed for the building blocks of Sea, Inland and Coastal Country, Rivers, estuaries and wetlands, and native animals. Drought is described as a driver to increased water extraction, a threat that received the “very high” impact level.

**Central Highlands Water, City of Ballarat, Corangamite CMA, 2018. Ballarat City Integrated Water Management Plan**

The Ballarat City Integrated Water Management (IWM) Plan (the Plan) explores and sets out recommendations for future water management in the City of Ballarat. The plan will deliver on broader liveability and community benefits by considering the whole urban water cycle, including management of stormwater, wastewater, water supplies (surface water and groundwater) and waterways.

The eight guiding IWM objectives are to: Support river health priorities and mitigate flooding risks; Optimise the use of local water sources; Maintain and influence water efficiency; Support a safe and secure urban water supply and demand future; Generate improved liveability outcomes, recreational opportunities and increase green infrastructure; Support a sustainable and productive economy; Deliver strategic direction to enhance IWM outcomes within land use planning; Develop a plan that reflects community and stakeholder values and outlines clear implementation pathways.

The recommendations fall into three categories: Targeted Moves: Projects which are deliverable in the immediate term (over the 5 year horizon); Planning for Growth: Projects that will support planning for growth and improved outcomes in new developments (over the 15 year horizon); Strategic Investigations and Options: Options that may be required (over the 50 year horizon) which require active planning and further investigations in the short term.

One of the actions listed in the Plan is the Green Blue Infrastructure initiative for Ballarat.

**North Central Catchment Management Authority, 2016. North Central Victoria Regional Sustainable Agriculture Strategy**

In 2016 the North Central Victoria Regional Sustainable Agriculture Strategy was published with the aim of productive farming while protecting the natural resources base. Two farming zones are identified that overlap with the Central Highlands region: a mixed farming zone in the west covering Marnoo, St Arnaud, Avoca and Clunes, and a diverse farming zone around Creswick, Daylesford, Kyneton and Woodend. The characteristics of each zone are presented. Three scenarios for sustainable agriculture are discussed; a paradigm shift, where agriculture is shifted to fully adapted to Australian conditions, e.g. moving towards a low input grazing system based on native grasses; a mid-level change where farming aims towards sustainability, e.g. increasing soil carbon through sub-soil manuring; and an incremental change, making small changes and allowing for adaptation to uncontrollable influences, without fully eliminating the risks to sustainable agriculture.

**North Central Catchment Management Authority, 2015. North Central Climate Change and Mitigation Plan**

In 2015, the North Central CMA published a Climate Change and Mitigation Plan. The process to develop this plan followed climate projections, followed by a vulnerability assessment, community workshops, and the development of a mitigation plan. Mitigation options focus on the topics of vegetation, soil, carbon farming and carbon sequestration options for multiple land uses. Community concerns related to climate change and related to the drought resilience plan include increased fire risk, declining water availability, water quality water security and water pricing, and the impact of extreme heat on human and animal health. The capacity for the community to respond to events is listed as a concern, especially related to service provision, social cohesion and issues faced by smaller rural communities. A specific set of strategic goals is listed for the Goldfields region, covering the Central Highlands, with focus on natural re-vegetation, monitoring of biodiversity, and implementing a large scale carbon sequestration action across the landscape in the goldfields area.



### **Djaara (Dja Dja Wurrung Clans Aboriginal Corporation), 2014. Dhelkunya Dja Country Plan 2014–2034**

The Dhelkunya Dja-Dja Dja Wurrung Country Plan 2014-2034 describes nine goals the Djaara aspires to. The Plan provides Country and cultural background, and provides an approach for the implementation of the Plan. The nine goals and themes are framed around Djaara (our Peoples), Cultural Practises and Customs, Cultural Heritage, Bush Tucker (edible and medicinal plants and animals), River and Waterways, Land, Self-determination, Traditional Owner Economy and Joint management.

Eighty seven percent of the Dja Dja Wurrung Country is privately owned; 65% of land is used for agriculture. The other 13% is a combination of parks, forests and reserves. A historical transformation of the natural landscape has been driven by agriculture, urban settlement and mining. The transformation is continuing, both driven by natural and human caused factors. The Vision for Country described in the Plan includes a strong health and wellbeing of Dja Dja Wurrung Peoples, underpinned by a living culture; Lands and water that are in good conditions and actively managed to protect Dja Dja Wurrung values; Laws, culture and rights of all Dja Dja Wurrung Peoples are promoted.

While there is no specific reference to drought, the themes of Rivers and Waterways, and Land, are related to drought management. The aspirations in the Plan for Rivers and Waterways are to ensure that rivers and waterways are healthy and meet the needs of our people and land. Actions defined under this theme include the assurance of a meaningful role in the development of water policy frameworks in Victoria and the Murray Darling Basin; the establishment of a formal role in regional water management through participation in development and implementation of Regional Water Strategies. Actions under the Land theme focus on remediation and restoration of mined land, with the objective that our upside-down Country is healthy again.

### **Urban Water Cycle Solutions, 2014. Systems Analysis of Water Cycle Systems – Analysis of base case scenarios for the Living Ballarat project**

This report is focused on the base case behaviour of the Ballarat and Maryborough water districts from the context of the performance of the entire region. A Systems Framework of the Ballarat region was developed as part of the Living Ballarat Project to assist in understanding the whole of water cycle challenges and opportunities across the region. The Systems Framework has demonstrated capability to understand local versus regional trade-offs for water sources and operating decisions. This process has the necessary capability to support development of policies for water operations and allocations for the Ballarat region. The framework can be utilised to optimise planned system behaviours including water restrictions, operating rules, allocations and reservoirs. This includes prioritising and optimising of operating rules and allocations throughout the system. The Systems Framework can be used to develop strategies and policies for management of waterways from the perspective of the entire water cycle –including a necessary governance structure for managing regimes for stormwater harvesting and use of aquifers. The Systems Framework has successfully replicated the observed changes in water use behaviour over the last decade as behaviour change, water efficient appliances and behaviours, and rainwater harvesting. Nevertheless, the mix of these actions is not well understood. For example, the changes in water use could be dominated by behaviour changes. The behaviour of the water systems and the required structure of operating rules have changed by inclusion of the Goldfields Pipe that conveys allocations to Ballarat from the Campaspe and Goulburn River basins. This analysis has revealed some interesting paradoxes including understanding that replacement of agricultural land uses with urban development results in the decreased loads of nutrients in waterways. However this waterway health impact is countered by increased nutrient loads from wastewater discharges and increased frequent flows in waterways. There is an outstanding opportunity to include local water resources of urban stormwater runoff, wastewater discharges to treatment plants, groundwater and rainwater harvesting in future water strategies.

**North Central Catchment Management Authority, 2013. Caring for Country – A sustainable land management guide for rural living in north central Victoria**

The North Central CMA (2013) published a document for new and existing landholders to support sustainable choices with the available resources. It contains suggestions for land planning, efficient irrigation and sustainable water sourcing. In the section on water savings, it is suggested to install and use rainwater tanks for domestic water use, as well as several other domestic water savings tips. For gardens, it is suggested to use grey water for irrigation, reduce lawn areas, use native, climate adapted plants, and use mulching to reduce evaporative losses. It is followed by a section on how to recycle water, and the best practices to manage recycled water. The chapter on biodiversity includes the benefits of native vegetation, and suggestions on how to manage native vegetation on rural properties. A large section on soils explains the different types of soils landholders may encounter, and the most sustainable ways to use the different soil systems. The plant and animal sections suggest best management practices for different land uses. These are followed by a climate section, explaining the drivers of weather systems and climate. A summary table shows the impact of a changing climate on the environment, the community, primary production, and water. This is concluded by a heading to prepare for weather emergencies, starting with risk assessment, then risk management, and preparation for specific weather-related events like fire, floods and thunderstorms. This document ends with a chapter on the community, and how to be good neighbours to each other.

**Victorian Auditor-General, 2008. Goldfields Superpipe**

For some years now the Victorian Government's delivery and management of its water resources have been undertaken in unprecedented drought conditions. In the key regional centres of Bendigo and Ballarat the drought has reduced the volume of water in storages to approximately 10 per cent of capacity, their lowest level ever recorded. Despite the severe water restrictions introduced by the Coliban Water Authority and the Central Highlands Water Authority, Bendigo and Ballarat almost exhausted their drinking water supplies in 2007.

In response to the extreme conditions, the State Government, in conjunction with Coliban and Central Highlands, is constructing a major water pipeline, called the 'Goldfields Superpipe' that connects Ballarat and Bendigo to the Goulburn River system. This was finalised in 2008. The Superpipe aims to improve the security of water supplies in the region by allowing both water authorities to access the more reliable supplies in the Goulburn River.

The Superpipe has three components: a Bendigo pipeline that will draw water from the Waranga Western Channel and deliver it to Bendigo via the Eppalock to Sandhurst pipeline, and supply Lake Eppalock; a Ballarat pipeline, from Bendigo's Sandhurst Reservoir to Ballarat; an augmentation of the existing Eppalock to Sandhurst pipeline. The 46.5km Bendigo pipeline is being managed by Coliban. The 87km Ballarat pipeline is being managed by Central Highlands. The Commonwealth and State Governments are part-funding the Bendigo and Ballarat pipelines.



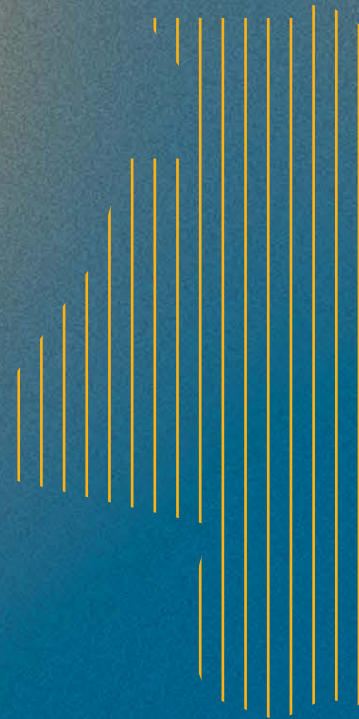
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For more information on the Future Drought Fund visit:  
**[www.agriculture.gov.au/fdf](http://www.agriculture.gov.au/fdf)**

For more information on Victoria's Regional Drought  
Resilience Planning program visit:  
**[www.agriculture.vic.gov.au/futuredroughtfund](http://www.agriculture.vic.gov.au/futuredroughtfund)**





# Drought in the Central Highlands Region

Information to support the Central Highlands Regional Drought Resilience Plan

November 2022



This research was jointly funded by the Australian Government and Victorian Government under the Future Drought Fund.

## Regional summary

The diverse Central Highlands region borders the western fringes of Melbourne and western Victoria, with an array of tourist attractions and growing cities. The region has a population of 207,300 and a Gross Regional Product of \$10.225 billion (2020). The proximity to



Melbourne is driving population growth with Ballarat the fastest growing regional centre in the region. Comparatively the western area of Central Highlands has many smaller towns and lower population growth.

The Central Highlands region includes the traditional lands of the Wadawurrung, Dja Dja Wurrung and Eastern Marr People and Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupgalk Nations as well as other Traditional Owner groups in Victoria who are not formally recognised.

The Central Highlands region is a diverse economy with a heavy reliance on agriculture in the west, and a high reliance on manufacturing and services in the eastern side of the region. The main regional centre is Ballarat where the economy is based on services (health and education) and manufacturing. In terms of agriculture, sheep and lambs play a large role in output; other outputs include wheat, poultry and horticultural products.

The Central Highlands region contributed \$1.4 billion in gross value of agricultural production (GVAP) in 2020 to 2021.

The region recently experienced drought and dry seasonal conditions during the Millennium drought, 2014 and 2015 (notably in the western parts of the region), and in 2017 to 2019.

## Assessing the impacts of drought

The Regional Drought Resilience Planning Program (RDRP Program) is about planning with communities at the regional level to better prepare for the next drought and forms part of the Commonwealth Government's Future Drought Fund.

Economic analysis, research and stakeholder discussions have been undertaken to consider three questions:



Consultation with local stakeholders was a key factor to the analysis, which enabled a better and more localised understanding of how droughts impact the region.

This research was jointly funded by the Australian Government and Victorian Government under the Future Drought Fund.

## Drought

The definition of drought varies depending on region, needs and disciplines. Below are 4 ways to measure whether a region is in drought.



**1. Meteorological drought:**  
degree of dryness  
or rainfall deficit



**2. Hydrological drought:**  
precipitation shortfalls  
on surface or subsurface  
water supply



**3. Agricultural drought:**  
links various characteristics of  
meteorological (or hydrological)  
drought to agricultural impacts



**4. Socioeconomic drought:**  
associates the supply and  
demand of some economic  
good with elements of  
meteorological, hydrological,  
and agricultural drought.

The first three approaches deal with ways to measure drought as a physical phenomenon. The last deals with drought in terms of supply and demand, tracking the effects of water shortfall as it ripples through socioeconomic systems.

However, there is no one definition that encompasses all factors that bring rise to drought conditions — and the resultant impacts on regions and communities. Drought is complex and dynamic, meaning a universal 'definition' is near impossible. For example, when referring to the Millennium drought in practice it was a combination of the types of drought listed above.



## Assessment framework

In order to consider how drought affects farms and the wider community, the following analytical framework distinguishes between agricultural impacts and non-agricultural impacts of drought. The framework is designed to consider the implications of specific drought impacts and what the outcomes of these implications will be. Within the two distinctions, the framework considers the social, economic and environmental impacts, to develop a more complete understanding of how drought impacts flow through the community.

**Figure 1** demonstrates how this analytical framework can be applied to agriculture. Drought reduces agricultural productivity, which results in a change in primary production on farm. This impacts farm income, consumption of farm inputs, and production of farm outputs. These on-farm implications of drought flow through to the community to generate a range of outcomes. The existence of agricultural markets (e.g. sheep and cattle prices, crop prices, etc) means the impact of drought on agriculture is easier to quantify than other non-market impacts of drought.

**Figure 1** also considers how drought impacts non-agricultural settings. Drought can lead to significant water restrictions and low availability of water in lakes, rivers and dams. A reduction in water availability may mean community greenspace is reduced which will in turn reduce liveability benefits in the community and the amenity values from the green space. Furthermore, there are flow on effects if parks and sportsgrounds cannot be used including impact on community cohesiveness. A lack of water in lakes, rivers and dams could also hurt tourism in the region as there is a reduced ability to boat, water ski or fish. This in turn reduces the income and spending within the regional economy.

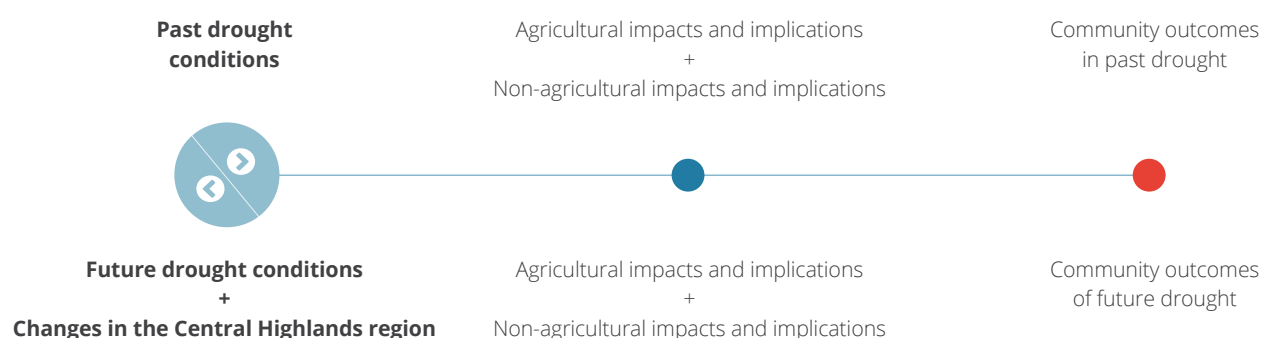
**Figure 2** demonstrates the structure of the analysis for both past and future drought periods, with considerations from both agricultural and non-agricultural impacts of drought flowing through to community outcomes.

**Figure 1 Impacts of drought and flow on effects**

➤ Drought impact	➤ Implications	➤ Outcomes
 <b>Change in agricultural productivity</b>	<ul style="list-style-type: none"> <li>• Change in primary production</li> <li>• Change in farm income</li> <li>• Change in farm inputs</li> <li>• Change in farm outputs</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced spending in the community</li> <li>• Reduced demand for ag farm services (but could increase in demand for feed)</li> <li>• Reduced output associated</li> <li>• transport, processing/ manufacturing</li> <li>• Reduced primary production for distribution and value-add</li> <li>• Mental toll (and potential migration)</li> </ul>
 <b>Water restrictions</b>	<ul style="list-style-type: none"> <li>• Households: outdoor water use</li> <li>• Community green assets: parklands and sportsgrounds</li> </ul>	<ul style="list-style-type: none"> <li>• Liveability and mental health</li> <li>• Mental toll</li> <li>• Potential migration</li> <li>• Access to green space and flow on effects (i.e. footy clubs, parent groups etc)</li> <li>• Amenity values from green space</li> </ul>
 <b>Water availability in lakes, rivers &amp; dams</b>	<ul style="list-style-type: none"> <li>• Less water available for recreation (boating, water skiing, etc)</li> <li>• Reduced fishing opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced recreation and tourism</li> </ul>

*Note: this summary does not provide an exhaustive list of impacts, but rather is about providing a consistent evidence base across Victoria's nine regions*

**Figure 2 Structure of analysis**





## 01 Past drought conditions

## 02 Agricultural impacts and implications of drought + Non-agricultural impacts and implications

## 03 Community outcomes in past drought

### 01 Past drought conditions

Large drought events have had wide effects across Victoria, with each drought being different in its regional severity and distribution. The last 25 years has seen Central Highlands experience extensive drought periods, starting with the Millennium drought from 1997 to 2009, the 2014 to 2015 drought periods and the dry conditions experienced from 2017 to 2019.

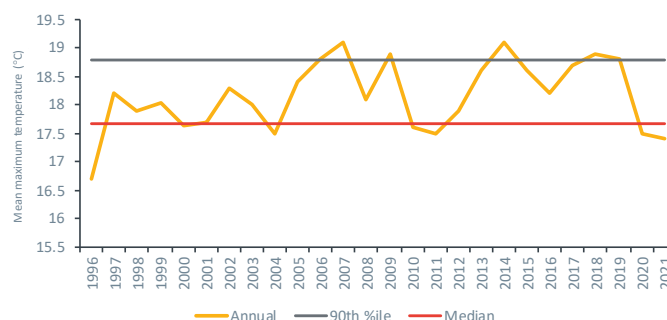
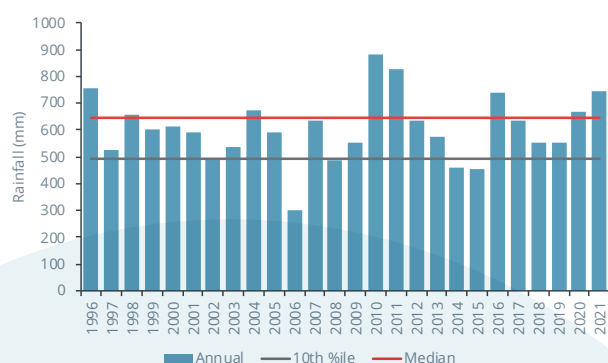
The historical rainfall and temperature charts in **Figure 3**, provides evidence of the severity of these recent drought events. 2014 and 2015 were particularly bad with rainfall below the 10th percentile, coupled with mean maximum temperatures over the 90th percentile in 2014.

Additionally, from 2001 to 2009, and in 2017 to 2019, the region experienced consecutive years of well below median rainfall and above median temperatures.

Agriculture in the region relies on rainfall and groundwater. The above charts show an annual average rainfall, however the success of dryland cropping and grazing is dependent on the timing of rainfall throughout the year. More intensive agricultural land uses (i.e. poultry and piggeries) are growing in the eastern parts of the region.

There are climatic differences across the breadth of the region meaning impacts of drought will not be the same across the Central Highlands.

**Figure 3 Annual rainfall and average maximum temperature in Ballarat**



#### Recently experienced droughts in the region:

- Millennium drought
- 2014 and 2015
- 2017 to 2019

### 02 Agricultural impacts and implications of drought + Non-agricultural impacts and implications

The variance of agricultural employment in the region, and the range of agricultural enterprises (from vegetable crops to extensive grazing and dryland cropping), means that communities within Central Highlands will be impacted differently. Furthermore there is a large reliance on secondary agricultural industries which are likely to experience the flow on impacts of drought. There is a high proportion of agricultural employment in the Pyrenees and Ararat Local Government Areas (LGA) which make them highly susceptible

to drought impacts. Although somewhat more diverse employment opportunities, the LGAs of Hepburn and Golden Plains also have a reliance on agriculture for direct employment.

Of note however, is the reliance on secondary agriculture industries across the entire Central Highlands region. One insight into this is looking at value add across the region - agriculture, fishery and forestry is the third largest contributor to gross value add with \$664 million, and manufacturing is the fifth largest contributor with \$655 million (2020). The Regional Economic Development Strategy (2022) identified the largest exporter in the region is manufacturing (\$508.6 million), of which food product manufacturing is the largest component (\$327.4 million). Agriculture, forestry and fishing is the second largest industry export (\$368.5m). Stakeholders raised this as a major implication of drought in the region.



The Central Highlands region contributed \$1.4 billion in gross value of agricultural production (GVAP) in 2020 to 2021. Agriculture production is dominated by livestock and livestock products (57%) comprising mostly of sheep and wool. Broadacre cropping is another large contributor to agriculture production (30%) with mostly wheat and canola grown in the region.

The high reliance on livestock means there are drought preparedness and operation practices that can be introduced to reduce the impacts of drought. For example, buying more fodder to replace pastures and on farm dam storages can be used to feed and water livestock.

The impacts of the 2017 to 2019 drought were mitigated somewhat due to experience and lessons farmers learnt from the Millennium drought. For example, livestock producers have honed drought preparedness and operation practices that can reduce the impacts of drought, such as buying more fodder to replace pastures and on farm dam storages can be used to water and feed livestock. We note that the timing of rainfall has a significant impact on fodder growth.

Stakeholder consultation noted that those agriculture producers in the Central Highlands that did not have access to alternative water supplies or drought response measures suffered extensively during the 2014 to 2015 dry period.

### Town water

Severe and enduring water restrictions were required during the Millennium drought.

Both the Ballarat (Ballarat, Ballan, Bungaree, Buninyong, Creswick, Gordon, Linton, Rokewood, Smythesdale, Skipton, Wallace) and Maryborough (Adelaide Lead, Alma/Moonlight, Carisbrook, Daisy Hill, Havelock, Majorca, Maryborough, Rodborough, Simson/Bet Bet, Talbot, Timor/Bowenvale) systems were restricted to Stage 4 restrictions from 2006 to 2009. Stage 4 water restrictions prohibit the watering of any outdoor space, amongst other restrictions, which had profound impacts on the community's liveability.

The Goldfields Superpipe was a crucial to maintaining a water supply during the Millennium drought. Just before the Superpipe was commissioned, Ballarat's major storages reached an all-time low of about 7% capacity (4,376 ML). More than 22,000 ML of water

was delivered to Ballarat in the two years after the Superpipe was commissioned in May 2008. Stakeholder consultation raised that the water from this pipe is saline and costly to pump and treat.

To mitigate community impacts of the Millennium drought, Central Highlands Water purchased water entitlements and allocations. They also facilitated trade by their customers – at May 2009, customers of Central Highlands Water, including car washes, sporting grounds and bowling clubs, had purchased 135 ML of water on the allocation market.

### Recreation and Tourism

Tourism in the region is both water dependent and non-water dependent. Increasing temperatures and less rainfall is likely to affect tourist's amenity benefit from visiting the towns and landscapes in the region.

### Environment

The Central Highlands are home to three National Parks, nine state forests/ state parks and other reserves that support nature based tourism. Lack of rainfall causes serious problems for native animals as they move closer to human life in search of water. For example, a wildlife shelter in Hepburn Springs was inundated with emaciated kangaroos, koalas and bird life in 2017 to 2019.

Lake Wendouree was essentially dry for six years during the Millennium drought. More broadly, the natural environment in the region includes a number of ecologically and recreationally important wetlands, including sites of international importance established by the UNESCO Ramsar Convention.

### Traditional owners

Culturally significant sites, particularly those located on flood plains and/or water dependent were exposed and became vulnerable to damage. Damage to these sites can lead to distress within the community. Consultation identified a loss of important species, for example the Eastern Bar Bandicoot, during previous drought periods. The strong connect to Country leads to mental health impacts in traditional owners during drought periods.

## 03 Community outcomes in past droughts

Farming communities are severely impacted during periods of drought, due to:

- Financial pressures resulting from reduced on-farm income and increased costs
- On-farm issues mostly relating to lack of water and feed for stock, and poor yields or failed crops
- Pressures from invasive native and pest animals on farms
- Physical and mental health and wellbeing impacts on individuals and families
- Flow on financial pressures being experienced by supporting businesses in the community.

The impacts of drought on agricultural production in the Central Highlands also affect the range of agricultural farm service providers and down-stream processing facilities in the region, including stock agents, Goldacres machinery and McCain Foods. This in turn affects spending and business activity across the broader communities.

Although not a prominent industry, the wild eel fishery is an example where environmental impacts of drought (to reduce fish movement and breeding) mean that commercial practices and recreational fishing is put under strain during drought periods.

Overall, the cumulation of impacts on production, regional economies, and liveability from drought led to significant impacts on the regional communities. An increase demand for mental health services and Rural Financial Counselling Services was also evident.



## 01 Future drought conditions + Changes in the Central Highlands region

## 02 Agricultural impacts and implications of drought + Non-agricultural impacts and implications

## 03 Community outcomes of future drought

### Future Impacts of drought

Future impacts will differ from past impacts depending on the severity of future droughts, and the changes in the characteristics of the Central Highlands region and its communities.

## 01 Future drought conditions

Climate change is likely to increase the variability of the weather in the Central Highlands region with future droughts expected to be longer, more frequent and more severe. Climate projections show that by 2050 the Central Highlands region on average will be hotter, drier and be exposed to a growing number of fire danger days. Similar to the past, the region and sub-regions will continue to face variable conditions within and across seasons — however in the future this variability will be around a lower average rainfall and higher average temperature than previously experienced. This means that, compared to current conditions, it is likely that parts of Central Highlands will face some seasons with rainfall significantly below and temperatures significantly above current averages.

The significant prevalence of dryland agriculture, which relies on timing and quantity of rainfall, does not offer resilience options that irrigated agriculture has access to (as they have continued access to water that can be drawn upon during dry periods).



### Changes in the Central Highlands region

There have been a number of changes in the Central Highlands that will alter the impacts of drought in the future, including:

- Town water security planning and investment has increased in the region, including Goldfields Superpipe (connecting the Ballarat system's White Swan Reservoir to Lake Eppalock and the Goulburn Murray system).
- Population changes (including an increase in sea/tree-changers due to Covid19) bringing additional water demand to the region.
- Increase in peri-urban development and number of lifestyle/hobby farmers which will change the water demands in the region.
- Water investments in community assets, for example Lake Wendouree water supply project now provides the option of supply of a combination of Class A recycled water and stormwater to the lake, due to construction of works and agreements.
- Continuing diversification of the region's economy.

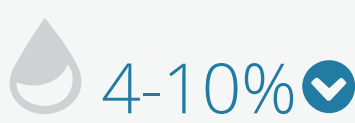
It is noteworthy that limited opportunities for water trade and irrigation distribution mean the Central Highlands region is less exposed to broader 'system level' responses to drought and a changing climate (as compared, for example, to the neighbouring Loddon Campaspe region) – including interregional water trade and Basin Plan water recovery.

### Figure 4 Climate projections for the Central Highlands region

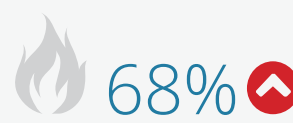
**Future droughts are likely to be longer, more frequent and more severe:** By the 2050s



Average maximum temperatures are expected to increase by 1.6 to 2.1°C. Number of days over 35°C in Ballarat are expected to increase from 5.2 days to 9.17 days.



Rainfall will continue to be very variable. Average rainfall expected to decrease by 4 to 10%.



Number of very high fire danger days expected increase by 12.4 per year. 8 days per year

## 02 Agricultural impacts and implications of drought + Non-agricultural impacts and implications

In response to the future increase in the likelihood and severity of drought (given expected increasing temperatures and decreasing rainfall), agricultural production in livestock and cropping farming operations will be most exposed. The adaptiveness of these producers, with farmers already having many strategies to manage drought, and their ability to maintain sufficient reserves will be critical to their farm profitability. The prevailing circumstances of a future drought — such as commodity prices, interest rates and fuel and fertiliser costs — will also play a role in resultant impacts.

Although, stakeholders raised concerns that when the sources of feed and fodder are in drought, the region will be at risk.

Viticulture production generally relies on on-farm water only. Given climate expectations there is a change that this industry could also be greatly exposed. The horticulture / vegetables in the region's east are high value production generating wealth for the region. It is important that this region continues to consider options for ongoing access to water/ water management.

Agri-food supply chain is considered a specialisation of the region. The flow on impacts of drought may put this sector at risk in the future.



Future implications of drought are likely to continue to impact the wellbeing and mental health of the local communities. Farmers and community businesses are likely to continue to rely on financial counselling services and the broader community will continue to rely on mental health services. The Rural Financial Counselling Service (RFCS) now has a wellbeing arm that will work to support farmers before, during and after droughts.

Stakeholder consultation raised the greater recognition of mental health impacts in the community will continue forward in the future.

### Town water

Town water security planning has improved building on lessons from past drought. Likewise, Urban Water Strategies are now required to incorporate future impacts of climate change (including potential droughts). For example, Central Highlands Water (CHW) has used the Department of Environment, Land, Water and Planning's 2020 'Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria' to undertake water demand system forecasts and identify a range of climate scenarios to assess potential impacts on water supply and customer demand. The water corporation is planning investment across a number of systems to maintain water supply security and treatment services in the coming decades. Actions from the 2022 Urban Water Strategy include:

- Extending CHW's interconnection to the State water grid — including connection of Goldfields Superpipe to Daylesford.
- Delivery of the Avoca bore upgrade project to improve reliability and security of supply.
- Completion of the Learmonth Tank Upgrade program to improve reliability and water quality.
- Design work for the major upgrade of the Waubra Water Treatment Plant to meet community water quality expectations

The Urban Water Strategy also notes: "during drought sequences, such as the Millennium drought, the system relies on being able to purchase allocation on the temporary market in northern Victoria to provide water for the [Goldfields Superpipe]".

There are also interactions between town water supply security and actions to improve environmental and cultural outcomes. For example, actions are being considered to provide 7,200 ML more water for the environment and for Aboriginal cultural purposes on the Moorabool River.

### Recreation and Tourism

Tourism will continue to be exposed to fluctuations in water access under future drought and dry conditions. Initiatives that are not dependent on water availability could boost visitors to the region. COVID-19 has provided a boost to regional travel and relocation.

### Environment

Inland lakes, rivers and dams are likely to be at lower levels during times of drought which will impact the native biodiversity living in and relying on these water bodies. There is likely to be a lack of food and drinking water for wild animals living in the region.

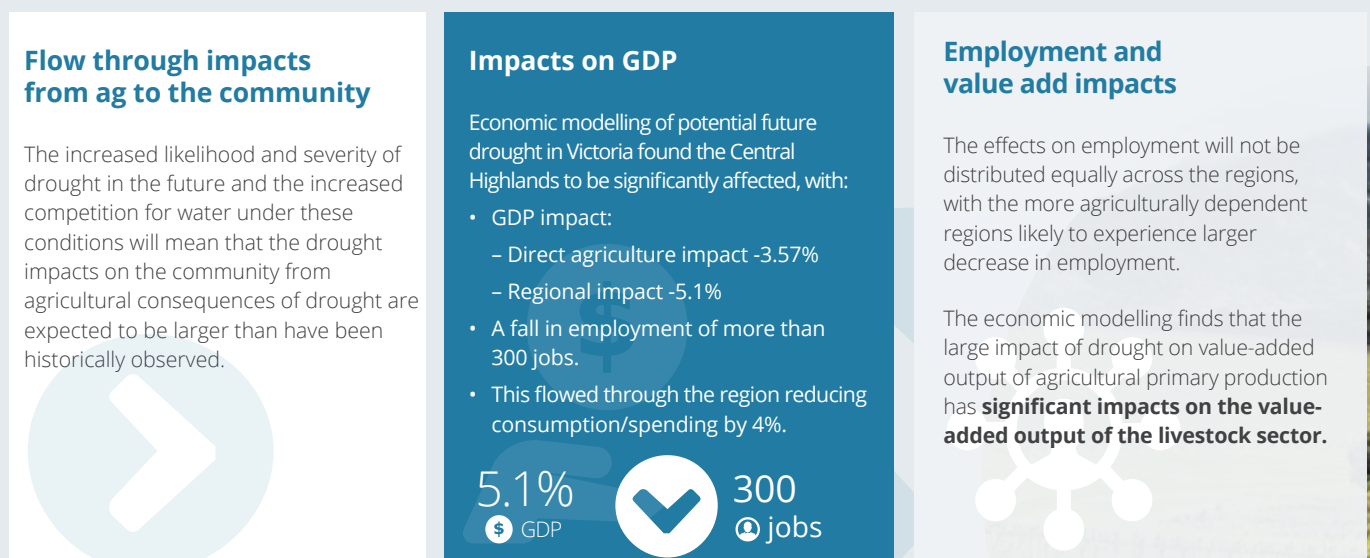
### Traditional owners:

Culturally significant sites particularly those that are dependent on water will increasingly be exposed to damage. Damage to these sites can lead to distress within the community.

## 03 Community outcomes in future droughts

Economic modelling of potential future drought in Victoria, undertaken by Victoria University's Centre of Policy Studies, found the Central Highlands would be affected with GDP falling by 5.1% and a reduction of almost 300 jobs in the region (see **Figure 5**). The modelled three-year drought, while prolonged, is not equivalent to the most severe recorded in Victoria.

**Figure 5 Computable General Equilibrium (CGE) Modelling for a future drought**



Access to local mental health services will be vital as drought conditions become more prevalent. Not only are mental health services important during times of drought, but improved mental health increase a person's ability to adapt. This can improve drought resilience by allowing people to effectively plan for future drought conditions.

Greenspace and associated community sport are drivers of community spirit and liveability within local communities in the region. Water Corporations and Councils now have a strong understanding of the importance of greenspace for their communities. However, should town water supply not allow watering of gardens this will have a mental health toll on residents.

The proximity to Melbourne and diversity of economy will provide resilience to future droughts in the eastern parts of the region. However, the western parts and those highly exposed to agriculture and agricultural dependent industries are a risk of impacts. Smaller communities that are highly dependent on agriculture and more geographically isolated will be most exposed. Population growth in Ararat and Golden Plains provides an opportunity for economic diversification. The region is also encouraging secondary growth in manufacturing.

Groundwater could come under pressure as an increasing number of lifestyle farmers are installing a bore to access groundwater.

Overall the Central Highlands region's exposure to agriculture and agricultural dependent industries creates the potential for significant community impacts from future drought.

## Vulnerabilities and gaps in preparedness

The diverse Central Highlands region already has many drought resilience measures in place or in development. Agricultural research, innovation and extension will remain important to support ongoing adaptation in agriculture and will aid preparedness to future drought. There is also a wide range in the capacity of farmers, in terms of the skills to maintain more adaptive farming practices and in the ability to maintain buffers of financial assets or feed stocks to manage drought conditions when they arise.

A significant vulnerability of the region includes the growing number of lifestyle properties. These owners may not have been exposed to a drought before so may not respond effectively when one happens. Furthermore, the growing number of bores from these properties could be putting pressure on ground water and there is a growth in the number of stock and domestic water licenses.

It was raised in consultation to vulnerabilities to water sharing across competing users and ensure the Traditional Owners are included in decision making on land management and water sharing.

Although the social resilience of the community to drought has increased, such as through urban water investments in pipelines and water transfers, the environmental/ecological resilience in the region has not increased. Now and looking forward, there is less connectivity in landscapes, and a high reliance on certain refugia.

Diversification is a key mechanism for the regional economy to contain the drought impacts flowing from agricultural sector. Towns throughout the Central Highlands region have varying degrees of diversification with larger, centrally located towns more likely to experience these benefits. Specifically:

- The major regional centre Ballarat will provide a buffer to these drought impacts as it is diverse economy. Townships near Ballarat can also benefit from some of this buffering in the face of less agricultural activity because of drought. Townships within an approximately 50 km radius provide people with the attraction of living in a smaller community, lower cost of housing but having employment opportunities in the larger centre.
- Smaller communities are still likely to feel impacts of drought. The tight knit social aspect and limited alternatives that can replace the economic activity provided by agriculture.

However, even Ballarat is exposed to the flow-through impacts of drought given the prevalence of agricultural support services, agriculture-related manufacturing, as well as logistics. The specialisation of food product manufacturing makes the region exposed to drought both in and outside of the regions boundaries.

Access to services such as mental health and Rural Financial Counselling are particularly important to manage drought. These kinds of health services have long wait times in the region, even outside of times of drought. Following the onset of a drought there is a general lag in the provision of additional health services. This means that individuals unable to access these services are having to make drought management decisions under significant stress.





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