GANNAWARRA
Shire Council

Climate Change Adaptation and Mitigation Strategy

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Prepared for Gannawarra Shire Council

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About Ironbark Sustainability

For nearly two decades, Ironbark Sustainability has worked with councils and their communities to reduce greenhouse emissions, tackle climate change and implement sustainability projects and programs. We bring together a wealth of technical and financial analysis, maintenance and implementation experience in the areas of building energy and water efficiency, climate action and strategy development, public lighting and data management. We pride ourselves on supporting our clients to achieve real action on sustainability.

Our Mission

The Ironbark mission is to achieve real action on sustainability for councils and their communities.

Ironbark is a certified B Corporation. We have been independently assessed as meeting the highest standards of verified social and environmental performance, public transparency, and legal accountability to balance profit and purpose.

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1. MAYOR'S MESSAGE

Together with my fellow Councillors, I am pleased to present our Climate Change Adaptation and Mitigation Strategy. This document confirms Council's commitment to long-term climate adaptation and mitigation.

As a Council, we acknowledge the scientific evidence and the risk that climate change presents to the community and the planet. During this century alone our communities have endured two prolonged droughts and a once in 100-year flood event.

Council is committed to taking strong and decisive action to minimise Council's environmental impact and build the resilience of Council operations, services and assets to reduce the vulnerability of the community to climate change. This strategy will assist us to achieve this, as well as position Gannawarra Shire Council as a highly sustainable and resilient regional Council by 2040.

We are also required to consider climate risk in Council activities, under the Victorian Climate Change Act 2017 and Local Government Act 2020. In doing this, we acknowledge our ancestors and descendants of the Barapa Barapa, Yorta Yorta and Wamba Wamba People, who have endured previous large-scale climatic change events. Their in-depth understanding of the land, together with their knowledge and their capacity to adapt to environmental change, is critical to our approach.

The successful implementation of the actions listed in this strategy rely on Council's partnerships with the community and regional agencies. Although we are one entity, it will take the efforts of everyone to mitigate climate change and ensure the Gannawarra is a great place to live and work for many years to come.

Mayor Charlie Gillingham

Acknowledgement of Country

Gannawarra Shire Council acknowledges the Barapa Barapa, Yorta Yorta and Wamba Wamba people as the traditional owners of the land now known as Gannawarra. We pay our respects to Elders past, present and emerging and acknowledge their rich culture and connection to Country.

2. INTRODUCTION

In December 2021, Gannawarra Shire Council (GSC) adopted its Climate Change Policy, confirming its commitment to long-term climate adaptation and mitigation. The objectives of the Policy include reducing the environmental impacts and operating costs of Council operations, undertaking actions to reduce the Gannawarra community's emissions, responding to the risks of climate change to Council assets and services, and assisting the community to be more resilient to the effects of climate change.

This Climate Change Adaptation and Mitigation Strategy has been developed to formalise a clear strategic direction for climate change adaptation and mitigation for GSC. It establishes clear, concise, and actionable plans across the short, medium and long term to guide Council towards achieving its climate vision. Whilst focused on Council's own operations and service delivery, the Strategy also includes high level opportunities for Council to influence positive outcomes in the broader Gannawarra community.

Section 3 of this document establishes the context of the Strategy in terms of Gannawarra's already changing climate, the decarbonisation of the economy, and relevant State and Federal government policies. Section 4 explores steps already undertaken by GSC to address climate change, including within the Growing Gannawarra plan and adoption of a formal Climate Change Policy.

Key climate change risks identified for Gannawarra are summarised in Section 5. This section also outlines the results of community consultation for this Strategy, identifying the needs and priorities of residents and business owners in responding to the impacts of climate change. GSC's corporate greenhouse gas emissions inventory is presented in Section 6. Section 7 highlights programs already implemented by Council, demonstrating our leadership in reducing emissions and improving liveability in the region.

Section 8 presents GSC's long-term climate change goals and strategic framework. With short, medium and long term objectives across four strategic priority areas, GSC have identified key actions to be completed over the next five years to set Gannawarra on a trajectory to achieve its goals.

3. STRATEGIC CONTEXT

3.1 Climate Change in Gannawarra

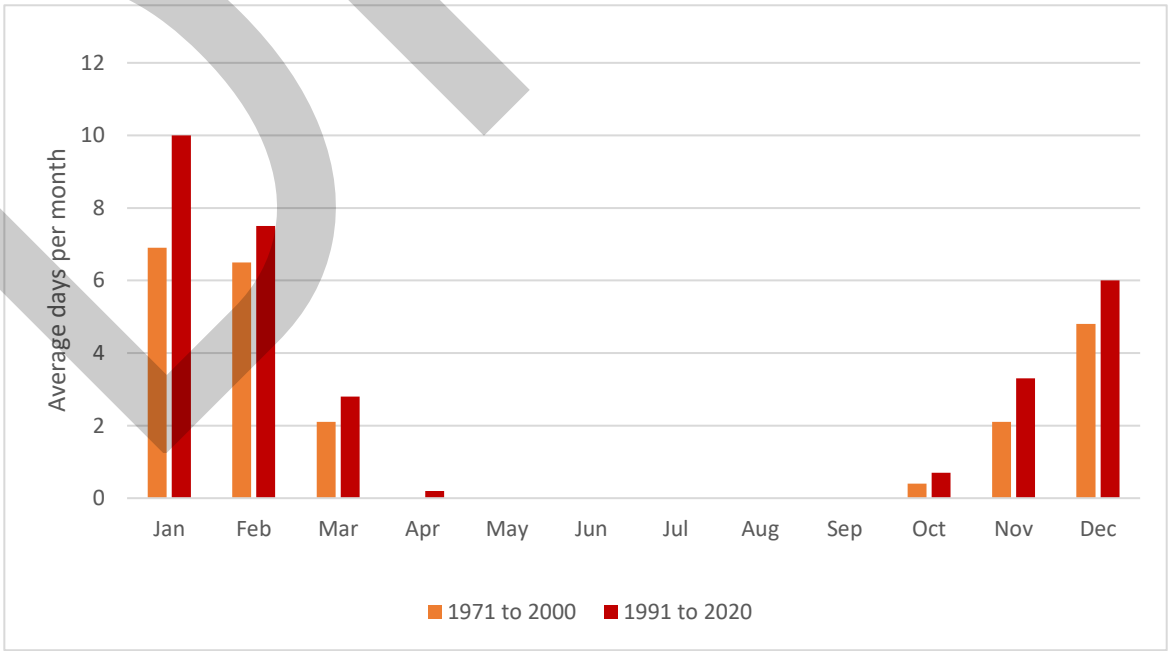
3.1.1 How the Shire's climate has already changed

Victoria is becoming hotter and drier as a result of climate change. Since 1910, annual average temperatures have increased by 1.2˚C in Victoria, while cool season rainfall has declined over the last 30 yearsi. These changes are already having short and long term impacts on the landscape, productivity, culture and health and well-being of regional Victoria.

In the Loddon Mallee region climate change has brought longer and harsher bushfire seasons, changed rainfall patterns, greater drought risk, more extreme heat and rainfall events and ecological changesii. In Gannawarra, the average number of days over 35˚C has increased by 33% from an average of 22.8 between 1971 – 2000 to 30.5 between 1991 and 2020iii. Figure 1 compares the average number of days over 35˚C per month between 1971 and 2000 and 1991 and 2020. This shows an increase in the number of days over 35˚C in all months from October to April.

These impacts are already being felt by the local Gannawarra Shire community. In addition to the concern about increasing extreme temperatures, community consultation conducted by Ironbark Sustainability in partnership with GSC highlighted a variety of community experiences and concerns related to the changing climate. These included water security concerns due to declining rainfall, negative impacts on livability, especially during summer months, and the health and mental health impacts on residents of drought and extreme heat events, particularly on vulnerable members of the community. The Kerang Aboriginal Elders group additionally spoke of the deterioration of the local environment, including waterways that were more polluted and more invasive species in the local area. They also discussed issues with extreme heat and the financial stress of needing to run air conditioning for longer in summer.

Figure 1: Average number of days over 35˚C per month in Kerang



3.1.2 Gannawarra in 2050

Without significant action to reduce emissions and mitigate climate change, these impacts are only going to increase. Modelling completed by the Victorian Government, CSIRO and the Bureau of Meteorology (BoM) confirms that both medium and high emissions scenarios will see an increase in average and daily maximum temperatures for the Gannawarra region. Under a high emissions scenario average daily maximum temperature rise is projected to increase from 22.8°C to approximately 25°C by 2050 and over 27°C by 2100[v]. The impact of this is set to almost double the average number of days over 35°C per year to over 42 per year by 2050 and up to 62 by 2090. Rainfall is projected to continue to decline under a high emissions scenario, with annual rainfall between 10-20% lower by 2050 (Figure 3).

Emissions Scenarios

To assist climate scientists in the consistent modelling of climate change impacts, the IPCC has outlined four standardised scenarios called Representative Concentration Pathways (RCPs), ranging from RCP8.5 (high emissions scenario) to RCP2.6 (low emissions scenario). These scenarios are based on the likely emissions production at a global level (i.e. the total amount of emissions produced by all countries) and consider the environmental systems used to process various concentrations of atmospheric carbon dioxide[iv]. Taking into account the diversity of climate action at a global scale, it is relevant to consider high (RCP8.5) and medium (RCP4.5) scenarios to understand our future climatic landscape.

Climate models also project an increase in solar radiation for the Murray Darling Basin, a decrease in relative humidity and an increase in evapotranspiration (the evaporation and transpiration of water from soil, vegetation, water bodies and the groundwater table). Increase evapotranspiration together with a decline in rainfall is projected to have large impacts on soil moisture, particularly in winter and spring[vi]

Figure 2: Extreme heat projections for the Gannawarra region[vii]

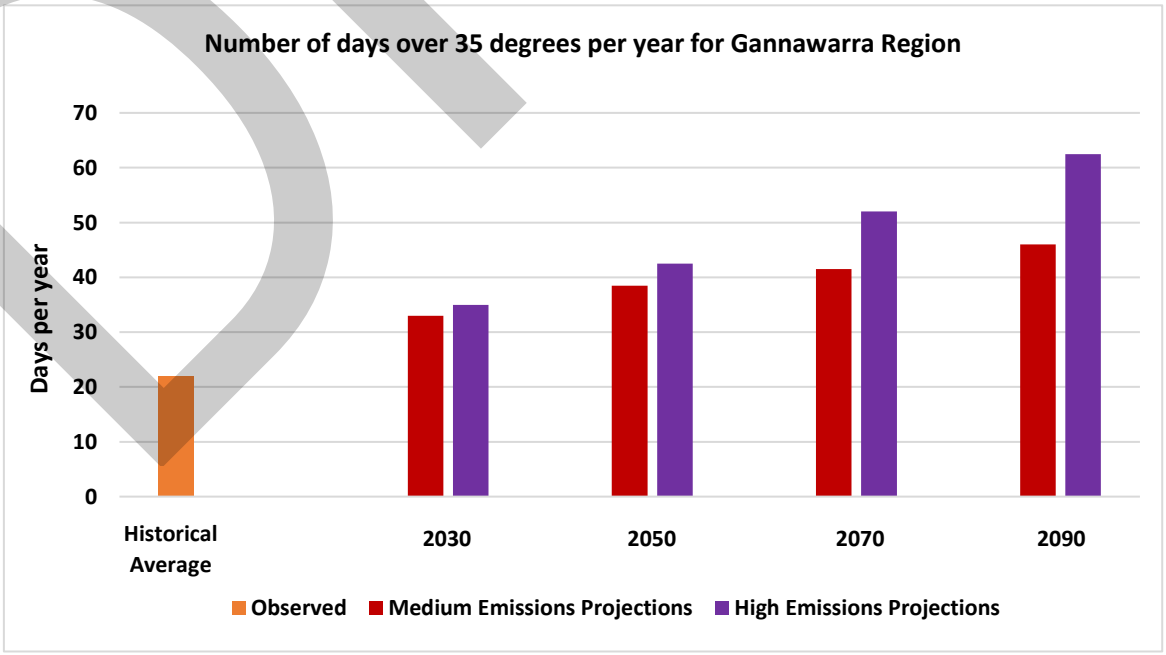
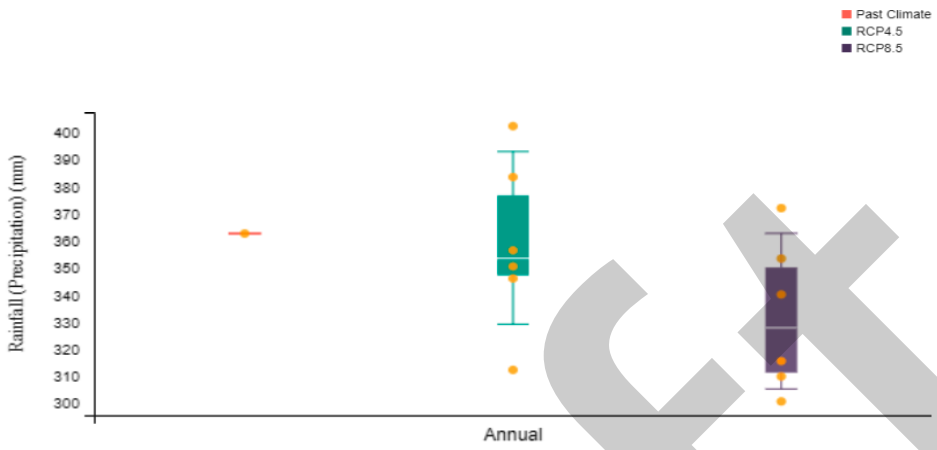


Figure 3: Rainfall predictions under medium (RCP4.5) and high (RCP8.5) emissions scenarios[viii]



Despite these trends, local and global action on climate change is still able to reduce emissions in line with low or medium emissions scenarios. Limiting global emissions to these lower concentration levels will help to avoid the worst impacts of climate change. Under a medium emissions scenario, for example, the region is projected to experience a much lower reduction in rainfall, while under a low emissions scenario average annual temperatures are projected to be 2.3˚C to 2.8˚C lower than under a high emissions scenario by the end of the century[ix].

3.2 State and Federal Policy Context

Paris Agreement At the United Nations Framework Convention for Climate Change (UNFCCC) Paris Conference in 2015, the Australian Government signed an international agreement between 195 countries to keep any temperature rise "well below 2°C", and to drive efforts to keep warming below 1.5°C higher than pre-industrial levels. The Paris Agreement, entered into force on 4 November 2016, explicitly recognises and engages local and subnational governments and their critical role in supporting the transformation, including setting goals and strategies aligned with the science. Climate science tells us that warming beyond the 1.5°C threshold is likely to have increasingly severe social, economic and environmental impacts, not least on a water scarce continent like Australia.

Victorian Government In 2017, the Victorian Government introduced the *Climate Change Act 2017*, which legislated a state-wide net zero emissions target by 2050. In 2021, the State Government further released the Victorian Climate Change Strategy, which introduced updated renewable energy targets and interim emissions reduction targets, including a 50% renewable energy target and a 45-50% emission reduction target (on 2005 levels) by 2030[x].

The *Climate Change Act* also requires the development of five-yearly Adaptation Action Plans covering the physical and non-physical systems applicable to Victorian communities[xi].

The amended *Local Government Act 2020* for the first time introduced overarching governance principles that Councils must consider climate change in their decision-making, specifically that *"the economic, social and environmental sustainability of the municipal district, including mitigation and planning for climate change risks, is to be promoted"*[xii].

Federal Government In October 2021, the Australian Government committed for the first time to achieving net-zero emissions by 2050. With the election of the new federal government in May 2022, Australia recommitted to the 2050 net zero emission target and increased its 2030 target from 26-28 per cent below 2005 levels to 43%[xiii]. While Australia's new 2030 target is now in line with the Australia Climate Change Authority's recommendation of between 40-60% reduction in emissions by 2030[xiv], the target remains at the lower end of the recommended range.

3.3 Low Carbon Transition

Council's Impact Australian local governments are at the forefront of climate change mitigation and have played a significant role in supporting the State and Federal Governments to take realistic but ambitious action. Avoiding the worst effects of climate change will require the decarbonisation of fossil fuel consuming industries and processes. This need to transition to a low carbon economy is the driving force behind the Victorian Government's emissions reduction target of 45-50% by 2030.

Global and national efforts to decarbonise at an organisational level have included transitioning to low carbon alternatives to internal combustion engine vehicles, improving the efficiency of equipment and building design, and installing onsite renewable energy. GSC can contribute to these efforts by reducing its own corporate emissions, a process Council has already begun with the installation of rooftop solar PV and efficient street lighting upgrades.

Large Scale Renewables The transition to a low carbon economy will require significant changes to Australia's energy industry. The Australian Energy Market Operator (AEMO) predicts that electricity demand will almost double by 2050 to serve the electrification of all sectors of the economy. Coal-fired generation, which currently provides over half the current electricity supply, has been forecast to cease entirely by 2043. Already, coal-fired power plants such as Eraring, in the Hunter Valley, are bringing their expected closure dates forward by more than 5 years.

AEMO is expecting Australia to need 141 GW of grid-scale renewable energy to serve energy demands in 2050. For Gannawarra Shire this presents enormous opportunity, due to the region's significant solar resources. With regulatory approval underway for VNI West (also known as Kerang link), Gannawarra Shire is well placed to supply both Victoria and NSW with low-cost renewable energy to support their transition to net zero.

Kerang Link

The Victoria New South Wales Interconnector West (VNI West or the Kerang Link) will see the Victorian and New South Wales electricity networks connected via infrastructure that passes through Gannawarra Shire. In addition to enabling greater electricity transfer capacity between Victoria and New South Wales, the upgraded electricity infrastructure will allow for significantly higher volumes of renewable energy to feed into the national grid. The upgraded network will encourage new local renewable energy investment in the region, while having positive impacts on grid stabilisation and electricity costs[xv].

"Kerang Link will set up Northern Victoria as the nation's largest renewable energy zone and will secure the Gannawarra's economic sustainability,"

Mayor Charlie Gillingham

The Australian Energy Market Operator (AEMO) recommended the project proceed in 2021, with an expected completion date of 2031. Once completed, Kerang Link will have significant regional and national outcomes through its role in supporting the accelerated exit of ageing coal fired power plants from the grid. Gannawarra is already part of Victoria's Renewable Energy Zones and has two existing large scale solar plants in function. Kerang Link will enable the further development of Large Scale Renewables in the region.

As well as environmental benefits, the project will also facilitate renewable energy infrastructure investment in the region, with the creation of local jobs and economic flow to the community.

Emerging Technologies Large-scale decarbonisation is driving the development of new technologies to support the transition away from fossil fuel usage across all sectors. These emerging technologies include green hydrogen for transport and industrial processes, energy storage in batteries, microgrids, and virtual power plants (VPPs).

Carbon Sequestration The commitment to achieve net zero emissions by State and Federal governments and private corporations means that the demand for carbon offsets will dramatically grow over the next decade. This presents opportunities for new carbon sequestration projects such as reforestation and afforestation to generate carbon credits.

4. GANNAWARRA SHIRE COUNCIL POLICY CONTEXT

Gannawarra Shire Council is taking notable steps to acknowledge and act upon climate change in the region. These steps include the integration of climate change within the Growing Gannawarra plan, the adoption of a formal Climate Change Policy in December 2021 and the development of this Climate Change Adaptation and Mitigation Strategy for Council operations and services.

4.1 Growing Gannawarra

The Growing Gannawarra Council Plan (2021 - 2025)[xvi] establishes three Council goals, which aim to ensure the Gannawarra region remains a prosperous and safe place to live and work: Liveability, Growth and Sustainability. Action on climate change underpins the achievement of each of these three goals. This includes (but is not limited to):

- Building transformational infrastructure that enhances liveability and passive and active recreation, under Goal 1 (Liveability),
- Facilitating the development of new energy projects and infrastructure, under Goal 2 (Growth), and
- Supporting community resilience through climate adaptation, clean energy, environmental sustainability and waste management programs, under Goal 3 (Sustainability)

4.2 Gannawarra Shire Council's Climate Change Policy

GSC's Climate Change Policy[xvii] lays the foundation for Council to take meaningful action to reduce emissions and build resilience to climate change. The policy *acknowledges the scientific evidence and the risk that climate change presents to the community and the planet* and provides *Council with a strategic framework for mitigating and adapting to climate change*.

It outlines five key policy objectives which establish the direction and ambition for Climate Action within the Shire. The policy objectives are to:

- Provide a strategic framework for Council to manage its response to climate change by using both adaptation and mitigation strategies;
- Reduce the environmental impacts and operating costs of Council operations and minimise fuel consumption while reducing corporate energy use, transition to 100% renewable energy and achieve corporate net zero emissions by 2025, and net zero emissions at the Landfill by 2040;
- Undertake actions to reduce the community's emissions by 50% by 2030 and achieve net zero by 2040 by providing opportunities for public engagement, education and action;
- Respond to the risks of climate change to Council assets and services and assist the community to be more resilient to the effects of climate change; and
- Actively join climate change initiatives that promote education, economic growth and the community to become more sustainable and increase liveability.

5. CLIMATE CHANGE RISKS FOR GANNAWARRA

Gannawarra Shire is exposed to a range of climate change related hazards, including extreme heat, drought and flooding, which present Council and the Community with a high level of climate change risk.

To assess and prioritise these risks, a climate change risk assessment was undertaken in line with Council's risk management procedure. The risk assessment examined the six main climate related hazards to which the Shire is exposed against each of Council's service areas as listed in Table 1. Through this process 62 potential climate change risks were identified, including four extreme risks and a further 21 high risks. A summary of all 62 climate changes risks is provided in **Appendix B**.

Table 1: Climate Change Hazards and Council Services Areas

Climate Change Hazards	Council Service Areas
Extreme Heat	Corporate Services
Low Rainfall	Community Development
Drought	Public Health and Wellbeing
Bushfire	Assets and Infrastructure
Riverine Flooding	Leadership and Governance
Extreme Weather	Environment and Parks
	Waste
	Water
	Economic Development

5.1 Key Climate Change Risks

Riverine Flooding

Riverine flooding was assessed as having the greatest overall risk to Council with three extreme and six high risks identified.

The three extreme risks all related to the potential impact of a major riverine flood event on Council and private property, assets and infrastructure across the region. The extreme risk rating is due to how widespread the impacts would be under a major flood event, in particular in the event that townships levees are breached.

High risks include short term displacement of local residents, townships being temporarily cut off and disruption to services as a result of a major flood event.

Riverine flooding was also a key concern raised by local residents during community consultations, with the memory of the 2011 floods still very prevalent in people's minds.

Drought

Drought was also assessed as a significant risk for the Gannawarra Shire. Given the importance of agriculture to the region, the economic impact of a major drought event is potentially catastrophic. This resulted in an extreme risk assessment.

Four additional risks related to drought were also assessed as high, including the impact of drought on local food security, water scarcity and supply, habitat and biodiversity loss and increase in pests and invasive species.

Extreme Heat

Extreme heat is the third main climate risk for the region. Six risks relating to extreme heat were assessed as high. The potential health impact of an increase in heatwaves and extreme heat days on vulnerable members of the community was assessed to have the greatest overall consequence (Major). Additionally, extreme heat impacts on mental health, green space, local habitat and biodiversity and Council services were assessed to have a moderate consequence. A key risk factor that stands out for extreme heat is that its likelihood in the future is *Almost Certain.* The greater likelihood of extreme heat events elevates each of these risks.

The current as well as potential future impact of extreme heat was raised as a key issue of concern during the community consultations.

Bushfire

The risk of bushfire to lives and property was assessed to be lower for Gannawarra due to the low density of forested areas around townships within the shire. The risk of increased bushfire events on habitat and biodiversity loss as well as natural and cultural assets is, however, high. The impact of bushfire on Ramsar Wetlands and other areas of high conversation value could be significant with increased frequency and severity of bushfires. More frequent bushfires can impact the environment's ability to regenerate, and more severe fires can have a critical impact on flora and fauna.

Community Concerns and Priorities

Community consultation conducted as part of the development of this strategy highlighted a number of critical concerns of Gannawarra residents and clear priorities for action.

Key concerns raised by community members included:
The impacts of extreme heat on health, well-being and liveability

The impact of reduced rainfall on agricultural, natural environment and mental health, and

The economic impact of climate change with more money having to be spent on electricity and fuel as well as flow costs from health impacts.

Significant concern was also raised about the potential for future flood events similar or greater than the 2011 floods. One community member spoke of the high level of trauma that was still present in the community from the 2011 floods.

The Kerang Elders Group raised many of the same issues, particularly in relation to extreme heat and the economic impacts climate change. The group also spoke about how the seasons had changed and voiced concerns about the deterioration of the local environment, including more polluted waterways and more weeds and invasive species in the local area.

Priority actions identified by community members included:
The need for more street trees and green spaces within towns,

The need to create cool spaces, shade belts and heat refuges to make towns more accessible on hot days, including free splash parks

More climate change education and outreach that can target critical information to vulnerable groups

Climate change extension and financial incentives to support adoption of energy savings and low emissions solutions in homes and businesses

More action to encourage shift away from private petrol vehicles

Greater consideration of climate change impacts in planning decisions

Support for community led power generation including Virtual Power Plants, and

Increasing Council solar and transitioning away from natural gas.

The need for Aboriginal communities in the Gannawarra Shire to be consulted and provided with opportunities for economic development as part of the low carbon transitions was also raised during the Kerang Elders meeting.

6. GSC EMISSIONS INVENTORY

GSC's corporate greenhouse gas inventory for the 2020/21 financial year was 1,696 tCO_2-e. This includes all emissions occurring as a result of Council's operations for one year. A summary of Council's emissions sources is presented in **Table 2**. The most significant emissions source is transport fuels, including diesel, petrol and LPG used in Council's fleet and plant. Transport fuel accounted for 55% of total emissions. Electricity at council-owned sites is the next largest contributor is electricity at 30%, or 507 tCO_2-e. Electricity for street lighting represents 9% of the inventory, and water supply to council facilities 6%.

Figure 4: GSC Corporate GHG Emissions Breakdown 2020/21

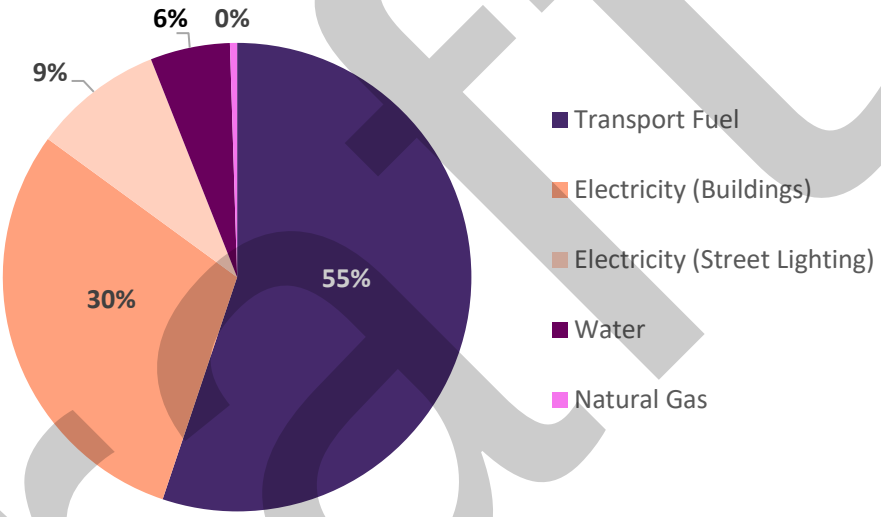


Table 2: GSC Corporate GHG Emissions Inventory 2020/21

Emissions Source	Consumption	Units	tCO2e	%
Direct emissions (Scope 1)				
Transport - Diesel for fleet	85	kL	230	13.5%
Transport - Diesel for plant	213	kL	579	34.1%
Transport - Petrol for fleet	34.7	kL	79	4.7%
Transport - LPG for fleet	1.2	kL	2	0.1%
LPG bottled & bulk for buildings	5,040	L	8	0.5%
TOTAL DIRECT EMISSIONS (Scope 1)			**898**	**53%**
Indirect emissions (Scope 2)				
Electricity (Council)	465,145	kWh	456	26.9%
TOTAL INDIRECT EMISSIONS (Scope 2)			**456**	**27%**
Indirect emissions (Scope 3)				
Electricity (Street Lighting - DNSP Owned)	139,528	kWh	137	8.0%
Water (Council)	51,918	kL	93	5.5%
Emissions from manufacture, transmission and other losses electricity for Council sites	465,145	kWh	51	3.0%
Emissions from manufacture, transmission and other losses electricity for Street Lighting	139,528	kWh	15	0.9%
Emissions from diesel extraction, production and transport for fleet & plant	298	kL	41	2.4%
Emissions from petrol extraction, production and transport fleet & plant	34	kL	4	0.3%
Emissions from LPG extraction, production and transport for fleet and buildings	6,269	L	0.6	0.04%
TOTAL INDIRECT EMISSIONS (Scope 3)			**343**	**20%**
TOTAL EMISSIONS (Scope 1+2+3)			**1,697**	**100%**

7. WHAT HAS ALREADY BEEN ACHIEVED?

Gannawarra Shire Council has shown leadership in the actions we have taken in response to climate change. GSC has already implemented an array of programs, which have sought to better understand climate change related impacts, such as extreme heat, and improve the livability of the region. Council has also undertaken actions to reduce our own impact on climate change through emissions reduction activities, including the installation of 170 KW of behind the meter Solar systems at Council facilities and the replacement of streetlights with energy efficient LEDs, and by supporting the development of large-scale renewable energy generation the region. These projects not only deliver improved environmental benefits but also achieve financial and operational savings for Council and help to create more economic development opportunities of the region.

Cool It Tree Selection and Heat Vulnerability Assessments

A council collaboration coordinated by the Central Victorian Greenhouse Alliance (CVGA) with funding from the Department of Environment, Land, Water and Planning (DELWP), the Cool It project utilised spatial data to determine urban areas of nine Victorian regional and rural councils that were socially vulnerable to heat impacts, including Gannawarra Shire[xviii]. This led to the identification of parcels of land within these areas where populations are most vulnerable to urban heat and heatwaves and prioritisation of these areas for responsive planning, strategy and communication mechanisms. The project placed a specific focus on the value of canopy cover and ground cover vegetation in lowering urban microclimate temperatures, including surface temperatures. It also successfully quantified the benefits associated with various vegetation types and urban surface treatments to help guide appropriate and responsive urban planning to mitigate heat associated urban risks. In partnership with the Castlemaine Institute, a secondary project phase sought to identify a selection of street trees resilient to future climate scenarios. A short-list of 100 candidate species was identified for detailed evaluation of their vulnerability to future climate[xix].

Gannawarra Large-Scale Renewable Energy

Gannawarra Shire has an abundance of land, solar and wind resources and is in the heart of one of Victoria's six Renewable Energy Zones. This makes the shire ideally placed to capitalise on opportunities associated with solar and wind power generation.

The Shire is already home to two large solar power stations (Stage 1 of a 300MW station and completion of a 34MW station) and has identified a number of additional large scale renewable projects, which would deliver further economic development opportunities for the region. The final approval and development the Kerang Link will provide certainty for these projects to proceed.

LED Streetlight Design and Bulk Changeover

With support from the CVGA, Gannawarra Shire Council took part in the Lighting the Regions program, seeking to replace inefficient mercury vapour lights with LEDs. Over 700 lights were changed in the Gannawarra region, part of a larger regional project that replaced approximately 23,000 lights. The savings associated with a renewable energy project such as this are both environmental and financial. The 16 Lighting the Regions participants seek to save a combined total of $57 million over 20 years, and 180,000 tCO_2-e of emissions. This is additional to the social and security benefits associated with a streetlight bulk changeover, such as ensuring all lights are functional and fit for purpose.

8. GSC'S CLIMATE CHANGE RESPONSE

8.1 Long Term Goal

Gannawarra Shire Council's long term climate change goal is:

By 2040, Gannawarra Shire Council is a highly sustainable and resilient regional Council and a leading region for renewable energy and low carbon technology.

Gannawarra Shire Council acknowledges the scientific evidence and the risk that climate change presents to the community and the planet. GSC is committed to taking strong and decisive action to minimise Council's environmental impact and build the resilience of Council operations, services and assets to reduce the vulnerability of the community to climate change.

Council also recognises the opportunities that the response to climate change presents, in particular the economic development opportunities available from the transition to a low carbon economy. As part of our response to climate change, GSC will support the region to maximise the available opportunities and reap the benefits for the economic transition.

8.2 Strategic Approach

Gannawarra Shire Council has developed a Climate Action Framework (Section 8.3) to guide Council action and ensure our long-term climate change goal is achieved.

Strategic Priorities

GSC will focus on four Strategic Priority (SP) areas that will enable Council to adapt to climate change, build our resilience, minimise our environmental impact and position the shire to act on the available opportunities. Each strategic priority will work towards achieving a long-term objective, as outlined in the section 8.3.

Strategic Priority 1:	Building resilience of GSC operations and services to climate change.
Strategic Priority 2:	Reducing community vulnerability to extreme weather.
Strategic Priority 3:	Reducing Council environmental impact and operating costs.
Strategic Priority 4:	Maximising opportunities of the low carbon transition.

Pathway Actions

Under each strategic priority area pathway actions have been identified. The pathway actions help to identify they types of actions that are required under each strategic priority area to achieve the long-term objectives and deliver on Council's long-term climate change goal.

Short and Medium Term Objectives

Short and medium-term objectives have also been developed for each strategic priority area. These objectives focus on the achievement of shorter-term priorities that are required to achieve Council's long-term climate change objectives. Achieving the short and medium-term objectives will help ensure GSC is on the right pathway to deliver on Council's climate change strategy.

8.3 Climate Action Framework

Goal	By 2040, Gannawarra Shire Council is a highly sustainable and resilient regional Council and a leading region for renewable energy and low carbon technology.					
Priority Issues	**Strategic Priority 1** Building Resilience of Council Operations and Services to Climate Change			**Strategic Priority 2** Reducing community vulnerability to extreme weather events		
Pathway Action	Build knowledge	Identify risks	Integrate into strategic operations and planning	Increase community awareness	Enhance natural assets & open space	Reduce vulnerability to extreme weather
Long Term Objectives	By 2040, GSC has built the resilience of its assets, operations and services to withstand climate change impacts and ensure continuity of service to the community.			By 2040, Council managed assets and open-spaces have been enhanced to improve livability and reduce community vulnerability to the impacts of climate change.		
Medium Term Objectives	By 2030, GSC has developed action plans and started to adapt its assets, operations and services to reduce risk and vulnerability to climate change impacts.	By 2030, consideration of potential climate change impacts becomes a business-as-usual practice in Council strategic planning and decision-making.	By 2030, GSC has investigated climate change cadetship and scholarship opportunities to upskill staff.	By 2035, GSC has increased tree cover and shading in town centres and major parks to reduce impact of extreme heat.	By 2035, all township levees have been upgraded to adhere to a 1-in-100 year flood level that accounts for climate change	
Short Term Objectives	By 2025, GSC has identified critical climate change risks to all council assets and services.	By 2025, GSC has integrated climate change across Council's Strategic Planning.		By 2025, a Gannawarra community sustainability group has established itself as a key resource for climate change information within the shire.	By 2025, GSC has updated its tree planting guidelines and trees policy to incorporate recommendations of the Cool It Project.	By 2030, all township flood levees have been assessed against a revised 1-in-100 year flood level that accounts for climate change.

Priority Issues	**Strategic Priority 3** Reducing Council environmental impact and operating costs				**Strategic Priority 4** Maximising opportunities of the low carbon transition		
Pathway Action	Renewable energy	Energy efficiency	Electrification	Offset	Large scale renewables	Green hydrogen	Carbon sequestration

Long Term Objectives	By 2040, GSC has completed the transition of its assets and facilities to energy efficient, low carbon technology.			By 2040, GSC is a leading LGA for the development and production of renewable energy and low carbon technology, providing financial and environmental benefits for the Gannawarra community.		
Medium Term Objectives	By 2030, GSC has developed a transition plan for its heavy fleet.	By 2035, GSC has transitioned all of its small plant and light fleet to electric alternatives.	By 2035, GSC has phased out all gas systems in Council facilities across the shire.	By 2030, GSC has established partnerships for development of new large-scale renewable energy, carbon sequestration and Green Hydrogen projects.		
Short Term Objectives	From 2025, GSC will source 100% of electricity from renewable sources.		GSC seeks to achieve zero net emissions for its operations and services by 2030.	By 2025 Council has successfully advocated for Kerang Link approvals		By 2025, GSC has investigated developing guidelines to ensure the Gannawarra community benefit from the renewable energy investment in the region.

8.4 Strategic Priority 1: Building Resilience of Council Operations and Services to Climate Change

SP1: Long Term Objective

By 2040, GSC has built the resilience of its assets, operations and services to withstand climate change impacts and ensure continuity of service to the community.

Ensuring that Council's own assets and infrastructure can withstand the projected impacts of climate change is a key responsibility for Local Governments. Under the *Victorian Local Government Act 2020,* Councils are required to:

- give priority to achieving the best outcomes for the municipal community, including future generations, 9(2)(b); and
- promote the economic, social and environmental sustainability of the municipal district, including mitigation and planning for climate change risks, 9(2)(c).

Additionally, Council needs to ensure that it can continue to carry out its normal operations and provide essential services to the community in a climate change affected future.

SP1: Pathway Actions

Build knowledge	Identify risks	Integrate into strategic operations and planning

Building the resilience of Council assets, operations and services to climate change requires Council to firstly build and maintain its internal climate change knowledge and capacity, relevant to key operational areas, and then to improve the identification and monitoring of critical climate change risks.

As climate change will have different impacts across Council's operations and areas of responsibility, the most effective way to identify, address and monitor risks is to integrate climate change considerations and actions into existing council process. This means incorporating climate change into key governance process such as Council's strategic risk management processes and integrating climate change into key strategies and plans, including the Council Plan, the Municipal Public Health and Well-Being Plan and the Municipal Emergency Management Plan.

Building knowledge, identifying risks and integrating climate change into strategic operations and planning represent the three pathway actions for this strategic priority area.

SP1: Short-Term Objectives	
By 2025, GSC has identified critical climate change risks to all council assets and services.	By 2025, GSC has integrated climate change across Council's Strategic Planning.
SP1: Short-term actions	
Build Knowledge	• Undertake assessment of relevant technical staff and decision-makers' knowledge of climate change. • Ensure relevant staff complete training to be able to integrate climate change considerations in assessments, planning and decision-making. • Investigate scholarship or cadetship opportunities for staff.
Identify Risks	• Integrate climate change risk and vulnerability assessments into asset management plans for all critical Council assets. • Assess impact of extreme weather events on Council services.
Integrate Climate Change into Strategic Operations	• Include climate change as a strategic risk within Council's strategic risk register. • Conduct contingency/business continuity planning for high and extreme climate change risks on key council operations and services. • Integrate climate change into the Municipal Emergency Management Plan, Municipal Public Health and Wellbeing Plan and Gannawarra Flood Emergency Plan.

Looking Forward

The majority of short-term actions for this strategic priority area will need to continue to be implemented in the medium to long term, including capacity development, risk and vulnerability assessments and integration of climate change into governance, operational and strategic planning. Medium term actions are, however, expected to have a greater focus on the development of specific adaptation actions and plans to address risks and reduce vulnerability of assets and services to climate change. Building the knowledge and experience of staff related to climate change will also help to improve Council processes and support consideration of climate change to become business-as-usual in decision-making.

8.5 Strategic Priority 2: Reducing Gannawarra community vulnerability to extreme weather events

SP2: Long Term Objective

By 2040, Council managed assets and open-spaces have been enhanced to improve livability and reduce community vulnerability to the impacts of climate change.

Riverine flooding, drought and extreme heat are the greatest climate change risks facing Gannawarra. Climate change is projected to lead to a significant increase in the number of extreme heat days and heatwave events in the Shire. If global emissions remain high, Gannawarra shire could see over 45 days above 35˚C per year by 2050, over double the number experienced in the 1990s. While overall rainfall is projected to decline, the occurrence of high intensity rainfall events is expected to increase. This shift in rainfall patterns will increase the risk of both drought and major flooding events.

Council has a crucial role to play in reducing the vulnerability of the local community through the effective management of Council owned assets, including Council buildings and facilities, natural assets and open spaces and township levees. Ensuring these assets are designed and adapted to meet expected climate change can greatly reduce the community exposure and vulnerability to climate change impacts.

SP2: Pathway Actions

Increase community awareness	Enhance natural assets & open spaces	Reduce Vulnerability to Extreme Weather

Enhancing council owned natural assets and open spaces and reducing community vulnerability to extreme weather, including extreme heat and flood events, are the key pathway action areas for Council under this strategic priority.

Enhance assets and reduce vulnerability to extreme weather

Council manages a large number of natural assets and open spaces across the Shire. Parks, green spaces and street trees play an incredibly important role in cooling towns and enhancing livability. Increasing canopy cover within towns provides greater shade, allowing people to go about their business for longer, while also helping to reduce the amount of heat trapped within urban areas on hot days. Enhancing parks and green spaces also provides more cool places for people to escape the heat and allows the community to be more active outside across the hotter months. As the climate changes ensuring that all new trees planted must be selected from species that are suited to Gannawarra's current and expected future climate. Appropriate tree species selection will also reduce watering and maintenance requirements and save Council money.

In addition to enhancing natural assets to reduce vulnerability to extreme heat, Council will upgrade public buildings that can be used as heat refuges and provide more sheltered and shaded areas and drinking water stations. Council will also review and update its vulnerable persons register to include people vulnerable to extreme heat.

To ensure Shire townships remain safe from major flood events, Council will advocate for flood models to incorporate projected climate change impacts and conduct assessments on all Council owned levees to ensure they continue to meet a 1-in-100 year flood level.

Increase community awareness

Council will also support the establishment of a community sustainability group and the development of a community-led adaptation and mitigation strategy. These actions will support the local community to increase their own understanding of the climate change impacts and risks, get information on resources and support available and help them take action appropriate actions, from reducing heat impacts in their homes to lowering emissions and energy bills through the installation of solar or undertaking energy efficiency actions.

SP2: Short-Term Objectives		
By 2025, a Gannawarra community sustainability group has established itself as a key resource for climate change information within the shire.	By 2025, GSC has updated its tree planting guidelines and trees policy to incorporate recommendations of the Cool It Project.	By 2030, all township flood levees have been assessed against a revised 1-in-100 year flood level that accounts for projected climate change.
SP2: Short-term actions		
Community Awareness	• Support the establishment of a community sustainability group to enhance community engagement on key climate change issues. • Support the development of a community-led climate change adaptation and mitigation strategy.	
Enhance Natural Assets and Open Spaces	• Enhance natural spaces for use as cool places during extreme heat events. • Increase urban canopy cover in shire townships, in particular around town centres, retail precincts and critical services. • Update GSC tree planting guideline based on recommendations of the Cool It Project, including priority locations and appropriate tree species selection. • Work with North Central Catchment Management Authority (NCCMA) and neighbouring councils to monitor key habitat and native vegetation areas for new and invasive species.	
Reduce Vulnerability to Extreme Weather	• Review and update vulnerable persons register to include residents at high risk to extreme temperatures. • Enhance open spaces such as parks and bus stops to provide further protection and relief from sun and extreme heat, including more sheltered and shaded areas and provision of drinking water stations. • Upgrade public buildings to provide cool places and heat refuges during extreme heat. • Explore the use of Environmental Upgrade Agreement opportunities to support local business and residents to increase the energy and thermal efficiency of their businesses and houses to reduce vulnerability to extreme temperatures. • Advocate to ensure that flood models account for projected climate change impacts, including to 1-in-100 year flood level. • Conduct assessments on all town levees to ensure they continue to exceed a 1-in-100 year flood level.	

Looking Forward

As with Strategic Priority Area 1, many of the medium term actions for this strategic priority area will focus on the implementation of assessments and plans developed in the under this initial climate change strategy. This is expected to include:

- Continued enhancement of green and open spaces, through further tree planting, shading and other small scale infrastructure to reduce heat impacts;
- Upgrading townships levees identified as requiring enhancement through assessments to maintain 1-in-100 year flood level protections, and
- Continued upgrading of Council buildings for use as cool refuges, as required.

Council is also expected to continue actions including, monitoring and managing invasive species, reviewing and updating vulnerable persons register and supporting community level climate change action. Improved risk and vulnerability assessments conducted in Strategic Priority Area 1 may also lead to additional action to reduce community vulnerability to extreme weather.

8.6 Strategic Priority 3: Reducing Gannawarra Shire Council environmental impact and operating costs

SP3: Long Term Objective

By 2040, GSC has completed the transition of its assets and facilities to energy efficient, low carbon technology.

Transitioning GSC's operations to energy efficient, low carbon technology will not only reduce Council's own impact on climate change and the environment but will also led to financial savings through reduced operational and maintenance costs. Renewable energy and energy efficiency actions can significantly reduce electricity use at Council facilitates and assets, while the electrification of council's fleet and gas system will reduce future fuel and maintenance costs.

The maturity of technology across these different areas, however, is at different stages. While some technologies, such as renewable energy and energy efficiency, are already technically and financially viable, other technology, such as batteries and electric or hydrogen heavy fleet are still many years away from being viable to use within Council operations.

By acting on the presently available opportunities and beginning required transition planning processes now, GSC will steadily reduce operational emissions and costs and ensure that larger change processes, such as the electrification of Council's fleet, are implemented in a timely and cost-effective way that minimises risk to Council.

SP3: Pathway Actions

Renewable energy	Energy efficiency	Electrification	Offsets

The three critical pathway action areas for Council to reduce its emissions are: switching to renewable energy, improving energy efficiency of building and assets and electrification of gas systems and Council fleet.

Renewable energy and Energy Efficiency

GSC has already taken substantial action in these areas with the installation of 170 KW of behind the meter solar panel across Council facilities and the replacement of all streetlights within the Shire with energy efficient LED lighting. Together these actions are already saving Council over $50,000 and 200 tCO_2-e per year. Council will continue to reduce electricity consumption through the development of minimum energy efficiency performance standards for new plant and equipment.

At the end of Council's current electricity contract, GSC will look into procuring 100% renewable energy, for example through a renewable energy power purchase agreement (PPA). GSC will also explore opportunities to develop a solar farm on Council land which would be able to directly supply GSC with 100% renewable energy and provide emissions offset opportunities through the sale of excess electricity generation.

As battery technology continues to improve and costs reduce, there may also be more opportunity for the installation of solar plus battery systems across more Council sites, further reducing in electricity costs and increasing energy security.

Electrification

Globally, the transition to electric vehicles is underway. A number of large economies, including the UK, EU, India and California have introduced petrol vehicle bans from 2030 or 2035, while leading car manufacturers are beginning to set targets to halt the production of internal combustion engine vehicles.

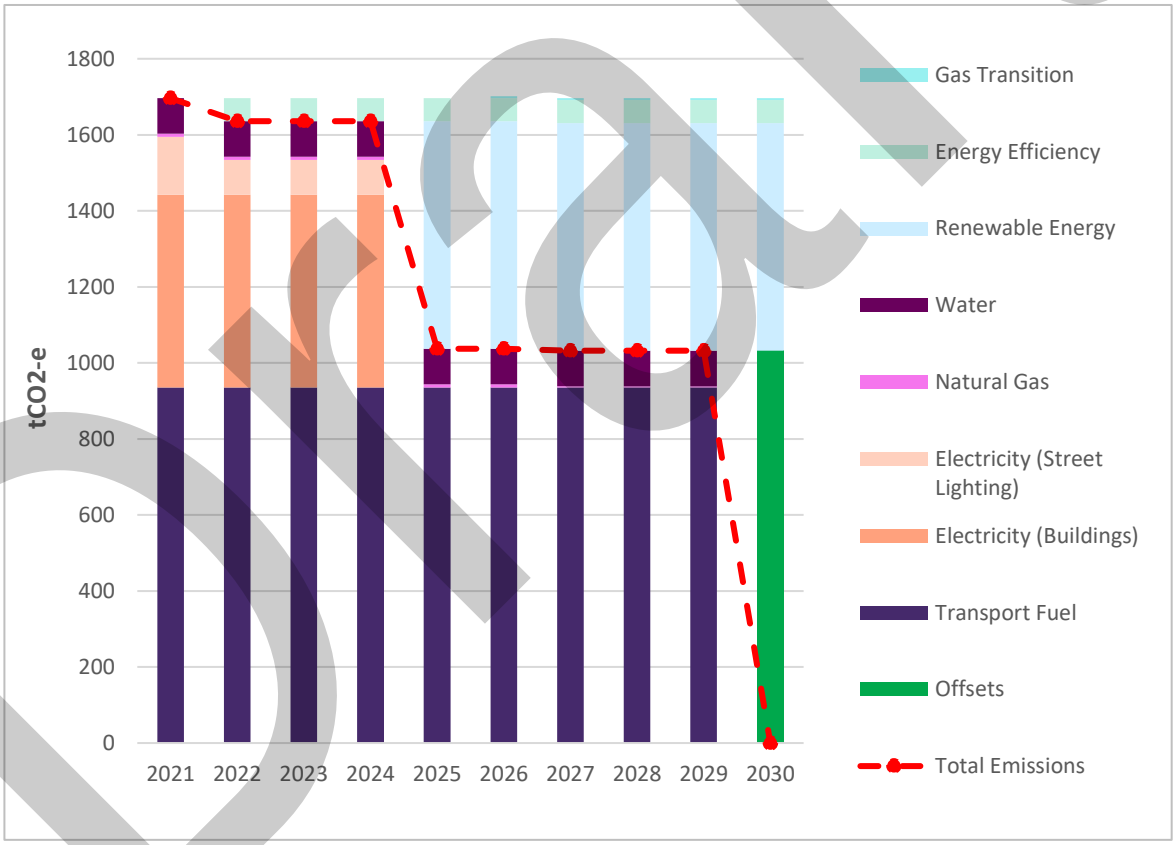
Transport fuel usage is the major operational emissions sources for GSC. While there are electric alternatives currently available for passenger vehicles and small plant, these assets account for less than 20% of Council's fuel usage. At present there are limited options within the Australian market for transitioning Council utes and heavy fleet and plant to electric alternatives. The electric vehicle transition will also require the development of supporting infrastructure both in the Shire and the region. This includes installation of charging infrastructure, development of maintenance capacity sand encouraging supply of EVs through dealerships within the region. Given these current constraints, GSC will initially focus on developing a fleet transition plan and trialing a small number of electric vehicles and plant alternatives. GSC will also work with regional partners, such as the Central Victorian Greenhouse Alliance, to encourage the development of EV supporting infrastructure in the region. While the full transition away from petrol and diesel vehicles may be 15-20 years away, beginning the planning process now will ensure Council can ensure the transition is cost effective and minimises the risk of being left with stranded assets.

Council will also phase out gas usage in its facilities across the Shire.

Offsetting Council's remaining emissions

After completing all viable renewable energy, energy efficiency and electrification actions GSC is expected to still be required to offset some emissions to achieve its net zero emissions by 2030 target. Figure 5: Pathway to Net ZeroFigure 5 presents a possible pathway for GSC to reach net zero by 2030, in accordance with the actions described above. Through street lighting upgrades, electrification of gas systems at Patchell Plaza and renewable energy procurement through a PPA, GSC's corporate emissions can be reduced to just over 1,000 tCO_2-e per year, approximately a 40% reduction from 2020/21. In order to achieve net zero by 2030, Council would then need to purchase certified carbon credits to offset these residual emissions, the majority of which will be from transport fuels. As GSC transitions its fleet to all electric over the next 10 to 15 years, these emissions will also reduce to zero without the need for offsets.

Figure 5: Pathway to Net Zero



As discussed further in Section 0, Gannawarra Shire contains significant solar and environmental assets that could be used by Council to locally offset any residual emissions in 2030. Sourcing offsets locally would reinvest money back into the region to the benefit of the local community and environment.

SP3: Short-Term Objectives	
From 2025, GSC will source 100% of electricity from renewable sources.	GSC seeks to achieve zero net emissions for its operations and services by 2030.
SP3: Short-term actions	
Emissions Monitoring and Reporting	• Improve GHG inventory data collection
Renewable Energy	• Procure Council electricity from 100% renewable energy sources from 2025. • Explore opportunities for the development of a solar farm on Council land to meet future Council electricity and offset needs.
Energy Efficiency	• Develop sustainability specifications requiring minimum energy efficiency performance for new plant and equipment.
Electrification	• Gas Transition • Adopt Council policy to adopt no new gas systems and replace all existing gas systems with electric alternatives at the end of the asset life cycle. • Fleet Transition • Development of Fleet Transition Plan • Switch small plant, e.g. Mowers, to electric alternatives. • Explore opportunity for trialing an electric vehicle within Council pool cars. • Partner with CVGA and other Councils in the region to facilitate regional infrastructure, retail and maintenance for EVs.
Offset	• Investigate offsetting options for Council to achieve net zero emissions by 2030, including through the generation of offset via local carbon sequestration or large-scale renewable energy projects or the procurement of offsets.

Looking Forward

By the conclusion of this climate change strategy, it is expected there will be a shift in Council's priorities to fleet electrification, completion of the gas transition and improvements to Council's building design specifications. Actions to support the achievement of GSC's medium-term objectives include:

- Develop heavy fleet transition plan.
- Continue electric vehicle trial with three to five vehicles within Council pool cars.
- Replace all gas systems at Council sites with electric alternatives at end of life.
- Develop an Ecologically Sustainable Development (ESD) Policy for all new Council buildings and renewals.

8.7 Strategic Priority 4: Maximising opportunities of the low carbon transition

SP4: Long Term Objective

By 2040, GSC is a leading LGA for the development and production of renewable energy and low carbon technology, providing financial and environmental benefits for the Gannawarra community.

The transition to a low carbon economy is already well underway in Victoria. In 2017, Victoria legislated a zero net emissions target by 2050 and in 2021 introduce new renewable energy and interim emissions reduction targets, including:

- a 40% renewable energy target by 2025 and 50% by 2030, and
- a 45-50% emissions reduction target by 2030.

Achieving these targets will require significant investment in new large scale renewable energy projects as well as investment in the development of new carbon sequestration projects and new technologies and fuel sources, such as green hydrogen, which can support the transition.

Gannawarra Shire's abundant solar and natural resources means it is well placed to capitalize on the economic development opportunities being brought by the transition to a low carbon economy.

SP4: Pathway Actions

Large scale renewables	Green hydrogen	Carbon sequestration

Facilitating the development of more large-scale renewable energy projects, exploring the opportunity for the production of green hydrogen and working with regional partners and landowners to develop more carbon sequestration projects within the Shire are the three key pathway actions areas for this Strategy Priority.

Large scale renewables

Gannawarra Shire sits within the heart of one of Victoria's six renewable energy zones and is already a leading LGA for the development of large-scale renewable energy projects. Two large scale solar projects have already been developed with over 94 MW of capacity and 50MWh of battery storage. The development of the Kerang Link, will greatly increase the opportunity for the development of new large-scale wind and solar projects within the Shire. Under the Victorian government's Payment in Lieu of Rates (PiLoR) scheme, the development of new large scale renewable projects could result in millions of dollars of income to Council each year, in addition to flow on economic impacts to the wider Gannawarra community through the construction and maintenance of the renewable energy sites[xx].

Green Hydrogen

Hydrogen is seen a potentially important alternative fuel sources in transition away from fossil fuels for heavy fleet and plant. The production of hydrogen, however, is itself energy intensive and is only a lower or zero emissions fuel source if its production is powered by renewable energy.

Gannawarra Shire's abundant solar resources make it well suited to the large-scale production of Green Hydrogen. GSC will explore opportunities to work with the private sector and partners such as the Central Victorian Greenhouse Alliance (CVGA) to determine the feasibility of producing Green Hydrogen within the region. As well as helping to enable Council and the States transition away from fossil fuels in transport, the local production of Green Hydrogen could also create more local jobs and further diversify Gannawarra's economy.

Carbon Sequestration

While reducing emissions is critical to mitigating the worst impacts of climate change, drawing down emissions already in the atmosphere through carbon sequestration is vital in helping to keep average global temperature rise under 2˚C and as close to 1.5˚C as possible. As more councils and corporations move toward net zero emissions targets there will also be more demand for carbon sequestration projects to offset the residual emissions that are unable to be reduced. Gannawarra Shire's abundant natural resources positions council well to capitalize on the expected demand for carbon credits.

GSC will explore opportunities to work with local landowners and partners such as North Central Catchment Management Authority (NCCMA) to develop local carbon sequestration projects under a regional carbon exchange. Investing in and providing opportunities for regional businesses and councils to offset residual emissions, will help to ensure the funds spent on offset remain within the region and are used to enhance the local environment and benefit the local community.

SP4: Short Term Objectives	
By 2025, Council has successfully advocated for Kerang Link approvals.	By 2025, GSC has investigated developing guidelines to ensure the Gannawarra community benefit from the renewable energy investment in the region.
SP4: Short Term actions	
Large Scale Renewables	• Maintain advocacy for the Kerang Link and facilitate development of new large-scale renewable energy projects within the shire. • Use the local planning approval process to facilitate the development of Large Scale Renewables that balances the environmental aspects and considers local land use opportunities. • Consider developing guidelines or a 'Future fund' with the funds generated from renewable energy projects (or a minimum % of funds), helping return funds back into the local community via climate change adaptation and mitigation projects.
Green Hydrogen	• Work with CVGA and private sector to explore the opportunity for green hydrogen production in the region.
Carbon Sequestration	• Explore opportunities for partnerships with NCCMA and others to identify land (including council owned sites and private land) that could be suitable for restoration, afforestation or other carbon sequestration projects under a regional carbon exchange.

APPENDIX A: ACTION TABLE

Table 3 assesses each of the short term actions across the four strategic priority areas against the expected cost range, return on investment, scale of impact and potential reach of the action.

Cost Range is assessed from low to high.

- *Low cost activities* predominately require staff time or training,
- *Medium cost activities* typically incur smaller capital input and asset costs, such as tree seedlings or small scale solar systems.
- *High cost activities* are likely to require larger capital works, such as building works.

Return on Investment (RoI) is assessed from low to high.

- *Low RoI actions are those that typically achieve small savings in the utilisation of resources across the lifetime of the activity, for example electricity savings achieved through energy efficiency specifications. They also include actions that help to reduce future potential financial losses through activities such as business continuity planning.*
- *Medium RoI actions are those that achieve larger utility savings or improve decision-making or planning leading to lower-cost actions in the future, for example Fleet Transition Planning.*
- *High RoI activities are those that can generate a new ongoing revenue stream for Council, such as Renewable Energy PiLoR.*
- *N/A Some actions have also been assessed as N/A for RoI. These include process-based actions that are required to be undertaken before other actions can begin as well as many adaptation actions that reduce a risk to the community but provide no direct RoI to council. However, indirect RoIs are likely to be achieved through many of these actions. This could result from reduced in demand for Council services or improved economic activity in Shire townships.*

Scale of Impact is assessed from low to high.

- *Low impact actions* are those that achieve minor gains relative to the issue. For example emissions from natural gas account for less than 1% of Council's inventory.
- *Medium impact actions* are typically those that help to reduce risks by increasing awareness or understanding of an issue.
- *High impact actions* are typically those that aim to directly address at a scale that is meaningful to the issue.

Impact Reach is assessed from Council to Community level impacts.

- *Council level actions* are those that primarily benefit Council operations or assets.
- *Community-Individual actions* are those that primarily benefit individual or discreet sections of the community.
- *Community-wide actions* are those that provide benefits to the Community at large.

Table 3: Assessment of Actions

Action No.	Action Pathway	Action Name	Linked Action	Type of Action	Resourcing		Potential Impact		
					Type of Resourcing	Cost Range	RoI	Scale of Impact	Impact Reach
SP1: Building Resilience of Council Operations and Services to Climate Change									
1.1	Building Knowledge	Undertake assessment of relevant technical staff and decision-makers' knowledge of climate change.		Capacity Building	Staff time	Low	N/A	N/A	Council
1.2		Ensure relevant staff complete training to be able to integrate climate change considerations in assessments, planning and decision-making.	1.1	Capacity Building	Staff time, training costs	Low-Medium	Medium	Medium	Community-Wide
1.3		Investigate scholarship or cadetship opportunities for staff.		Capacity Building	Staff time, training costs	Low	N/A	Medium	Council
1.4	Identifying Risks	Integrate climate change risk and vulnerability assessments into asset management plans for all critical Council assets.		Adaptation	Staff time, training, access to technical data	Low-Medium	Medium	Medium	Community-Wide
1.5		Assess impact of extreme weather events on Council services.		Adaptation	Staff time, monitoring	Low	Low	Medium	Community-Wide
1.6	Strategic Planning and Operations	Include climate change as a strategic risk within Council's strategic risk register.	1.8	Adaptation	Process change	Low	N/A	Medium	Council
1.7		Conduct contingency/business continuity planning for high and extreme climate change risks on key council operations and services.	1.4, 1.6	Adaptation	Staff time, workshop costs, travel costs.	Low-Medium	Low	Medium	Community-Wide
1.8		Integrate climate change into the Municipal Emergency Management Plan, Municipal Public Health and Wellbeing Plan and Gannawarra Flood Emergency Plan.		Adaptation	Process change, access to technical data, training.	Low	Low	Medium	Community-Wide

Action No.	Action Pathway	Action Name	Linked Action	Type of Action	Resourcing		Potential Impact		
					Type of Resourcing	Cost Range	RoI	Scale of Impact	Impact Reach
SP2: Reducing Community Vulnerability to Extreme Weather									
2.1	Community Awareness	Support the establishment a community sustainability group to enhance community engagement on key climate change issues, including heat vulnerability, flood risk, energy efficiency and renewable energy.		Adaptation/ Mitigation	Staff time, meeting space, stipends (if required)	Low	Low	Medium	Community-Wide
2.2		Support the development of a community-led climate adaptation and mitigation strategy.	2.1	Adaptation/ Mitigation	Consultant and Engagement Costs	Low-Medium	Low	High	Community-Wide
2.3	Enhance Natural Assets and Open Spaces	Enhance natural spaces for use as cool places during extreme heat events.	2.5, 2.6, 2.8	Adaptation	Tree planting, landscaping	Medium	N/A	High	Community-Wide
2.4		Increase urban canopy cover in shire townships, in particular around town centres, retail precincts and critical services.	2.5, 2.8	Adaptation	Tree planting, watering and maintenance	Medium	N/A	High	Community-Wide
2.5		Update GSC tree planting guideline based on recommendations of the Cool It Project, including priority locations and appropriate tree species selection.		Adaptation	Staff time	Low	Low	High	Community-Wide
2.6		Work with NCCMA and neighbouring councils to monitor key habitat and native vegetation areas for new and invasive species.	2.3	Adaptation	Staff time	Low	N/A	Medium	Community-Wide
2.7	Reduce Vulnerability to Extreme Weather	Review and update vulnerable persons register to include residents at high risk to extreme temperatures.		Adaptation	Staff time	Low	N/A	Medium	Community-Individual
2.8		Enhance open spaces such as parks and bus stops to provide further protection and relief from sun and extreme heat, including more sheltered and shaded areas and provision of drinking water stations.	2.3, 2.4	Adaptation	Tree planting, landscaping, small infrastructure, e.g. drinking water stations, shading	High	N/A	High	Community-Wide
2.9		Upgrade public buildings to provide cool places and heat refuges during extreme heat.		Adaptation	Building works	High	Low	High	Community-Wide
2.10		Explore the use of Environmental Upgrade Agreement opportunities to support local business and residents to increase energy and thermal efficiency of businesses and homes to reduce vulnerability to extreme temperatures.		Adaptation	Staff time	Low-Medium	N/A	High	Community-Individual
2.11		Advocate to ensure that flood models account for potential climate change impacts, including to 1-in-100 year flood level.		Adaptation	Staff time	Low	N/A	High	Community-Wide
2.12		Conduct assessments on all town levees to ensure they continue to exceed a 1-in-100 year flood level.	2.11	Adaptation	Technical Assessment Costs	Medium	N/A	High	Community-Wide

Action No.	Action Pathway	Action Name	Linked Action	Type of Action	Resourcing		Potential Impact		
					Type of Resourcing	Cost Range	RoI	Scale of Impact	Impact Reach
SP3: Reducing Council Environmental Impact and Operating Costs									
3.1	Emissions Monitoring and Reporting	Improve GHG inventory data collection		Mitigation	Staff time, Technical Support	Low	N/A	N/A	Council
3.2	Renewable Energy	Procure Council electricity from 100% renewable energy sources from 2025.		Mitigation	Renewable Energy Premium	Low	Low	High	Council
3.3		Explore opportunities for the development of a solar farm on Council land to meet future Council electricity and offset needs.	3.2, 3.10	Mitigation	Solar System and Installation Costs	Medium	Medium	Medium	Council
3.4	Energy Efficiency	Develop sustainability specifications requiring minimum energy efficiency performance for new plant and equipment.		Mitigation	Policy Development	Low	Low	Low	Council
3.5	Electrification – Gas Transition	Adopt Council policy to adopt no new gas systems and replace all existing gas systems with electric alternatives at the end of the asset life cycle.		Mitigation	Policy Development	Low	Low	Low	Council
3.6	Electrification – Fleet Transition	Development of Fleet Transition Plan		Mitigation	Policy Development	Low	Medium	High	Council
3.7		Switch small plant, e.g. Mowers, to electric alternatives.	3.6	Mitigation	Capital difference between standard petrol and electric plant	Low	Low	Low	Council
3.8		Explore opportunity for trailing an electric vehicle within Council pool cars.	3.6	Mitigation	Capital difference between standard petrol and electric vehicle	Low-Medium	Low	Low	Council
3.9		Partner with CVGA and other Councils in the region to facilitate regional infrastructure, retail and maintenance for EVs.	3.6	Mitigation	Staff time	Low	Low	High	Community-Wide
3.10	Offset	Investigate offsetting options for Council to achieve net zero emissions by 2030, including through the generation of offset via local carbon sequestration or large-scale renewable energy projects or the procurement of offsets.	3.1, 3.3, 4.5	Mitigation	Purchase of ACCUs/Investment in Council offsetting projects	Medium	N/A	High	Council

Action No.	Action Pathway	Action Name	Linked Action	Type of Action	Resourcing		Potential Impact		
					Type of Resourcing	Cost Range	RoI	Scale of Impact	Impact Reach
SP4: Maximising Opportunities of the Low Carbon Transition									
4.1	Large Scale Renewables	Maintain advocacy for the Kerang Link and facilitate development of new large-scale renewable energy projects within the shire.		Mitigation/ Economic Development	Staff time	Low	High	High	Community-Wide
4.2		Use the local planning approval process to facilitate the development of Large Scale Renewables that balances the environmental aspects and considers local land use opportunities.	4.1	Mitigation/ Economic Development	Staff time, policy development, technical support	Low	High	High	Community-Wide
4.3		Consider developing guidelines or a 'Future fund' with the funds generated from renewable energy projects (or a minimum % of funds), helping return funds back into the local community via climate change adaptation and mitigation projects.	4.1, 4.2	Mitigation/ Economic Development	Staff time and fund administration	Low	N/A	High	Community-Wide
4.4	Green hydrogen	Work with CVGA and private sector to explore the opportunity for green hydrogen production in the region.		Mitigation/ Economic Development	Staff time, stakeholder engagement	Low	High	High	Community-Wide
4.5	Carbon Sequestration	Explore opportunities for partnerships with NCCMA and others to identify land (including council owned sites and private land) that could be suitable for restoration, afforestation or other carbon sequestration projects under a regional carbon exchange.		Mitigation/ Economic Development	Staff time, stakeholder engagement	Low	High	High	Community-Wide

APPENDIX B: CLIMATE CHANGE RISK ASSESSMENT

Riverine Flooding Risk

Risk ID	Council Area	Climate Hazard	Risk Category	Future Climate Projections	2050 Risk Assessment			Future risk description
					Consequence	Likelihood	Risk Rating	
RID015	Community Development	Riverine Flooding	Property damage and loss	There is high confidence that the intensity of daily rainfall extremes will increase. The magnitude of change is less certain. Increase frequency and severity of riverine flooding. For example 1 in 100 year flood events may become 1 in 20 year events.[xxi]	Catastrophic	Possible	Extreme	Major riverine flooding that exceeds the 1 in 100 year flood levee level could have result in significant loss and damage to property and assets in Shire townships. Risk consequence higher in 2050 due to potentially increased severity of floods.
RID031	Assets and Infrastructure	Riverine Flooding	Damage and loss of assets and infrastructure		Catastrophic	Possible	Extreme	Major riverine flooding that exceeds the 1 in 100 year flood levee level could have result in significant loss and damage to Council infrastructure. Risk consequence higher in 2050 due to potentially increased severity of floods.
RID058	Economic Development	Riverine Flooding	Damage to assets		Catastrophic	Possible	Extreme	Major riverine flooding that exceeds the 1 in 100 year flood levee level could have result in significant loss and damage to economic assets in Shire. Risk consequence higher in 2050 due to potentially increased severity of floods.
RID060	Economic Development	Riverine Flooding	Townships cut off for extended periods		Major	Possible	High	Severe riverine flood that cut off townships such as in the 2011 floods would lead to major economic impacts to community.
RID016	Community Development	Riverine Flooding	Population displacement to evacuation centres		Major	Possible	High	Major riverine flooding that exceeds the 1 in 100 year flood levee level could have result in displacement of large sections of the community to evacuation centres.
RID027	Public Health and Wellbeing	Riverine Flooding	Loss of life		Major	Possible	High	Major riverine flooding that exceeds the 1 in 100 year flood levee level could result in local loss of lives.
RID006	Corporate Services	Riverine Flooding	Disruption of services		Major	Possible	High	Severe riverine flood that cut off townships such as in the 2011 floods would lead to major disruption of Council services.
RID035	Leadership and Governance	Riverine Flooding	Reputational due to lack of preparedness and response		Major	Possible	High	Potential for loss in faith in council if council is not seen to have appropriately prepared for severe flood events.

RID057	Economic Development	Riverine Flooding	Damage to agriculture		Major	Possible	High	Major and prolonged riverine flooding could lead to significant and widespread loss of agricultural produce in the Shire.
RID007	Corporate Services	Riverine Flooding	Staff secondment to emergency management roles		Moderate	Possible	Moderate	Significant floods could lead to secondment of a large number of council staff to emergency management roles impacting Council's ability to perform usual functions.
RID028	Public Health and Wellbeing	Riverine Flooding	Increased vector born diseases		Moderate	Possible	Moderate	More frequent and prolonged flood events may lead to increased occurrence of vector borne diseases such as Ross River fever.
RID045	Waste	Riverine Flooding	Increased waste disposal due to damaged assets		Moderate	Possible	Moderate	Major riverine flooding that exceeds the 1 in 100 year flood levee level could result in large volume of household waste needing to be collected and disposed of.

Drought Risk

Risk ID	Council Area	Climate Hazard	Risk Category	Future Climate Projections	2050 Risk Assessment			Future risk description
					Consequence	Likelihood	Risk Rating	
RID053	Economic Development	Drought	Loss of agricultural produce	Time spent in drought is projected to increase over the course of the century (medium confidence)[xxii].	Catastrophic	Likely	Extreme	Increased frequency and severity of drought is likely to have a significant impact on the economy of the Shire, impacting agricultural and downstream businesses and flow on economic impacts to other businesses in the region. The risk of a major drought event increases with greater levels of climate change, therefore consequence expected to be higher in 2050.
RID022	Public Health and Wellbeing	Drought	Food security impacts		Major	Likely	High	Increased frequency and severity of drought is likely to lead to greater food insecurity lost production, economic losses from farms and downstream businesses and lost household produce.
RID041	Environment and Parks	Drought	Habitat & biodiversity loss		Major	Likely	High	Increased frequency and severity of drought is likely to lead to greater stress on local ecosystems, potentially leading to diebacks and habitat loss.
RID038	Environment and Parks	Drought	Pest and invasive species		Major	Likely	High	An increase in drought offers new opportunities for invasive species to proliferate and spread e.g. weeds colonise bare patches after droughts.
RID047	Water	Drought	Water scarcity and supply issues		Major	Likely	High	Increased frequency and severity of drought is likely to lead to water supply issues resulting in water restrictions. Consequence expected to be higher in 2050 with more severe drought leading to greater water scarcity issues.
RID054	Economic Development	Drought	Increased irrigation		Major	Likely	Moderate	Increased frequency and severity of drought is likely to lead to greater demand for irrigation to support farms. Consequence expected to be higher in 2050 with more severe drought impacting more farming communities.

RID062	Assets and Infrastructure	Drought	Asset damage due to soil contraction		Moderate	Likely	**Moderate**	Soil contraction due to drying of the soil could lead to cracking assets and infrastructure leading to increased maintenance requirements and costs.
RID021	Public Health and Wellbeing	Drought	Mental health impacts		Moderate	Likely	**Moderate**	Increased frequency and severity of drought is likely to lead to greater economic stain on rural communities. Flow on mental health impacts to community. Mental health impacts raised during community consultations including impacts of seeing dead and dried up landscapes, parks and gardens.
RID023	Public Health and Wellbeing	Drought	Increased demand for services		Moderate	Likely	**Moderate**	Increased frequency and severity of drought is likely to lead to greater demand for council services, including health and mental health as well as economic and other assistance
RID042	Environment and Parks	Drought	Deterioration of Green Space		Moderate	Likely	**Moderate**	Increased frequency and severity of drought is likely to lead to greater stress on and deterioration of council green spaces.
RID048	Water	Drought	Greater water use by Council and community		Moderate	Likely	**Moderate**	Increased frequency and severity of drought is likely to lead to greater water requirements by Council to maintain ovals, parks, tree and green spaces. This will increase water usage and maintenance costs.

Extreme Heat Risk

Risk ID	Council Area	Climate Hazard	Risk Category	Future Climate Projections	2050 Risk Assessment			Future risk description
					Consequence	Likelihood	Risk Rating	
RID017	Public Health and Wellbeing	Extreme Heat	Heat related health issues	More frequent extreme heat days and longer heatwaves. Days over 35 degrees per year: 1986 - 2005 historical average: *20 - 24 days* 2030 projections: *31 - 39 days* 2050 projections: *38 - 47 days*[xxiii]	Major	Almost certain	**High**	More extreme heat days and prolonged heatwaves may lead to a significant increase in heat health related issue particularly in vulnerable groups, including elderly and low-socio economic groups.
RID018	Public Health and Wellbeing	Extreme Heat	Mental health impacts		Moderate	Almost certain	**High**	Increased frequency of extreme heat days, more hotter nights and prolonged heatwaves could lead to greater mental health impacts within the community.
RID036	Environment and Parks	Extreme Heat	Habitat & biodiversity loss		Moderate	Almost certain	**High**	Increased frequency and severity of extreme heat days is likely to lead to greater stress on local ecosystems, potentially leading to diebacks and habitat loss.
RID037	Environment and Parks	Extreme Heat	Deterioration of Green Space		Moderate	Almost certain	**High**	Longer and more extreme heat waves is likely to lead to greater stress on local ecosystems, potentially leading to diebacks and habitat loss.

RID019	Public Health and Wellbeing	Extreme Heat	Disruption of services		Moderate	Almost certain	High	More extreme heat days and prolonged heatwaves may lead to disruptions in provision of council services.
RID032	Leadership and Governance	Extreme Heat	Reputational impacts due to disruption of services		Moderate	Almost certain	High	Potential reputation risk if Council is unable to deliver services due to extreme heat and community perceive Council as unprepared.
RID001	Corporate Services	Extreme Heat	Disruption of services		Minor	Almost certain	Moderate	More extreme heat days and prolonged heatwaves may lead to disruptions in provision of council services.
RID002	Corporate Services	Extreme Heat	Increased energy use at Council facilities		Minor	Almost certain	Moderate	More extreme heat days may lead to greater electricity usage to cool council and public buildings.
RID008	Community Development	Extreme Heat	Increased demand on Council facilities		Minor	Almost certain	Moderate	More extreme heat days will likely lead to greater demand for Council facilities such as swimming pools.
RID009	Community Development	Extreme Heat	Disruption of services		Minor	Almost certain	Moderate	More extreme heat days and prolonged heatwaves may lead to disruptions in provision of council services.
RID050	Economic Development	Extreme Heat	Economic losses due to extreme heat work disruptions		Minor	Almost certain	Moderate	Potential high level of economic losses in construction, manufacturing and agriculture due to increased number of extreme heat days
RID051	Economic Development	Extreme Heat	Loss of agricultural produce		Moderate	Almost certain	Moderate	Loss of agricultural produce due to issues like burning and scorching from more extreme heat days.
RID046	Water	Extreme Heat	Greater water use by Council and community		Minor	Almost certain	Moderate	Increased demand for water during prolonged heatwave events.
RID049	Economic Development	Extreme Heat	Economic losses due to reduced retail activity.		Insignificant	Almost certain	Moderate	Greater number of extreme heat days will likely have an impact on economic activity in shire townships due to less retail activity as people remain indoors to escape the heat.

Bushfire Risk

Risk ID	Council Area	Climate Hazard	Risk Category	Future Climate Projections	2050 Risk Assessment			Future risk description
					Consequence	Likelihood	Risk Rating	
RID043	Environment and Parks	Bushfire	Habitat & biodiversity loss	The number of days in the Mallee where the Forest Fire Danger Index is greater than the 95th percentile is predicted to increase by 50% (approx. 9 days per year) by the 2050s under high emissions[xxiv].	Major	Likely	**High**	Impact of bushfire on Ramsar Wetlands and other areas of high conversation value could be significant with increased frequency and severity of bushfires. More frequent bushfires can impact the environment's ability to regenerate, and more severe fires can have a critical impact on flora and fauna.
RID011	Community Development	Bushfire	Heritage Loss		Major	Possible	**High**	Increase bushfire risk within the Shire increases risks to cultural assets within local forests and wetlands.
RID029	Assets and Infrastructure	Bushfire	Damage and loss of assets and infrastructure		Major	Unlikely	**High**	Likelihood of bushfire impacting on council assets and infrastructure unlikely due to low density of forested areas around townships within Shire.
RID013	Community Development	Bushfire	Population displacement to evacuation centres		Major	Rare	**Moderate**	Evacuation of population to evac centres highly unlikely due to low density of forested areas around townships within Shire.
RID024	Public Health and Wellbeing	Bushfire	Loss of life		Major	Rare	**Moderate**	Likelihood of loss of life due to bushfire rare due to low risk of bushfires impacting on townships within Shire.
RID026	Public Health and Wellbeing	Bushfire	Air quality		Moderate	Possible	**Moderate**	More frequent and severe bushfires may lead to higher number of days with smoke population impacting the Shire.
RID059	Economic Development	Bushfire	Loss of agricultural produce		Moderate	Likely	**Moderate**	Loss of agricultural produce from bushfires that spread to farmland.
RID003	Corporate Services	Bushfire	Disruption of services		Minor	Unlikely	**Low**	Disruption of council services due to bushfire likely to have minor impact given low density of forested areas around townships within Shire.
RID004	Corporate Services	Bushfire	Staff secondment to emergency roles		Minor	Possible	**Low**	Impact of bushfire on council staffing likely to minor due to low density of forested areas around townships within Shire.
RID010	Community Development	Bushfire	Property damage and loss		Major	Unlikely	**Low**	Likelihood of bushfire threatening a significant number of private properties low given low density of forested areas around townships within Shire.

RID012	Community Development	Bushfire	Disruption of services		Minor	Unlikely	**Low**	Disruption of council services due to bushfire likely to have minor impact given low density of forested areas to townships within Shire.
RID025	Public Health and Wellbeing	Bushfire	Mental health impacts		Minor	Possible	**Low**	Mental health impacts of bushfire likely to only be minor due to low risk of bushfires impacting on townships within Shire.
RID033	Leadership and Governance	Bushfire	Reputational due to lack of preparedness		Minor	Rare	**Low**	Due to low risk of bushfires impacting on townships within Shire.
RID055	Economic Development	Bushfire	Economic losses due to disruption of business		Minor	Unlikely	**Low**	Economic disruption due to bushfire likely to only be minor due to low risk of bushfires impacting on townships within Shire.

Low Rainfall Risk

Risk ID	**Council Area**	**Climate Hazard**	**Risk Category**	**Future Climate Projections**	**2050 Risk Assessment**			**Future risk description**
					Consequence	Likelihood	Risk Rating	
RID039	Environment and Parks	Low Rainfall	Habitat & biodiversity loss	Decline in annual average rainfall, in particular in cool seasons. Average annual rainfall change: 1986 – 2005 historical average: *343 – 387 mm* 2030 projections: *322 – 364 mm* 2050 projections: *312 – 356 mm*[xxv]	Moderate	Likely	**Moderate**	Low annual rainfall is likely to lead to greater stress on local ecosystems, potentially leading to diebacks and habitat loss.
RID040	Environment and Parks	Low Rainfall	Deterioration of Green Space		Minor	Likely	**Moderate**	Low average annual rainfall may lead to greater stress on parks and green spaces and greater maintenance requirements.
RID052	Economic Development	Low Rainfall	Loss of agricultural produce		Moderate	Likely	**Moderate**	Loss of agricultural produce due to insufficient rainfall for dry land agriculture.
RID020	Public Health and Wellbeing	Low Rainfall	Air quality		Minor	Possible	**Low**	Lower rainfall may result increased dust and dust storms resulting in public health issues.

Extreme Weather Risk

Risk ID	Council Area	Climate Hazard	Risk Category	Future Climate Projections	2050 Risk Assessment			Future risk description
					Consequence	Likelihood	Risk Rating	
RID005	Corporate Services	Extreme Weather	Disruption of services	High confidence a future increase in the intensity of extreme rainfall events, although the magnitude of the changes cannot be confidently projected[xxvi].	Minor	Possible	**Moderate**	More severe storms and rainfall events may lead to short lived and isolated service disruptions.
RID030	Assets and Infrastructure	Extreme Weather	Damage and loss of assets and infrastructure		Moderate	Possible	**Moderate**	Extreme rainfall or wind events may lead to isolated damage to infrastructure or assets. Consequence higher in 2050 due to possibility of greater intensity events.
RID044	Environment and Parks	Extreme Weather	Damage to trees and parks		Minor	Likely	**Moderate**	Greater damage to trees due to more extreme storms and wind.
RID061	Environment and Parks	Extreme Weather	Pest and invasive species		Minor	Likely	**Moderate**	An increase in extreme events will offer new opportunities for invasive species to proliferate and spread e.g. foxes and cats prey on animals whose shelter is destroyed by extreme events.
RID014	Community Development	Extreme Weather	Property damage and loss		Minor	Possible	**Low**	Increase extreme weather events may result in isolated property damage and loss.
RID034	Leadership and Governance	Extreme Weather	Reputational impacts due to disruption of services		Minor	Possible	**Low**	Potential reputation risk if Council is unable to deliver services due to extreme weather events and community perceive Council as unprepared.
RID056	Economic Development	Extreme Weather	Crop damage		Minor	Unlikely	**Low**	Extreme rainfall or wind events may lead to isolated damage or loss of crops or other produce.

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