Urban & Rural Water Strategy

2022

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Acknowledgement

GWMWater respectfully acknowledges the Traditional Custodians of the lands and waterways throughout Victoria, and pays its respect to their elders - past, present and emerging.

The Registered Aboriginal Parties representing the Traditional Owners of lands and waters across the GWMWater operational area include (in alphabetical order):

- *Barengi Gadjin Land Council*
- *Dadi Dadi Weki Weki Aboriginal Corporation*
- *Djaara (Dja Dja Wurrung Clans Aboriginal Corporation)*
- *Eastern Marr Aboriginal Corporation*
- *First People of Millewa Mallee Aboriginal Corporation*
- *Gunditj Mirring Traditional Owners Aboriginal Corporation*
- *Latji Latji Mumthelang Aboriginal Corporation*
- *Wadawurrung Traditional Owners Aboriginal Corporation*
- *Wadi Wadi Land & Water Indigenous Corporation*
- *Wadi Wadi Traditional Owner Group*
- *Wadi Wadi Wemba Wamba Barapa Barapa First Nations Aboriginal Corporation*

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1. Executive Summary

1.1 Background

GWMWater has one of the largest geographic footprints of all Victorian water corporations, covering some 62,000 square kilometres or 25 percent of regional Victoria. We provide water and wastewater services for approximately 72,000 people living either on farms or in one of 71 urban centres. The purpose of this Urban and Rural Water Strategy (U&RWS) is to identify the best mix of measures to provide water services in our towns and cities now, and over a period of 50 years into the future.

As GWMWater has both urban and rural water corporation responsibilities, this Urban and Rural Water Strategy considers both urban and rural pipeline supplied customers in each of our five water supply systems; Murray and Goulburn, Grampians, Pyrenees and Eastern Grampians urban systems, and Groundwater towns. These supply systems are very different to each other in terms of supply source, number of customers and options available to manage any shortfalls in supply.

1.2 About this Strategy

The GWMWater Urban & Rural Water Strategy 2022 comprises this overarching document, supported by a series of separate reports detailing the full technical work and analysis undertaken to produce this Strategy.

Learnings from our 2017 Urban and Rural Water Strategy, and feedback from customers and stakeholders through a range of forums and consultation opportunities, has been incorporated into the development of this Strategy.

This Strategy refers to both our 'Minimum' and 'Aspirational' levels of service. GWMWater's Minimum Level of Service is the provision of water supply under Stage 4 level of restriction. This reflects the minimum level of service GWMWater is committed to providing in the event of drought or other water shortage. The aspirational level of service is described in terms of the frequency of years that some level of restriction needs to be imposed as a direct result of low water availability. The aspirational level of service is that urban Permanent Water Saving Rules level of demand can be met in 93 years out of 100 (93% reliability), and applies to all supply systems.

These levels of service were set based on previous consultation with our customers. We have elected to maintain these levels of service for the 2022 Urban and Rural Water Strategy, and propose to further consult with customers and stakeholders in detail about levels of service ahead of our 2027 Urban and Rural Water Strategy. This will enable us to complete the detailed investigation and costing of future augmentation and alternate water supply options, in order to have an informed conversation with customers around the level of investment required and costs to achieve a range of aspirational, agreed and minimum levels of service into the future.

1.3 Future Water Demands

Historical water demands over the period 2016-17 to 2020-21, combined with recent trends and population projections (Victoria in Future 2019), were used to inform demand forecasts for the 50-year outlook period of this Strategy. It is acknowledged that there is some uncertainty relating to projected versus actual population increase in towns serviced by GWMWater, between 2020 and 2022 in particular, as a result of pandemic related migration from major cities to regional areas.

Key observations from developing urban demand projections were that:

- Projections indicate small town populations are likely to decline, while larger centres are projected to grow slowly over the forecast period.
- Projected 2045 total urban water demand volume is very similar to the current average demand volume, due to the projected decline in small town population being offset by growth in larger urban centres.
- Total urban demand for Horsham, Ararat and Stawell is forecast to increase by 26% by 2070, reflecting an additional 1,520 ML needed to service this demand. Up to 60% of this volume is projected to be offset by decreases in demand resulting from projected population decline in other Wimmera-Mallee towns supplied from the Grampians.
- Urban demands supplied from the Murray and Goulburn systems are projected to decline by about 18% (160 ML) by 2070.
- There is a high level of uncertainty as to whether water demand will decrease in all towns projected to observe population decline.

Rural pipeline demand from existing customers was forecast to remain relatively consistent over the forecast period. Increases in rural pipeline demand were forecast to result from completion of the East Grampians Rural Pipeline, connection of additional towns to a Grampians supply, and sale of Growth Water over the period to 2045. The commencement of mineral sands mining operations in the region will increase the demand for water, and this has been considered within the Urban and Rural Water Strategy supply and demand assessments.

1.4 Supply System Key Findings

Murray & Goulburn Supplied Systems

GWMWater entitlements held in the Murray and Goulburn systems support the Northern Mallee Pipeline, Wimmera Mallee Pipeline (Supply System 5) and three private pipeline schemes. Historically, demand in this system has been considerably less than entitlement holdings, providing relatively good water security.

Based on population projections, urban demand is likely to decrease slightly over the next 50 years in Murray supplied towns. Average rural pipeline demand supplied from the River Murray is projected to remain relatively consistent over the next 50 years. As there is limited operational data for the South West Loddon Pipeline, rural water use was estimated for the 2020, 2045 and 2070 time slices. For the purpose of the supply assessment, two thirds of the total estimated demand was assumed to be sourced from the Goulburn system.

Supply and demand assessments for the Murray and Goulburn Supplied systems identified that water security in these systems remains high, owing to the annual demand volumes relative to the size of GWMWater's entitlements, and that carryover remains a crucial tool in balancing water security from year to year. By maintaining carryover reserves of up to 3,000 ML (as is current practice), the assessment found Permanent Water Saving Rules level of demand could be met in 100% of years under Historic, Post-1975, Post-1997 and Low Impact Climate Change scenarios, and at least 94% of years under Medium Impact Climate Change.

In light of changes to inter-valley trade rules and limits since the 2017 Urban and Rural Water Strategy was prepared, this 2022 Strategy lists an action for GWMWater to review the operational management of its Murray and Goulburn water entitlements and carryover, and to incorporate the findings from this 2022 Strategy.

Grampians Supply System (Overall)
Supported by hydrologic modelling, the Grampians supply system performance was assessed at both a system-wide scale, and also at an individual reservoir scale.

The Grampians reservoir catchments have experienced a greater decline in rainfall and runoff over recent decades than many other catchments in Victoria. The average annual inflow to the Grampians reservoirs since 1997 is 63% lower than the historic average for the period prior to 1997. Our analysis determined that climatic conditions reflective the period since 1997 (Post-1997 climate) best represented the observed water availability over the period the current water entitlements have been in operation (i.e. since 2010, post-Wimmera Mallee Pipeline), and the climatic conditions which may be experienced in the short to medium term. This is a change from the 2017 Urban and Rural Water Strategy, which followed the best available advice at the time, and adopted a climate baseline which reflected climatic conditions since 1975.

The system performance assessment identified that under a continuation of Post-1997 climate conditions and baseline demands (2020 level of demand + projected growth in urban and rural pipeline demand to 2070), GWMWater would likely have sufficient water holdings in the Grampians system to meet the projected level of demand in 100% years until 2045. The assessment also indicated that GWMWater would likely have sufficient water holdings to meet the aspirational level of service (demands met in 93% of years) beyond 2070.

GWMWater's Grampians system water holding has provided a high level of security as a consequence of a number of factors. These include:

- the underutilisation of rural allowances,
- large commercial users who are not taking supply,
- allocations from unsold growth water, and
- the ability to carryover all unused allocation (subject to spillable water rules).

The combination of these factors has meant the security of supply to GWMWater's urban and rural customers has remained very high, despite climate-driven reductions in allocations. The reduction in the current water security buffer resulting from presently inactive large commercial users commencing operations combined with the sale of Growth Water were

assessed to be the dominant factors influencing the timing of when the Grampians supply system may require augmentation into the future.

The analysis also reinforced the 2017 Strategy finding, being the importance of 'unlimited' carryover in the Grampians system as a tool to manage multi-year security. The modelling for the 2022 Strategy highlighted that carryover is even more important under Post-1997 climate, in order to provide multi-year water security.

Grampians Supply Sub-systems (individual reservoir scale)

The modelling analysis for both the 2022 and 2017 Urban and Rural Water Strategies identified that Lake Wartook, which services GWMWater's largest urban centre, is at higher risk than the rest of the Grampians system. Under baseline demands, modelling showed that all Grampians system supply shortfalls resulted from a lack of resource in Lake Wartook (GWMWater, 2022a). There is significant demand for water from Lake Wartook to meet urban, rural and environmental supply requirements, with the modelling assessment showing significant shortfalls in supply to Horsham under all climate scenarios. Under Post-1997 climate, Lake Wartook and Moora Moora Reservoir only have sufficient resource to supply current levels of demand for Horsham, Natimuk and Supply System 6 rural customers in 86% of years. An action from this Strategy is for GWMWater to work with the Storage Manager and other key stakeholders to define and implement rules for the equitable sharing of access to water from Lake Wartook.

There is significant demand for water from Lake Wartook to meet urban and rural supply requirements and environmental needs. This has resulted in competition for supply between GWMWater (for urban and rural supply) and environmental water holders, particularly in low inflow years. Demand forecasts indicate an additional 500 ML/yr will be required for Horsham urban supply by 2045, and more than 1,000 ML additional by 2070. In response to these findings, GWMWater intends to undertake more detailed feasibility assessments of conceptual supply augmentation options for the Horsham urban system and Supply System 6 over the next five years. The findings of these investigations will inform the 2027 Urban and Rural Water Strategy, other business planning processes and discussion with customers and stakeholders. Opportunities for increased efficiency in supply networks and customer water use will also be investigated as part of this work.

It was assessed that the Lake Bellfield and Taylors Lake supply to the Wimmera-Mallee Pipeline remains secure under all climate scenarios up to 2045, except under scenarios with significantly increased levels of demand.

The Lake Fyans Supply System was assessed to be able to meet Stawell, Ararat and Great Western demands in all climate scenarios up to 2045, even when supplying the East Grampians Rural Pipeline.

Pyrenees and Eastern Grampians Urban Supply Systems

The East Grampians Rural Pipeline (EGRP) will interlink with the existing headworks infrastructure supplying the Pyrenees and Eastern Grampians Urban Supply Systems, and also have capacity to supplement the Elmhurst system. This augmentation is set to occur within the next five years, and so the performance of this system was not assessed in detail for this

Strategy. The connection of these systems to East Grampians Rural Pipeline network will mean that their security of supply will not be less than assessed for the Grampians supply systems which take water from Lake Bellfield or Lake Fyans. The method for assessing the performance of these urban systems will be reviewed at the time of the 2027 Urban and Rural Water Strategy as this will be post-construction of the East Grampians Rural Pipeline, and the operational arrangements for supplying the Pyrenees and Eastern Grampians Urban Supply Systems will be well understood.

Groundwater towns

GWMWater's groundwater supplied towns span a range of groundwater management areas with differing levels of security. In most cases, the existing groundwater resource provides a long-term supply option because climatic factors have little influence.

The Edenhope urban supply borefield is located in a highly localised area with low salinity groundwater. There is an inherent risk that the salinity of water being extracted will increase due to groundwater pumping inducing movement of higher salinity water towards the urban supply bores. The current borefield was also assessed to be operating at its maximum production capacity during peak demand periods. This Strategy includes actions to continue the current Edenhope groundwater monitoring regime and undertake a further technical assessment 'health check' of the groundwater resource, and complete planning and deliver short-term augmentation works to increase Edenhope urban supply system resilience during peak demand periods.

In the West Wimmera area there has been considerable landowner and community interest in a rural pipeline. For Edenhope township, this discussion has extended to a secure long-term water supply which can support and facilitate growth, with a concept for a pipeline solution from Rocklands Reservoir having been developed. This will be a key consideration in the planning for long-term augmentation of the Edenhope supply system.

1.5 Priority Actions

	Action Description
Action 1	Undertake detailed investigations and costing of future augmentation and alternate water supply options to inform consultation on levels of service ahead of the 2027 Urban and Rural Water Strategy.
Action 2	Deliver upgrades at Donald, Ararat, Horsham and Dimboola Wastewater Treatment Plants during 2022-2028.
Action 3	GWMWater to continue working with local governments on opportunities for the use of recycled water in GWMWater serviced towns.
Action 4	GWMWater will continue to support local government and communities to maximise the beneficial use of stormwater.
Action 5	Undertake an analysis of historic population projections with observed changes in population and urban demand, to inform the 2027 Urban & Rural Water Strategy.

	Action Description
Action 6	Investigate the cause of increasing unaccounted for water in the Murray supplied pipeline systems.
Action 7	Review the operational management of GWMWater's Murray and Goulburn water entitlements and carryover, and update this for changes to inter-valley trade rules and limits and findings from the 2022 U&RWS.
Action 8	Confirm the volume of new Growth Water commitments which can be supported by the projected future yield of existing entitlements over the next 20 years, and develop a policy which supports the release of Growth Water, while maintaining a high level of water security for urban and rural pipeline customers.
Action 9	Develop an operating strategy to guide the future use of the Mt Zero borefield, and the evaluation of borefield and aquifer performance when it is operated.
Action 10	GWMWater to work with the Storage Manager, Wimmera Catchment Management Authority, Department of Environment, Land, Water and Planning, and the Victorian Environmental Water Holder to define and implement rules for the equitable sharing of access to water from Lake Wartook that reflects the primary role of Lake Wartook as an urban water supply source.
Action 11	GWMWater to undertake detailed feasibility assessment of conceptual supply augmentation options for the Horsham urban system and Supply System 6 over the 2022-2027 period, and investigate opportunities for increased efficiency in supply networks and customer water use.
Action 12	Review the method for assessing the performance of the Pyrenees and East Grampians Urban Supply Systems following the completion of the East Grampians Rural Pipeline.
Action 13	Continue current Edenhope groundwater monitoring regime and undertake a further technical assessment 'health check' if the current borefield is likely to remain in operation for the next five years.
Action 14	Complete planning and deliver short-term augmentation works to increase Edenhope urban supply system resilience during peak demand periods.
Action 15	Commence planning of long-term supply system augmentation for Edenhope.
Action 16	Continue to promote water efficiency initiatives and the use of GWMWater's Customer Portal for customers to monitor and understand their water use behaviour.
Action 17	Continue to pursue opportunities to maximise the benefit and value to both customers and GWMWater from digital metering data.

2. About this Strategy

This Urban and Rural Water Strategy (U&RWS) provides a framework for the way in which GWMWater will meet demands for water services over a 50-year time frame. A specific emphasis of the strategy relates to the management of water security under a range of possible climate futures established by Victorian Government guidelines for the preparation of Urban Water Strategies, and for assessing the impacts of climate change on water availability in Victoria.

GWMWater is a vertically integrated water business that provides both urban and rural water services. Situated in north west Victoria, the communities in our region are reliant on water sourced from the Grampians reservoirs, River Murray, Goulburn River via the Waranga Channel, groundwater, and for some smaller towns and systems, stream diversions. Our rural domestic and stock pipeline service has similar characteristics to urban services, with both rural and urban customers supplied with water sourced under GWMWater's entitlements. Due to this common factor, GWMWater's Urban and Rural Water Strategy applies the *Guidelines for the Development of Urban Water Strategies (DELWP, 2021)*, herein referred to as 'Urban Water Strategy Guidelines', to water supply planning for both urban and rural pipeline supplied customers.

This strategy does not consider rural users who access water directly from groundwater or unregulated surface water sources (i.e. not from a reservoir) by way of an authorisation or licence issued under the *Water Act 1989*.

In the Grampians reservoir system (Wimmera-Glenelg system) GWMWater has both entitlement holder and Storage Manager responsibilities. This strategy only considers the water available to GWMWater as an entitlement holder, under the urban and rural entitlements held for supplying its customers. The demands of GWMWater's other entitlements (such as Recreation) are not directly considered within this strategy.

Other entitlement holders' requirements are within the domain of the Storage Manager, and so are not discussed within this Strategy. Further information on the Storage Manager and its responsibilities can be found at www.storagemanager.com.au.

2.1 Purpose, Objectives and Policy Context

2.1.1. Purpose and Objectives

Victoria's water planning framework requires Urban Water Strategies to be developed by those water corporations providing urban services.

The purpose of an Urban Water Strategy is to identify the best mix of measures to provide water services in our towns and cities now and into the future. Urban Water Strategies have a long-term outlook of 50 years; and contain actions which:

- consider the total water cycle, consistent with the principles of integrated urban water management;
- support the development of resilient and liveable communities;
- balance social, environmental and economic costs and benefits; and
- take account of the consequences and uncertainty associated with population growth, climate change and climate variability.

The primary objectives of GWMWater's Urban and Rural Water Strategy are to:

- Articulate the already observed impacts of a changing climate on our water systems;
- Explain when, and under what conditions, water available from existing sources is projected to become insufficient to meet both current and future customer demand;
- Explain when, and under what conditions, actions such as system augmentation or alternate water sources may be required;
- Recommend actions which support the purpose of this strategy; and
- Identify any further work needed over the next five years to inform water security planning and priority actions.

2.1.2. Policy Context

Water for Victoria (2016) outlines the water management opportunities and challenges facing Victoria over the coming decades. It builds on the planning framework established in *Our Water, Our Future (2004)*, while incorporating lessons from the millennium drought and the 2010-11 floods. Among these lessons is a recognition that resilient and liveable cities and towns are fundamental to economic prosperity, social and environmental needs, and community identity and wellbeing. Water has an essential role in supporting these outcomes through more integrated and strategic approaches to urban water service provisions and urban land use planning.

The Urban Water Strategy Guidelines are written for metropolitan and regional urban water authorities. GWMWater has developed its Urban and Rural Water Strategy, encompassing both urban and rural pipeline supplied customers.

2.2 Learnings from 2017 Urban and Rural Water Strategy

The 2017 Urban and Rural Water Strategy was developed in accordance with the applicable guidelines to meet GWMWater business needs at the time. A review of the 2017 Urban and Rural Water Strategy in 2021 identified aspects of the strategy which were successful, and learnings which were used to improve the 2022 Urban and Rural Water Strategy.

The key outcomes from this review were:

- The scope of the Strategy should continue to focus on the customer groups serviced by GWMWater's water entitlements, including rural pipeline customers.
- Urban demand forecasts would benefit from a thorough review as part of the 2022 Strategy. Analysis of the past five years of metered customer usage data will incorporate water use across a range of 'average' to 'dry' years.
- The Victoria In Future (VIF) 2019 data should be analysed to establish population tends based on total households for future demand projections.
- Impacts of climate change and climate risk will need to be thoroughly investigated.

2.3 Customer & Stakeholder Consultation

GWMWater continues to consult extensively with its customers and stakeholders on issues including water security, water quality and capital investment opportunities. GWMWater's Communications and Engagement Strategy for the Urban and Rural Water Strategy identifies stakeholders to be engaged through the development of the Strategy, and details key messages and communication channels. Some of our key consultation activities are described below.

Stakeholder Workshop

At GWMWater's 2021 Stakeholder Workshops, the Urban and Rural Water Strategy and water resource challenges we face as a region were discussed. The reluctance of some stakeholders to accept that our climate is changing and severely impacting inflows to our Grampians reservoirs, remains a constant challenge. Through these workshops we also consulted on priority towns to receive upgrades to drinking water quality, and potential alternative approaches to deliver water supply upgrades for very small towns in the region.

At our October 2021 Stakeholder Workshop, customers and stakeholders shared their thoughts and voted on the factors which they believed influence perceptions of the value GWMWater provides. Interestingly, the availability of water for recreation consistently ranked well above factors relating to the cost and reliability of GWMWater's water and wastewater services.

Community Panel

As part of the process for determining our pricing path for the next five years, GWMWater has built on its normal customer and stakeholder framework with an intensive engagement program that will help influence and shape the future of the organisation and the services that we deliver to our customers.

An independent Community Panel reflecting GWMWater's diverse customer base has been appointed, and reports to the Board of GWMWater. The Panel's purpose is to help inform

GWMWater of community preferences and concerns regarding service provision and a future pricing model and, as such, will make recommendations to the Board.

The Community Panel complements the existing engagement and consultative processes which have been developed and implemented over the past several years. The Panel will have the opportunity to examine and deliberate on the observations and directions that GWMWater has taken from these engagement and consultative processes to ensure that they accurately reflect customers' needs and expectations.

At its meeting on 16 May 2022, the Panel was presented with an overview of the findings of this Strategy. Preliminary feedback suggests the Panel supported GWMWater's approach to investigating opportunities to secure water supply over the next five years, with a view to investing in any necessary improvements beyond 2027.

Consultation with Traditional Owners

GWMWater invited all Registered Aboriginal Parties representing Traditional Owners across the GWMWater region to participate in the development of this Urban and Rural Water Strategy. While GWMWater has met with interested Registered Aboriginal Parties, engagement and discussions with Traditional Owners in relation to water management will extend beyond the timeframe for developing this Strategy.

GWMWater also consults with Traditional Owners and/or Registered Aboriginal Parties on capital works and major infrastructure projects, and various planning activities as part of its standard business activities. Where Cultural Heritage Management Plans are required, these are developed in consultation with the Registered Aboriginal Parties and Traditional Owners.

Community Engagement

Our Communications and Engagement Strategy 2019-2024 ensures that GWMWater has a detailed understanding of the expectations of our customers, and supply and demand issues across the region. The community will have the opportunity for further input through the engagement processes available during development of the GWMWater's pricing submission and Water Plan through 2022.

Customer Satisfaction Surveys

Customer satisfaction and perceptions of GWMWater and the services we provide are actively tracked by engaging an independent third-party to periodically survey a range of customer segments. The most recent customer survey in 2021 interviewed 652 customers receiving either urban or non-urban water services provided by GWMWater. Customers were asked about their views of water service reliability, the quality of water supplied, waste water services, service interruptions, customer information, customer service, value for money, trust and reputation.

2.4 Aspirational and Minimum Levels of Service

The objective of the Urban and Rural Water Strategy is to balance the demand for water with water availability in order to provide an appropriate level of service to customers. For the purpose of this Strategy, levels of service will only be prescribed for urban customers.

GWMWater's Minimum Level of Service is the provision of water supply under Stage 4 level of restriction. This reflects the minimum level of service GWMWater is committed to providing in the event of drought or other water shortage (i.e. when the Drought Response Plan is implemented). This Minimum Level of Service was defined through consultation with GWMWater customers when developing its 2012 Water Supply and Demand Strategy.

The aspirational level of service is described in terms of the frequency of years that some level of restriction needs to be imposed as a direct result of constrained water availability. The aspirational level of service is that urban Permanent Water Saving Rules level of demand can be met in 93 years out of 100, and applies to all supply systems. While GWMWater aspires to provide the highest possible level of service, it is possible that water restrictions could be implemented in some years while still meeting the aspirational target (i.e. water restrictions in less than one year in ten). A 2021 customer satisfaction survey found that 96% of the 652 GWMWater customers surveyed were satisfied with the reliability of their water supply.

The 93% aspirational level of service was based on modelled entitlement reliability under historic climate conditions, and was last discussed with customers in 2011-12. This was following many years of water restrictions during the millennium drought, and at the time, customers agreed that 93% was a good target. Given the average yield of GWMWater's entitlements in Grampians system under current climatic conditions is well below 93%, aspirational and agreed level of service targets will need to be revisited with customers in the future. If customers wish to receive an actual level of service equal to or better than the aspirational level, it is expected that GWMWater would need to pursue water supply augmentation actions in the future, which could have a cost impact to customers.

However, to have an informed conversation with customers, options and costs to achieve a range of aspirational, agreed and minimum levels of service need to be understood. The relatively high water security GWMWater has experienced across its supply systems over the past decade has not necessitated detailed planning and costing of major augmentation or alternate water supply options.

This Strategy confirms that major augmentation is not likely to be required within the next five years. It is therefore recommended that over the next five years, detailed investigation and costing of augmentation and alternate water supply options is undertaken, guided by the findings and outcomes of this Strategy. This will enable an informed discussion with customers as part of our community consultation program for the next Urban and Rural Water Strategy.

Action 1: Undertake detailed investigations and costing of future augmentation and alternate water supply options to inform consultation on levels of service ahead of 2027 Urban and Rural Water Strategy.

Integral to the conversation with customers, will be a discussion with the community as to their preparedness to accept the water sharing outcomes upon completion of the Wimmera Mallee Pipeline. Underutilisation of growth water and rural allowances over the past decade has enabled GWMWater to transfer surplus water allocation to supply pipeline recreation lakes across the region, due to a lack of water allocation to the dedicated recreation entitlement. This action recognises the importance of these lakes to the social fabric and liveability of the communities we serve, and reflects GWMWater's commitment to achieving social and community benefits, beyond our core water service business. It is acknowledged that as demand for water increases into the future, GWMWater is less likely to hold surplus allocation to be able support recreation lakes supply from its urban and rural entitlements.

2.5 Supporting Documents

GWMWater's Urban and Rural Water Strategy is based on detailed analysis and findings documented within the following background and technical reports:

GWMWater. (2021). *Urban and Rural Water Strategy 2022 - Demands Report.* Horsham, Victoria, Australia: Grampians Wimmera Mallee Water. doi:R2021-47147

GWMWater. (2022a). *Technical note for 2022 Water Strategy Modelling Scenarios (Grampians System).* Horsham, Victoria, Australia: Grampians Wimmera Mallee WAter. doi:R2021-47121

GWMWater. (2022b). *Technical note for 2022 Water Strategy Modelling Scenarios (Murray and Goulburn Systems).* Horsham, Victoria, Australia: Grampains Wimmera Mallee Water. doi:R2021-47786

2.6 GWMWater Region

2.6.1. History of Water Supply

The history of the colonial settlement of the Wimmera Mallee is largely linked with access to adequate and reliable water supplies.

In 1878, the Shires of Dunmunkle and St Arnaud constructed a timber weir in the Wimmera River near Glenorchy, turning water into the Dunmunkle and Swedes Creeks. The Shire of Wimmera constructed a similar structure near Longerenong to facilitate diversion of water into Yarriambiack Creek. Both of these structures were severely damaged by floodwaters on several occasions and were eventually abandoned.

The dry years following 1882 led to the construction of Lake Wartook Reservoir in 1887, by the Wimmera United Waterworks Trust. The natural watercourses of the Wimmera River, Yarriambiack and Dunmunkle Creeks and the Richardson River were used as the main distribution channels.

Settlement of the Northern Wimmera and Southern Mallee continued over the next few years, leading to further demands for water and many kilometres of new channels were constructed. In the dry period culminating in the 1902 drought the water supply scheme partially failed, leading to the construction of Lake Lonsdale in 1903.

The State Rivers and Water Supply Commission took control of the water supply scheme in 1906 and was the responsible Authority until July 1984.

In response to the 1914 drought, reservoirs were constructed at Lake Fyans and Taylors Lake and, in 1919 (also a dry year) the construction of Pine Lake was authorised. During the dry period 1927 to 1930, the Waranga Western Main Channel, which brings water from the Goulburn and Loddon River systems to the east, was extended 208 kilometres west of the Loddon River to supply the northern part of the Wimmera-Mallee channel system. Moora Reservoir, Green and Dock lakes were added to the system in 1934 and 1935.

After the construction of Rocklands and Toolondo reservoirs, which were both completed in 1953, arrangements were made to supply the whole of the channel system from the Grampians reservoirs, thereby removing the heavy dependence on the Waranga Western Main Channel from 1962 onwards. It was not until the 1967/68 drought that it was again found necessary to open the channel to supplement supplies to the Wimmera-Mallee. The Waranga Channel remained an essential component of the system until the completion of Northern Mallee & Wimmera Mallee Pipeline projects.

The last and most recent reservoir to be constructed as part of the headworks was Lake Bellfield, completed in 1966.

Government restructuring in the 1980s led to the formation of the Rural Water Commission, and later, the Rural Water Corporation. These bodies existed until June 1994 when the Rural Water Corporation was split to form four rural water businesses, with the north-west region

becoming Wimmera Mallee Water. Wimmera Mallee Water was responsible for the region's rural and bulk water services until 2004.

To reduce water losses, a program to replace channels with pipelines commenced in 1994 with the Northern Mallee Pipeline Project. Completed in 2004, the project saved an average 50,000 ML per year in the Wimmera and Glenelg catchments to improve water security for existing customers, improve environmental flows and to provide water for growth. The Northern Mallee Pipeline is now sourced from the River Murray, rather than the Grampians headworks.

In 2004, Wimmera Mallee Water merged with Grampians Water, which was responsible for providing urban water and wastewater services. The resulting GWMWater was formed through a specific policy initiative in *Our Water Our Future,* where it was stated that the merger had the specific objective of '*ensuring the Wimmera Mallee Pipeline would succeed*'. The Wimmera Mallee Stock and Domestic channel network had supported the colonial settlement of the region, and served the community well for many decades. However, the community had been advocating for its conversion to a pipe supply for some time, to improve the water efficiency of the system. Whilst initially conceptualised as a water saving project, during its construction, it became a drought response imperative, as in August 2007, the Wimmera Mallee headworks system held only 3% in storage.

Construction of the Wimmera Mallee Pipeline commenced in 2006 to replace 17,500 km of earthen channels with 9,159 km of pressurised pipeline and associated infrastructure. One of Australia's largest infrastructure projects at the time, the pipeline was completed in April 2010, four years ahead of schedule and within the $688-million project budget.

The completion of the Northern Mallee Pipeline in 2004 and Wimmera Mallee Pipeline system in 2010 reflect the most significant investments in the security of water supply across the Wimmera-Mallee region since the construction of the Grampians reservoirs and former Wimmera-Mallee stock and domestic channel system. The collective pipeline systems across the region continue to underpin highly efficient water distribution.

Since 2010 there have been a number of extensions to the Wimmera Mallee Pipeline network, to provide rural water supply to adjoining areas such as Coonooer Bridge, Pella and the Wartook Valley.

More significant extensions and pipeline projects since 2010 have included:

- The Landsborough Valley Pipeline, completed in 2015/2016, which provides a high quality and reliable water supply to number of vineyards and rural properties east of Stawell.
- The $89.8-million South West Loddon Pipeline, completed in 2020, which linked the Waranga Western Channel with the existing Wimmera Mallee Pipeline network. This pipeline now provides year-round water supply to rural properties and businesses across an area of 1,670 km^2, between the existing Wimmera-Mallee Pipeline network (to the east of Charlton and St Arnaud), and the Loddon River.

- The East Grampians Rural Pipeline (not yet constructed) which will service rural properties and enterprises within an area of 330,000 hectares around, and to the south of Ararat *(East Grampians Rural Pipeline Business Case*).

In a quest for improved climate resilience, many other rural landowners across parts of north west Victoria have been seeking access to a reticulated water supply to sustain and enhance agricultural productivity.

2.6.2. Climate of the region

Rainfall in the Grampians, Wimmera and Mallee regions is winter-spring dominant, with summer having the lowest and most unreliable rainfall. The average annual rainfall decreases, and average temperature increases, from the Grampians (Gariwerd) in the southern part of the GWMWater region, to the Mallee in the north. The average annual rainfall ranges from nearly 900mm at Lake Wartook in the Grampians (Gariwerd), to 414mm at Longerenong near Horsham, to less than 330mm at Ouyen.

Annual rainfall has decreased over the past 30 years. Annual rainfall in the Wimmera has decreased by about 40 mm (9%), from about 480 mm to about 440 mm over 30 years (1989–2018) when compared to the prior 30 years (1959–1988). Over the 30 years (1989-2018), winter growing season rainfall (April to October inclusive) for Birchip was 214 mm; 48 mm lower than the 262 mm average for the prior 30-year period (1959–1988). Reductions in rainfall across the Grampians reservoir catchments has resulted in significant reductions in runoff and inflow to the Grampians reservoirs (CSIRO, 2019).

The Wimmera and Mallee regions have experienced more hot days in the past 30 years, with more consecutive days above 38 degrees Celsius. These hot days usually coincide with hot northerly winds which drive very high evaporation rates from reservoirs and other water storages across GWMWater's supply systems.

As GWMWater's service area covers such a vast geographic area, with water for some supply systems sourced from catchments hundreds of kilometres away (such as the River Murray catchments) the impact of reduced rainfall is different for the respective water sources accessed by GWMWater. Water availability from the Grampians reservoirs is very different to water availability from the Murray and Goulburn systems. Further discussion on water availability and climate factors specific to each supply source is detailed in Section 3.

2.6.3. GWMWater Overview

Grampians Wimmera Mallee Water Corporation (trading as GWMWater) is a government-owned Statutory Corporation established on 1 July 2004 under the *Water Act 1989*. GWMWater was formed through the amalgamation the former Grampians Water (urban supply) and Wimmera Mallee Water (rural supply and headworks operation).

GWMWater has one of the largest geographic footprints of all Victorian water corporations, covering some 62,000 square kilometres or 25 percent of regional Victoria. Our service area includes 13 municipalities in full or in part. We provide water and wastewater services for

approximately 72,000 people living either on farms or in one of 71 urban centres. We provide water for use in and around homes, in business, on farms, for environmental purposes, and for recreational and sporting uses for community benefit.

Our large service area presents considerable challenges, as we must transfer and distribute water over long distances to supply many of our customers. To deliver water services we manage an extraordinary number of assets including bulk water supply reservoirs, hundreds of smaller water storages, tanks, water towers and approximately 16,400km of pipes.

Our ability to provide a water service and charge a fee to a customer exists through the creation of water districts. All urban centres in our region have a water district, and a service obligation defined within the Urban Customer Charter. Much of the rural water supply service area is within the Wimmera Mallee Waterworks District which existed to service landowners from the former Wimmera Mallee Stock and Domestic channel network (since converted to a pipeline supply). The service obligation for rural landowners receiving a stock and domestic pipeline supply is defined within the Rural Customer Charter.

3. Our Water Resources

GWMWater owns and operates a number of water supply systems which comprise of headworks reservoirs, bulk water supply assets and distribution assets (e.g. pipelines). These supply systems are broadly categorised as the:

a) Murray supplied systems
b) Grampians supplied systems
c) Goulburn supplied systems,
d) Pyrenees and Eastern Grampians urban systems
e) Groundwater supplied towns

These supply systems are very different to each other. GWMWater holds entitlements totalling 6,409 ML which are used to supply Murray pipeline systems and the South West Loddon Pipeline. This volume is equivalent to approximately 0.005% of total Victorian River Murray high reliability entitlements. The Grampians reservoir system, which comprises nine water supply reservoirs, associated channels and regulating structures supplies GWMWater's urban and rural entitlement of 32,720 ML (excluding supply by agreement users). This volume represents 26% of all entitlements in this system. In terms of both geographic areas supplied and volumetric demand, groundwater supplied towns and the Pyrenees and Eastern Grampians urban systems are relatively small compared to the extent of the Grampians and Murray supplied pipeline systems.

Each of these supply systems is described in more detail in the following sections. A summary of GWMWater's entitlements can also be found in **Appendix 3 – GWMWater Entitlements**.

Figure 1: GWMWater service area map showing respective supply networks

3.1 Murray Supply Systems Description

GWMWater operates four pump stations on the River Murray located at Swan Hill, Piangil, Nyah and Liparoo. These pump stations supply bulk water to urban storages and rural customers through the Northern Mallee Pipeline (NMP) and Supply System 5 of the Wimmera Mallee Pipeline (WMP) (refer to ***Figure 2***).

GWMWater holds 6,409 ML of high reliability entitlements within the Victorian Murray and Goulburn systems, which are used to service all demands in the Murray supplied systems, inclusive of recreation lakes supplies and pipeline water losses. GWMWater's entitlement holdings in the Goulburn system can be accessed from its River Murray pumps through water trading mechanisms.

Figure 2: Northern Mallee Pipeline and Supply System 5 supply areas

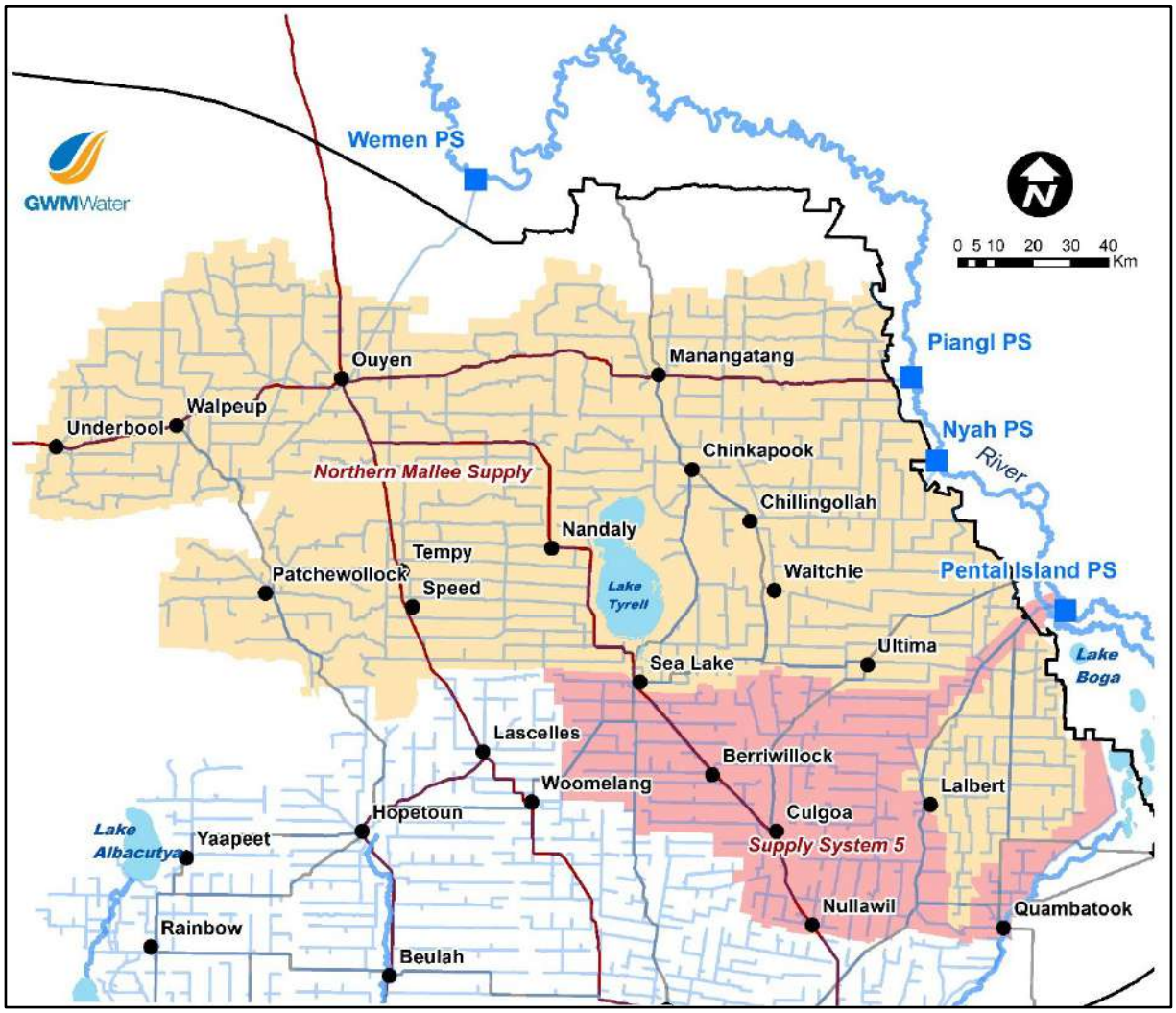


Table 1 provides an overview of the Northern Mallee Pipeline and Wimmera Mallee Pipeline Supply System 5 user groups and the towns supplied from the respective systems.

Table 1: River Murray supplied systems and customer user groups

Pipeline System	User Group	Towns or Area Supplied
Northern Mallee Pipeline	Urban	Ouyen, Underbool, Manangatang, Nullawil, Ultima, Walpeup, Chillingollah, Chinkapook, Nandaly, Patchewollock, Speed, Tempy, Waitchie
	Rural Pipeline	See *Figure 2*
	Recreation Lakes	Ouyen Lake (Ouyen township)
WMP Supply System 5	Urban [1]	Berriwillock, Culgoa, Lalbert, Nullawil
	Rural Pipeline	See *Figure 2*
	Recreation Lakes	Green Lake (near Sea Lake township)
	Environment [2]	*Wimmera-Mallee Pipeline connected wetlands*
Private Pipelines	Rural	North of Piangil, outside of GWMWater's Northern Mallee Pipeline footprint

Note 1: The township of Sea Lake is no longer supplied from the River Murray via Supply System 5. Sea Lake was connected to the Warracknabeal Water Treatment Plant in 2019 via a 130km pipeline, and is now supplied with drinking water sourced from the Grampians reservoirs.

Note 2: Environmental water demand for wetlands is not considered directly in this strategy.

3.2 Goulburn Supply Systems Description

Following the completion of the Wimmera Mallee Pipeline, only the Quambatook township was supplied from the Goulburn System, via the Normanville Pipeline. GWMWater holds a 100ML Bulk Entitlement to supply Quambatook. The South West Loddon Pipeline network (completed in 2020) also sources part of its supply from the Goulburn System via the Waranga Western Channel. It provides water to rural properties and can supply Coliban Water treatment plants at Bridgewater, Korong Vale and Laanecoorie.

Supply to Quambatook and the South West Loddon Pipeline can be supplemented through water trade between GWMWater's various Goulburn and Murray system entitlements. Information on GWMWater's Goulburn system entitlements can be found in **Appendix 3 – GWMWater Entitlements**.

Table 2 provides an overview of the user groups and the towns supplied from the respective systems.

Table 2: Goulburn supplied systems and customer user groups

Supply System	User Group	Towns or Area Supplied
South West Loddon Pipeline (in part)	Urban	Bulk water supply to Coliban Water Treatment Plants at: Bridgewater, Korong Vale, Laanecoorie
	Rural Pipeline	See *Figure 1*, south-eastern part of *Pipeline supplied from Grampians System* area
	Recreation Lakes	Skinners Flat Reservoir
Quambatook Urban	Urban	Quambatook township
	Rural (via cross connection)	Backup supply option for 'Quambatook leg' of Supply System 5

3.3 Grampians Supply Systems Description

GWMWater owns and operates nine bulk water supply reservoirs and a number of other headworks assets as part of the Grampians reservoir system, under the direction of the Storage Manager. The reservoirs are Lake Bellfield, Lake Fyans, Mt Cole Reservoir, Lake Lonsdale, Lake Wartook, Moora Reservoir, Rocklands Reservoir, Toolondo Reservoir and Taylors Lake.

Green Lake near Horsham is no longer used for water supply, but provides valued recreation opportunities. Pine Lake and Dock Lake are no longer used for water storage or supply, and are considered to be offline.

GWMWater has a 44,720 ML entitlement (36% of total entitlements) from the Grampians Reservoir system for supplying its urban, rural and large 'supply by agreement' commercial customers. Coliban Water, Wannon Water and the Victorian Environmental Water Holder also hold bulk entitlements in this system. Only the urban and rural component of GWMWater's entitlement (32,720 ML) used in supplying urban and rural pipeline customers is considered in this Strategy. Supply by agreement users (12,000 ML) receive a bulk water allocation and have the ability to manage their own water security through carryover. Bulk water allocations are determined by the Storage Manager.

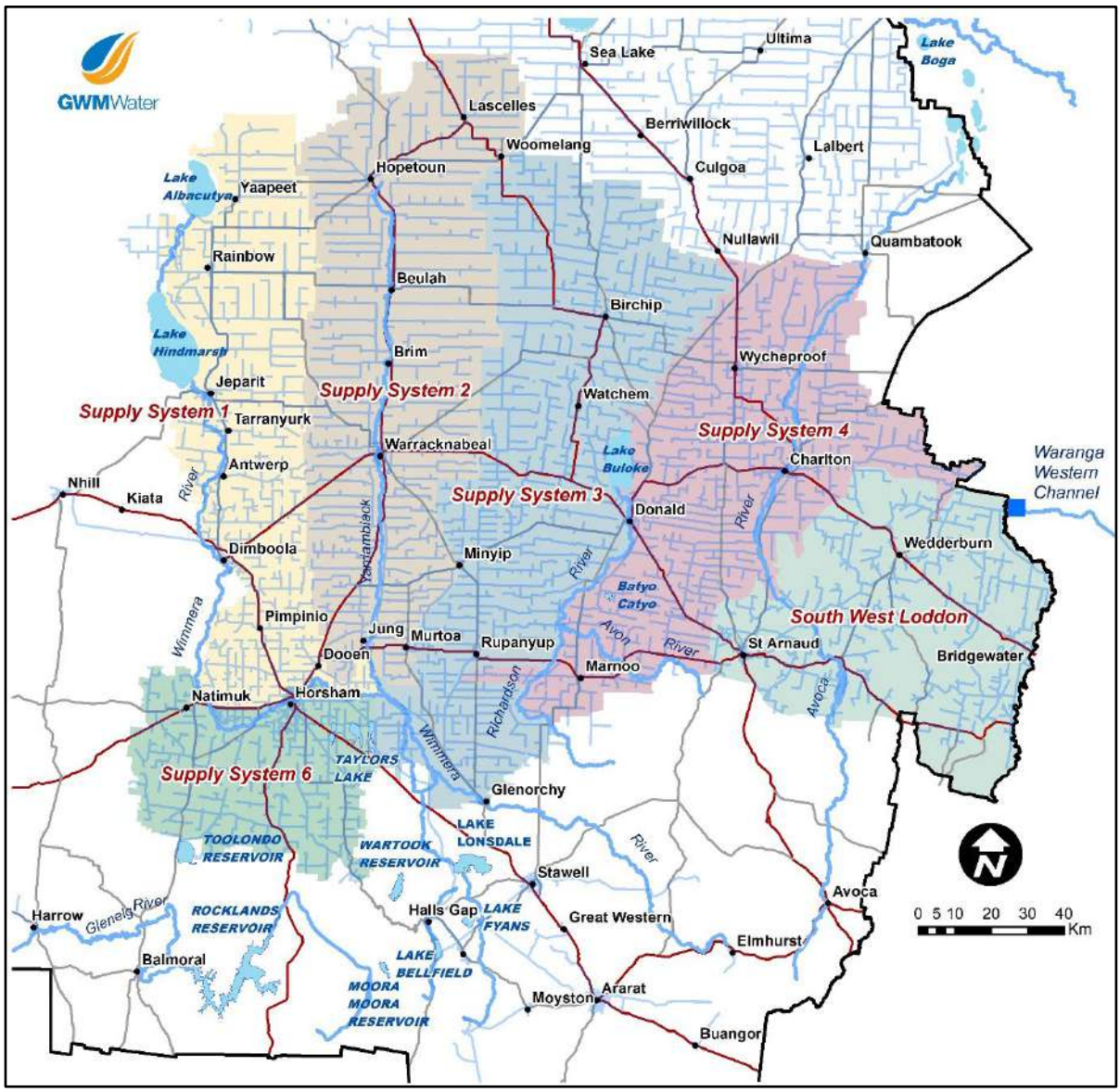
The Grampians reservoirs support supply systems 1,2,3,4,6,7 of the Wimmera Mallee Pipeline (refer to ***Figure 3***). ***Table 3*** identifies the reservoirs which are typically used to supply particular towns and rural areas. The South West Loddon Pipeline (SWLP) is connected to Supply System 4 and is therefore supplied partially by Lake Bellfield. The SWLP was designed to be supplied from the Waranga Western Channel during peak demand periods, but can be entirely supplied from the Grampians system when demand is lower.

Coliban Water has a 300 ML bulk entitlement in the Grampians system which is used to provide urban supply the townships of Korong Vale, Wychitella and Borung via the Wimmera Mallee Pipeline. Coliban Water supplied towns connected to water treatment plants at Bridgewater and Laanecoorie will now be partially supplied with water from Lake Bellfield via the South West Loddon Pipeline.

3.3.1. East Grampians Rural Pipeline Project

The East Grampians Rural Pipeline Project moves from the planning phase into construction phase in 2022. The rural pipeline network will service rural farming enterprises and lifestyle properties wishing to connect over an area of up to 330,000 hectares. The rural pipeline network will connect key water sources in the Grampians reservoir system (Lake Fyans as the primary supply source), with Mt Cole Reservoir and the Mt William headworks (Eastern Grampians urban system). All of these existing water supply assets are owned and operated by GWMWater. This project will expand the Victorian Water Grid, and enable GWMWater to optimise the use its water entitlements for the benefit of customers, communities and the environment.

Figure 3: Areas supplied from Grampians supply system



Some other reservoirs within the headworks system (not listed in ***Table 3***) are able to support GWMWater's demands through water transfers (e.g. Rocklands Reservoir to Taylors Lake). All reservoirs in the Grampians headworks system have been included in the assessment of water security.

Table 3: Grampians supplied systems and customer user groups

Reservoir/ Delivery System	User Group	Town or Area supplied
Lake Bellfield & Taylors Lake	**Urban via Wimmera Mallee Pipeline**	Birchip, Charlton, Dimboola, Hopetoun, Murtoa, Rainbow, St Arnaud, Warracknabeal, Beulah, Brim, Donald, Jung, Minyip, Rupanyup, Woomelang, Wycheproof, Antwerp, Dooen, Glenorchy, Jeparit, Lascelles, Marnoo, Pimpinio Tarranyurk, Watchem, Yaapeet, Nhill, Sea Lake, Kaniva (1)
	Urban from Lake Bellfield	Halls Gap, Pomonal
	Rural	Wimmera-Mallee Pipeline Supply System 1, 2, 3, 4, 7 & north east part of Supply System 6 (see ***Figure 3***) South West Loddon Pipeline (in part) via SS4 (see ***Figure 3***)
	Industrial from Headworks	Users supplied by agreement
	Environment	*Environmental demand from Lake Bellfield and Taylors Lake is not directly considered in this Strategy.*
Lake Wartook	**Urban**	Horsham, Natimuk
	Rural	Wimmera-Mallee Pipeline Supply System 6 (see ***Figure 3***)
	Environment	*Environmental demand from Lake Wartook is not directly considered in this Strategy.*
Moora Reservoir	**Rural**	Wimmera-Mallee Pipeline Supply System 6, including Clear Lake and Noradjuha areas (see ***Figure 3***)
Lake Fyans	**Urban**	Ararat, Great Western, Stawell, Moyston (2) Streatham, Westmere (3) Supplementary supply to Elmhurst, Willaura & Lake Bolac, Wickliffe (4)
	Rural	Landsborough Valley Pipeline Rural users supplied from Lake Fyans to Stawell & Lake Fyans to Ararat raw water pipelines East Grampians Rural Pipeline(5)
Mt Cole Reservoir	**Urban**	Ararat
	Rural	Rural users supplied from Mt Cole to Ararat raw water pipeline, East Grampians Rural Pipeline (5)

Notes to this table:

(1) Kaniva will switch from groundwater supply to receive water from Dimboola Water Treatment Plant by 2024.

(2) Moyston will switch from the Eastern Grampians Urban Supply System to receive water from Ararat Water Treatment Plant by 2024.

(3) Streatham and Westmere are anticipated to switch from groundwater supply to receive water via the East Grampians Rural Pipeline.

(4) Elmhurst, Willaura, Lake Bolac and Wickliffe may receive supplementary supply from the East Grampians Rural Pipeline.

(5) East Grampians Rural Pipeline will not take water from this source until construction is sufficiently progressed.

3.4 Pyrenees and Eastern Grampians Urban Supply Systems Description

GWMWater operates a number of smaller systems which supply the towns of Elmhurst, Buangor, Willaura, Lake Bolac, Moyston and Wickliffe, located in the far south and east of GWMWater's operational area. GWMWater also provides bulk water from the Eastern Grampians urban system headworks to Wannon Water, which supplements its supply to Glenthompson township.

The existing East Grampians urban system (Willaura system) is supplied by six weirs on small streams, with two each located on Stoney Creek, Mt. William Creek and Masons Creek. During summer the supply is supplemented by groundwater sourced from four bores near Mt William. The system services approximately 1,000 GWMWater connections, including rural customers who draw untreated water from transfer pipelines.

The Elmhurst water supply system comprises a weir which diverts water from Hickmans Creek to the Elmhurst Service Basin (via a small sedimentation and strainer tank). The Buangor water supply system comprises a weir which diverts water from McLeods Creek to the Buangor Service Basin (via a small sedimentation and strainer tank). There are a small number of rural customers between the weir and the storage basin. Both creeks are tributaries of the Wimmera River.

Table 4 describes the areas and towns serviced by GWMWater from the Eastern Grampians and Pyrenees urban systems. The entitlement volumes for supply to these areas are also shown against the supply source.

It should be noted that the East Grampians Rural Pipeline (EGRP) will interlink with the existing headworks infrastructure supplying the Eastern Grampians urban system townships listed in ***Table 4***. The East Grampians Rural Pipeline will receive supplementary supply from the existing urban system headworks, and also be able to supply the Eastern Grampians urban system with water from Lake Fyans. The East Grampians Rural Pipeline will not take water from the urban system headworks sources until construction is sufficiently progressed.

Table 4: Pyrenees and Eastern Grampians supplied urban systems and customer user groups

Supply System	Supply Source	User Group	Town or Area Supplied
Pyrenees Urban	Hickmans Creek (48 ML)	Urban	Elmhurst
	McLeods Creek (28 ML)	Urban	Buangor
Eastern Grampians Urban	Mount William Creek, Stoney Creek, Masons Creek, (390ML) Groundwater (220 ML)	Urban	Lake Bolac, Moyston, Wickliffe, Willaura
		Rural	Rural users supplied from raw water pipeline. Supplementary supply to the East Grampians Rural Pipeline network (when constructed)
		Bulk Water	Transfer to Wannon Water Glenthompson system

3.5 Groundwater Urban Supply Systems Description

GWMWater operates a number of groundwater bores that fully supply or supplement water to 14 towns in the south-east and western parts of GWMWater's operational area (refer ***Figure 1***). Groundwater for urban supply is taken from West Wimmera, Murrayville, East Grampians and West Grampians groundwater resources. In most cases, the existing groundwater resource provides a long-term supply option which is influenced very little by climatic factors.

Information relating to the management of groundwater resources can be found on the GWMWater website (www.gwmwater.org.au).

Where groundwater is used as a supplementary source to surface water supplies, such as the Eastern Grampians system, or as a drought contingency such as for Horsham, then these supplies may also be discussed in the respective surface water sections. Irrigation and stock and domestic are major groundwater users in many areas, however their requirements are outside of the scope of this Strategy.

The largest groundwater licence held by GWMWater is a 1,200 ML entitlement from the Mt Zero borefield, to supplement the Horsham urban system. Historically this supply source has only been used during periods of very low surface water availability. GWMWater's licence permits up to 1,200 ML per year to be extracted from the borefield, and a maximum of 2,400 ML within any five-year period. These limits are designed to allow flexibility in operating the borefield, while minimising impacts to the aquifer and allowing groundwater levels to recover after the borefield is used.

Table 5 lists the towns supplied or supplemented from groundwater sources, and identifies the Groundwater Management Area from which the water is extracted.

Table 5: Groundwater supplied towns & corresponding Groundwater Management Area

Groundwater Management Area	**Towns Supplied**
West Wimmera: Northern zone	Kaniva, Kiata, Lillimur, Miram, Serviceton, Nhill (1)
West Wimmera: Southern zone	Apsley, Edenhope, Harrow
West Wimmera: Gymbowen zone	Goroke
Murrayville	Cowangie, Murrayville
East Grampians	Streatham, Westmere, Willaura, Lake Bolac, Moyston (2)
West Grampians	Horsham & Natimuk

Notes to this table:
(1) Groundwater is not presently used for the potable water supply network in Nhill.
(2) Once connected to the Ararat Water Treatment Plant, Moyston will not receive supplementary supply from groundwater.

3.6 Other Water Supplies

3.6.1. Wastewater & Recycled Water

State Government policies recognise the importance of using water resources sustainably, and the benefits of using recycled water to improve the reliability of other water supplies. Recycled water is regulated by the Environment Protection Authority (EPA) and supplied by water corporations in accordance with EPA guidelines, principally Publication 1910.2 '*Victorian Guideline for water recycling*'.

For more than 30 years, GWMWater has supplied recycled water for community benefit and regional development. GWMWater operates 29 wastewater treatment plants (WWTP), with 10 of these sites supplying Class C standard recycled water to 39 customers. Six sites produce recycled water which is used at onsite irrigation areas (surrounding the WWTP). GWMWater has 13 WWTP sites where evaporation is generally greater than the volume of recycled water produced. The level of service for recycled water customers is based on the quality of water being fit-for-purpose for the specific use under the relevant environmental management guidelines.

GWMWater's wastewater facilities have integrated on-site reuse, or recycled water is supplied to third parties under commercial agreement. Only four of the 29 sites are at 100% allocation capacity. However, the actual use of recycled water can be less than the volume produced in certain years. GWMWater typically recycles all wastewater from the sites that produce enough volume for reuse. Noteworthy schemes in operation include those at Horsham, Ararat and Warracknabeal.

Opportunities for beneficial reuse exist at Birchip, Charlton, Dimboola, Horsham, Murtoa, Ouyen, Rupanyup, Sea Lake, St Arnaud, Warracknabeal and Willaura. It is recognised that some scope exists to improve the value achieved from recycled water use within the region.

Future wastewater system inflows and capacity was modelled for all GWMWater WWTPs using an EPA model. Forecast inflows were based on *Victoria in Future 2019* population forecasts, and considered potential inflows from new 'trade waste' customers. This information is presented in **Appendix 4**.

Only the towns of Ararat, Horsham and Stawell are projected to experience population growth over the next 50 years, with population in other towns projected to remain stable or to decline. As a result, wastewater system inflows are only likely to increase materially in these three towns. Ararat and Horsham WWTPs are projected to require upgrades in the near future, however capacity of the Stawell wastewater system was assessed as remaining sufficient over the forecast period. It was assessed that Nhill WWTP may require an upgrade in the event of a potential major 'trade waste 'connection, however timing and eventuality of this connection remains uncertain.

Wastewater Treatment Plant upgrades were assessed to be required within the next five years at:

- Donald - to improve the plant operation and renew irrigation infrastructure for compliance with EPA regulations for recycled water quality (not capacity related).
- Ararat - to improve plant operation and renew treatment infrastructure. This will improve the efficiency of plant operation and also accommodate increasing future inflows as a result of growth and development.
- Horsham - to improve the quality of recycled water for reuse, and ensure plant capacity can meet increased loads from new trade waste customers and population growth.
- Dimboola - to improve plant operation and renew treatment infrastructure to maintain compliance with EPA regulations.

Action 2: Deliver upgrades at Donald, Ararat, Horsham and Dimboola Wastewater Treatment Plants during 2022-2028.

The Horsham SmartWater project commenced in 2021 and provides opportunity to increase the beneficial use of recycled water from Horsham's wastewater stream, and develop a sustainable model for the ongoing allocation of this resource. The project includes major upgrades to water infrastructure at Horsham SmartFarm (Agriculture Victoria), the largest user of Horsham recycled water.

The second stage of the project aims to leverage future Integrated Water Management opportunities, to deliver:

- integration of a stormwater main into the reuse network
- new recycled water supply mains and infrastructure to enable irrigation of a number of parks and ovals in and around Horsham, including proposed connections to the cemetery and racecourse to supply recycled water for irrigation.

GWMWater will continue to work with Horsham Rural City Council to explore opportunities for the use of recycled water in and around Horsham, and work with local governments across the GWMWater service area on recycled water opportunities.

Action 3: GWMWater to continue working with local governments on opportunities for the use of recycled water in GWMWater serviced towns.

3.6.2. Stormwater

The 1996–2009 drought was a key driver for local government and communities to develop systems to utilise stormwater for watering sports grounds and community gardens. Examples of stormwater harvesting include the Racecourse Wetlands in Horsham, and parks and sports grounds in Stawell including Cato Lake Park, Cemetery Gardens, Central Park, Federation Park, North Park and Taylors Gully Park.

Future stormwater harvesting projects will need to be assessed in line with government policy for allocating stormwater in urban areas, as stated in the Central, Northern and Western Sustainable Water Strategies:

"The Government adopts the following allocation rules for storm water in urban areas:

- *if stormwater is flowing to the sea via a drain, all of the storm water may be harvested; and*
- *if stormwater is flowing to a stream from an existing development, assume up to 50 per cent of existing stormwater can be harvested for consumptive use and 50 per cent is reserved for the environment. If there is a scheme to harvest more than 50 per cent of the resource a study is required to assess the implications for the environment"*

GWMWater considers stormwater a viable alternative water source with the ability to support local government and local community uses, within relevant State Government policies.

Action 4: GWMWater will continue to support local government and communities to maximise the beneficial use of stormwater.

3.7 Water Quality

In some cases, the water resource may not be fit for purpose due to water quality issues such as blue green algae. The water resource modelling that underpins this Urban and Rural Water Strategy does not directly consider water quality, nor the impacts of climate change on water quality, such as the increased likelihood of BGA.

The GWMWater Algae Management System provides a framework for the management of blue-green algae (BGA) blooms in GWMWater's source waters and supply systems. The management system was developed out of experience in managing the 2016 BGA outbreak in the River Murray System, and is aligned with the DELWP 'BGA Circular' framework. It has since been extended to include all surface water sources used by GWMWater.

GWMWater has continued to invest in infrastructure which can mitigate the impact of water quality issues in source water on the customers we supply. In recent years, these investments have included:

- Cross-connections between rural pipeline networks, and new reverse pumping capability to supply customers from pipeline and urban system balancing storages where source waters are affected.
- Connection of Sea Lake township to a potable water supply from the Grampians System via a 130km pipeline from the Warracknabeal Water Treatment Plant.
- Planning and design of a Dissolved Air Floatation Plant to be constructed at Ouyen, which will filter and clarify water taken from the River Murray for the Ouyen system of the Northern Mallee Pipeline (refer ***Figure 2***). Once in operation, Ouyen system rural customers will see significant improvement in water quality, and both urban and rural customers will benefit from a reduction in the risk of blue-green algae affecting supply.

3.7.1. Water quality during extreme weather events

Other than blue green algae, the primary water quality issues likely to affect supply to GWMWater towns and rural pipelines are high levels of turbidity or organic matter in source water resulting from extreme weather events, such as flood, bushfire, and in rare circumstances, other contaminants. GWMWater has a Water Quality Management System, supported by Water Quality Risk Management Plans for all towns. Risk Management Plans include town-specific assessments of possible water quality risks which consider water source and water treatment processes. Recommended response actions are identified based on the type of risk and severity of impact.

4. Our Water Demands

4.1 Background

Historical water demands (2016-17 to 2020-21), combined with recent trends have informed the baseline demand forecast for the 2022 Urban and Rural Water Strategy. Given the five years between 2016 and 2021 have included the relatively wet (2016-17) to the very dry (2018-19), this period is viewed as a good representation of 'baseline' demand behaviour in response to variations in seasonal climate. The baseline demand forecast, plus additional higher demand scenarios were compared against the prescribed climate change scenarios to identify when demand is projected to exceed supply over the next 50 years. This analysis also identified circumstances where there may be a low level of confidence, or high degree of uncertainty in key factors impacting upon demand projections.

To enable more detailed analysis, metered customer water use data was separated into the following user groups supplied from urban reticulation systems:

- Commercial/Industrial (e.g food processing, general businesses, hotel/motel)
- Non-Residential (e.g. halls, municipal buildings, toilets blocks, cemetery, schools)
- Residential (e.g. houses, flats, units, vacant residential land)
- Municipal Public Space (e.g. public parks, roadside reserve, public gardens, ovals)
- Recreation Asset (e.g racecourse, golf clubs, tennis courts, swimming pools).

A baseline demand volume was then developed for each user group within each urban town.

As per 'Urban Water Strategy Guidelines', *Victoria in Future (VIF) 2019* projections were used to assess how population changes across GWMWater's towns may affect urban demand over the next 50 years. As a result of the uncertainty caused by the COVID-19 pandemic, and because the VIF projections were released prior to the pandemic, GWMWater also looked at the change in urban customer connection numbers for each of the Victoria in Future Small Areas (VIFSA) regions, and compared this with the projections from VIF. It should be noted that this data would not capture existing homes that were unoccupied, but had become occupied as a result of pandemic related migration to regional areas, so there is potentially some population increase not reflected in this data.

The analysis showed positive growth in the number of urban connections for some regions where the VIF projections had forecast a decline in population, however, the rate of change was not greater than pre-pandemic. There is also some uncertainty relating to projected versus actual population increase in towns serviced by GWMWater, between 2020 and 2022 in particular, as a result of pandemic related migration from major cities to regional areas. This highlights the need for GWMWater to compare historic population projections with actual population change based on census data, and analyse changes in water demand over the corresponding periods. This will allow a better understanding of the level of confidence in urban demand projections based on projected population changes for the GWMWater region.

Action 5: Undertake an analysis of historic population projections with observed changes in population and urban demand, to inform the 2027 Urban and Rural Water Strategy.

Residential demand was assumed to increase or decrease linearly with the population forecasts, or at the rate of new connections between 2018 and 2021, in the case of the township of Stawell. Urban system losses were estimated for each town by comparing the volume metered to customers with the bulk offtake volumes for each urban system. Urban system losses were varied for 2045 and 2070 time-slices, based on projected changes in total demand. Commercial/industrial, non-residential, municipal and recreation asset demands were assumed to be unaffected by changes in population.

The rural demand baseline for the Wimmera-Mallee Pipeline (WMP) and Northern Mallee Pipeline (NMP) systems was based on the average end user demand over the five- year period of 2016-17 to 2020-21, which was viewed to capture a range of climatic conditions. Demands for South West Loddon Pipeline (SWLP) were estimated based on the available period of metered data. No increase in average demand was forecast for existing rural pipeline customers. Other than small fluctuations resulting from seasonal conditions, annual consumption by rural pipeline customers has remained very consistent over the past decade for NMP customers, and since 2014 for WMP customers. Although no material increase in rural pipeline consumption by existing users is forecast, scenarios reflecting increased rural pipeline consumption were analysed.

The commencement of mineral sands mining operations in the region will increase the demand for water in future, and this has been considered within the Urban and Rural Water Strategy supply and demand assessments. Nearly 12,000 ML of water entitlements are already held by mineral sands mining entitles as 'Supply By Agreement' entitlements. The exact timing of these operations commencing remains uncertain.

Demand forecasts for each supply system source are described in the following sections.

4.2 Murray and Goulburn System Demand Forecast

GWMWater has 6,509 ML of entitlements held in both the Murray and Goulburn systems. These entitlements provide water for urban, rural, industry and recreation uses (refer to **Appendix 3 – GWMWater Entitlements** for details of these entitlements).

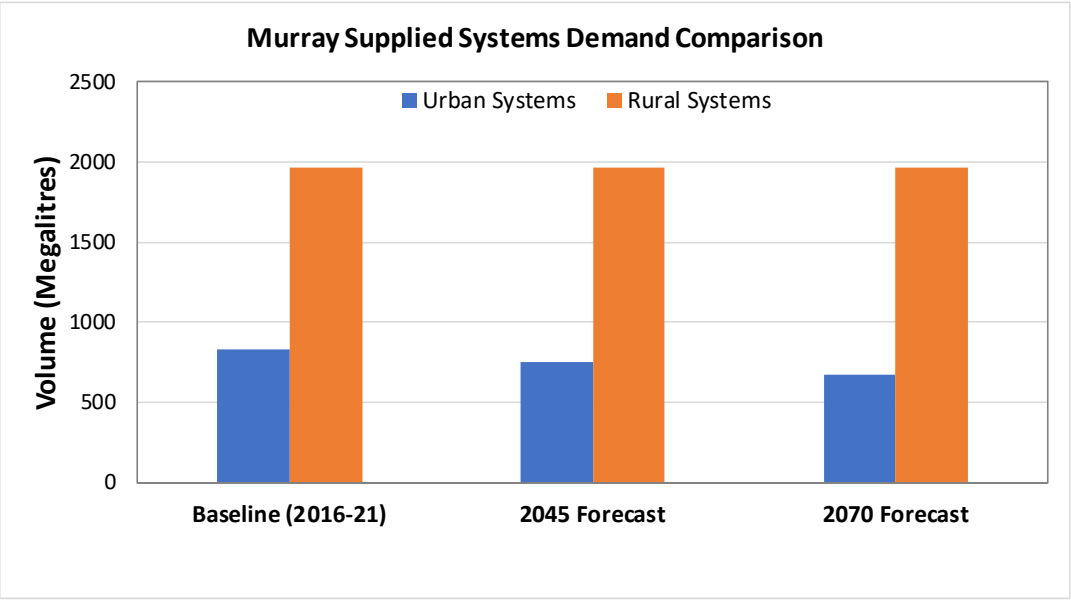
4.2.1. Murray Supplied Systems Demand Forecast

GWMWater operates four pump stations on the River Murray located at Swan Hill, Piangil, Nyah and Liparoo. These pump stations supply bulk water to urban storages and rural customers through the Northern Mallee Pipeline and Supply System 5 of the Wimmera Mallee Pipeline.

Summary of demands for Murray supplied systems:

- Current baseline annual demand for the Northern Mallee Pipeline system urban systems is 750 ML, and rural demands 1530 ML.
- Current baseline annual demand for the Wimmera Mallee Pipeline Supply System 5 urban systems is 80 ML, and rural demands 250 ML.
- Annual demand for recreation lakes is 410 ML for Green Lake near Sea Lake, and 280 ML for Ouyen Lake.
- Private pipeline systems administered through GWMWater, have an average annual demand of 180 ML.
- Population forecasts for areas serviced by Murray Supplied Systems indicate that the population is declining by 0.88% per annum. As a result, urban demand is projected to decrease slightly over the next 50 years, and reduce bulk water requirements by about 160 ML/year by 2070.
- Average rural demand is projected to remain relatively consistent over the next 50 years.

Figure 4: Murray Supplied Systems Demand Comparison



Analysis of demands for Murray supplied systems identified a trend of increasing unaccounted for water in the rural networks. The average volume unaccounted for across all Murray supplied rural pipelines operated by GWMWater has increased by 143 ML, from 573 ML/year at the time of the 2017 Urban and Rural Water Strategy, to 717 ML/year over the five years to 2021.

Action 6: Investigate the cause of increasing unaccounted for water in the Murray supplied pipeline systems

4.2.2. Goulburn Supplied Systems Demand Forecast

The Quambatook township is supplied from the Goulburn System via the Normanville Pipeline. GWMWater's demand from the Goulburn system will grow as it more regularly supplies water into the South West Loddon Pipeline (SWLP) from the Waranga Western Channel (WWC). There is limited operational data for the volume taken from the WWC, because the South West Loddon Pipeline was only completed in 2020.

For the purpose of this Strategy, it was assumed that South West Loddon rural customers would use 40%, 50% and 60% of their total allowance volume in the 2020, 2045 and 2070 time slices, and two thirds of this volume would be supplied from the Goulburn system. The corresponding volumes are summarised in ***Table 6*** below.

Table 6: South West Loddon Pipeline demand estimates

	2020	2045	2070
Estimated SWLP rural customer demand (ML/yr)	250	310	370
Share of demand supplied from Grampians (ML/yr)	80	100	120
Share of demand supplied from Waranga Channel (ML/yr)	170	210	250

Due to the limited operational data for South West Loddon Pipeline, there is high degree of uncertainty in how much will be used on average by rural customers connected to this system over the period of this strategy. Demands for all supply systems will be reviewed again as part of the 2027 Urban and Rural Water Strategy, at which time more operational data will be available for the South West Loddon Pipeline.

Summary of demands for Goulburn supplied systems:

- The baseline annual urban demand for Quambatook is 90 ML. Annual population forecasts across this area indicate a decline of 0.15%. The projected annual urban demand for Quambatook in 2045 and 2070 is 80 ML.
- The annual demand from the Goulburn system for rural customers supplied via the South West Loddon Pipeline is estimated to increase from 170 ML to 210 ML by the year 2045, and to 250 ML by the year 2070.

4.3 Grampians Supplied Systems Demand Forecast

There are nine bulk water supply reservoirs and a number of other headworks assets as part of the Grampians water supply system.

A pool of 20,000 ML Growth Water for regional development and farm diversification was generated from water savings resulting from the Wimmera-Mallee Pipeline project. This growth water is included in GWMWater's bulk entitlement. Growth water sales since completion of the pipeline project have bettered expectations and approximately 7,650 ML of Growth Water entitlement remained unsold as of June 2021 (i.e. is held by GWMWater, but has not been purchased by a customer). Of this unsold volume, 1,200 ML is reserved for purchase by customers connecting to the East Grampians Rural Pipeline. Growth Water which has not been sold or committed to a user provides additional security to existing Grampians-supplied GWMWater customers, as it still receives water allocations under bulk entitlement rules (GWMWater, 2022a).

The 2017 Urban and Rural Water Strategy forecast a 270 ML increase in urban demands from the Grampians system by 2065. The Grampians supply system services the largest townships of Horsham, Stawell and Ararat, which were predicted to grow in population and hence observe some increase in demand. This was projected to be balanced by a reduction in demand from smaller towns due to population decline. However, over the past five years the increase in urban demand has exceeded projections made in 2017 as a consequence of:

- Sea Lake township changing from a Murray supply to a Grampians supply (estimated additional demand of 165 ML per year)
- The five-year average urban demand in Horsham increased by 170 ML/yr, and Ararat increased by 125 ML/yr

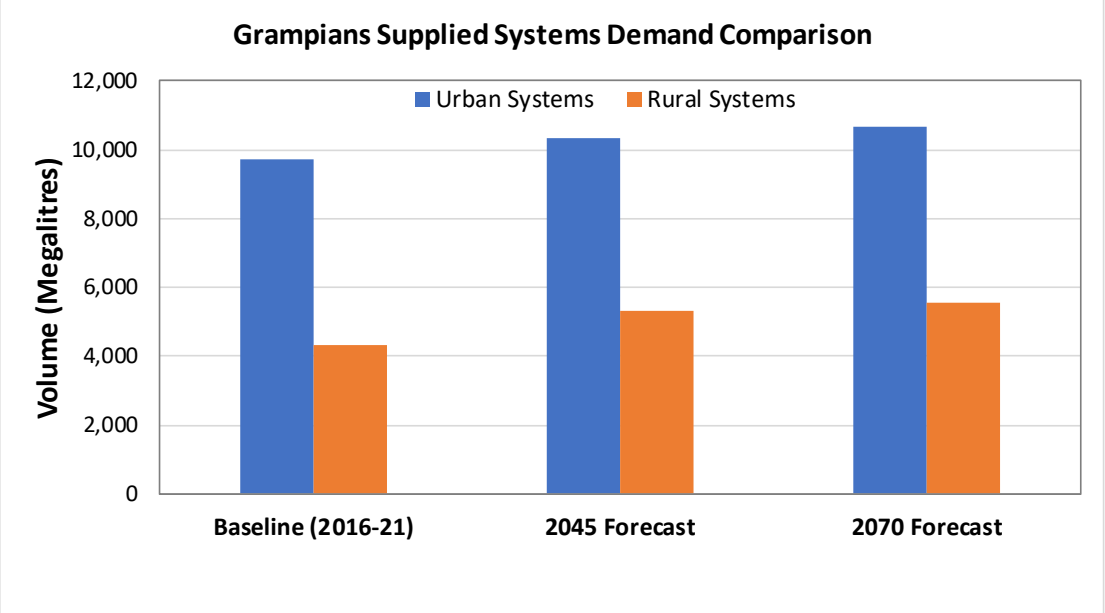
This demonstrates the uncertainty in estimating demand change based on population projections, but also the variability of demands in response to climate and customer behaviour.

Summary of demands for Grampians supplied urban and rural pipeline systems:

- The current baseline annual demand is 9,710 ML for urban systems, and 3,945 ML for rural pipeline supplies.
- Annual urban demand is projected to increase by 640 ML to 10,350 ML by 2040, and increase by 950 ML to 10,660 ML by 2070. *Note: Growth in demand for larger towns is projected to be largely balanced by declines in smaller town demand. The projected increase in demand is attributable to the inclusion of demand volumes to service the possible future connection of Nullawil, Lalbert, Berriwillock, Culgoa, Goroke, Edenhope and Harrow from the Grampians system.*
- The sale of Growth Water, and the completion of the East Grampians Rural Pipeline is projected to be the main driver of increased rural pipeline demand.
- All Growth Water is assumed to be sold by 2045, and includes commitments for possible future pipeline projects and mining ventures, which are not guaranteed.

It should be noted that the above demand forecasts do not consider large commercial Supply by Agreement (SBA) holders who access water direct from headworks reservoirs, and are subject to the same bulk system water allocations as GWMWater's urban and rural entitlement.

Figure 5: Grampians Supplied Systems Demand Comparison



4.3.1. *Lake Bellfield Supplied Systems Demand Forecast*

Water is supplied from **Lake Bellfield** to the north and north-east Wimmera through Wimmera-Mallee Pipeline Supply Systems 1, 2, 3 and 4. Water is now also supplied further east via the South West Loddon Pipeline, which is connected to Supply System 4 as well as being able to be serviced from the Goulburn system via the Waranga Channel.

Summary of demands supplied from Lake Bellfield (component of Grampians system):

- Current baseline annual urban demand is 3,920 ML, inclusive of estimated water requirements for Kaniva township. The baseline annual rural demand is 2,800 ML.
- Population forecasts across this region indicate that the population is decreasing by approximately 0.84 % per annum, with the volume required for urban supply estimated to decline by 270 ML by 2040 (3,650 ML total demand) and 740 ML by 2070 (3,180 ML total demand).
  Note: The decline in urban demand may be over-estimated, as there is an assumed to be a linear relationship between population and consumption decline.
- Rural demand from existing customers is projected to remain stable over the next 50 years.

4.3.2. Lake Wartook and Moora Supplied Systems

The **Lake Wartook and Moora Reservoir** system provides urban supply to Horsham and Natimuk and rural supply south of Horsham via Wimmera Mallee Pipeline Supply System 6. During periods of water shortage, the Mt Zero borefield can provide a supplementary supply to Horsham and Natimuk.

Summary of demands supplied from Lake Wartook (component of Grampians system):

- The baseline annual urban demand in this system is 3,030 ML. The baseline annual rural demand is 580 ML.
- Annual population forecasts across this area indicate 0.77% growth for Horsham and Natimuk, with the annual volume required for urban supply projected to increase by 500 ML by 2040 (3,530 ML total demand), and 1,140 ML by 2070 (4,180 ML total demand).
- Rural demand from existing customers is projected to remain stable over the next 50 years.

4.3.3. Lake Fyans Supplied Systems

Lake Fyans provides urban supply to Ararat, Stawell and Great Western. Its inflows are supplemented with transfers from Lake Bellfield. Having only a small catchment area, Lake Fyans receives relatively small natural catchment inflows.

Summary of demands supplied from Lake Fyans (component of Grampians system):

- The baseline annual urban demand from this system is 2,760 ML.
- Population forecasts for Ararat indicate that the population is increasing by approximately 0.55% per annum, and the population of Stawell township has been estimated to increase at a rate of 0.38% per annum, based on GWMWater data for new connections
- The annual volume required for urban supply to Stawell and Ararat is projected to increase by 270 ML by 2040 (3,030 ML total demand), and 500 ML by 2070 (3,260 ML total demand). This includes an estimated 160 ML/yr for supplementing East Grampians urban systems, once the East Grampians Rural Pipeline is completed.

4.4 Pyrenees and Eastern Grampians Urban Systems Demand Forecast

The Eastern Grampians and Pyrenees urban supply systems service the towns of Elmhurst, Willaura, Moyston, Wickliffe, Lake Bolac and Buangor, located in the far south and east of GWMWater's operational area.

Summary of demands supplied from Eastern Grampians Urban Systems:

- Current baseline demand for the townships of Willaura, Lake Bolac, Wickliffe, Moyston and rural connections is 340 ML/year. This demand is forecast to decrease modestly based on Rural City of Ararat populations projection, which predict a population decline of 0.33%/year. Demand is forecast to be 325 ML/year by 2045 and 310 ML/year by 2070. However, it is noted that the current baseline demand has increased by nearly 5% from the 2017 Strategy baseline (325 ML/year to 340 ML/year), and so it is uncertain whether demand decline will in fact be observed over the short-term.
- Baseline annual supply to Wannon Water for Glenthompson is 39 ML/year, although this volume can vary from year to year.

Summary of demands supplied from Elmhurst and Buangor urban systems:

- Baseline annual demand for Elmhurst is 29 ML/year.
- Baseline annual demand for Buangor is 19 ML/year.
- Rural City of Ararat population projections of 0.33% decrease per annum were used for Elmhurst and Buangor, resulting in a projected decline in demand of 2 ML/yr by 2070 for Buangor, and 4 ML/year by 2070 for Elmhurst.

4.5 Groundwater Towns Demand Forecast

GWMWater supplies 11 towns from the Murray Group Limestone Aquifer in the west of the region. Irrigation and stock and domestic are the major uses of groundwater, however they are not within the scope of this Strategy.

The baseline bulk water demand for urban supply to groundwater towns in the West Wimmera is 582 ML/yr. Baseline groundwater extraction for urban supply to towns within the Murrayville Groundwater Management Area is 128 ML/yr. Groundwater extraction for urban supply in the West Wimmera and Murrayville areas comprises less than 2% of the total volume permitted to be extracted each year.

Urban groundwater allocations remain in excess of baseline demand, with West Wimmera groundwater towns using 27% of licensed entitlement volume and Murrayville towns using 25% of licensed entitlement volume. Population for much of the West Wimmera and Murrayville groundwater areas is projected to decline at between 0.7% and 1.2% per annum. A small decline in urban groundwater extraction volumes was observed over the period of 2016 to 2021. In the absence of population growth or stabilisation in these areas, demand is likely to experience further gradual decline over the next 50 years.

Groundwater is a supplementary supply annually for the Eastern Grampians urban systems. The baseline annual extraction for Eastern Grampians towns is 158 ML/year. Extractions are projected to remain relatively consistent into the future, as groundwater will continue to be used to supplement these towns, and the East Grampians Rural Pipeline network.

The townships of Streatham and Westmere currently use on average 33 ML, or 55% of the 60 ML urban groundwater entitlement. This is partly due to the quality of supply only being suitable for some outdoor use (4,000 microSiemens/cm). Both Streatham and Westmere are anticipated to be connected to the East Grampians Rural Pipeline, and this has been considered with the relevant Grampians system demand forecast.

Groundwater can be used to supplement surface water sources for the Horsham urban system during periods of very low surface water availability. The average extraction volume over the five years to 2021 was 23 ML/year (2% of licence volume), which was used for testing of bore operation, water quality sampling and water for firefighting. This supply source was not used to supplement Horsham urban system during the five-year baseline period (2016-17 to 2020-21). Extractions from this borefield will increase should GWMWater commence operation of the borefield due to low surface water availability. This is discussed further in the assessment of system performance.

4.6 Summary of Average Urban and Rural Demand Volumes

4.6.1. Urban System Bulk Water Demand

Data presented in this section reflects the bulk water volume used to service urban demands, and will include water treatment process losses and water lost from the urban reticulation network.

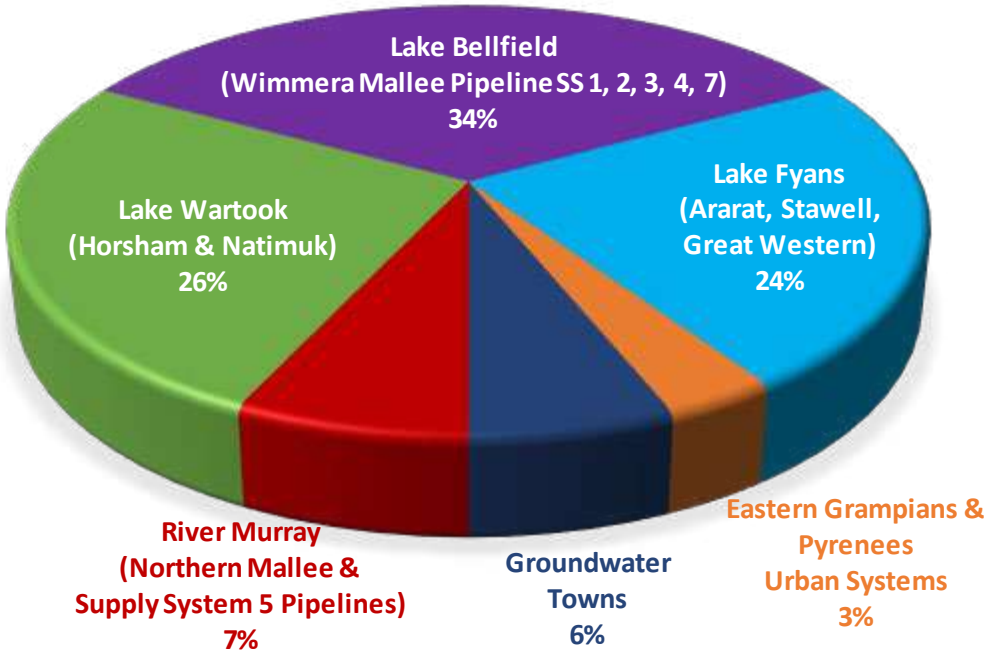
Table 7: Summary of bulk water volumes used to service urban demands

Supply System	Average bulk water used (ML) between 2011-2016	Average bulk water used (ML) between 2017-2021	Percentage change 2011-2016 to 2017-2021
Northern Mallee Pipeline (NMP) [1]	930	750	-19%
Wimmera Mallee Pipeline Supply System 5 (WMP - SS5)	60	70	17%
Lake Wartook (Horsham & Natimuk)	2,910	3,030	4%
Wimmera Mallee Pipeline [2] Supply System 1, 2, 3, 4, 7	3,320	3,980	20%
Stawell, Ararat and Great Western	2,870	2,760	-4%
Pyrenees and Eastern Grampians Urban Systems	360	390	8%
Groundwater Towns	1,050	720	-31%
Total	**11,500**	**11,700**	**2%**

Note 1: Reduction in Northern Mallee Pipeline urban demand volume is influenced by the connection of Sea Lake township to a Grampians supply in 2019.
Note 2: Increase in Wimmera Mallee Pipeline urban demand volume is influenced by the connection of Nhill township to a Grampians supply in 2013.

Figure 6 provides a graphical representation of the above data, showing the proportion of total urban demand supplied from the respective supply systems. This shows the majority of GWMWater's urban customers are supplied from the Grampians reservoir system (primarily Lake Bellfield, Lake Wartook and Lake Fyans), with 84% of the total urban demand met from these sources. Urban demands supplied from the River Murray (Wimmera-Mallee Pipeline Supply System 5 and the Northern Mallee Pipeline) comprise 7% of GWMWater's total urban demand, having decreased in recent years due to Sea Lake township switching to a Grampians supply.

Figure 6: Annual urban demand by supply system, as percentage of total (2017-2021)



4.6.2. Rural Pipeline Systems Demand

Data presented in this section reflects the average volumes supplied to rural users, it does not include rural pipeline system losses or recreation lake demands.

Note: In Murray supplied pipelines, recreation lakes demand and pipeline system losses are met from within the same entitlements used for urban and rural supply. In the Grampians supplied pipeline systems, recreation demands and pipeline system losses are met from separate entitlements which are not directly considered within this strategy.

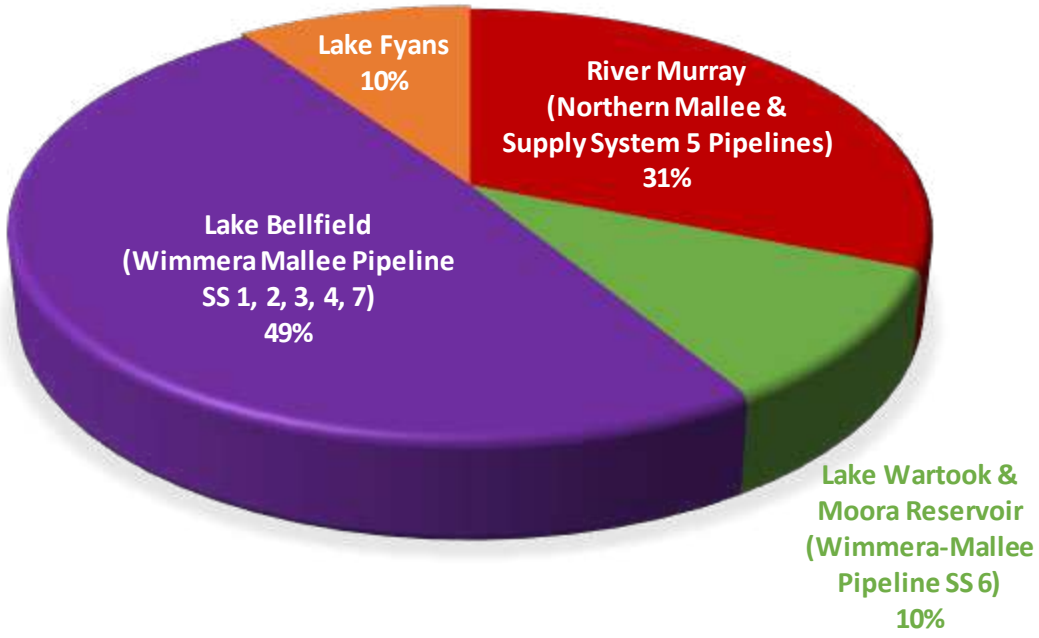
Table 8: Summary of water use by rural pipeline customers

Supply System	Average annual rural demand (ML) between 2011-2016	Average annual rural demand (ML) between 2017-2021	Percentage Change 2011-2016 to 2017-2021
Northern Mallee Pipeline (NMP)	1,530	1,530	0%
Wimmera Mallee Pipeline – Supply System 5 (WMP – SS5)	240	250	+4%
Wimmera Mallee Pipeline – Supply System 6 (WMP – SS6)	430	580	+35%
Wimmera Mallee Pipeline – Supply System 1, 2, 3, 4, 7	2,525	2,800	+11%
Total	**4,725**	**5,160**	**+9%**

The Landsborough Valley Pipeline, and other rural users connected to the Stawell raw water system receive supply from a combination of Lake Fyans and the Stawell Diversion Weir. The average annual demand for these users between 2017 and 2021 was 550 ML per year. As the Landsborough Valley Pipeline was constructed during the 2011-2016 period, there is no average annual demand data for that period, and so is not shown in ***Table 8***.

Figure 7 shows that in the case of rural demands, the Murray system supplies a much larger proportion of total rural demand across GWMWater pipeline systems. However, it should be noted that the total rural demand volume is approximately half that of the total urban demand.

Figure 7: Average annual rural demand by supply system, as percentage of total (2017-2021)



5. Assessing System Performance

Extensive supply–demand assessments have been undertaken for the Grampians supply system and Murray and Goulburn supplied systems. A detailed REALM modelling assessment was completed for the Grampians supply system, whereas analysis for the Murray and Goulburn supplied systems used REALM and Source model outputs provided by DELWP. For further detail on modelling assessments and methodology refer to *Technical note for 2022 Water Strategy Modelling Scenarios (Murray System)* (GWMWater, 2022b) and *Technical note for 2022 Water Strategy Modelling Scenarios (Grampians System)* (GWMWater, 2022a).

The baseline demand and 2045 and 2070 demand forecasts are discussed in summary in section 4 of this document, with full details in *Urban and Rural Water Strategy 2022 - Demands Report* (GWMWater, 2021).

5.1 Murray and Goulburn Supplied Systems Performance

GWMWater's entitlements in the Murray system support the Northern Mallee Pipeline, Wimmera Mallee Pipeline (Supply System 5) and three private pipeline schemes. GWMWater's entitlements in the Goulburn system support supply to the township of Quambatook, and supply to the South West Loddon Pipeline (SWLP) from the Waranga Western Channel (WWC).

5.1.1. Murray and Goulburn Systems Assessment Summary

Historically, demand in these systems has been far less than water available under GWMWater's entitlements. In years where all GWMWater's entitlements receive 100% allocation, baseline demands will result in approximately 2,000 ML of allocation remaining unused, which can 'carryover'. Subject to inter-valley trade rules and limits, GWMWater has the option to transfer allocation between its Murray and Goulburn accounts. However, it is noted that the operation of inter-valley trade rules and limits has changed since 2017. It is recommended that GWMWater reviews the operational management of its Murray and Goulburn water entitlements and carryover, and updates its management approach in light of changes to inter-valley trade rules and limits, and findings from this Urban and Rural Water Strategy.

Action 7: Review the operational management of GWMWater's Murray and Goulburn water entitlements and carryover, and update this for changes to inter-valley trade rules and limits and findings from the 2022 Urban and Rural Water Strategy.

Analysis undertaken for the 2022 Urban and Rural Water Strategy confirmed that carryover remains a key tool in managing the water security of Murray and Goulburn supplied systems. However, carryover is limited to 100% of entitlement volume, and can be subject to deductions when Murray or Goulburn system storages spill. This means the risk of 'losing' carried-over allocation must be balanced with the need to maintain adequate carryover reserves to buffer against low early season allocations and sub-100% allocation years.

Key findings from the Murray and Goulburn system performance assessments are summarised below:

- Water security remains high, owing to the annual demand volumes relative to the size of GWMWater's entitlements.
- Security of supply in years of reduced allocations is dependent on the volume of carryover maintained to balance supply and demand in these years.
- With no carryover reserve, Permanent Water Saving Rules level of demand was assessed to be met in:
  - 98% of years under Historic and Post-1975 climate
  - 94% of years under Post-1997 climate
  - At least 92% of years under Low and Medium Impact Climate Change for both 2045 and 2070 time slices
  - 81% of years under at 2045 time slice, and 50% of years at 2070 time slice for High Impact Climate Change scenarios.

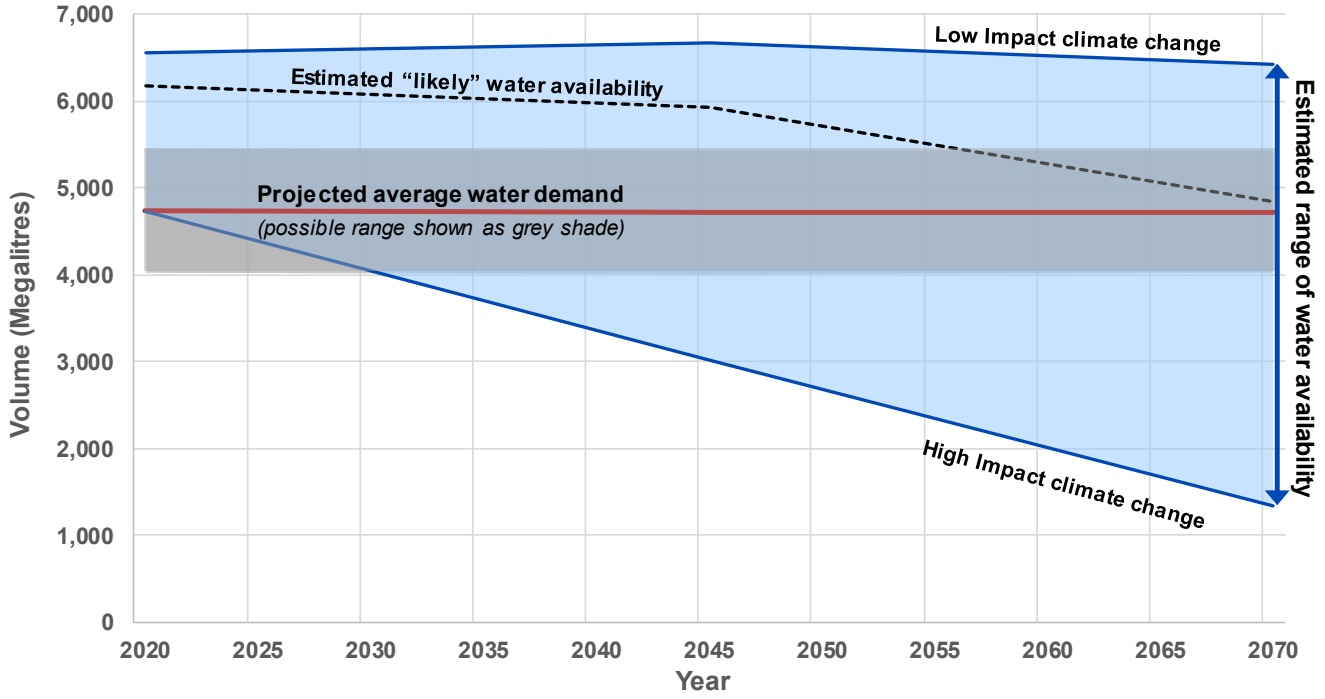
- The added security afforded by having an accessible carryover reserve of up to 3,000 ML enabled Permanent Water Saving Rules level of demand to be met in:
  - 100% of years under Historic, Post-1975, Post-1997 and Low Impact Climate Change scenarios, and
  - at least 94% of years under Medium Impact Climate Change.
- Under High Impact Climate Change scenarios, carryover becomes a less effective risk management tool, as the reduction in water availability causes a significant decline in allocations. Less carryover, coupled with larger allocation shortfalls, meant that Permanent Water Saving Rules level of demand could not be met in 35% of years, under the 2070 High Impact Climate Change scenario, even with 3,000 ML of carryover reserves.

5.1.2. Murray and Goulburn Systems Supply & Demand Summary

In ***Figure 8*** (below), projected water demand for Murray and Goulburn supplied systems is compared with the estimated range of water available in at least 93% of years (aspirational level of service), under a variety of possible climate scenarios without carryover reserves. An estimated 'likely' water availability reference line is shown, based on long-term water availability trending towards that of a Post-1997 climate.

While the projected average water demand volume is within the estimated range of water availability, the volume of projected demand remains well below the estimated 'likely' water availability until at least 2055 for a high demand year, or 2070 for an average demand year. As such, water availability would need to fall below that estimated for medium impact climate change in order for demand to exceed supply prior to 2055.

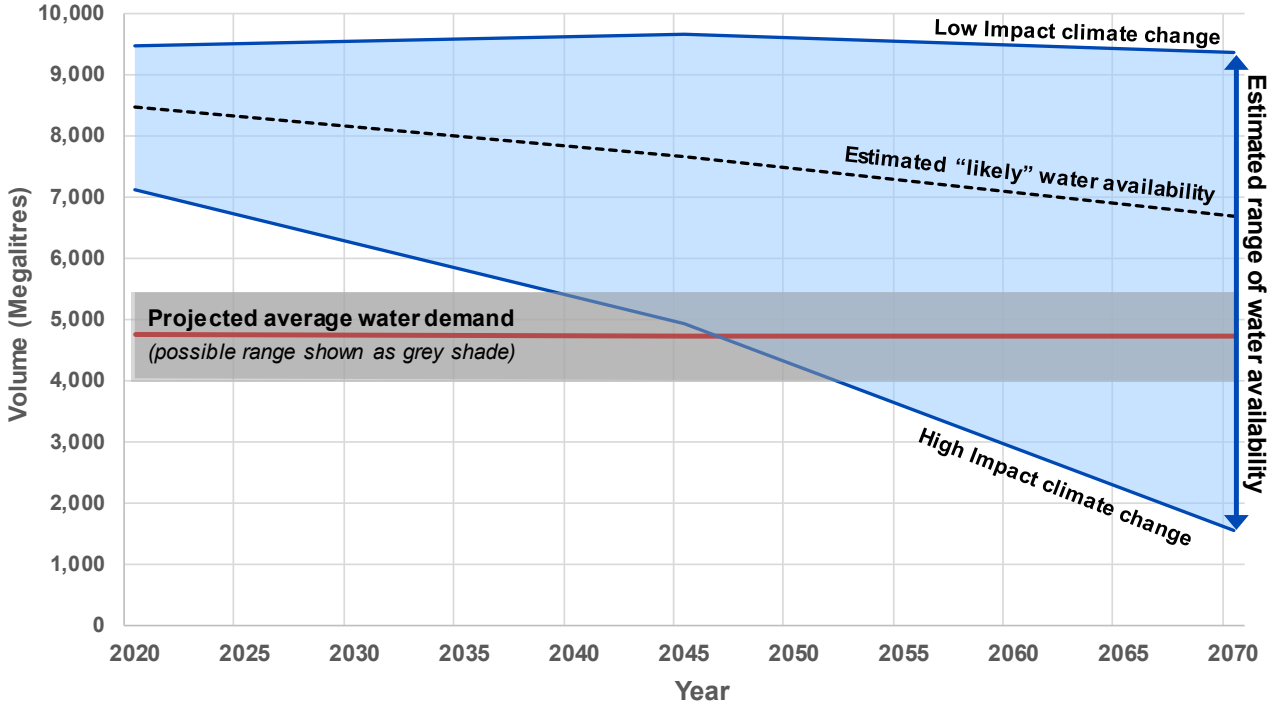
Figure 8: Comparison of estimated water availability and projected urban and rural pipeline demand to 2070 for Murray and Goulburn supplied systems (assumes no carryover)



However, as discussed in the Murray and Goulburn systems assessment summary, carryover remains an important tool for balancing year-to-year water security. ***Figure 9*** presents the estimated range of water availability inclusive of the additional volumes available from a carryover reserve of up to 3,000 ML. In order to build up this volume of carryover, GWMWater may carry forward and accumulate volumes of unused allocation through multiple years, subject to carryover and spillable water rules.

This scenario is reflective of how GWMWater actually manages its water security, and indicates that with the use of carryover reserves, projected average demand could be supplied in at least 93% of years (aspirational level of service) under all climate change scenarios up to 2039 (high demand) or 2047 (average demand). Excluding high impact climate change, the full range of projected demand is able to be satisfied under all other climate scenarios until at least 2070.

Figure 9: Comparison of estimated water availability and projected urban and rural pipeline demand to 2070 for Murray and Goulburn supplied systems (with carryover reserve)



Further details of the supply-analysis completed for the Murray and Goulburn Systems can found in *Technical note for 2022 Water Strategy Modelling Scenarios (Murray and Goulburn Systems)* (GWMWater, 2022b).

5.2 Grampians Supplied Systems Performance

The Grampians water supply system consists of nine bulk water supply reservoirs, associated transfer channels and regulating structures. The supply system performance was assessed at both a system-wide scale, and also at individual reservoir scale. The assessment of system performance for the Grampians-supplied systems used REALM hydrologic modelling, supported by spreadsheet analysis of model outputs.

5.2.1. Climate Context for System Performance Analysis

A significant step-change reduction in inflows to the Grampians reservoirs has persisted for the past 24 years. The average annual inflow to the Grampians reservoirs since 1997 is 63% lower than the historic average for the period prior to 1997. The Grampians reservoirs have not seen consecutive years with above average inflow since the mid-1990s. Instead, each of the two above average inflow years since 1997 have been proceeded by a sequence of years with inflows well below the historic average.

Grampians catchments have experienced a greater decline in rainfall and runoff compared with many other catchments in Victoria. The already observed reduction in average annual rainfall and runoff for the Grampians catchments equals or exceeds the changes predicted to occur in the region over future decades. For example, downscaled climate projections produced by CSIRO in 2019 predicted a 12% decline in rainfall under high impact climate change for the Wimmera Southern Mallee region by 2050 (CSIRO, 2020). However, a 15% decline in the average annual rainfall at Lake Wartook has been observed over the period since 1997. The observed decline in reservoir inflows is a direct result of both reductions in annual rainfall, and also changes in the seasonal timing of rainfall.

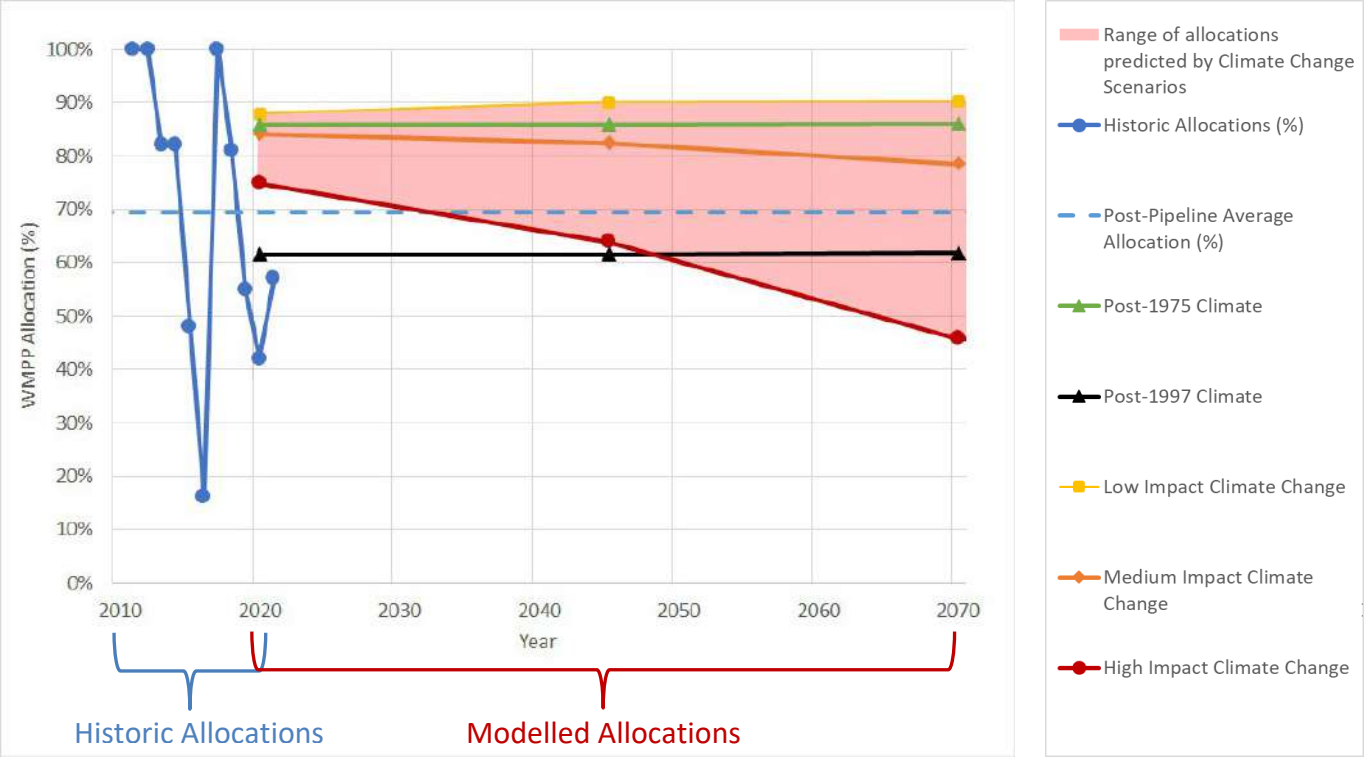
It is not apparent to what extent climate change versus natural climate variability has contributed to the observed decline in water availability since 1997. These reductions have been so extreme that system performance assessments using Post-1997 climatic conditions show lower water availability than all climate change scenarios, until the year 2045. The use of scaled historic inflow data to represent estimated future water availability may be a factor which influences the result. The pattern of inflows (i.e. wetter and drier years) observed since 1997, are very much different to the pattern of inflows observed in decades prior to 1997.

The prevailing advice from climate scientists that DELWP consulted with when developing the *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria* was that climate variability is the stronger driver of the drying that has been experienced from the late 1990s (DELWP, 2020). However, the guidelines also noted that the Global Climate Models (GCMs) relied upon to reach that conclusion have a strong tendency to under-estimate the observed declines in cool season rainfall in Victoria. Given it is primarily the decline in winter and spring rainfall that is driving the observed reduction in inflows, it is reasonable to expect the region may continue to experience the same climatic conditions for an ongoing period. Global climate modelling has also predicted that the impacts of climate change will be felt more acutely in Western Victoria compared to the rest of the state (Timbal, Debbie , Jonas , & Francis , 2015).

For this Urban and Rural Water Strategy, it was determined that climatic conditions reflective of the period since 1997 (Post-1997 climate) best represented the actual water availability since Wimmera Mallee Pipeline construction, and the climatic conditions which may be experienced in the short to medium term. This is a change from the 2017 Urban and Rural Water Strategy, which followed the best available advice at the time, and adopted a climate baseline which reflected climatic conditions since 1975 (Post-1975 climate). It should be noted that the average annual inflow to Grampians reservoirs between 1975 and 2021 is only 23% lower than the historic average.

Comparison of observed allocations since the Wimmera-Mallee Pipeline entitlements were issued in 2010 (69%), and modelled average allocation results for the prescribed climate scenarios confirmed that the Post-1997 climate scenario with a modelled average allocation of 62%, provided an appropriately conservative representation of water availability into the future.

Figure 10: Comparison of observed allocations and modelled average allocations to Wimmera-Mallee Pipeline Product (WMPP) entitlements under various climate scenarios



5.2.2. Total Grampians Supply System Assessment

While all holders of Wimmera-Mallee Pipeline Product entitlements have been and will continue to be affected by lower allocations under a continuation of Post-1997 climate, modelling results indicate GWMWater would likely have sufficient water holdings in the Grampians system to meet the projected level of demand in 100% years until 2045 with current levels of demand, under a Post-1997 climate.

The system performance assessment identified that GWMWater's very high level of water security under current (2020) baseline demands and a Post-1997 climate is the result of several factors:

- The underutilisation of rural allowances (total rural customer use is less than 50% of the total allowance volume on issue)
- Large commercial users who are not taking supply
- Allocations from unsold growth water supporting the security of existing urban and rural users
- Ability to carryover all unused allocation, subject to spillable water rules.

The combination of these factors has meant the security of supply to GWMWater's urban and rural customers has remained very high, despite climate-driven reductions in allocations. The 2017 Urban and Rural Water Strategy highlighted the importance of 'unlimited' carryover in the Grampians headworks system as a tool to manage multi-year security by continual carryover of unused allocation to meet demands in dry years (GWMWater, 2017). The modelling analysis for the 2022 Strategy reinforced this finding, with modelling under Post-1997 climate showing that multi-year security is needed to an even greater extent. Existing carryover rules for the Grampians system provide an effective tool for GWMWater to manage its security of supply to its urban and rural customers.

The system performance assessment identified that the factors likely to have the greatest impact on security of supply for urban and rural customers into the future are the reduction of the current water security buffer resulting from the further sale of Growth Water combined with supply commencing to very large commercial users, and any further climate-driven decline in water availability. The underutilisation of water allowances by rural customers is a trend that is projected to continue. Rural allowance volumes were set based on livestock water requirements across the Wimmera-Mallee, however, cropping is now the dominant agricultural activity and has a far lower water requirement.

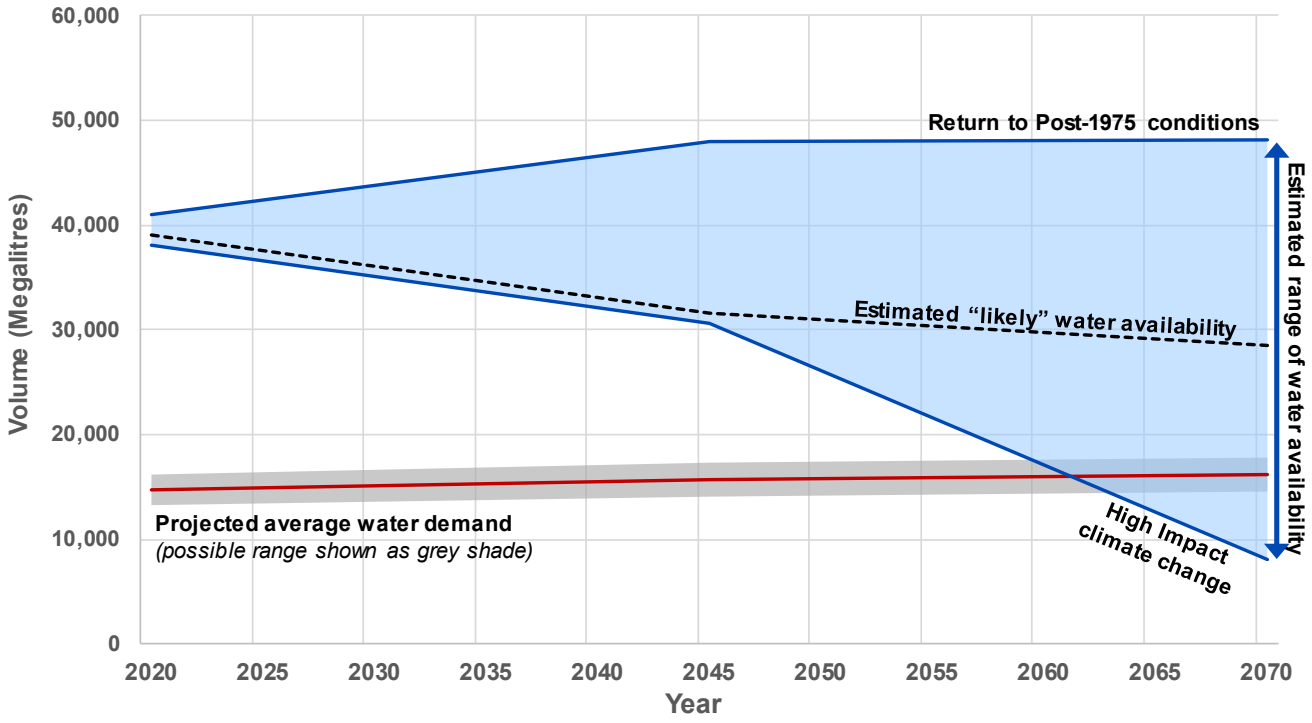
To manage the risk of becoming overcommitted, GWMWater should confirm the volume of new Growth Water commitments which can be supported by the projected future yield of existing entitlements over the next 20 years, and develop a policy which supports the release of Growth Water, while maintaining a high level of water security for urban and rural pipeline customers. This may include identifying points at which supply augmentation would be necessary to maintain an appropriate long-term supply-demand balance.

Action 8: Confirm the volume of new Growth Water commitments which can be supported by the projected future yield of existing entitlements over the next 20 years, and develop a policy which supports the release of Growth Water, while maintaining a high level of water security for urban and rural pipeline customers.

Figure 11 below presents the projected average water demand and estimated range of water available in at least 93% of years (aspirational level of service) for current and projected urban and rural pipeline growth to 2070. A high demand scenario is presented in ***Figure 12*** to provide an indicative representation of how the water availability for urban and rural pipeline supply may change if all large commercial users were taking supply concurrently. An estimated 'likely' water availability reference line is shown in both figures, which assumes a further 12% climate related decline in water availability from Post 1997 conditions, by 2070.[1]

Figure 11 shows that projected water demand does not exceed water available until after 2060, under high impact climate change. The projected baseline water demand does not exceed the estimated 'likely' water availability at any point over the 50-year outlook.

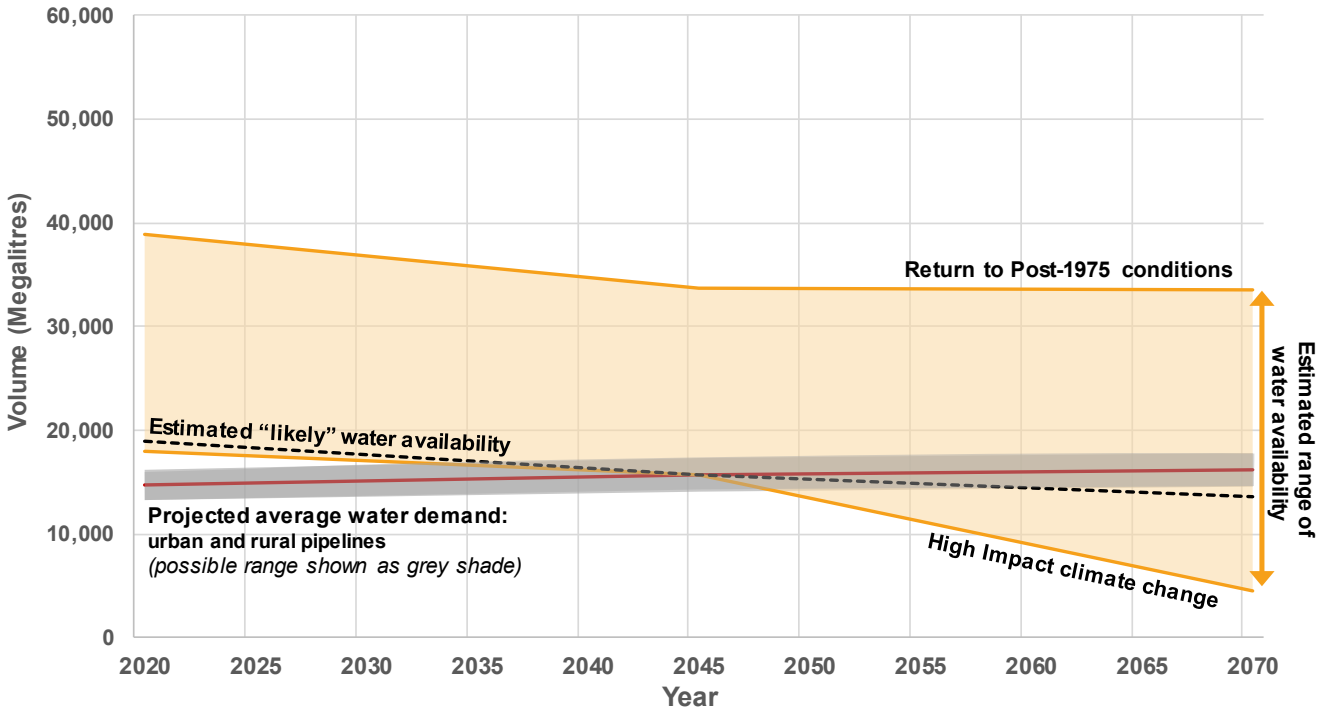
Figure 11: Comparison of estimated water availability and projected urban and rural pipeline demand to 2070 for Grampians supplied systems (no supply to large commercial users)



[1] 12% decline estimated using mid-point between *Wimmera Southern Mallee Climate Projections 2019 (CSIRO, 2019)* projected rainfall decline for Horsham to 2059 under RCP4.5 & RCP8.5 scenarios, adjusted for observed declines and scaled to estimate runoff impact.

Figure 12 indicates that if all large commercial users were to take supply concurrently, along with the sale of all remaining Growth Water between 2020 and 2045, the projected urban and rural pipeline water demand could exceed the volume available to service those demands (at the aspirational level of service) between 2035 and 2045, under the estimated 'likely' water availability scenario. This demonstrates how the water use requirements of presently inactive large commercial users and the sale of Growth Water are the dominant factors anticipated to drive the timing of when the Grampians supply system may require augmentation.

Figure 12: Comparison of estimated water availability and projected urban and rural pipeline demand to 2070 for Grampians supplied systems under full supply to large commercial users and sale of all Growth Water



5.2.3. *Individual Supply System Performance*

In the Grampians reservoir system, the calculation of water allocations considers all water in the headworks system, but not specifically which reservoirs the water is physically located in. This means an entitlement holder may have sufficient allocation and carryover available, but could be unable to access it if the reservoir they are dependent on is empty due to variability in inflows between reservoirs, large demand from that reservoir relative to its storage volume, or reservoir efficiency factors. Due to this, an assessment was made of the security of supply from the individual reservoirs servicing GWMWater demands. The key findings at an individual reservoir scale are summarised below.

Key findings for the Wartook & Moora Reservoir supply system

The modelling analysis for both the 2017 and 2022 Urban and Rural Water Strategies identified that Lake Wartook, which services GWMWater's largest urban centre, is at higher risk than the rest of the Grampians system. Under current baseline demands, modelling showed that all

Grampians system supply shortfalls resulted from a lack of resource in Lake Wartook (GWMWater, 2022a). There is significant demand for water from Lake Wartook to meet urban, rural and environmental supply requirements, with the modelling assessment showing:

- Significant shortfalls in supply to Horsham under all climate scenarios. Under Post-1997 climate, Lake Wartook and Moora Moora Reservoir only have sufficient resource to supply current levels of demand for Horsham, Natimuk and Supply System 6 rural customers in 86% of years.
- Use of the Mt Zero borefield could mitigate some, but not all, of the modelled supply shortfalls, due to licence extraction limits.
- Significant failure in ability to meet demand is observed under extreme climate scenarios after 2045. Before 2045, the Post-1997 climate scenario represents the lowest water availability.
- In scenarios where Lake Wartook has insufficient volume to meet urban demands, Supply System 6 rural supply is also at risk, as Moora Moora Reservoir is generally already at or near empty.
- Modelling with the environmental demand assumptions used in the 'Security of Supply' assessment which informed the design of Supply System 6, indicates GWMWater would have access to sufficient water from Lake Wartook to meet urban and rural demands in 98% of years under current levels of demand and Post-1997 climate, and 94% of years at 2045 level of demand. This indicates that GWMWater's security of supply from Lake Wartook is affected by the changes in environmental watering priorities and objectives since the pipeline was designed.
- Changes in environmental watering priorities from Lake Wartook may bring forward the need to augment the Horsham supply system by as much as 20 years, as well as creating a greater reliance on the Mt Zero Borefield to maintain supply and meet levels of service.
- GWMWater's demand volume is relatively consistent from year to year, whereas modelled environmental demand volumes fluctuate significantly based on seasonal conditions.

GWMWater views the groundwater supply from the Mt Zero Borefield as a contingency supply source, rather than a normal part of the supply mix. GWMWater's groundwater licence allows for up to 1,200 ML to be extracted per year, limited at 2,400 ML extraction over any five-year period. This is less than Horsham's average annual demand, and is estimated to support stage 4 water restriction demand for 12 to 16 months. The groundwater extraction limits are designed to allow flexibility in operating the borefield, while minimising impacts to the aquifer and allowing groundwater levels to recover after the borefield is used.

GWMWater's extraction from the Mt Zero Borefield has not exceeded 500 ML in any year since it was constructed. Therefore, the capacity for the borefield and the aquifer to sustain higher volumes of extraction has not been tested. As the borefield is currently the only alternate supply source option for Horsham and Natimuk, it is recommended that a strategy be developed to manage the operation of the borefield up to extraction licence limits, should this be required during periods of low surface water availability.

Action 9: Develop an operating strategy to guide the future use of the Mt Zero borefield, and the evaluation of borefield and aquifer performance when it is operated.

With modelling results suggesting security for Horsham and Supply System 6 could be compromised as a result of Lake Wartook being unable to support all entitlement holders' water demands under Post-1997 climate scenarios, GWMWater supports the development of a framework which ensures the fair and equitable access to headworks reservoirs by all water users. The modelling results are supported by operational experience which has demonstrated that one year of below average inflow to Lake Wartook can require the Storage Manager to convene its Drought Planning Group for Lake Wartook, while GWMWater's holdings in the broader system are very secure.

Work on the equitable sharing of access to water from Lake Wartook has been progressed through the Headworks Operations Review Project. It is anticipated that some agreement on fair and equitable water sharing rules for Lake Wartook will be achieved within the 2022 Urban and Rural Water Strategy period (before 2027). Equitable water sharing rules will provide more certainty and improve modelling to identify how and when the system needs to be augmented to ensure GWMWater customers supplied from Lake Wartook enjoy the same security customers supplied from other parts of the Grampians system.

Action 10: GWMWater to work with the Storage Manager, Wimmera Catchment Management Authority, Department of Environment, Land, Water and Planning, and the Victorian Environmental Water Holder to define and implement rules for the equitable sharing of access to water from Lake Wartook that reflects the primary role of Lake Wartook as an urban water supply source.

While some conceptual augmentation options for GWMWater's Horsham urban system and rural Supply System 6 exist, few of these have been investigated in detail. As a result, the feasibility of some options are not well understood, and would need to be determined to inform a 'preferred option' for future augmentation. Existing conceptual options include:

- Expansion of the existing Mt Zero Borefield, or establishment of new borefield subject to hydrogeological (groundwater) investigations
- Upgrading water treatment facilities at Murtoa, and connecting via pipeline to the Horsham urban system in order to utilise water sourced from Lake Bellfield and deliver increased resilience for the urban system
- Replacing the Rocklands to Taylors Lake Transfer Channel with a highly water efficient pipeline solution, including direct connection(s) to Horsham's water treatment plant, and/or Supply System 6.
- Constructing a connecting pipeline from the Lake Bellfield to Taylors Lake Pipeline to Horsham's water treatment plant
- Replacing the Mt Zero Channel with a pipeline, to improve the efficiency of transferring water to Horsham's water treatment plant.

With the Lake Wartook supply system already experiencing some stress during low inflow periods, and demand forecasts indicating an additional 500 ML/yr will be required for

Horsham urban supply by 2045, and more than 1,000 ML additional by 2070, it is recommended that GWMWater undertakes the necessary investigations over the next five years to determine the feasibility of its conceptual augmentation options for the Horsham urban system and Supply System 6, to inform the 2027 Urban and Rural Water Strategy and other business planning processes. Opportunities to increase water efficiency across bulk water distribution and urban /rural supply networks (including at the customer level), should be investigated in parallel to support the development of optimised augmentation options.

Action 11: GWMWater to undertake detailed feasibility assessment of conceptual supply augmentation options for the Horsham urban system and Supply System 6 over the 2022-2027 period, and investigate opportunities for increased efficiency in supply networks and customer water use.

Key findings for the Lake Bellfield and Taylors Lake system:

- Supply to both urban and rural users from Wimmera Mallee Pipeline system remains secure for the next 20 years, except under scenarios with a significantly increased level of demand (such as full use of rural allowances, or all large commercial customers taking supply concurrently).
- Water availability from Lake Bellfield is projected to remain sufficient to meet demands under all climate scenarios up to 2045, even with the East Grampians Rural Pipeline in operation, and additional urban demands. The underutilisation of rural allowances contributes to this security.
- Lake Bellfield storage volume is impacted significantly in scenarios where the remaining Growth Water volume is assumed to be predominately serviced with water from Lake Bellfield.
- Under the high impact climate change scenarios, the reduction in long-term inflows to Lake Bellfield results in the depletion of the reservoir. Modelling indicates an inability to supply Permanent Water Saving Rules demand volumes for periods of up to 10 consecutive years by 2070, even in the absence of any significant increase in demand over the next 50 years.

Key findings from the Lake Fyans Supply System

- Sufficient resource is available from Lake Fyans Supply System to meet Stawell, Ararat and Great Western demands in all climate scenarios up to 2045, even with increased demand from the East Grampians Rural Pipeline.
- As Lake Fyans is dependent on transfers from Lake Bellfield, its ability to supply demands is also severely affected by 2070 under high impact climate change.

5.3 Pyrenees and Eastern Grampians Urban System Performance

The performance of the existing Pyrenees and Eastern Grampians Urban Supply Systems was not assessed in detail for this Strategy. This is because the East Grampians Rural Pipeline (EGRP) will interlink with the existing headworks infrastructure supplying the Pyrenees and Eastern Grampians Urban Supply Systems, and also have capacity to supplement the Elmhurst system. With this augmentation set to occur within the next five years, there is little value in attempting to assess the long-term performance of the existing supply systems. The connection of these systems to the East Grampians Rural Pipeline network will mean that their security of supply will not be less than assessed for the Grampians supply systems which take water from Lake Bellfield or Lake Fyans.

The method for assessing the performance of these urban systems will need to be reviewed at the time of the 2027 Urban and Rural Water Strategy. This will be post-construction of the East Grampians Rural Pipeline, and the operational arrangements for supplying the Pyrenees and Eastern Grampians Urban Supply Systems will be well understood by that time.

Action 12: Review the method for assessing the performance of the Pyrenees and East Grampians Urban Supply Systems following the completion of the East Grampians Rural Pipeline.

5.4 Groundwater Towns Supply System Performance

GWMWater's groundwater supplied towns span a range of groundwater areas with differing levels of security. In most cases, the existing groundwater resource provides a long term supply option which is influenced very little by climatic factors.

Towns supplied within West Wimmera Groundwater Management Area
The response of groundwater to climate change is discussed in the West Wimmera Groundwater Management Area (GMA) Local Management Plan (2019). The groundwater resource is understood to be predominately an ancient water resource, and the modern recharge rate is very small across the majority or the GMA, with the exception of the south and south west. For most of the area, the influence of rainfall on groundwater levels is not projected to be as dominant as the influence of groundwater extraction (primarily for irrigation) into the future. Based on groundwater resource assessments undertaken for the West Wimmera Groundwater Management Area, access to groundwater for urban supply is assessed to be very secure for the foreseeable future (i.e. greater than 50 years), with the exception of Edenhope township (assessed separately).

Edenhope Urban System Performance
In 2017, GWMWater commissioned the *Edenhope Bore Field Hydrogeological Review* to further understand the security of supply for Edenhope township. This review has informed the current assessment of system performance for the Edenhope borefield, which is summarised below:

- The current bores are located in a highly localised area of low salinity groundwater. This has always been acknowledged as a finite groundwater resource from a quality perspective. Radiocarbon analysis in 2017 indicated the age of the water to be on average 12,670 years old, indicating an absence of local recharge to the aquifer (i.e. recharge points are distant from the production bores).
- The current borefield is operating at its maximum production capacity during peak demand periods, based on water level drawdown within the production bores.
- There is an inherent risk that the salinity of water at the production bores will increase due to groundwater pumping inducing movement of higher salinity water towards the production bores.

In the West Wimmera area there has been considerable landowner and community interest in a rural pipeline. For Edenhope township, this discussion has extended to a secure long-term water supply which can support and facilitate growth. A concept for a pipeline solution has been developed that would source water from Rocklands Reservoir. Whilst this has been considered from a feasibility perspective, Rocklands Reservoir typically experiences elevated salinity during periods of below average inflow, so any solution would need to consider this aspect within an overall strategy for Edenhope supply.

Action 13: Continue current Edenhope groundwater monitoring regime and undertake a further technical assessment 'health check' if the current borefield is likely to remain in operation for the next five years.

Action 14: Complete planning and deliver short-term augmentation works to increase Edenhope urban supply system resilience during peak demand periods.

Action 15: Commence planning of long-term supply system augmentation for Edenhope.

Harrow Urban System Performance
GWMWater's groundwater licence for Harrow is now able to meet current levels of demand, following an increase to the licence volume in 2018 (recommendation from 2017 Urban and Rural Water Strategy). Harrow accesses a relatively secure groundwater resource, and increasing the licence volume has proved to be successful in improving the security of supply for this town.

Towns supplied within Murrayville Groundwater Management Area
Groundwater in the Murrayville area is sourced from the Murray Group Limestone aquifer. Below the township of Murrayville, the aquifer is up to 100 metres thick and the total volume in storage is significant. While it is considered that there is no modern day recharge of the aquifer, the management regime permits a small proportion of the groundwater in storage to be utilised each year. The slow rate at which the aquifer is declining (and projected to decline into the future) means that the volume of extraction required to supply the township of Murrayville is able to be accessed with a high level of security well beyond 2070.

Mt William Borefield
Although this aquifer is shallow, with a water table at 20 metres below ground surface, the short to medium term climate risks to this groundwater supply are assessed to be low, based on a consistent seasonal recovery in the standing water level. This level of recovery shows that the aquifer is able to sustain current rates of extraction, which are not anticipated to experience a material increase into the future. The performance of this borefield will be assessed again at the time of the 2027 Urban and Rural Water Strategy.

6. Future water supply considerations

Rural communities affected by the impacts of a drying climate on their local water sources, are seeking more secure water supply options. This is evidenced by the construction of the South West Loddon Pipeline, and funding of the East Grampians Rural Pipeline between 2017 and 2022. GWMWater continues to investigate the feasibility of new pipelines and extensions of existing networks to areas where there is a need for more secure water supply. The findings and outcomes from this Strategy will form a key input to these investigations.

In some areas identified for rural pipeline feasibility studies, there are existing privately owned and operated water supply schemes, which may supply small towns, or groups of rural properties. Construction of a rural pipeline in these areas presents a series of potential opportunities for these communities, including:

- Private water supply schemes to be connected with rural pipeline networks to provide additional water security to those users;
- Private water supply schemes to be transferred to GWMWater and integrated with the rural pipeline network, to optimise the use of existing water supply assets, including water storages and pipelines, where suitable.

GWMWater will continue to investigate opportunities to expand its water supply networks and diversity water sources in order to continue providing secure and reliable water supply services to our vital rural communities. Proposed major infrastructure such as the West Grampians Rural Pipeline would deliver infrastructure securing access to reliable water supply to support both farming communities and West Wimmera townships, in particular, Edenhope.

7. Urban and Rural Water Strategy Actions

7.1 Water Efficiency Actions

GWMWater is committed to working collaboratively to deliver the objectives of the Victorian Water Efficiency Strategy. We have representation on the Victorian Water Efficiency Resources Committee and leverage Smart Water Advice content to inform and educate our customers about water conservation.

GWMWater is currently involved in a range of water efficiency and water conservation programs and initiatives, including:

Community Rebate Program
The Community Rebate Program is a joint initiative with the Victorian Government. The program aims to reduce water bills through a free water audit and the repair or replacement of inefficient water fittings for eligible hardship customers. The Victorian Government has confirmed that the Community Rebate Program will continue to be funded until 30 June 2023.

Water Tariff Reduction
A 15 percent tariff reduction is available to not-for-profit organisations that conserve water by watering at night via dedicated timed sprinkler systems.

Integrated Water Management
GWMWater actively participates in Integrated Water Management (IWM) forums established by the Department of Environment, Land, Water and Planning. The Wimmera model leverages existing relationships and strong, strategic alignments with local government and the Wimmera Catchment Management Authority.

'Target Your Water Use'
This program focuses on taking a longer-term view of our water use habits, while providing our customers with easy access to the information they need to make informed decisions about the amount of water they use. Customers can access a range of water use information through the GWMWater Customer Portal in addition to the information presented on water bills.

GWMWater Customer Portal
The GWMWater Customer Portal allows residential, commercial and rural customers to see all of their water accounts under one login, monitor water use, set alerts for high usage, identify leaks, track spending, and where allocations apply, the volume used year-to-date. Customers can set their own threshold for high water use (as water use volume or cost), to trigger an email warning or text message alert.

Urban customers can view their historical water use patterns, statistics such as the volume of water used compared with the prior week and comparative information which puts the customer's water use into perspective, such as comparing the volume used with the equivalent number of 12 litre water cooler bottles. Empowering customers to monitor their water use and use water more efficiently ultimately helps the same volume of water resource to 'go further' and supply a greater number of customers.

Use of Digital Meter Data

The advent of digital metering across our urban and rural networks means GWMWater now collects high resolution customer water use data for both urban and rural pipeline customers. We continue to pursue opportunities to maximise the use of digital meter data to deliver value and benefits to our customers, such as those described in the Customer Portal section, above. As our data sets grow over time, we are able to gain an increasing level of insight into customer water use behaviour as well as the performance of our water supply systems.

Action 16: Continue to promote water efficiency initiatives and the use of GWMWater's Customer Portal for customers to monitor and understand their water use behaviour.

Action 17: Continue to pursue opportunities to maximuse the benefit and value to both customers and GWMWater from digital metering data.

7.2 Summary of Priority Actions from Urban and Rural Water Strategy

All actions identified in this 2022 Urban and Rural Water Strategy are anticipated to be addressed or completed over the next five years (2022-2027). However, it is possible that additional longer term actions may result from those actions completed between 2022 and 2027.

Table 9: Priority Actions over next 5 years

	Action Description
Action 1	Undertake detailed investigations and costing of future augmentation and alternate water supply options to inform consultation on levels of service ahead of 2027 Urban and Rural Water Strategy.
Action 2	Deliver upgrades at Donald, Ararat, Horsham and Dimboola Wastewater Treatment Plants during 2022-2028.
Action 3	GWMWater to continue working with local governments on opportunities for the use of recycled water in GWMWater serviced towns.
Action 4	GWMWater will continue to support local government and communities to maximise the beneficial use of stormwater.
Action 5	Undertake an analysis of historic population projections with observed changes in population and urban demand, to inform the 2027 Urban & Rural Water Strategy.
Action 6	Investigate the cause of increasing unaccounted for water in the Murray supplied pipeline systems
Action 7	Review the operational management of GWMWater's Murray and Goulburn water entitlements and carryover, and update this for changes to inter-valley trade rules and limits and findings from the 2022 U&RWS.
Action 8	Confirm the volume of new Growth Water commitments which can be supported by the projected future yield of existing entitlements over the next 20 years, and develop a policy which supports the release of Growth Water, while maintaining a high level of water security for urban and rural pipeline customers.
Action 9	Develop an operating strategy to guide the future use of the Mt Zero borefield, and the evaluation of borefield and aquifer performance when it is operated.
Action 10	GWMWater to work with the Storage Manager, Wimmera Catchment Management Authority, Department of Environment, Land, Water and Planning, and the Victorian Environmental Water Holder to define and implement rules for the equitable sharing of access to water from Lake Wartook that reflects the primary role of Lake Wartook as an urban water supply source.
Action 11	GWMWater to undertake detailed feasibility assessment of conceptual supply augmentation options for the Horsham urban system and Supply System 6 over the 2022-2027 period, and investigate opportunities for increased efficiency in supply networks and customer water use.

	Action Description
Action 12	Review the method for assessing the performance of the Pyrenees and East Grampians Urban Supply Systems following the completion of the East Grampians Rural Pipeline.
Action 13	Continue current Edenhope groundwater monitoring regime and undertake a further technical assessment 'health check' if the current borefield is likely to remain in operation for the next five years.
Action 14	Complete planning and deliver short-term augmentation works to increase Edenhope urban supply system resilience during peak demand periods.
Action 15	Commence planning of long-term supply system augmentation for Edenhope.
Action 16	Continue to promote water efficiency initiatives and the use of GWMWater's Customer Portal for customers to monitor and understand their water use behaviour.
Action 17	Continue to pursue opportunities to maximise the benefit and value to both customers and GWMWater from digital metering data.

8. Monitoring, Reporting and Investigations

8.1 Monitoring

Essential to this Strategy is an ongoing commitment by GWMWater to monitor implementation of the actions, which will include:

- Review of water availability and demand compared to Urban and Rural Water Strategy forecasts
- Review prioritised list of actions for the next five years, identifying any need to bring actions forward or delay them
- Prepare an Annual Water Outlook and update the status of Urban and Rural Water Strategy priority actions as part of this Outlook.

8.2 Reporting

Water Corporations must make available to its customers and DELWP an Annual Water Outlook by 1 December of each year, although they may be updated progressively throughout the year. GWMWater's Annual Water Outlooks are developed consistent with the relevant guidelines prepared by DELWP.

8.3 Reviewing the Strategy

The Urban and Rural Water Strategy will be reviewed, and a new Strategy prepared every five years as required by the Statement of Obligations and/or directed by the Minister.

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10. Appendices

10.1 Appendix 1 - Acronyms

AGL	Agreed Service Level
BE	Bulk Entitlement
BGA	Blue-Green Algae
CMA	Catchment Management Authority
DELWP	Department of Environment, Land, Water and Planning
EC	Electrical Conductivity in micro Siemens/cm
EGRP	East Grampians Rural Pipeline
ESC	Essential Services Commission
GL	Gigalitre
GMA	Groundwater Management Area
GMU	Groundwater Management Unit
GWMWater	Grampians Wimmera Mallee Water Corporation
MDB	Murray-Darling Basin
ML	Megalitre
NMP	Northern Mallee Pipeline
PWSR	Permanent Water Saving Rules
REALM	Resource Allocation Model (hydrologic model)
SLA	Local Government Statistical Local Area
SoO	Statement of Obligations
SWLP	South West Loddon Pipeline
TCSA	Tertiary Confined Sand Aquifer
U&RWS	Urban and Rural Water Strategy
VEWH	Victorian Environmental Water Holder
VIF 2019	Victorian in Future, population projections 2016 to 2056
WMP	Wimmera Mallee Pipeline
WMP SS	Wimmera Mallee Pipeline Supply System
WSDS	Water Supply Demand Strategy

10.2 Appendix 2 – Climate Modelling Scenarios

The *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria (DELWP, 2020)* prescribes a number of climate scenarios that Victorian water corporations should consider in the development of their Urban Water Strategies. These scenarios, listed below, were assessed for GWMWater's Urban and Rural Water Strategy under various levels of demand, to assess the potential impacts to water availability across a range of possible future climates for the Grampians system, as well as the Murray & Goulburn systems.

The prescribed climate scenarios are:

1) Post-1975 historic climate reference period;
2) 2045 low impact climate change;
3) 2045 medium impact climate change;
4) 2045 high impact climate change;
5) 2070 low impact climate change;
6) 2070 medium impact climate change;
7) 2070 high impact climate change;
8) Post-1997 step climate change scenario.

The climatic inputs for the "Post-1975 historic climate reference period" and the "Post-1997 step climate change scenario" assume that there has been a step change in climate. The inputs were generated by scaling historic inflows to give the inflow or rainfall data prior to the user determined "break point date" similar statistical properties to the data after the "break point date". For the Post-1975 climate scenario, the "break point date" is July 1975, and for the Post-1997 climate scenario, the "break point date" is July 1997. The historical data is scaled using decile scaling and flow duration curves to reduce the highest magnitude flows the most, and avoid setting flows to zero. The scaled inputs were provided to GWMWater by DELWP, who produced them using the eWater Source streamflow transformation utility plug-in.

The high, medium and low impact climate change climatic inputs were constructed by applying the projected changes at a basin scale, at each of the respective points in time, according to global climate modelling for the RCP8.5 emissions scenario. The low impact scenario takes the 10th percentile of the projected change from all the results produced by an assembly of 42 global climate models, in the years 2045 and 2070. This projected change is then applied to the Post-1975 historic climate reference period inflow and rainfall inputs. The medium impact climate change inputs have the median (or 50th percentile) change applied. The high impact scenario applies the 90th percentile change.

In addition to the prescribed climate scenarios, modelling with the historic hydro-climatic sequence was also considered to allow comparison with previous modelling studies and bulk entitlement modelling.

Further details on the application of climatic scenarios in modelling for this Strategy can be found in the background technical reports; *Technical note for 2022 Water Strategy Modelling Scenarios (Grampians System)* (GWMWater, 2022a) and *Technical note for 2022 Water Strategy Modelling Scenarios (Murray and Goulburn Systems)* (GWMWater, 2022b).

10.3 Appendix 3 – GWMWater Entitlements

Murray System: Northern Mallee Pipeline Wimmera-Mallee Pipeline SS5, Private Pipelines
Goulburn System: South West Loddon Pipeline, Quambatook township

Entitlement Type	Volume (ML)	Reliability
Murray Bulk Entitlement	3,485.8	High
Murray Water Share	1,874	High
Goulburn Water Share	1,049	High
Quambatook Bulk Entitlement	100	High
Total	***6,508.8***	

Grampians System: Wimmera-Mallee Pipeline (SS 1,2,3,4,6,7), urban towns direct from headworks, South West Loddon Pipeline, East Grampians Rural Pipeline

Entitlement Type	Volume (ML)	Reliability
Wimmera-Glenelg Bulk Entitlement (Urban & Rural)	32,720	High
Wimmera-Glenelg Bulk Entitlement (SBA – not considered in this Strategy)	12,000	High
Total	***44,720***	

Eastern Grampians and Pyrenees Urban Systems

Entitlement Type	Volume (ML)	Reliability
Bulk Entitlement (Willaura System)	390	Not defined
Bulk Entitlement (Elmhurst)	48	Not defined
Bulk Entitlement (Buangor)	28	Not defined
Total	***466***	

Groundwater Towns

Entitlement Type	Volume (ML)	Reliability	Groundwater Management Area or Unit
S51 Licence (Goroke)	86	Not defined	West Wimmera
S51 Licence (Kiata)	40	Not defined	West Wimmera
S51 Licence (Nhill)	1,000	Not defined	West Wimmera
S51 Licence (Mt William - Willaura)	220	Not defined	East Grampians
S51 Licence (Kaniva)	600	Not defined	West Wimmera
S51 Licence (Serviceton)	25	Not defined	West Wimmera
S51 Licence (Edenhope)	250	Not defined	West Wimmera
S51 Licence (Harrow)	60	Not defined	West Wimmera
S51 Licence (Murrayville)	475	Not defined	Murrayville
S51 Licence (Lillimur)	32	Not defined	West Wimmera
S51 Licence (Cowangie)	40	Not defined	Murrayville
S51 Licence (Mt Zero - Horsham)	1,200	Not defined	West Grampians
S51 Licence (Apsley)	40	Not defined	West Wimmera
S51 Licence (Miram)	7	Not defined	West Wimmera
Total	***4,104***		

10.4 Appendix 4 – Future Wastewater System Inflows

Town	Projected wastewater inflow in 2027/28 (ML)	Sufficient system capacity
Ararat	941.0	No
Birchip	54.2	Yes
Charlton	64.9	Yes
Dimboola	104.7	Yes[1]
Donald	134.2	Yes[1]
Edenhope	73.2	Yes
Goroke	48.2	Yes
Great Western	8.2	Yes
Halls Gap	117.3	Yes
Hopetoun	35.6	Yes
Horsham	1600.1	No
Jeparit	32.6	Yes
Kaniva North	9.2	Yes
Kaniva South	0.9	Yes
Lake Bolac	10.0	Yes
Minyip	24.3	Yes
Murtoa	68.0	Yes
Natimuk	22.0	Yes
Nhill	172.5	Yes[2]
Ouyen	132.7	Yes
Rainbow	46.6	Yes
Rupanyup	30.0	Yes
Sea Lake	40.5	Yes
Serviceton	4.6	Yes
St Arnaud	160.9	Yes
Stawell	528.4	Yes
Warracknabeal	200.4	Yes
Willaura	48.2	Yes
Wycheproof	42.2	Yes

Note (1): Wastewater treatment plants at Dimboola and Donald have sufficient system capacity, however are anticipated require upgrading during 2022-2028 to improve treatment process, water quality and maintain EPA compliance.

Note (2): Nhill wastewater treatment plant may require an upgrade in the event of a potential major 'trade waste' connection, however timing and eventuality of this connection remains uncertain.

10.5 Appendix 5 – Summary of Allocations and Security of Supply under modelled scenarios

10.5.1. Grampians System

Figure 8.1: Grampians system modelled allocations and security of supply (Baseline Demands)

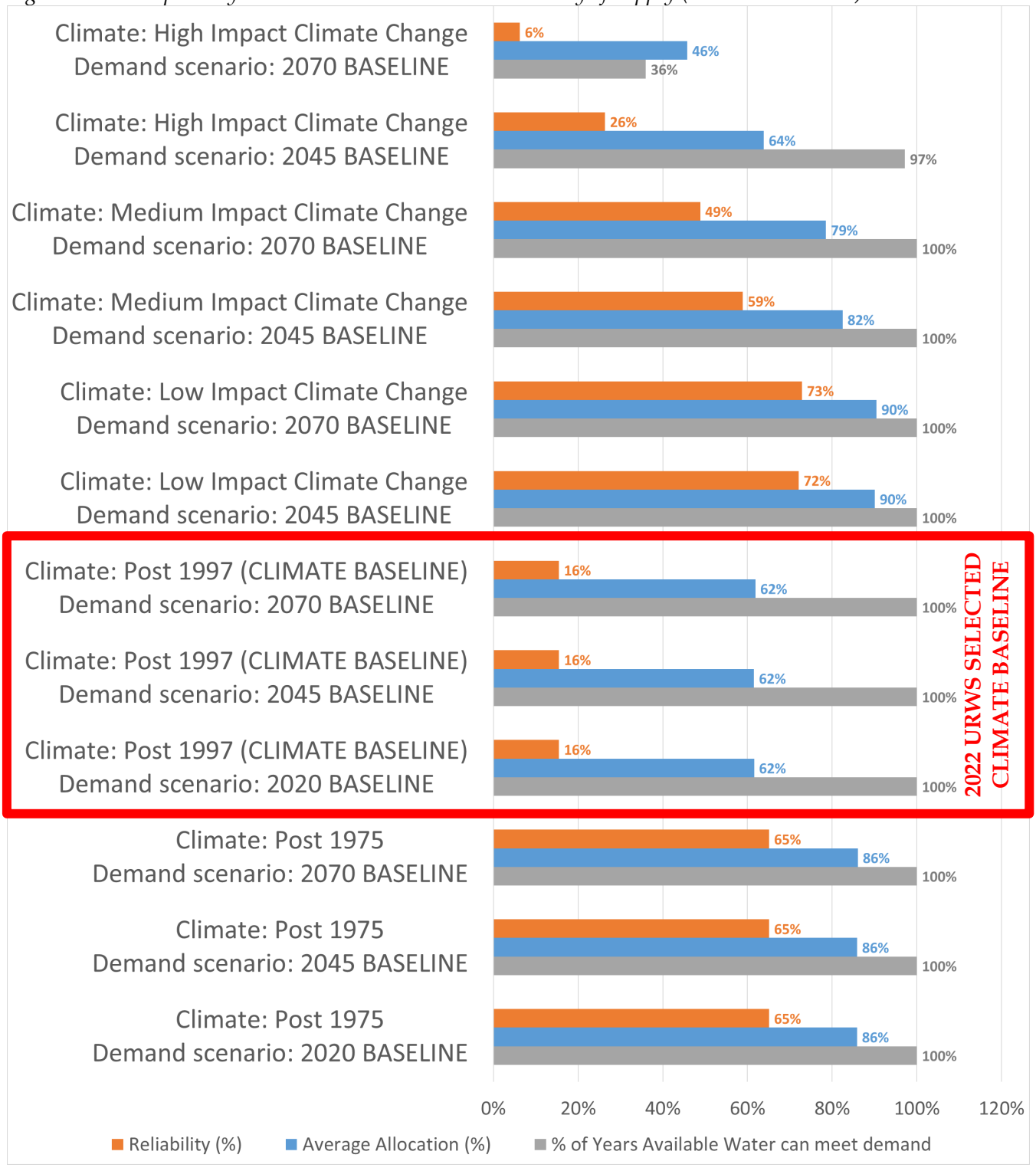
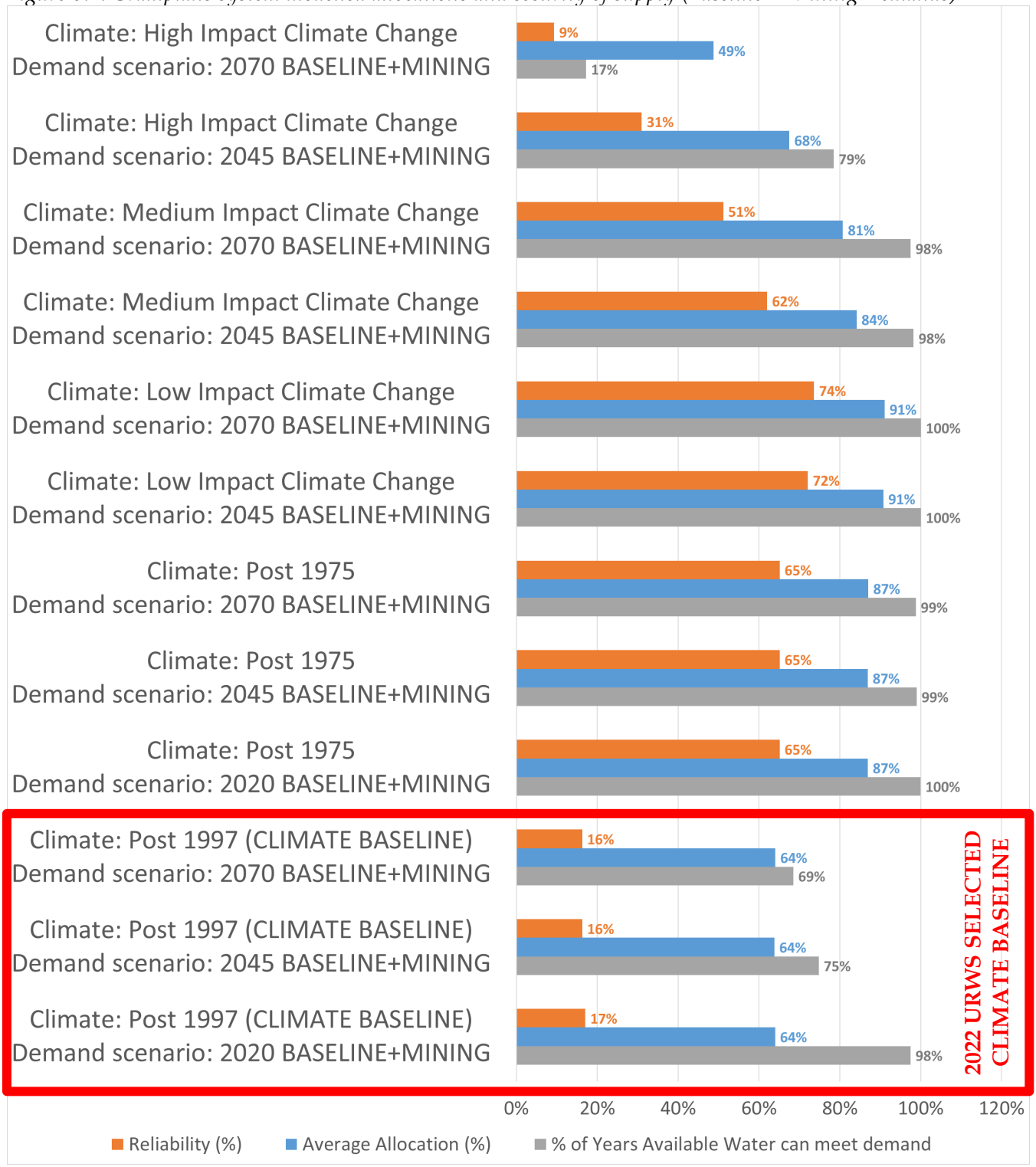


Figure 8.2: Grampians system modelled allocations and security of supply (Baseline + Mining Demands)



10.5.2. Murray and Goulburn Systems

Figure 8.3: Murray and Goulburn systems modelled allocation results (provided by DELWP)

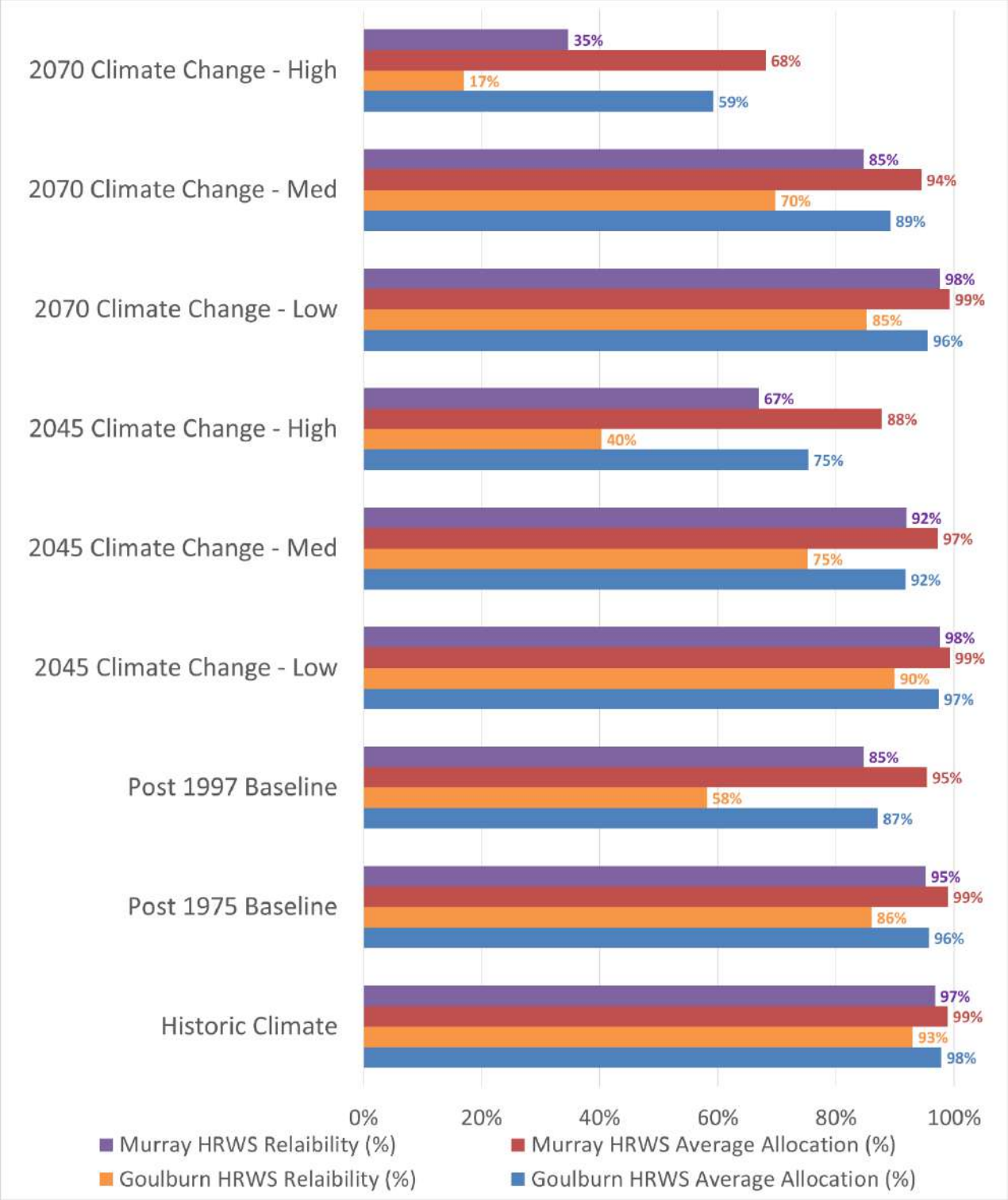
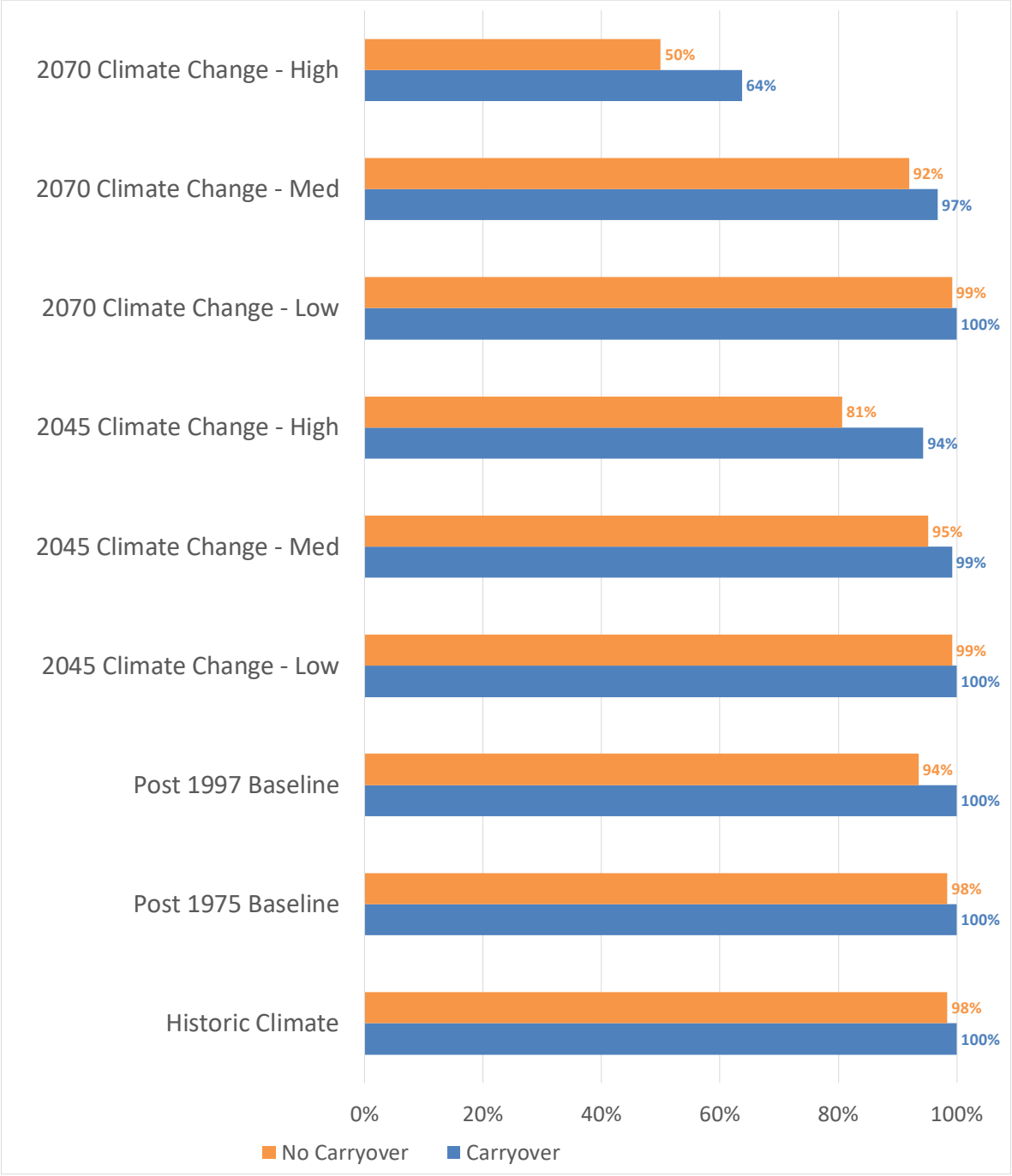


Figure 8.4: Percent of years unrestricted demand was assessed to be met in the Murray & Goulburn systems without carryover, and with carryover reserve of up to 3,000 ML



10.6 Appendix 6 – Stocktake of 2017-2021 Urban and Rural Water Strategy Actions

Action	Recommendation	Status February 2022
1	GWMWater to undertake further detailed assessments to determine the level of security GWMWater wishes to maintain for Murray/Goulburn supplied systems, and the appetite for exposure to the temporary water market to make up shortfalls in dry years.	Assessments have been completed. The operational management of GWMWater's Murray and Goulburn water entitlements and carryover is to be reviewed again as per 2022 U&RWS action.
2	GWMWater to work with the Storage Manager to investigate options or a framework which provides rules-based equitable access to reservoirs.	Matter is in progress through the Wimmera-Glenelg Headworks Operations Review.
3	Stawell Urban Reservoir operating rules are to be developed.	In progress, due to be completed in 2022.
4	Continuous streamflow monitoring should be installed upstream of Eastern Grampians diversion weirs to build understanding of water availability.	Eastern Grampians Rural Pipeline has negated the need to implement this action.
5	Develop Storage Operating Rules for Eastern Grampians Urban Storages.	Water security triggers have been developed for each of these urban storages.
6	GWMWater to undertake further assessment on which combination of options will best improve water security in the East Grampians water supply system.	Completed through the East Grampians Rural Pipeline Project.
7	Continuous streamflow monitoring should be installed on Hickman's and McLeod's Creeks to build understanding of water availability.	To be reassessed following the East Grampians Rural Pipeline construction, and water quality upgrades for Elmhurst.
8	Develop Storage Operating Rules for Elmhurst and Buangor Urban Storages.	Water security triggers have been developed for each of these urban storages.
9	Investigate an increase to the Buangor Bulk Entitlement volume to reflect improvements in bulk metering of diversions.	Not completed. To be reassessed following completion of bulk entitlement metering plan.
10	Continue current Edenhope groundwater monitoring regime and undertake a technical assessment 'health check' of the current supply to	Edenhope Bore Field Hydrogeological Review was completed in 2017.

	determine expected remaining life and identify triggers as to when resource is becoming stressed.	
11	GWMWater to commence work to apply for an increase in licence volume for Harrow.	Completed.
12	GWMWater to undertake further detailed assessments in conjunction with the Murray assessment (Recommendation 1) to determine the desired level of security GWMWater will maintain for Goulburn supplied systems, and the appetite for exposure to the temporary water market to make up shortfalls in dry years.	Assessments have been completed. The operational management of GWMWater's Murray and Goulburn water entitlements and carryover is to be reviewed again as per 2022 U&RWS action.

10.7 Appendix 7 - Drought Preparedness Plan

GWMWater Drought Preparedness Plan 2022
Document reference: R2022-10692