



BANNOCKBURN INTEGRATED WATER **MANAGEMENT PLAN**

FEBRUARY 2025



ACKNOWLEDGEMENT OF COUNTRY

Golden Plains Shire spans the traditional lands of the Wadawurrung and Eastern Maar people. We acknowledge them as the Traditional Owners and Custodians.

Council pays its respects to Wadawurrung Elders past, present and emerging. Council also respects Eastern Maar Elders past Present and Emerging.

Council extends that respect to all Aboriginal and Torres Strait Islander People who are part of the Golden Plains Shire.



| WATER IS LIFE

Bannockburn is situated within the traditional lands of the Wadawurrung People. We acknowledge them as the Traditional Owners and Custodians.

Golden Plains Shire Council pays its respects to Wadawurrung Elders past, present and emerging. The Wadawurrung people recognise the rivers and waterways on Wadawurrung Country as living entities and Traditional Owners are the voices that speak for their health and well-being. Cultural water and Cultural flows are the water that exists on country – because water is life. Without water, life suffers and ultimately cannot exist.

Cultural flows are water entitlements, that are owned or have decision making agency by Indigenous Nations over them, of a sufficient and adequate quantity and quality to improve spiritual, cultural, environmental, social and economic conditions of those Nations. Inherently, Cultural flows are to Heal Country and to enable us to undertake our obligations to care for country and to bring our lifeblood, water, back to its natural flowing state, so that it can continue to support Country, Culture and Community.

In 2020, Wadawurrung released “Paleert Tjaara Dja – Let’s make country good together”, 10-year Healthy Country Plan. This plan outlines the objectives, aspirations and obligations for water on Wadawurrung Country.

Rivers and water bodies are highly modified and under threat from increased and incorrect usage. They are heavily over allocated and are suffering from everlasting extraction for irrigation, industry and potable assets. On Wadawurrung Country, there are no remaining water allocations, leaving no water for Cultural flows. The majority of rivers on Wadawurrung Country are extensively licensed and over sold, while only receiving very small environmental entitlements and very limited passing flows.

From Wadawurrung’s perspective, rather than continually extract and license water from natural flowing systems, new sources of water like storm water and recycled water, through IWM projects, can be used as the asset for sale, on selling it to users like irrigators, golf courses and other major industry. By increasing the confidence of users for alternative water sources, waterways can begin to heal, and Wadawurrung Peoples can regain agency over what has always been theirs.

Water that exists on Wadawurrung Country, must stay on Country as it is part of the holistic wellbeing of that landscape. Water is not just an asset for sale, water has its own spirit and its own connection to Country, it needs to be healthy to be able to support Country. Water is the lifeblood of Country, without water life within Country cannot be.

Source: Adapted from Wadawurrung Traditional Owners Corporation IWM Statement.

FOREWARD

Golden Plains Shire is a unique and thriving community with a rich history and strong economy. The Shire's appealing lifestyle attracts many, and we anticipate significant population growth in the coming years.

While a growing population offers numerous benefits, it also presents challenges that could impact the quality of life we cherish in Bannockburn. One of the key challenges is water management, which requires innovative solutions in response to our changing climate. Water management in particular is a known challenge without simple fixes. To ensure Bannockburn becomes a water sensitive community, we must utilise a diverse array of water resources, manage stormwater flows to protect sensitive downstream environments and educate our staff and the community about the crucial role our water systems play in liveability and resilience.

This Integrated Water Management Plan for Bannockburn is a crucial tool for guiding our growth. This plan has been developed through extensive engagement with our water cycle management partners – Barwon Water, Corangamite Catchment Management Authority, Wadawurrung Traditional Owners Aboriginal Corporation and supported by the Department of Energy, Environment and Climate Action.

The plan identifies and explores a range of opportunities which are detailed in a comprehensive technical report. This summary highlights the most promising initiatives explored through the technical work. Moving forward, Council will work closely with our water cycle partners, developers and the Victorian Government to further explore these opportunities, design and build the infrastructure while managing the water cycle to support the healthy, safe, vibrant, prosperous and sustainable Bannockburn community.

The Action Plan within this plan includes a series of initiatives aimed at advancing water infrastructure planning and management. We are committed to reporting our progress on these actions in our Annual Report.



Cr Sarah Hayden
Mayor of Golden Plains Shire

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ACRONYMS

IWM	Integrated Water Management	VPA	Victoria Planning Authority
ML	Mega Litres	WRP	Water Recycling Plant
PSP	Precinct Structure Plan	WSUD	Water Sensitive Urban Design

INTRODUCTION

Water plays a critical role in creating liveable and resilient cities and towns. As our urban centres grow, and as a changing climate impacts rainfall patterns, consideration of how water is sourced, used and managed is crucial to a sustainable future.

This Integrated Water Management (IWM) Plan seeks to improve water cycle management in Bannockburn, delivering a greener and more liveable township. In doing so this plan also seeks to reduce potable water consumption, utilise alternative water resources, enhance landscapes, and improve waterway health.

IWM is a framework for water management authorities and stakeholders to understand the importance of water systems and water cycle processes, and collaboratively develop ways to manage the water cycle to deliver enhanced outcomes that align with community values.

This IWM Plan outlines a series of opportunities to improve management practices across Bannockburn over the coming 30 years. Critical water service requirements include water supply, sewage management, flood and stormwater management, and public open space irrigation and maintenance. Through delivering critical water services, and managing the water cycle holistically, a growing Bannockburn will become increasingly liveable and resilient.



Figure 1. Bannockburn township

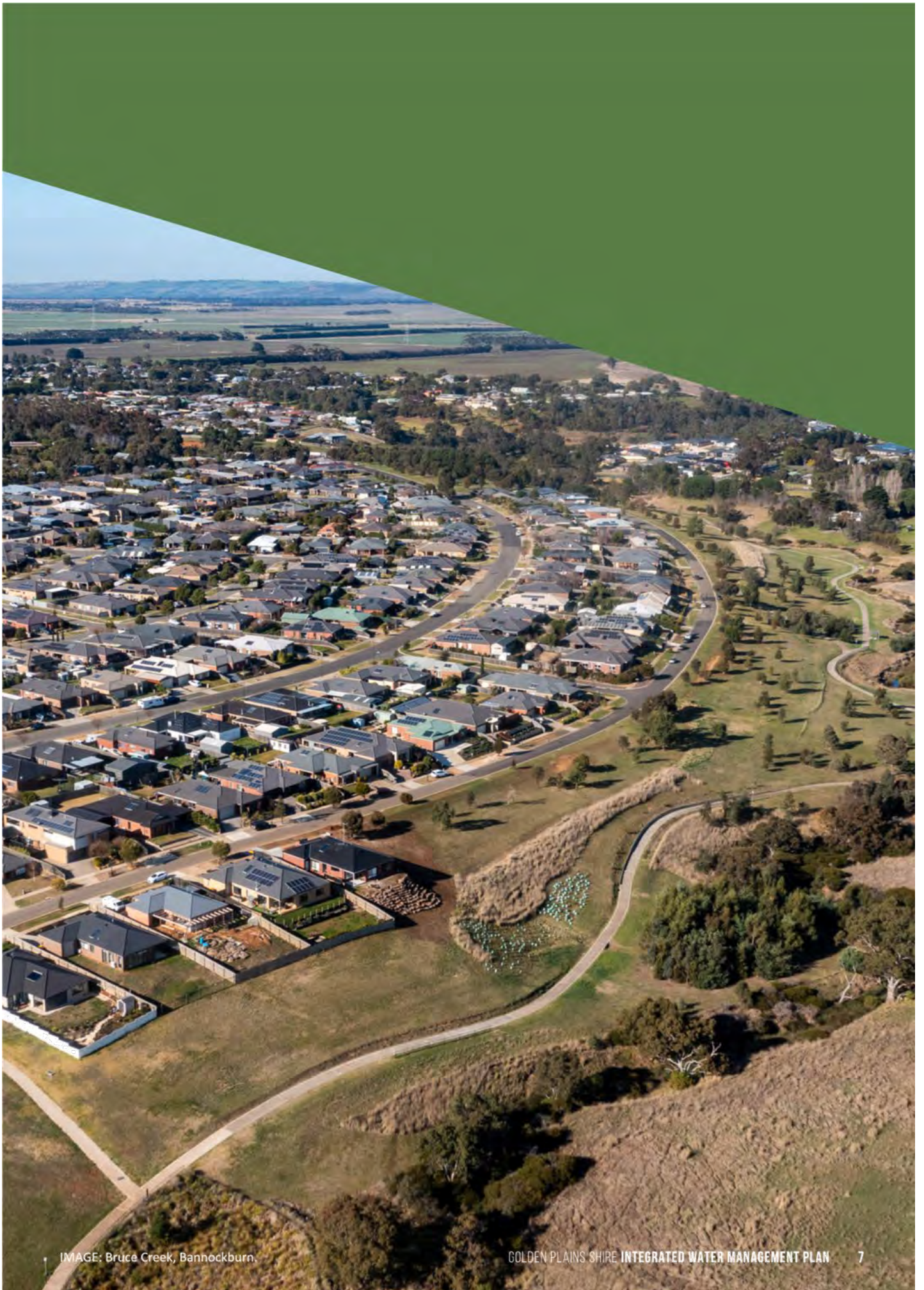


IMAGE: Bruce Creek, Bannockburn.

BANNOCKBURN – A GROWING TOWNSHIP

The land that is now known as Bannockburn was first inhabited by the Wadawurrung people of the Kulin Nation. The Wadawurrung people have lived in the Geelong region for many thousands of years and continue to have a deep connection to country.

In 1837, the area was surveyed by Europeans and soon after, pastoralists began to settle. During the mid-19th century, gold was discovered in the region around Bannockburn, and this led to a period of rapid growth and development within the town. As the gold rush came to an end, Bannockburn’s economy transitioned to agriculture. Today, Bannockburn is a thriving regional centre that has a rich history encompassing both Indigenous and European cultures.

Existing water cycle services for Bannockburn are as follows:

- * Bannockburn is serviced with drinking water sourced from the nearby Moorabool River, supported by supplies from Geelong and Melbourne when demand exceeds river supply.

- * Bannockburn is partially sewered, with some housing serviced through on-lot septic tanks. Sewage that is reticulated is treated at the Bannockburn water reclamation plant, which produces Class C recycled water.
- * Recycled Water is utilised for the irrigation of the Bannockburn Golf Course and adjacent agriculture.
- * The bulk of stormwater generated across the township is collected and treated in raingardens and wetlands before being discharged to Bruce Creek.
- * Open spaces are irrigated with potable water.

It is also recognised that low permeability soils are present across Bannockburn.

The approximate water balance for Bannockburn is shown in Figure 2.

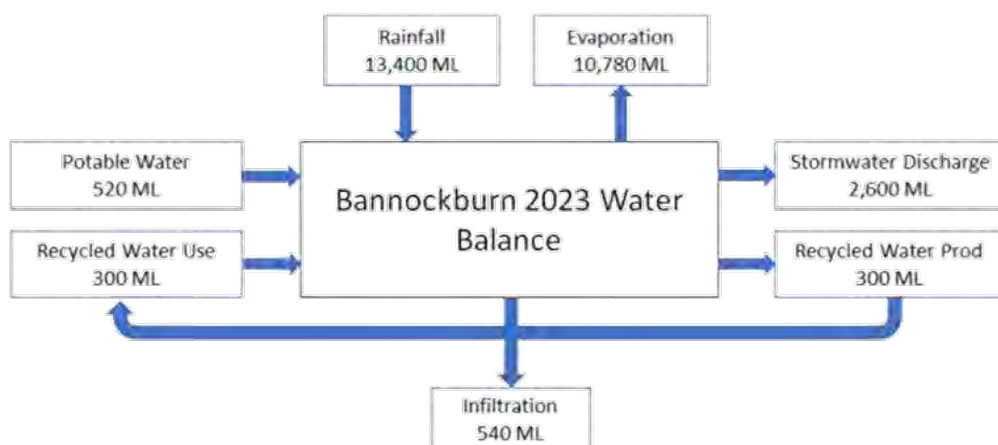


Figure 2. Current Township Water Balance

Bannockburn is projected to grow significantly through to 2050 and beyond. The Bannockburn Growth Plan (2021) was developed by the Victorian Planning Authority (VPA), in partnership with Golden Plains Shire Council, to inform the sustainable development of Bannockburn through to the 2050.

The 2021 Census counted a population of 6,178 for Bannockburn. By 2041 this population is expected to grow to almost 20,000 and over 25,000 by 2050.

The proposed Bannockburn Growth Areas are located in the north-west, south-west and the south-east of the township as shown in Figure 3.



Figure 3. Bannockburn Growth Plan concept plan

If a business as usual water cycle management approach were taken in servicing these new growth areas, the volumes of water to be managed would change significantly:

- An increase in potable water demand of 680 ML per year (+130%)
- An increase in sewage management of 540 ML per year (+180%)
- An increase in stormwater runoff of 1900 ML per year (+75%)
- An increase in open space irrigation demand of 80 ML per year (+500%)
- A reduction in infiltrated stormwater of 90 ML per year (-17%)

EXISTING ISSUES AND PROJECTED CHALLENGES

Bannockburn township is located within an area subject to water security and wastewater management challenges. The impending growth in Bannockburn will add to these challenges. Additionally the increase in urban stormwater runoff has the potential to degrade the values of Bruce Creek.

Water for Bannockburn is supplied from several sources. Outside the urban area, farm dams capture rural runoff to provide water for stock watering. Recycled water is also available and is used by the golf course and for agriculture adjacent to the water reclamation plant. Drinking water is sourced from the Moorabool River, which has historically serviced townships across the Golden Plains region. As these townships have grown, and as climate change has reduced the reliability of rainfall in the Moorabool River catchment, supply from Geelong to service Bannockburn has become important. This additional water is sourced from local and Melbourne supplies. And as Bannockburn grows, it is likely that desalinated water will become part of the supply mix.

Areas of Bannockburn are not currently sewered, with septic tanks servicing the older parts of town. The new growth areas will be sewered, with increased sewage volumes being processed through an augmented Bannockburn water reclamation plant. Recycled water generated cannot be beneficially discharged to Bruce Creek, and so there will be additional volume of recycled water to be managed.

The increased urban footprint of a growing Bannockburn will result in increased stormwater runoff and reduced base flows. Downstream of Bannockburn, the Moorabool River and the Barwon River provide critical flows to the Ramsar Convention recognised Lake Connearre. There is potential for the stormwater discharge generated from Bannockburn to negatively impact these water bodies.

To manage the environmental impact of urban development on waterways, water sensitive urban design infrastructure will continue to be built. There is potential that this infrastructure can do more than only treat stormwater, it can also harvest and infiltrate stormwater. This harvested and infiltrated stormwater can then also be used to meet environmental shortfalls and urban demands. Golden Plains Shire Council will see additional irrigation demand for water in the development of recreation spaces, supply with alternative water can reduce the cost of maintaining these assets while also delivering environmental outcomes.

A holistic integrated approach to managing these challenges will see solutions delivering multiple outcomes, and in doing so, demonstrate economic feasibility and environmental sustainability.

STRATEGIC DRIVERS	CONTEXT
Drinking Water Supplies	The region is becoming increasingly dependent on imported drinking water to meet a growing demand
Recycled Water Management	Increasing recycled water generation needs to be sustainably managed.
Flooding	Nuisance flooding is experienced in parts of Bannockburn. New development areas will require flood retardation infrastructure.
Healthy Waterways	Bruce Creek contains ecological values and is highly valued by the community. Very high value water bodies are downstream.
Healthy Landscapes	Existing and future open spaces will require water to maintain vegetation.
Community Values	The community is active in environmental outcomes across Bannockburn.
Innovation and Economic Outcomes	Water can be used to supply agriculture and industry, supporting employment.



STRATEGIC DIRECTION

VISION

Through extensive engagement with Golden Plains Shire Council staff and stakeholders, an IWM Vision for Bannockburn was developed.

Bannockburn will grow as a water sensitive township, with water supporting liveability and resilience within the community, and a thriving environment.

This vision for Bannockburn and Bruce Creek, recognises the role of water in our communities, landscapes and environment. Water is important for our health and wellbeing, and to support and attract agriculture, businesses and industry. The water cycle for Bannockburn needs to provide for the needs of the community and environment, even in times of scarcity and in the face of climate change.

Water management across Bannockburn requires collaborative planning that contributes towards enhancing environmental flows and systems, considers alternative water use, stormwater management, and supports a liveable, sustainable and healthy community.

OBJECTIVES

The following objectives and outcomes aligns Bannockburn's water cycle aspirations with Council's Strategic Plan, the Barwon Region IWM Forum and stakeholder strategies.

Objective 1: Community values are reflected in the way water is used and managed

Outcomes:

- Reduction in potable water usage
- Increased usage of fit-for-purpose alternative water supplies in households
- Traditional owner values are considered in water cycle management
- The community is informed and educated on the water cycle

Objective 2: Water enables a green and liveable Bannockburn

Outcomes:

- Open spaces are supported through alternative water supplies
- Street tree canopy is supported through alternative water provision
- Water cycle management is promoted through highly visible projects



Objective 3: The sustainability of waterways and landscapes is supported by water

Outcomes:

- Waterways are protected from the detrimental impacts of development and supported through improved water cycle management, including stormwater harvesting and beneficial release
- WSUD infrastructure is built and managed to provide benefits into the long term

Objective 4: Water creates opportunity and economic prosperity of Bannockburn

Outcomes:

- Agriculture and industry are supported by alternative water supplies

TARGETS

The following targets were developed to be measures demonstrating the effectiveness of this IWM Plan. Actions are developed to achieve these targets.

Table 1. IWM Plan Targets

#	OBJECTIVE	#	TARGETS	TIMEFRAME
1	Community values are reflected in the way water is used and managed	1.1	100% of public buildings and sports pavilions fitted with rainwater tanks and plumbed to toilets	10 years
		1.2	Rainwater tanks, connected to toilets, laundry and gardens, installed across 100% new residential properties	10 years
		1.3	New water management infrastructure, such as wetlands and alternative water supply schemes, referred to Wadawurrung Traditional Owners Aboriginal Corporation for input into design, construction and ongoing maintenance	5 years
		1.4	IWM education signage installed on 100% of new high priority WSUD assets	5 years
2	Water enables a green and liveable Bannockburn	2.1	100% of active public open spaces irrigated with alternative water supplies	10 years
		2.2	100% of new street trees supported through passive stormwater irrigation	10 years
		2.3	Blue-green infrastructure installed on 3 high priority streetscapes	10 years
3	The sustainability of waterways and landscapes is supported by water	3.1	Bruce Creek predevelopment volumes and flow rates restored through managed stormwater harvesting.	20 years
		3.2	WSUD assets designed, built and operated to industry best practice (100%)	5 years
4	Water creates opportunity and economic prosperity of Bannockburn	4.1	50% increase in beneficial use of alternative water supplies by agriculture and industry	10 years
		4.2	100% excess stormwater generated across Bannockburn is beneficially reused	20 years

WATER CYCLE OPPORTUNITIES

The following water cycle management opportunities were developed to better manage the water of a growing Bannockburn. The seek to integrate the water cycle, reducing the need for import of water, to protect valued waterways and to educate the community on the importance of water management. The opportunities demonstrate how the objectives will be realised, which targets they will contribute to and what is needed to be done to start the implementation process.

MANAGING STORMWATER VOLUME TO PROTECT WATERWAY VALUES

Excess stormwater flows are collected and treated in wetlands throughout the growth areas of Bannockburn. Stormwater is harvested from these wetlands, stored and if required treated further. This stormwater could be transferred back to Bruce Creek to offset upstream extractions, or transferred to a regional stormwater management system being considered for the Northern and Western Geelong Growth Areas.

OBJECTIVE	TARGET	ACTION
The <u>sustainability</u> of waterways and landscapes is supported by water	Bruce Creek predevelopment volumes and flow rates restored through managed stormwater harvesting.	Develop stormwater harvesting concept: <ul style="list-style-type: none"> Analyse flows within Bruce Creek and determine optimal flow regime Determine infrastructure requirements and management Build a business case for initial and future investment
Water creates opportunity and economic <u>prosperity</u> of Bannockburn	100% excess stormwater generated across Bannockburn is beneficially reused	

RAINWATER TANKS FOR TOILET FLUSHING, LAUNDRY AND IRRIGATION

Installation of rainwater tanks on all new buildings to provide rainwater for toilet flushing, laundry and garden irrigation demands.

OBJECTIVE	TARGET	ACTION
<u>Community values</u> are reflected in the way water is used and managed	100% of public buildings and sports pavilions fitted with rainwater tanks and plumbed to toilets Rainwater tanks, connected to toilets, laundry and gardens, installed across 100% new residential properties	Enable rainwater tank installation: <ul style="list-style-type: none"> Embed requirement for rainwater tank installation on all lots in PSP/ Planning Schemes Develop plumbing specification, including optimal tank size Engage with developers to communicate requirement and process for compliance with rainwater tank installation

PASSIVELY IRRIGATED STREET TREES

Street tree growth can be supported through provision of additional water. This initiative proposes to construct a small underground water storage with each street tree which can be filled with roof water or street stormwater runoff. This water would be released slowly to the soil to support street trees, increasing canopy cover and reducing the urban heat island effect.

OBJECTIVE	TARGET	ACTION
Water enables a green and <u>liveable</u> Bannockburn	100% of new street trees supported through passive storm-water irrigation	Enable passive street tree irrigation installation: <ul style="list-style-type: none"> • Embed requirement for passive street tree irrigation system installation for all street trees in PSP/Planning Schemes • Develop design specification for passively irrigation system • Engage with developers to communicate requirement and process for compliance with passive irrigation system installation.

CLASS C RECYCLED WATER SUPPLY FOR PUBLIC OPEN SPACE IRRIGATION

As Bannockburn grows, and additional recycled water volumes are generated, this recycled water could be supplied to the township to irrigate public open spaces. Existing demands are present at the active open space sites within Bannockburn Town Centre, with future demand from open spaces in each of the growth areas. This option contributes to responsible management of treated effluent, which also reduces potable water demand.

OBJECTIVE	TARGET	ACTION
Water enables a green and <u>liveable</u> Bannockburn	100% of active public open spaces irrigated with alternative water supplies	Collaborate with Barwon Water to explore recycled water supply for existing and new public open spaces across Bannockburn, and explore funding mechanisms.



IMAGE: Example of recycled water infrastructure for open space irrigation, image courtesy of DEECA

KERB CUT-OUTS

Stormwater runoff from roads may be directed to open spaces for absorption and infiltration instead of directing the runoff to the drainage system. This would increase the water available for vegetation in open spaces while reducing the discharge of detrimental runoff to waterways. Systems must be designed for local conditions such as low permeability soil.

OBJECTIVE	TARGET	ACTION
The <u>sustainability</u> of waterways and landscapes is supported by water	WSUD assets designed, built and operated to industry best practice (100%)	Enable kerb cut-out installation: <ul style="list-style-type: none"> • Embed requirement for kerb cut-out installation for appropriate locations in PSP/Planning Schemes • Develop design specification for kerb cut-out infrastructure • Engage with developers to communicate requirement and process for compliance with kerb cut-out installation

REVIEW AND RECTIFY EXISTING WSUD

Several existing WSUD assets across Bannockburn are inefficient and require work to get them providing the outcomes for which they were designed. These installations require detailed assessment of their effectiveness in treating stormwater, and a program developed to modify the WSUD systems and improve their functionality.

OBJECTIVE	TARGET	ACTION
The <u>sustainability</u> of waterways and landscapes is supported by water	WSUD assets designed, built and operated to industry best practice (100%)	Undertake review of functionality of existing WSUD infrastructure and develop a rectification plan where required.

RECYCLED WATER / STORMWATER FOR AGRICULTURE / INDUSTRY

Stormwater flows can be collected from treatment wetlands and pumped to a storage at the Bannockburn WRP. These stormwater volumes could then be combined with Class C recycled water generated and this combined water would be supplied to agriculture and industry through an expanded recycled water supply network. With a sufficiently large network, this option could manage both excess stormwater and recycled water for beneficial reuse. It is also compatible with open space reuse.

OBJECTIVE	TARGET	ACTION
Water creates opportunity and economic <u>prosperity</u> of Bannockburn	50% increase in beneficial use of alternative water supplies by agriculture and industry 100% excess stormwater generated across Bannockburn is beneficially reused	Engage with Barwon Water to understand how Golden Plains Shire Council can support the increased provision of recycled water for industry and agriculture.

STORMWATER HARVESTING FOR ACTIVE OPEN SPACE IRRIGATION

Stormwater generated from impervious area across Bannockburn may be used to irrigate open spaces. Stormwater flows can be collected and treated in wetlands located throughout the development. Stormwater is treated and conveyed by gravity to an open water storage adjacent to the wetland or open space. Water would then be pumped from this storage, be filtered and supplied at irrigation pressure to the open space irrigation system.

OBJECTIVE	TARGET	ACTION
Water creates opportunity and economic prosperity of Bannockburn	50% increase in beneficial use of alternative water supplies by agriculture and industry 100% excess stormwater generated across Bannockburn is beneficially reused	Develop localised stormwater harvesting for public open space irrigation concept, and compare with recycled water supply opportunity.

INFILTRATION WETLANDS

Urban areas reduces the ability of rainfall to infiltrate into the subsoil and replenish shallow groundwater, which provides baseflow to waterways. To restore baseflows wetlands can be constructed to facilitate infiltration, allowing water collected in wetlands to soak into the soil. While the soil across Bannockburn is of low permeability, wetland design and reducing extent of clay liner is expected to facilitate a degree of infiltration.

OBJECTIVE	TARGET	ACTION
The sustainability of waterways and landscapes is supported by water	Bruce Creek predevelopment flows restored through managed stormwater harvesting.	Enable infiltration wetland installation: <ul style="list-style-type: none"> • Embed requirement for infiltration functionality for all treatment wetlands in PSP/Planning Schemes • With reference to Melbourne Water’s wetlands design guidelines, develop design specification for infiltrating functionality • Engage with developers to communicate requirement and process for compliance with infiltrating wetland installation



REVIEW INFRASTRUCTURE DESIGN MANUAL

The Infrastructure Design Manual, a joint initiative of Victorian rural and regional councils, outlines consistent requirements and standards for the design and development of infrastructure. This manual can be reviewed in the context of the enhanced water cycle outcomes this IWM Plan is seeking to deliver including how infrastructure is developed and who is engaged through that process. An Addendum, specific to the needs of Golden Plains Shire Council, could be created. E.g. to incorporate infiltration functionality into wetlands.

OBJECTIVE	TARGET	ACTION
Community values are reflected in the way water is used and managed	New water management infrastructure, such as wetlands and alternative water supply schemes, referred to Wadawurrung Traditional Owners Aboriginal Corporation for input into design, construction and ongoing maintenance	Engage with internal teams and explore the benefits of reviewing the WSUD design specifications outlined in the Infrastructure Design Manual within the context of the Bannockburn IWM Plan.
	IWM education signage installed on 100% of new WSUD assets	
The sustainability of waterways and landscapes is supported by water	WSUD assets designed, built and operated to industry best practice (100%)	

EDUCATE STAFF ON IWM

Run education sessions for Golden Plains Shire Council councillors and staff to improve water literacy and support for IWM projects across the municipality.

OBJECTIVE	TARGET	ACTION
All objectives	All targets	Engage with internal teams and explore the benefits of educating staff in Integrated Water Management, and if viewed as worthwhile, engage a consultant to design a program run a session(s) with council staff.

EDUCATE COMMUNITY ON IWM

Run an education session for Golden Plains Shire Council community members and groups to improve water literacy and support for IWM projects across the municipality.

OBJECTIVE	TARGET	ACTION
All objectives	All targets	Engage with internal teams and explore the benefits of engaging with the community in Integrated Water Management, and if viewed as worthwhile, develop a program for community engagement.

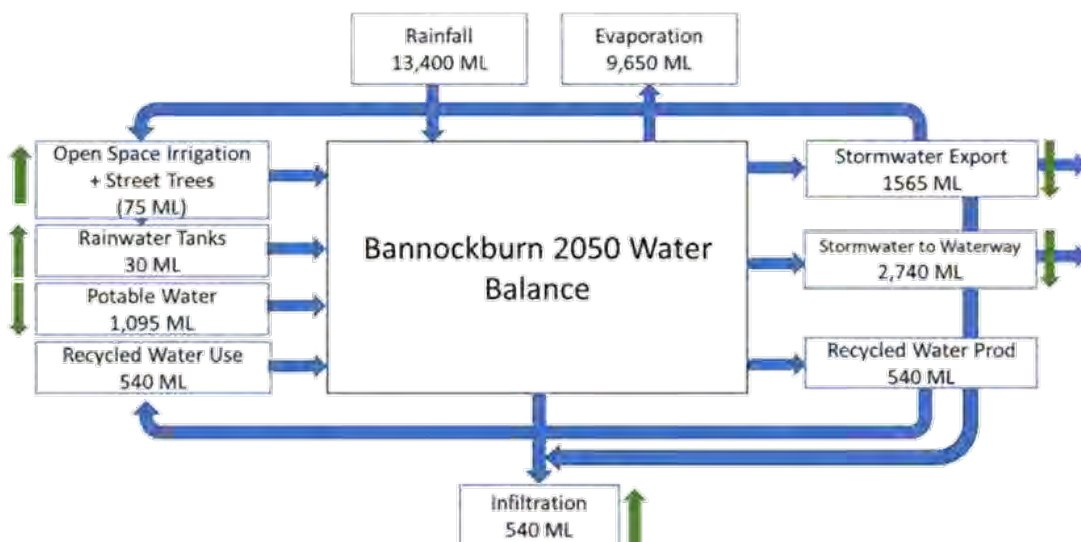
PRIORITY BLUE-GREEN INFRASTRUCTURE

Installation of water sensitive urban design assets within the Bannockburn town centre. This initiative would provide real water quality improvement, and would encourage the community to engage with the water cycle, facilitating improvement in water literacy.

OBJECTIVE	TARGET	ACTION
Water enables a green and <u>liveable</u> Bannockburn	Blue-green infrastructure installed on 3 high priority streetscapes	Engage with internal teams and explore the potential for high profile blue green infrastructure within the Bannockburn town centre.

REALISING THE BENEFITS

The implementation of these opportunities will realise a significantly improved water cycle.



In this way potable water usage is reduced, recycled water resources are beneficially reused and Bruce creek is protected from harmful stormwater flows.

ACTION PLAN

ACTION DESCRIPTION	OPTION	OUTCOME/ TARGET	TIMING	PRIORITY	RESOURCES REQUIRED	COLLABORATIVE PARTNERS
1 Establish internal governance structure for the implementation of the Bannockburn IWM Plan actions. This includes formation of a cross-disciplinary working group and regular reporting mechanisms.	All	All	2024	High	Environment and Open Space Planning Asset Services	
2 The Bannockburn IWM Plan is supported by Barwon IWM forum with participation from collaboration partners to provide direction and advocate for resources for its delivery.			Ongoing	High	Environment	Barwon IWM Forum Members
3 Finalise growth areas wide IWM approach with BW and communicate to VPA for inclusion in PSPs, and incorporate into planning schemes	All	All	2025	High	Planning Environment	Barwon Water Victorian Planning Authority
4 Develop stormwater harvesting concept including: 4.a) Analyse flows within Bruce Creek and determine optimal flow regime 4.b) Determine infrastructure requirements and management 4.c) Build a business case for initial and future investment	1	3.1 4.2	2026 2026-27 2027	High High High	Consultant Environment Asset Services Planning	Corangamite Catchment Management Authority Barwon Water
5 Enable rainwater tank installation: 5.a) Embed requirement for rainwater tank installation on all lots in PSP/ Planning Schemes 5.b) Develop plumbing specification, including optimal tank size 5.c) Engage with developers to Develop process to enable compliance with rainwater tank installation	2	1.1 1.2 3.1 4.2	2025 2026 2026-27	High High High	Consultant Environment Asset Services Planning	Developers

	ACTION DESCRIPTION	OPTION	OUTCOME/ TARGET	TIMING	PRIORITY	RESOURCES REQUIRED	COLLABORATIVE PARTNERS
6	Enable passive street tree irrigation installation including: 6.a) Embed requirement for passive street tree irrigation system installation for all street trees in PSP/ Planning Schemes 6.b) Develop design specification for passively irrigation system 6.c) Engage with developers to enable requirement and process for passive irrigation system installation.	3	2.2 3.1 4.2	2026 2026 2026-27	High High	Consultant Environment Asset Services Planning	Developers
7	Collaborate with Barwon Water to explore recycled water supply for existing and new public open spaces across Bannockburn and explore funding mechanisms. Engage with Barwon Water to understand how GPSC can support Barwon Water to increase provision of recycled water for industry and agriculture. Ensure development of necessary community education and awareness campaigns around safety/assurance of recycled water.	4, 7	2.1 4.1	2026	High	Environment and Open Space Asset Services Planning	Barwon Water
8	Enable kerb cut-out installation including: 8.a) Embed requirement for kerb cut-out installation for appropriate locations in PSP/Planning Schemes 8.b) Develop design specification for kerb cut-out infrastructure 8.c) Engage with developers to enable requirement and process for kerb cut-out installation	5	4.1	2025 2026 2026-27	High High	Consultant Environment Asset Services Planning	
9	Undertake review of functionality of existing WSUD infrastructure. Also explore options to independently review/assess engineering solutions submitted to Council.	6	3.1 3.2	2026	Medium	Consultant Environment Asset services	
10	Engage with internal teams and explore the benefits of educating staff in Integrated Water Management, and if viewed as worthwhile, engage a consultant to design a program run a session(s) with council staff.	11	1.4	2027	Medium	Consultant Environment	
11	Engage with internal teams and community groups to explore the benefits of engaging with the community in Integrated Water Management, and if viewed as worthwhile, develop a program for community engagement.	12	1.4	2027	Medium	Environment Community development	Community Groups - Friends of the Barwon - People for A Living Moorabool

ACTION DESCRIPTION	OPTION	OUTCOME/ TARGET	TIMING	PRIORITY	RESOURCES REQUIRED	COLLABORATIVE PARTNERS
12 Develop localised stormwater harvesting for public open space irrigation concept, and compare with recycled water supply proposal.	8	3.1	2026	Medium	Consultant Environment and Open Space Asset services Planning	Barwon Water
13 Enable infiltration wetlands installation including: 13.a) Embed requirement for infiltration functionality for all treatment wetlands in PSP/Planning Schemes 13.b) With reference to Melbourne Water's wetlands design guidelines, develop design specification for infiltrating functionality 13.c) Engage with developers to enable requirement and process for infiltrating wetland installation.	9	3.1	2025 2026 2026-27	High High High	Consultant Environment Asset services	Melbourne Water Corangamite Catchment Management Authority
14 Engage with internal teams and explore the benefits of reviewing the WSUD design specifications outlined in the Infrastructure Design Manual within the context of the Bannockburn IWM Plan.	10	3.2	2027	Medium	Environment Asset services Planning	
15 Engage with Regional Stormwater Management programs including the Northern and Western Geelong Bannockburn Growth Areas Adaptive Stormwater Volume Management Project to improve the understating of waterway health and identify potential stormwater interventions in the growth areas.	1	3.1,4.2	2025-26	Medium	Environment Asset services Planning	Barwon Water
16 Engage with internal teams and community groups to explore the potential for high profile blue green infrastructure within the Bannockburn town centre.	13	1.3 1.4 2.2 2.3	2027	Medium	Environment	Community Groups - Friends of the Barwon - People for A Living Moorabool
17 Update Action Plan to incorporate findings from the first 12 months of plan implementation and resources available.	All	All	2026	High	Environment	

MONITORING, EVALUATION, REPORTING AND IMPROVEMENT

The real value of any plan or strategy lies in its implementation. The vision, objectives, targets and actions that comprise this IWM Plan will be realised through commitment from Golden Plains Shire Council and supported through governance systems to monitor, evaluate, report and improve its implementation.

As projects are implemented, Golden Plains Shire Council will utilise the Monitoring, Evaluation, Reporting and Improvement (MERI) framework to ensure outcomes are progressing and stakeholders are receiving value for participation. The MERI framework is designed to fit within council's project management, reporting and prioritisation structures. A MERI framework should also be specifically developed for the management of Bruce's Creek, with the assessment of IWM measures directly tied to the ongoing state of this waterway.

The progress of the implementation of this plan will be reported on through the Annual Report for Council, in a similar manner to other strategic initiatives and sustainability activities.





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2 Pope Street, Bannockburn, VIC 3331
19 Heales Street, Smythesdale, VIC 3351
PO Box 111, Bannockburn, VIC 3331

☎ 5220 7111
✉ enquiries@gpslains.vic.gov.au
🌐 goldenplains.vic.gov.au

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BANNOCKBURN INTEGRATED WATER MANAGEMENT PLAN

PREPARED FOR GOLDEN PLAINS SHIRE COUNCIL

12 NOVEMBER 2024

This report has been prepared by the office of Spiire
Level 6, 414 La Trobe Street PO Box 16084 **Melbourne** Victoria 8007

Acknowledgements and Recognition

Kate Milburn – Golden Plains Shire Council
Laura Murphy – Golden Plains Shire Council
Daniel Murrhy – Golden Plains Shire Council
Luke Purcell – Golden Plains Shire Council
Rhys Bennet – Barwon Water
Sean Keown – Barwon Water
Claire Mennen – Wadawurrung Traditional Owners Aboriginal Corporation
Jayden Woolley – Wadawurrung Traditional Owners Aboriginal Corporation

Issue Date	Rev No	Authors	Checked	Approved
8 Feb 2024	1	M. Taylor	N. Corby	N. Corby
11 Apr 2024	2	M. Taylor	A. Davidson	N. Corby
11 Jul 2024	3	N. Corby	-	N. Corby
12 Nov 2024	4	N. Corby	N. Corby	A. Brown

Spiire Job Number: 320487

Citation: Spiire 2024, BANNOCKBURN INTEGRATED WATER MANAGEMENT PLAN Report for GOLDEN PLAINS SHIRE COUNCIL Authors: M. Taylor, G. Gallucci, N. Corby, Spiire Australia Pty Ltd. Project Number 320487

File Name: 320487-REP-SW-01-BANNOCKBURN IWM PLAN (Final).docx

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Cover photo – Bruce Creek, Bannockburn: Courtesy of Nigel Corby, Spiire

ACKNOWLEDGEMENT OF COUNTRY

Bannockburn is situated within the traditional lands of the Wadawurrung People. We acknowledge them as the Traditional Owners and Custodians.

Spiire and Golden Plains Shire Council pay respect to Wadawurrung Elders past, present and emerging.



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EXECUTIVE SUMMARY

This Integrated Water Management (IWM) Plan has been developed to support Golden Plains Shire Council (GPSC), and the wider IWM network, in managing the impacts and demands of urbanisation and population growth in Bannockburn. Urbanisation and population growth cause significant changes to the water cycle, and without planning and collaboration across the water cycle service providers and stakeholders, these changes can degrade waterways and landscapes, and impact water security.

In response to the projected growth of Bannockburn, the Barwon IWM Forum has identified the development of this IWM Plan as critical in securing the sustainability of water resources in the region and the resilience of waterways and landscapes. GPSC has engaged Spiire Australia Pty Ltd to conduct the investigations and stakeholder engagements required to develop this IWM Plan. The investigations conducted to develop this IWM Plan have included:

1. Situational analyses of the Bannockburn township (current and projected conditions)
2. Reviews of the policies and strategies of organisations across the IWM network
3. Reviews of the water management systems in Bannockburn
4. Existing and future state water cycle analysis of Bannockburn
5. Identification of existing water management issues and projected challenges
6. Development of the IWM Vision and Objectives
7. Identification of IWM Opportunities
8. Assessment of IWM Opportunities
9. Development of Concept Designs for recommended regional scale IWM Opportunities
10. Discussion of a Monitoring, Evaluation, Reporting and Improvement (MERI) Framework

An IWM vision, objectives and targets were established in this plan. The IWM vision, objectives and targets are primarily informed by the *Golden Plains Shire Council Plan* and the Strategic Outcomes established by the Barwon Water IWM Forum, and are influenced by policies and visions across the IWM network. The IWM vision and objectives established in this IWM plan are:

Vision: Bannockburn will grow as a water sensitive township, with water supporting liveability and resilience within the community, and a thriving environment.

Objective 1: Community values are reflected in the way water is used and managed

Objective 2: Water enables a green and liveable Bannockburn

Objective 3: The sustainability of waterways and landscapes is supported by water

Objective 4: Water creates opportunity and economic prosperity of Bannockburn

A long list of IWM opportunities at the lot, precinct, and regional scale, were identified and explored through a series of workshops held with GPSC, Barwon Water, Corangamite Catchment Management Authority and Wadawurrung Traditional Owners Aboriginal Corporation. These opportunities were explored through a qualitative assessment framework and narrowed down to a short list of 13 opportunities, which are recommended for further exploration. These 13 IWM opportunities are:

1. Managing stormwater volume to protect waterway values
2. Rainwater tanks for toilet flushing, laundry and irrigation
3. Passively irrigated street trees
4. Class C recycled water supply for public open space irrigation
5. Stormwater Kerb Cut-Outs



6. Review and rectify existing WSUD
7. Recycled water/ stormwater for agriculture/ industry
8. Stormwater harvesting for active open space irrigation
9. Infiltration Constructed Wetlands
10. Review Infrastructure Design Manual (IDM) to better facilitate IWM
11. Educate GPSC staff on IWM to increase engagement and implementation
12. Educate the Golden Plains Community on IWM
13. Prioritise blue-green infrastructure

An IWM Options Portfolios was subsequently presented. This of all the shortlisted options, and must be delivered adaptively as stormwater or recycled water for public open space must be decided on. Critically, the IWM Portfolio requires significant collaboration with Barwon Water, Corangamite Catchment Management Authority and Wadawurrung Traditional Owners Aboriginal Corporation.

An Action Plan has been developed to guide stakeholder collaboration and realisation of opportunities that comprise both portfolios. While Targets are set over a 10 year period, the Action Plan outlines the actions for GPSC to undertake over the initial 18 months of the IWM Plan. Some of these actions involve collaboration, with other stakeholders and require council to partner with other water cycle management or planning organisations to work through investigations and designs. This 18 months of actions are intended to provide a foundation for the ongoing implementation of the IWM Plan which will require further actions to be identified, committed to and implemented.

This IWM Plan will create a foundation for the town to develop in a manner that is sensitive to the water cycle and will protect and enhance the water cycle value in Bannockburn for future generations.

The 18-month Action Plan timeline will enable authorities and stakeholders to develop and explore in more detail the IWM opportunities for Bannockburn.



1. INTRODUCTION

Spiire Australia Pty Ltd has been engaged by Golden Plains Shire Council (GPSC) to prepare an Integrated Water Management (IWM) Plan for the expanding township of Bannockburn. The recommendations outlined in this IWM Plan address existing water management issues and support the significant development planned for Bannockburn across 30 plus years. The development and implementation of this IWM Plan is critical in securing the sustainability of water resources and the resilience of waterways affected by the growth and development of Bannockburn.

As outlined in the *Barwon IWM Strategic Directions Statement* (2018), this project is an important opportunity to improve water cycle management in the region and is supported by the Department of Energy, Environment and Climate Action (DEECA). In developing and implementing this IWM Plan, GPSC is striving to deliver a greener and more liveable Bannockburn, while reducing potable water consumption, utilising alternative water resources, enhancing landscapes, and protecting and enhancing waterway health.

Water for Victoria and the *Integrated Water Management Framework for Victoria*, support collaborative planning for the management and improvement of water cycle infrastructure. IWM is a framework for water management authorities and stakeholders to understand the importance of water systems and water cycle processes, and collaboratively develop ways in which water cycle management can deliver enhanced outcomes that align with community values.

Paleert Tjaara Dja: Let's make Country good together 2020-2030 is the Country Plan of the Wadawurrug Traditional Owners Aboriginal Corporation. The plan is focussed on working with all people and organisations on Wadawurrug Land to make Country and culture strong. Managing and co-managing waterways is a core theme. The collaborative theme of the Country Plan is well aligned with an IWM approach. This IWM Plan is intended to support *Paleert Tjaara Dja*.

This IWM Plan details the existing state of the water cycle in Bannockburn and outlines the impacts and opportunities related to water cycle management in the urban and peri-urban contexts of Bannockburn. The analysis presented in this plan outlines GPSC's role in managing the water cycle, and recommends a series of IWM Opportunities to improve management practices and advance the strategic outcomes established by the Barwon IWM Forum. In developing the recommended IWM Opportunities, a key consideration was supporting and retaining the existing character and values of Bannockburn.

This IWM Plan has been developed through the process outlined in Figure 1 to ensure that GPSC, and other authorities and stakeholders, are able to deliver IWM outcomes while providing the water services required in a growing Bannockburn. Critical water service requirements as identified by stakeholders include water supply, sewage management, flood and stormwater management, and public open space irrigation and maintenance. In delivering wide-ranging IWM outcomes, and critical water services, Bannockburn will become increasingly liveable and resilient as the township grows and welcomes new residents and industries.

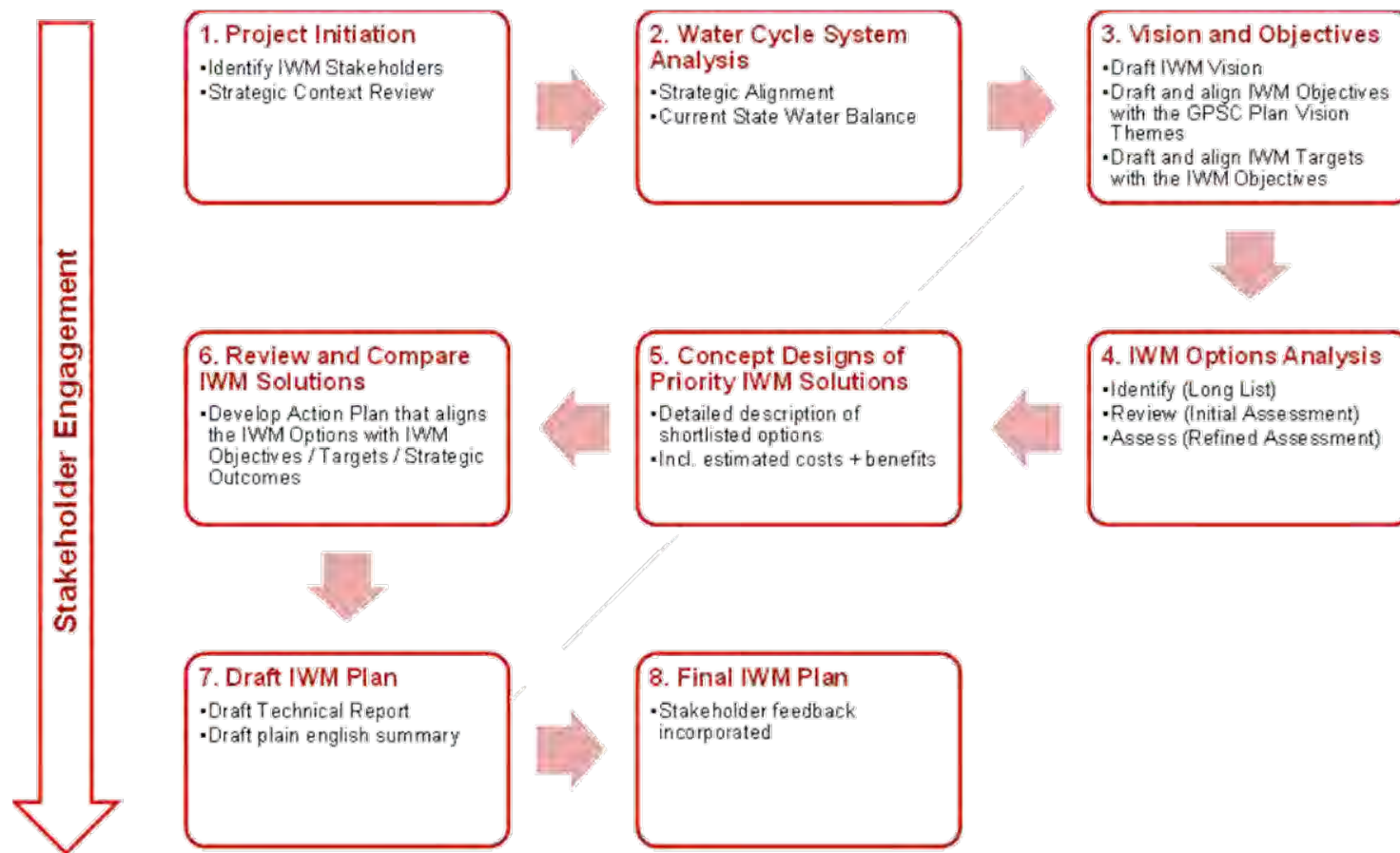


Figure 1: Bannockburn IWM Plan Development Process

2. BANNOCKBURN TOWNSHIP – SITE APPRECIATION

2.1. CURRENT STATE - OVERVIEW

Bannockburn is located approximately 90 kilometres South-West of Melbourne and approximately 20 kilometres North-West of Geelong. The Bannockburn township area, incorporating areas included in the *Bannockburn Growth Plan* (VPA, 2021), is estimated as 2,650 ha. Aerial image of Bannockburn and the growth area outline is shown in Figure 2.



Figure 2: Bannockburn current state and growth boundary



In 2018, the township had an estimated population of 7,120 (ABS, 2021) with approximately 2,500 total dwellings (VPA, 2021). Bannockburn has experienced significant growth over the past two decades, averaging 5.8% and 6.6% annual population growth from 2006-2011 and 2011-2016 respectively (VPA, 2021). During this period, a key growth demographic has been young families, drawn to the township due to a range of drivers. These drivers are expected to deliver the projected ongoing growth through to 2050 and beyond:

- ▶ Housing affordability
- ▶ Proximity to Geelong and Melbourne
- ▶ Rural character and lifestyle
- ▶ Access to services
- ▶ Proximity to agricultural industry

2.2. PROJECTED GROWTH - BANNOCKBURN GROWTH PLAN

As outlined in the *Bannockburn Growth Plan* (VPA, 2021), Bannockburn is projected to grow significantly through to 2050. The current and projected states of the township contextualise the scale of development that will occur in the coming decades. Table 1 presents the current and projected population estimates.

The *Bannockburn Growth Plan* (2021) was developed by the Victorian Planning Authority (VPA), in partnership with Golden Plains Shire Council, to inform the sustainable development of Bannockburn through to the 2050. Based on a medium growth scenario, it is projected that by 2036 the population of Bannockburn will grow to approximately 13,090 people, almost double the 2018 population of 7,120.

Extending through to 2050, across the three proposed growth areas, an estimated additional population of 18,267 will be accommodated in 6,192 dwellings.

The proposed Bannockburn Growth Areas are located in the north-west, south-west and the south-east of the township. The south-east growth area is the largest, accounting for over 60% of the projected growth. These growth areas make up a cumulative 860 hectares, 517 hectares of which are developable. Refer to Figure 3 for the layout and the proposed concept plans for the growth areas.

The *Bannockburn Growth Plan* establishes a set of eight principles that will inform the development of Bannockburn. The following key principles relate directly to IWM and are supported by the delivery and implementation of this IWM Plan:

- ▶ **Principle 5: Protect and Enhance the Natural Environment.** This includes Bruce Creek and the establishment of new environmental links.
- ▶ **Principle 6: Ensure Sustainable Use and Management of Water.** This includes adoption of IWM initiatives and the protection of local water sources.
- ▶ **Principle 8: Respect and Integrate Traditional Wadawurrung Heritage and Values.** Bruce Creek is a particularly important element of Wadawurrung local cultural heritage.



Table 1: Interpreted projected growth of Bannockburn, based on a medium growth scenario

	2018	2036	2050
Existing Population	7,120	7,120	7,120
South East Precinct	-	5,555	11,109
North West Precinct	-	415	3,738
South West Precinct	-	-	3,420
Total Population	7,120	13,090	25,387
Dwellings	2,500	5,200	8,692

Subsequent engagement with GPSC provided an update to the lot density and population for the South East Precinct, and extrapolated to the North West Precinct. The impact of these changes is shown in Table 2.

Table 2: Update projected growth of Bannockburn, based on a medium growth scenario

	2018	2036	2050
Existing Population	7,120	7,120	7,120
South East Precinct	-	8,000	16,000
North West Precinct	-	490	4,410
South West Precinct	-	-	3,420
Total Population	7,120	15,610	30,950
Dwellings	2,500	5,200	10,747

2.3. SOUTH EAST BANNOCKBURN PSP IWM PLAN

VPA engaged Spiire in 2021 to undertake an IWM opportunities and constraints analysis of the Bannockburn South-East PSP. Options were identified through discussions with stakeholders and explored through a stakeholder workshop. The opportunities were then described and assessed through an agreed assessment framework. Estimated water balances for each opportunity were developed and discussion regarding implementation pathway, ownership and operation, pros and cons and a recommendation made.

Recommended options were compiled into two recommended portfolios. Both of these portfolios meet the EPA Stormwater Management Guidance Targets to protect receiving waterways (with the assumption waterways are considered priority), the first portfolio utilises only regional solutions to meet the Stormwater Management Targets. The second portfolio recommends further opportunities to improve water management within the Precinct Structure Plan (PSP) area, and employs lot and precinct scale opportunities in addition to the regional solutions. Finally these two portfolios were compared against their contributions to meeting the strategic outcome areas of the Barwon IWM Forum.

The core IWM servicing constraints and opportunities identified were:

1. Excess treated wastewater
2. Proximity to the flow stressed Moorabool River
3. Bruce Creek is a high value waterway with growling grass frog present and potentially susceptible to erosion in high flow conditions
4. Downstream Barwon River is also considered a high value waterway
5. Proposed waterway in the east
6. Rail culverts to facilitate drainage to the south



Figure 3: Bannockburn Growth Plan concept plan, including the SE PSP area

3. IWM NETWORK

The Victorian Government is committed to realising the enhanced outcomes for the water cycle that can be achieved through taking a collaborative IWM planning approach to development areas and infrastructure planning. *Water for Victoria* sets the strategic direction, the *Integrated Water Management Framework for Victoria* outlines the structure to facilitate collaboration across the IWM network. *Strategic Directions Statements*, produced by the IWM Forums, are the foundational products of this collaboration.

Individual organisations across the IWM network also develop policies and strategies that contribute to the IWM body of knowledge and provide context in setting the strategic direction of collaborative IWM planning.

3.1. IWM NETWORK – KEY STAKEHOLDERS

The water sector in Victoria is made up of various service providers and authorities established to enable policy, regulation, and service delivery. However, stakeholders in the IWM Network are broader than just these authorities.

The key stakeholders who have an interest in IWM within the region of Bannockburn are listed in Table 3, along with their roles in IWM planning. In addition, the table lists key documents and policies that detail the strategies and impacts of each stakeholder.

Table 3: Key Stakeholders and Applicable Documents and Policies

Organisation / Stakeholder	Role	Main documents / Policies
Bannockburn Landcare Group	Part of the Gwydir and Macintyre Resources Management Committee. Activities include research, fencing out stock so that vegetation can regrow, weed removal, creating windbreaks for livestock protection, tackling soil erosion and improving soil health.	No applicable documents or policies
Barwon Water	Barwon Water is the water and sewerage service provider across the region. Barwon Water also leads the region's IWM Forum.	<i>Urban Water Strategy 2022: Water for our Future</i>
Corangamite Catchment Management Authority	Corangamite Catchment Management Authority (CMA) is responsible for the integrated planning and coordination of land, water and biodiversity management within the Corangamite Catchment.	<i>Corangamite Waterway Strategy 2014-2022</i> <i>Corangamite Regional Floodplain Management Strategy 2018-2028</i> <i>Corangamite Natural Resource Management Plan for Climate Change</i>
Department of Environment, Energy and Climate Action (DEECA)	DEECA works in partnership with agencies and stakeholders 'to maximise connections between the environment, community, industry and economy'. The Department is responsible for aligning the strategic planning of all agencies in its responsible for both land use and water cycle planning in accordance with policy.	<i>Central and Gippsland Region Sustainable Water Strategy (2022)</i> <i>Barwon Region IWM Forum Strategic Directions Statement (2018)</i> <i>Plan Melbourne (2016)</i> <i>Water for Victoria (2016)</i>
Environmental Protection Authority (EPA)	State authority with respect to environmental protections. The regulator is independent statutory authority, established under the Environment Protection Act 1970 to prevent and reduce harmful effects to the environment	<i>EPA Act 1970</i> <i>Environment Protection Amendment Act (2021)</i> <i>Urban stormwater management guidance (2021)</i>
Friends of Bannockburn Bush (FOBB)	FOBB aims to support Parks Victoria and DEECA in managing local native vegetation and in promoting retention of native vegetation throughout the region. FOBB is a founding member and supporter of Victorian Volcanic Plains Biosphere Inc.	No applicable documents or policies



Organisation / Stakeholder	Role	Main documents / Policies
Friends of the Barwon	A catchment wide network of groups and individuals working to protect and restore the long-term health of the Barwon River and its tributaries through building partnerships, empowering communities and engaging with government.	
People for A Living Moorabool (PALM)	Members and supporters are from communities along the whole length of the Moorabool catchment and beyond. They are urban and rural dwellers, and include 3rd generation farmers, scientists, artists and Waterwatch volunteers.	
Golden Plains Shire Council	Local governing body. Council has set out the planning conditions for the site including the requirements for IWM planning.	<i>Council Plan 2021-2025</i> <i>Environment Strategy 2019-2027</i>
Southern Rural Water		
Victorian Planning Authority (VPA)	The VPA is responsible for precinct structure planning in Victoria's Growth Areas and coordination of agencies to deliver integrated land use planning that aims to provide affordable housing, job creation and development.	<i>Bannockburn Growth Plan</i> <i>Bannockburn South East PSP - Co-Design Summary Document</i> <i>Bannockburn South East IWM Issues and Opportunities Report</i>
Wadawurrung Traditional Owners Corporation	Statutory authority. Wadawurrung Traditional Owners Corporation, is an organisation under Registered Aboriginal Party (RAP). This authority has responsibilities for the protection and management of Aboriginal cultural heritage and engages with a large variety of stakeholders including the development industry, local government, state government, and state government agencies.	<i>Healthy Country Plan 2020</i>

Bannockburn also has some active community groups that have indicated an interest in IWM-related matters, and are to be considered in awareness and consultation activities. These groups include:

- Ross Creek Landcare Group
- Bannockburn Community Coordinators
- Bannockburn Men's Shed
- Beautify Bannockburn
- Local business groups
- General community

3.2. STAKEHOLDER ENGAGEMENT PLAN

Stakeholders across the IWM Network play various roles in the development and delivery of this IWM Plan. Accordingly, stakeholders are engaged in various forms and frequencies as appropriate for their respective roles. In developing this IWM Plan, and through its implementation, engagement with stakeholders is informed by the stakeholder analysis undertaken through the Power Interest Grid, as shown in Figure 4.

Stakeholders that are recognised as exhibiting high interest and high power, in the context of this IWM Plan, have been directly involved in the development. The interest and power of the remaining stakeholders warrant that they be informed about the IWM Plan, in a form and frequency that is suitable for each stakeholder.



Some of these stakeholders were engaged in the workshops used in developing this IWM Plan, others will be engaged following its finalisation.

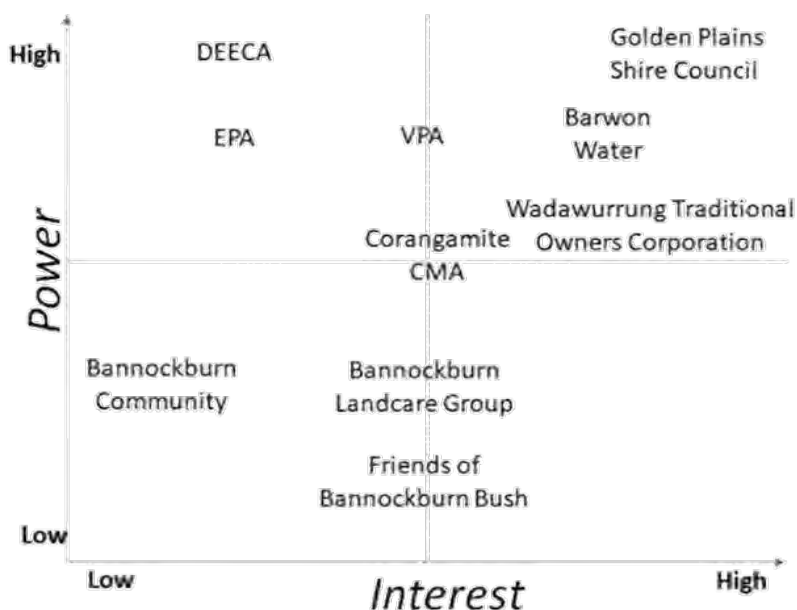


Figure 4: Bannockburn IWM Plan Stakeholder Power Interest Grid

The above figure identifies different engagement approaches that should be taken for the segmented stakeholders. The outcomes of the analysis and recommended engagement approach is shown in Table 4.

Table 4: Prioritized Stakeholders

Segment	Stakeholders
<p><u>High Power - High Interest</u> These stakeholders are decision makers and have the biggest impact on the project success. Expectations should be closely managed.</p>	Golden Plains Shire Council Barwon Water Wadawurrung TOAC Corangamite CMA
<p><u>High Power - Low Interest</u> These stakeholders needed to be kept in loop, and kept satisfied, even though they may not be particularly interested.</p>	Victorian Planning Authority DEECA EPA Victoria
<p><u>Low power – High interest</u> Keep these stakeholders adequately informed, and talk to them to ensure that no major issues are arising. Can be strong allies in the project</p>	Bannockburn Landcare Group Friends of Bannockburn Bush
<p><u>Low power - low interest</u> Monitor this cohort, but do not bore them with excessive communication.</p>	Bannockburn Community



3.3. IWM NETWORK ALIGNMENTS - COUNCIL AND THE BARWON IWM FORUM

Underpinning the success of a collaborative IWM approach is the establishment of a common set of values and objectives, typically articulated through the corporate strategies of organisations in the IWM Network. These various strategies are detailed in Section 4. In the context of this IWM Plan, two key strategies that inform the collaboration are the *Golden Plains Shire Council Plan 2021-2025*, and the *Barwon Region Strategic Directions Statement (SDS)*.

The *Golden Plains Shire Council Plan 2021-2025* outlines the strategic direction of the council. This document, developed through extensive community engagement, addresses key themes aimed at achieving the council’s vision of a healthy, safe, and sustainable community. Figure 5. presents the *Vision Themes* and *Community Priorities* outlined in the Council Plan.










Figure 5: Vision Themes (Community, Liveability, Sustainability, Prosperity) and the respective Community Priorities established in the GPSC Council Plan 2021-2025

The *Barwon Strategic Directions Statement (SDS)*, establishes seven strategic outcomes that direct collaboration across the IWM Network and guide the implementation of IWM practices.



Table 5 presents the Barwon IWM Forum’s seven IWM strategic outcomes. These strategic outcomes best summarise the aims of the IWM Forum members.

Table 5: The Barwon IWM Forum’s seven strategic outcomes for IWM

IWM Outcome		Further Description
Safe, secure and affordable supplies in an uncertain future		Indicated by the amount of water conserved or alternative water volume supplied to meet an identified demand.
Effective and affordable wastewater systems		Ensuring environmental and public health standards are met, and maximising resource recovery.
Healthy and valued waterways and marine environments		Resilience to existing and future flood risk.
Opportunities are optimised to manage existing and future flood risks and impacts		Indicated by the ecological health of riparian areas, hydrology and water quality.
Healthy and valued urban, agricultural, rural and green landscapes		Maximising the connectivity, accessibility, greening and vegetation, cooling, aesthetic and/or recreational values of landscapes.
Traditional Owner and Community values reflected in place-based planning		Ensuring that different communities are considered and included in planning and design, and provided with water-systems literacy to enable their involvement.
Jobs, economic growth and innovation		Recognising that water management is an integral part of economic growth.

This IWM Plan is an opportunity to further the alignment between the respective visions and outcomes of GPSC and the Barwon IWM Forum. The common elements of these visions and outcomes are presented in Table 6. This framework has informed the development of the IWM Plan, and the design of the recommended IWM Opportunities, presented in Section 10.



Table 6: Strategic alignment of GPSC Plan and Barwon Region SDS

#	IWM Outcomes	Community	Liveability	Sustainability	Prosperity
1	Safe, secure, and affordable supplies in a changing future	Safe drinking water Mixture of water supplies to create a resilient system	Water supply supports rural and urban lifestyles as well as active and passive recreation	Water supply systems are responsibly managed with regards to the environment	Fit for purpose water supply supports local producers and businesses
2	Effective and affordable wastewater systems	Sewage managed to protect community health		Water supply systems are responsibly managed with regards to the environment	Sewage management by-products are utilised within the agricultural supply chain
3	Manage flood risks	Community protection from flood risks	Flood management infrastructure is integrated with open space infrastructure	Flood management infrastructure is designed to provide ecological outcomes	
4	Healthy and valued waterways and water bodies	Community is engaged and contributes to the health of waterway Community has a sense of pride in their waterways	Waterways provide recreational activities contributing to health and wellbeing	Waterways and waterbodies are respected for their ecological functions and are protected from negative impacts of urban development and agriculture	The community is educated about the values of waterways and waterbodies Tourism opportunities are realised
5	Healthy and valued landscapes	Community is engaged and contributes to the health of landscapes Community has a sense of pride in their landscapes	Landscapes provide recreational activities contributing to health and wellbeing	High valued natural landscapes are respected for their ecological functions	The community is educated about the values of natural landscapes Tourism opportunities are realised
6	Traditional Owner and community values reflected in a place-based planning	Place-based planning is inclusive of Traditional Owner and community views	The community provides input to liveability outcomes	Ecosystems are managed and protected with input from Traditional Owners and community	Partnerships with Traditional Owners and community supported through common water outcomes
7	Jobs, economic opportunity, and innovation		Water can innovatively support liveability outcomes	Innovation and investment provides for a clean and green future	Responsible agriculture is an integral element of urban water cycle management



4. STRATEGIC CONTEXT

4.1. IWM STRATEGIC DOCUMENTS

Organisations across the IWM Network establish their respective visions and targeted outcomes through a series of strategies, statements, and plans. These various documents establish the strategic context for IWM in Bannockburn, and inform the development and implementation of this IWM Plan. The key documents that have been consulted through this process are detailed in this section.

4.1.1 INTEGRATED WATER MANAGEMENT FRAMEWORK FOR VICTORIA

Integrated Water Management involves a coordinated approach to water management in collaboration with key water stakeholders. It also extends to those able to affect and enable urban design, natural resource management, land-use planning, and economic development. An IWM approach has the potential to provide greater value to our communities by identifying and leveraging opportunities to optimise the outcomes of water cycle planning and management.

The *Integrated Water Management Framework for Victoria* provides guidance aimed at helping government, the water sector, and the community in working together to “provide a consistent process for collaborative integrated water management planning with clear roles and responsibilities to deliver effective urban water management, including water supply, wastewater, flood resilience, urban waterway health and management of public spaces”.

The *IWM Framework for Victoria* outlines expectations for IWM Forums and IWM Plans.

4.1.2 BARWON REGION STRATEGIC DIRECTIONS STATEMENT (2022)

The Barwon IWM Forum was the first convened out of *Water for Victoria* in December 2017. The *Strategic Directions Statement* (SDS) established the 12 stakeholder organisations of the Forum and the shared goals and drivers for IWM across Barwon region. The first SDS was updated in June 2022. The SDS commits the Forum to delivering the following vision:

Integrated, collaborative management of the water cycle that enables sustainable environmental, social, cultural and community prosperity for the Barwon Region

The strategic outcomes of the SDS are outlined in Table 5.

The Bannockburn IWM Plan is an important initiative of the Barwon Region SDS, with an aim to look at options at a range of scales, costs, complexities and include both public and private land. The plan is also to explore diverse water sources.

4.1.3 URBAN WATER STRATEGY 2022: WATER FOR OUR FUTURE STRATEGY

Barwon Water’s *Urban Water Strategy* was developed over two years in close consultation with the Barwon region community in a co-design effort to devise a water future that meets all the needs of the community.

There is significant growth taking place across the Barwon Water service region. Combined with a hotter, drier climate, Barwon Water stands to face water security challenges. Average water consumption over the past three years across the Barwon Water region was 34 GL/yr. In 50 years, under the worst-case scenario, an additional 53 GL/yr will be needed. For the Golden Plains region, water security may be under threat as soon as 2027.

The strategy outlines actions that will deliver 5.4 GL/yr of extra water and return 3.7 GL/yr of water back to the environment. Actions that relate directly to this IWM Plan are listed below.



- ▶ **Action GG1:** Increased Barwon Water's pooled entitlement in the Yarra Thomson system, allowing 3.7 GL/yr of entitlement in the Moorabool River, the most flow stressed river in Victoria, to be provided to Wadawurrung Traditional Owners and/or the Victorian Environmental Water Holder. These entitlements will be held in Lal Lal and Bostok Reservoirs.
- ▶ **Action GG2:** Put more recycled water to productive use. This will involve exploring new opportunities for agriculture or industrial use of Class C recycled water in the Thompson Valley and around Bannockburn.
- ▶ **Action GG5:** Expand use of smart technology to help reduce costs and save water across networks and in homes and businesses.
- ▶ **Action GG7:** Deliver the Integrated Water Management Plan for the new Northern and Western Geelong Growth areas, substituting 3.4 GL/yr of potable water use with recycled water. Provision for long term stormwater harvesting to provide up to 5 GL/yr of potable water over a 30-50 year time frame.
- ▶ **Action GG8:** Work with Golden Plains Shire Council in the development of an IWM plan for Bannockburn.

4.1.4 HEALTHY COUNTRY PLAN

The Wadawurrung Healthy Country Plan, *Paleert Tjaara Dja – Let's make country good together 2020-2030*, invites a respectful working, learning and committed "sharing together" approach, based on cultural knowledge and practices. The Plan establishes the vision:

Wurrgurwilwa gumpa bengadak Wadawurrung wurring-wurring baap dja

All people working together to make Wadawurrung country and culture healthy and strong

The Plan identifies the current health of the waterways through Wadawurrung country, including the Moorabool and Barwon Rivers as being poor. The Plan includes the goal, "By 2030, there is enough water in the waterways of *Barre Warre Yulluk* that it flows through the system, without barriers and is clean enough to drink". The plan also identifies key threats to the values of the Wadawurrung Traditional Owners Aboriginal Corporation:

- ▶ Urban development
- ▶ Lack of coordinated management for rivers, estuaries, and wetland
- ▶ Water extractions
- ▶ Droughts

To support the values outlined in the Plan, the Wadawurrung Traditional Owners Aboriginal Corporation established the goal to be known and be engaged with by 60% of its stakeholders in any decisions to do with cultural and environmental management in Wadawurrung country.

4.1.5 CORANGAMITE REGIONAL CATCHMENT STRATEGY

The *Corangamite Regional Catchment Management Strategy (CRCS)* guides the long-term direction for managing land, water resources, biodiversity and coastlines across the Corangamite Catchment Authority (CCMA) region.

The RCMS provides a vision for the integrated management of natural resources in the Corangamite Region. It is a strategy for supporting catchment health into the future that builds on the achievements and lessons from previous strategies. The vision of the CRCS is:

Healthy and productive lands and waters cared for and enjoyed by thriving communities

Partnerships are an integral success factor of the CRCS with the CCMA recognising the need for government, communities, and industry to work together to improve catchment health.



The RCMS identifies four foundations for change, these being:

- ▶ Increased breadth and depth of participation
- ▶ Increased investment and develop joint priorities
- ▶ Improved integration and coordination
- ▶ Increased and widely shared knowledge

Specific actions are identified to support rivers and wetlands to protect and enhance ecological function. One such action identifies restoration works along Bruce Creek to enhance cultural and waterway amenity values. These actions and outcomes align well with those sought to be achieved through IWM.

4.1.6 CORANGAMITE WATERWAY STRATEGY

The *Corangamite Water Strategy* provides a framework and work program for the management of rivers, estuaries, and wetlands in the Corangamite region supporting environmental, social, cultural, and economic values. The strategy is aimed at encouraging the community to participate in the protection and enhancement of its waterways.

Bruce Creek runs from the North to the South of the growth extents and has been identified as a high-value waterway. A danger to the health of this waterway is urbanisation. Urbanisation causes an increase in stormwater run-off which can lead to a degradation in water quality, soil disturbance and erosion. With this in mind, there are currently no specific management activities identified for Bruce Creek within the strategy.

The nearby Moorabool River, East of Bannockburn, has been identified as a priority waterway. The highly regulated nature of the Moorabool River, and significant offtakes, have impacted both the quality and quantity of water. The river receives 50%-25% of its natural flows, and this has negatively impacted the ecology of the river. A range of activities to protect the river are identified in this strategy, including how to best utilise its environmental water entitlement.

4.1.7 ENVIRONMENT STRATEGY 2019-2027

The *Golden Plains Shire Council Environment Strategy (2019-2027)* sets the strategic direction for environmental sustainability in the Golden Plains Shire. The strategy is aligned to the *Council Plan* and reflects feedback from the community and stakeholders. The vision for the strategy is "Environmental Sustainability underpins life in Golden Plains Shire". This vision is supported by five strategic directions:

- ▶ Environmental connected communities
- ▶ Greener economies
- ▶ Thriving natural environments
- ▶ Sustainable urban and rural design
- ▶ Council leadership

The management of water and water resources have been recognised as an important mechanism in enabling environmental sustainability.

The following themes have been identified as being significant to this:

- ▶ **Biodiversity.** Protect, restore, and enhance the health of our natural ecosystems, biodiversity, and natural habitats.



- ▶ **Aboriginal Cultural heritage land management.** Preserve and protect Aboriginal heritage values and culture through sensitive land management practices and community education and appreciation.
- ▶ **Water Security.** Protect the ecological health of our waterways and wetlands whilst facilitating sustainable water use in the GPS community.
- ▶ **Parks and green places.** Protect and enhance parks and green spaces while ensuring a network of land and water that supports recreation and conservation whilst providing aesthetic value.
- ▶ **Leadership.** Demonstrate leadership in environmental sustainability and empower action with stakeholders and the wider community.

This strategy and direction from Golden Plains Shire Council provides a strong foundation for a collaborative IWM design approach and fulfills the requirements of the Bannockburn South-East PSP.

4.1.8 RIVERS OF THE BARWON ACTION PLAN

The Rivers of the Barwon Action Plan is a long term strategic response to meet the challenges to protect the Barwon River, its tributaries and lakes, wetlands and estuaries with the knowledge of it as a connected system. This knowledge is represented by the Wadawurrung term *Barre Warre Yulluk*. The plan was developed through extensive consultation with Traditional Owners, community and government agencies and takes steps to protect *Barre Warre Yulluk* and improve the liveability of the region.

The Action Plan has three parts:

- seven directions and 30 actions that guide the Victorian Government's commitment to implementation over the next five years
- the 50-year community vision for the Rivers of the Barwon (*Barre Warre Yulluk*)
- the background for the actions, setting out the key issues for the waterways and
- the implementation context for the Action Plan.

4.1.9 CENTRAL AND GIPPSLAND REGION SUSTAINABLE WATER STRATEGY

The Central and Gippsland Region Sustainable Water Strategy seeks to secure the region's long-term water supplies. Its spatial extent includes the Central and Gippsland Region, including Bannockburn, and covers the waterways and catchments south of the Great Divide, down to the coast from the Otways to Mallacoota. The strategy acknowledges that water and waterways are essential to our liveability, sustainability and prosperity, and that more than 6 million Victorians depend on the rivers, wetlands and lakes in the region for work and pleasure. As well as providing drinking water to 90% of Victorians.

The strategy aims to help prepare for the region's water future. With future forecasts suggesting drier conditions and a growing population, the region's water supplies will need to double in the next 50 years. It advocates for the use of manufactured water use, with some river water to become available for other uses including returning water to Traditional Owners and the environment, without taking water from farmers or other water users.

4.2. IWM PLAN BACKGROUND

4.2.1 ESTABLISHED AS A PRIORITY

The development of this Bannockburn IWM Plan was first established as a priority for the Barwon IWM Network by the *Barwon IWM Forum Strategic Directions Statement* (2018), followed by the *Barwon Water Urban Water Strategy* (2022). The Plan was prioritised due to the existing growth profile of Bannockburn and the absence of IWM-related planning.



The development and implementation of this IWM Plan advances the respective IWM outcomes established by the Barwon IWM Forum and Barwon Water. Both these stakeholders are key partners in the implementation of this Plan and its further development through adaptive management practices

4.2.2 BANNOCKBURN IWM DESIGN SPRINT

Preceding the development of this IWM Plan, in September 2020, Barwon Water and Golden Plains Shire Council collaborated in an ideation process called the *IWM Plan Design Sprint*. This process was conducted to identify IWM Opportunities for Bannockburn, and to further develop high-level IWM thinking across the IWM Network.

The results of this Design Sprint inform the *Bannockburn Growth Plan* that was being developed concurrently by the VPA, and continue to inform corporate strategies and plans across the IWM Network.

Many of the identified IWM Opportunities have a high value proposition in the context of Bannockburn. All these IWM Opportunities have been considered in the development of this IWM Plan, as well as challenges related to water cycle management. The IWM Opportunities considered in the development of this IWM Plan are detailed in Section 10.

Key takeaways from the SWOT Analysis and Design Sprint that inform this IWM Plan include:

IWM Context

- ▶ Acknowledgement that key stakeholders, notably GPSC, need support to develop IWM knowledge and have a strong interest in developing this knowledge
- ▶ Low frequency and magnitude of flood damage
- ▶ Strong community love for Bruce Creek and the recreational opportunities it supports
- ▶ On-lot septic tanks are recognised as beneficial for on-lot greening and drought resilience, but also recognised as an environmental risk
- ▶ Recognition that Bannockburn has insufficient open space, green linkages and amenity, and irrigation supplies
- ▶ Climate change is recognised as a threat to water supply security

IWM Opportunities

- ▶ Interest in fulfilling water demands with fit-for-purpose alternative water supplies
- ▶ Support for the implementation of “urban design opportunities” such as blue-green infrastructure and WSUD assets
- ▶ Interest in establishing a ‘growth plan developer contributions scheme’
- ▶ Interest in establishing urban orchards and community gardens capable of providing local produce to Bannockburn residents
- ▶ Review of the Infrastructure Design Manual to improve alignment with IWM practices
- ▶ The development of a *Bannockburn IWM Plan* was identified as critical for establishing IWM practices in Bannockburn and the Barwon IWM catchment

Potential projects identified in the Design Sprint are shown in Figure 6.

Element	Potential Projects
Water for our Future <ul style="list-style-type: none"> • Drinking water distribution • Sewerage collection and transfer • Wastewater treatment • Recycled Water reuse 	<ol style="list-style-type: none"> 1. Undertake strategic review of WRP to reflect revised development in Bannockburn Growth Plan 2. More use of Class C for open space in Bannockburn. Opportunities around the main street via subsurface irrigation 3. Class C pipe to Victoria Park Reserve, (utilising existing disused sewer pipe) 4. Trial of on lot greywater recycling system
Waterways and flooding <ul style="list-style-type: none"> • Waterways and floodplains • Stormwater and drainage • Stormwater quality including Blue-Green (WSUD) 	<ol style="list-style-type: none"> 1. Improvements in stormwater treatment discharging to key water ways, i.e. Bruce's Creek; 2. Improvements in access and connectedness through these waterways; i.e. Create a Bannockburn loop trial 3. Potential for Blue Green infrastructure retrofitted to wide streets in Bannockburn for with key outcome to reduce urban heat island affect through urban cooling, i.e. High Street, Pope St, Burnside Road <ul style="list-style-type: none"> ○ Tree pits, rain gardens, swales, etc. ○ Streetscape, lot scale WSUD; ○ More permeable areas (i.e. car parks etc.) 4. Blue Green infrastructure opportunities maximising stormwater retention in the residential areas still to be built; <ul style="list-style-type: none"> ○ naturalisation of major waterways and flow paths; ○ new waterways designed to incorporate linear infiltration/evaporation swales; 5. Roof water harvesting from new GPS office or Woolworths
Liveability <ul style="list-style-type: none"> • Urban land use • Street scapes • Parks and Open space • Blue-Green Infrastructure • Suitable open space (i.e connected, walkable, safe, exercise and health) 	<ol style="list-style-type: none"> 1. Urban orchards/Community gardens to prepare produce for the town; 2. Investigate IWM for new future growth areas identified in new Bannockburn UDF Review 3. Review the Engineering Design manual, and align with revised IWM Objectives 4. Educate all council staff on the benefits of IWM 5. Smart Irrigation Trial of key public space

Figure 6: Potential projects identified in the Bannockburn the IWM Plan Design Sprint

5. WATER MANAGEMENT SYSTEMS

5.1. HISTORICAL CONTEXT

The land that is now known as Bannockburn was first inhabited by the Wadawurrung people of the Kulin Nation. The Wadawurrung people have lived in the Geelong region for many thousands of years and continue to have a deep connection to country.

In 1837, the area was surveyed by Europeans and soon after, pastoralists began to settle. During the mid-19th century, gold was discovered in the region around Bannockburn, and this led to a period of rapid growth and development within the town. As the gold rush came to an end, Bannockburn began to transition into more of an agricultural town. Many farmers settled in the area, and the town became an important centre for wool, wheat, and agricultural production. Today, Bannockburn is a thriving regional centre that has a rich history encompassing both Indigenous and European cultures.

5.2. REGIONAL CONTEXT

The existing Bannockburn township is located within an area subject to water security and wastewater management challenges. The impending growth in Bannockburn will likely exacerbate the water security and sewage management issues. This will likely degrade the value of local waterways should a traditional water cycle management approach be adopted.

Figure 7 outlines the downstream water management context. The Moorabool River and the Barwon River provide flows to the Ramsar recognised Lake Connewarre. There is potential that stormwater discharge generated from the growth of Bannockburn will have a negative impact on the ecological stability of Lake Connewarre and conveying waterways, Bruce Creek and the Barwon River. Additionally the increase in urban stormwater runoff has the potential to degrade the values of Bruce Creek, Barwon River and the RAMSAR listed wetland of Lake Connewarre.

Soils across Bannockburn predominantly are low permeability which influences the interaction between surface and ground water.

Water security is also provided from south of the Bannockburn township through the Geelong supply from Wurdiboluc Reservoir, as well as the Melbourne-Geelong pipeline from entitlements held in the Yarra-Thomson system. When water resources stored in Lal Lal Reservoir and Bostok Reservoir are insufficient to meet demands of townships of the Golden Plains area, including Bannockburn, the supply from Geelong-Melbourne becomes critical.

North of the Bannockburn township is the region's original water supply, provided from the Moorabool at She Oaks. Water is extracted from the river, treated, and provided to townships across the Golden Plains, including Bannockburn.

A pipeline exists connecting the Moorabool System at She Oaks with the Geelong/Melbourne water supply system. Currently water from She Oaks can be supplied to Melbourne if available, however water from Melbourne can only be supplied up to Bannockburn. Townships further north are too high in elevation to receive water from the Geelong-Melbourne water supply system.

Agriculture is a vital industry in Bannockburn and the wider region, contributing to the local economy and providing employment opportunities for the community. The primary agricultural activities in Bannockburn include beef and dairy farming, sheep farming, and cropping. Farmers in the area grow crops such as wheat, barley, oats, canola, and potatoes. Several broiler and egg laying farms are located just south of the township.



Figure 7: The layout of regionally significant infrastructure, landscapes and waterways, located downstream of Bannockburn



5.3. POTABLE WATER SUPPLY

Potable water service for Bannockburn is provided by Barwon Water. Water is supplied from the Moorabool Water Treatment Plant through entitlements held in Lal Lal and Bostok Reservoirs. This supply is supplemented by Geelong water resources, including those held in Wurdee Buloc Reservoir and from the Melbourne water supply system provided through the Melbourne to Geelong Interconnector.

The Geelong region’s rapidly increasing population, as well as low annual rainfall rates and increasing temperatures, has resulted in insecurity of water supply across the region, including Bannockburn.

Figure 8 shows the network of Bannockburn’s potable water supply infrastructure.



Figure 8: Bannockburn existing potable water supply network



5.4. SEWAGE MANAGEMENT

Reticulated sewage across Bannockburn is managed by Barwon Water. Sewage is conveyed through gravity sewers to a pump station located adjacent to Bruce Creek, just south of the Bannockburn-Shelford Road. An additional pump station services the properties to the west of Bruce Creek. Sewage is then pumped to the Bannockburn Reclamation Plant. The reclamation plant has capacity to service 5,000 properties, with approximately 3,700 currently connected.

As seen in Figure 9, not all properties across Bannockburn are connected to the reticulated sewerage system, with only those properties south of the Railway line around the town centre serviced. New development across Bannockburn’s growth areas will require a dedicated new sewerage system.

The remaining properties across Bannockburn manage their own sewage through onsite septic tanks. Golden Plains Shire Council is responsible for the oversight of planning and operational compliance of these septic tanks.



Figure 9: Bannockburn existing sewerage system



5.5. RECYCLED WATER

Recycled water produced at the Bannockburn WRP is classified as Class C, which is suitable for a range of agricultural and community irrigation uses as per EPA Victoria guidelines. Recycled water is currently used to irrigate the Bannockburn Golf Course, and on a local farm adjacent to the plant. Excess recycled water is managed through application on Barwon Water owned land further south of the golf course. Barwon Water is actively pursuing additional customers for this recycled water resource.

The current *Bannockburn Growth Plan* mentions that consideration will be given to improving recycled water quality. Should this take place, additional demands may be opened for the recycled water.

The current recycled water supply network to the Bannockburn Golf Club and land further south is shown in Figure 10 below.



Figure 10: Bannockburn existing recycled water supply system

5.6. STORMWATER MANAGEMENT

Stormwater across Bannockburn is currently managed through a gravity stormwater drainage system as shown below in Figure 11.

The majority of the Bannockburn township grades from the north-east to the south-west, towards Bruce Creek. A smaller urban area to the west of Bruce Creek drains via gravity eastwards towards the creek.

Stormwater generated from urban areas in the south-east of the township drain to drainage channels that convey stormwater through agricultural land and then onwards to a series of culverts, with the minor waterway eventually reconnecting with Bruce Creek south of the township.

While there are water sensitive urban design (WSUD) installations across Bannockburn, stormwater from the older parts of Bannockburn does not receive any treatment. The WSUD assets have been constructed to manage stormwater pollution and flows at various discharge points along Bruce Creek. However, as outlined in Section 7, these WSUD assets are underperforming due to inappropriate installation. There is currently no stormwater harvesting from any WSUD asset in Bannockburn.

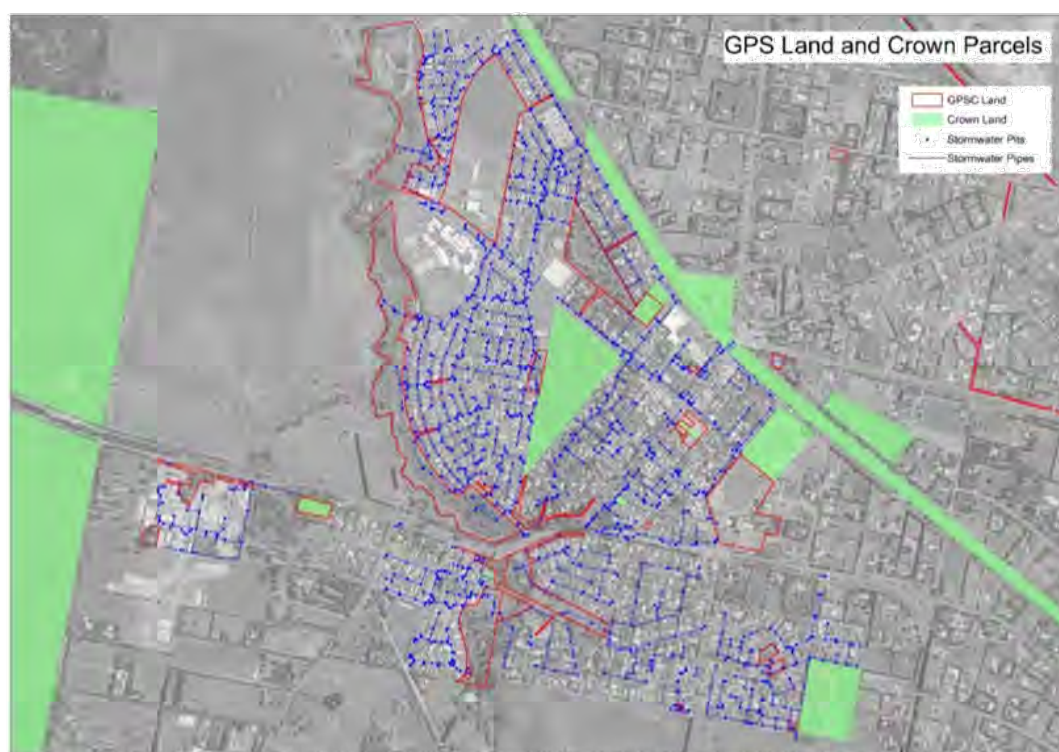


Figure 11: Bannockburn existing stormwater drainage

5.7. FLOOD MANAGEMENT

As seen in Figure 12 provided by Golden Plains Shire Council, Bannockburn is prone to nuisance flooding during periods of significant rainfall. A brief analysis of these flood extents indicates that this nuisance flooding, which is causing inconvenience to the public, spilling onto roads and properties. Nuisance flooding is likely a result of undersized drainage and flat grade of land.



Figure 12: Bannockburn current flood extents (GPSC)



5.8. OPEN SPACES

The principal active open spaces servicing Bannockburn are located at Victoria Park Recreational Reserves, which includes two cricket ovals. A soccer pitch services Golden Plains Soccer Club. Playgrounds are located at the Bannockburn Civic Heart, Bannockburn Recreation Centre, and Glenmore Estate Reserve. The Bannockburn Golf Club is located to the west of the township near the water reclamation plant. Bannockburn P-12 College also has a large cricket oval and soccer pitch within its grounds.

Significant passive open space is also present across Bannockburn with The Bannockburn Bushland Reserve, Gemma’s Bush Reserve, and the Bruce Creek waterway corridor. The active open space, and passive open space across Bannockburn are shown in Figure 13.



Figure 13: Bannockburn’s current and potential future open space network



5.9. BIODIVERSITY, ECOLOGY AND VEGETATION

Bannockburn is home to flora and fauna species of national and state significance. Several grasslands including the Western (Basalt) Plains Grasslands and Natural Temperate Grasslands may be present within the growth areas. Flora species including Dwarf Spider-Orchid, Spiny Rice-Flower and Adamson’s Blown Grass have been connected to the area. In conjunction with this, nationally significant fauna species including the Golden Sun Moth, Striped Legless Lizard and Growling Grass Frog have also been found within the area. An ecological assessment of Bruce Creek along the South-East PSP frontage was undertaken in 2022 identifying several important species. The feature map from this study is shown in Figure 14

The biodiversity linked to Bannockburn is supported by environmental assets such as Bruce Creek, the Bannockburn Flora and Fauna Reserve and local streetscapes. It is important that the values and conditions of these areas are preserved and enhanced through the delivery of IWM practices during the growth and development of Bannockburn. This can be achieved through the implementation of WSUD infrastructure, habitat links, strategically developed public open spaces, and additional IWM Opportunities outlined in Section 10.

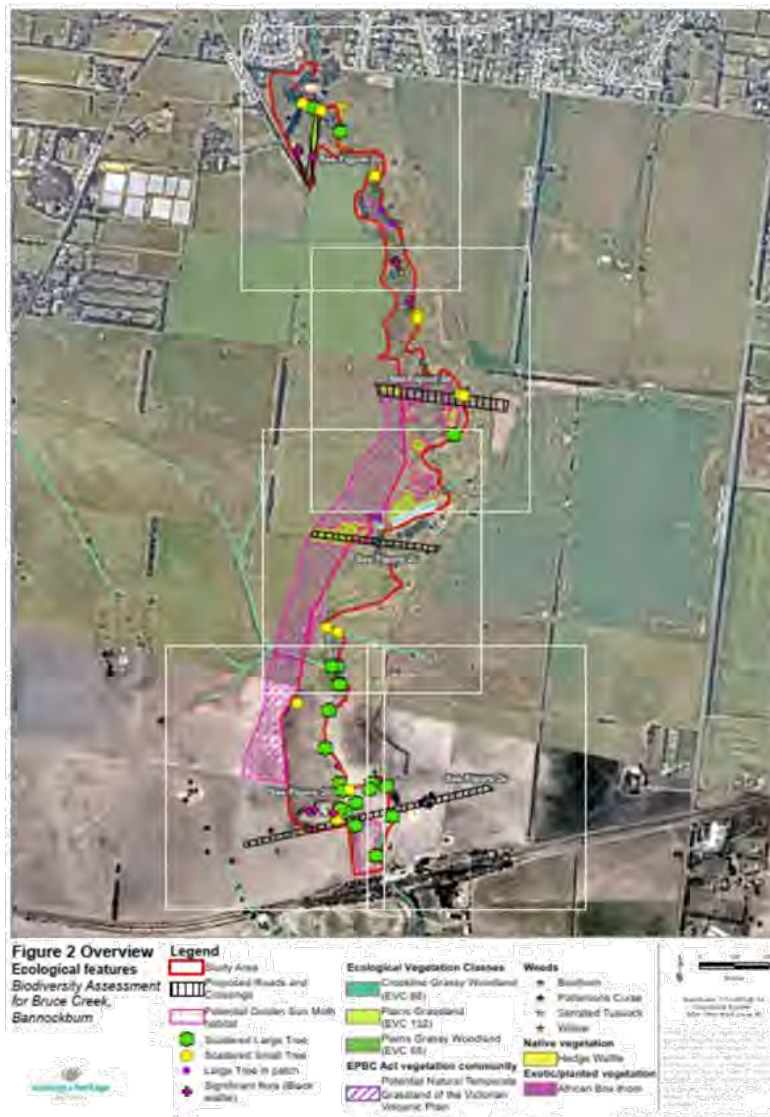


Figure 14: Ecological Features of Bruce Creek along the South East PSP Frontage



6. CURRENT WATER CYCLE ANALYSIS

6.1. CLIMATE

Bannockburn has a temperate climate with warm, dry summers and cool, damp winters. The nearest weather station to Bannockburn is located 16.5 km away at She Oaks.

The average temperature in Bannockburn ranges from around 5°C in winter to 26°C in summer with January and February the hottest months. Temperatures occasionally reach over 40°C. In winter, temperatures can drop below freezing.

Rainfall in Bannockburn is relatively evenly distributed throughout the year, with an average annual rainfall of around 508mm. The wettest months are typically during winter and early spring. Average climate metrics for Bannockburn (She Oaks weather station) are shown in Table 7.

Table 7: Bureau of Metrology Climate Metrics for Bannockburn

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature													
Mean maximum temperature (T _m)	26.1	25.4	23.1	19.2	15.5	12.9	12.3	13.4	15.5	16.3	21.1	23.8	18.9
Mean minimum temperature (T _n)	12.5	12.7	11.2	8.9	7.3	5.6	5.1	5.4	6.2	7.3	9.1	10.5	8.5
Rainfall													
Mean rainfall (mm)	39.3	37.3	26.2	38.6	36.9	42.4	39.4	43.9	46.8	59.2	60.6	34.1	507.9
Depth 5 (median) rainfall (mm)	26.5	32	24	33.6	36.8	39.2	34.6	40.7	45.9	47	52.3	29	513.8
Mean number of days of rain ≥ 1 mm	4.9	4	4.4	6.2	7.9	8.1	9.1	9.8	9.5	9	7	5.3	85.2

6.2. WATER USAGE

Data obtained from Barwon Water shows an increase in total water usage from 2014 through to the end of the 2022. Total water usage almost doubled between 2014 and 2019, though it has since remained steady. This increase in water usage is consistent with the population trends occurring in Bannockburn over the same period. Figure 15 shows the historical water usage data for Bannockburn.

6.3. SEWAGE MANAGEMENT

Reticulated sewage in Bannockburn is treated within the Bannockburn Waste Reclamation Plant (WRP). Sewage inflows have been gradually increasing from 2017 to 2021, as shown in Figure 16. This sewage inflow data presented in this section has been obtained from Barwon Water.

These increases are projected to continue and require the WRP to manage significantly greater inflows of sewage, generated by a growing population. Table 8 presents the recorded inflows from FY2017 to FY2021, and projected inflows based on the Bannockburn Growth Plan population forecasts.

In 2012 the WRP was upgraded to cater for the projected growth. The upgrades include an additional wastewater treatment maturation lagoon (16ML), additional winter storage of 85ML, and a pump station. Given ongoing growth and projected development, further upgrades will be required in the coming years as outlined in the *Barwon Water Urban Water Strategy (2022)*.

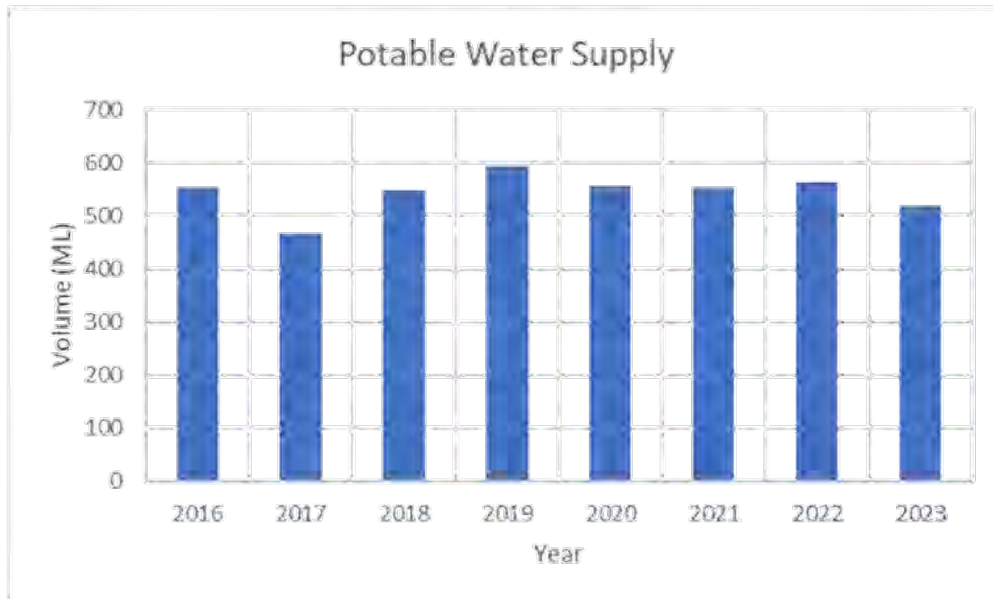


Figure 15: Bannockburn historical water usage

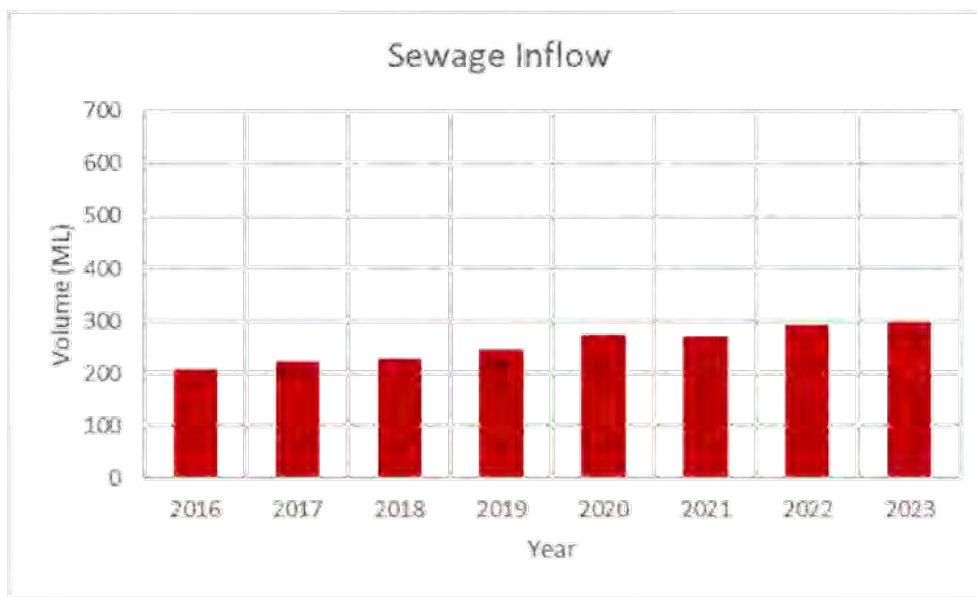


Figure 16: Bannockburn Waste Reclamation Plant sewage inflows



Table 8: Bannockburn Waste Reclamation Plant actual and predicted inflows

	Financial Year	Bannockburn WRP yearly inflow (ML)
Recorded	2017-18	224.1
Recorded	2018-19	241.6
Recorded	2019-20	270.0
Recorded	2020-21	268.7
Recorded	2021-22	289.3
Recorded	2022-23	294.6
Projected	2023-24	305.7
Projected	2024-25	316.9
Projected	2025-26	328.0
Projected	2030-31	383.6
Projected	2035-36	439.3
Projected	2040-41	495.0
Projected	2045-46	550.6
Projected	2050	595.1

6.4. WATER BALANCE – BUSINESS AS USUAL (BAU)

Bannockburn currently has a traditional water management system, with few IWM practices in operation. Given the projected growth in Bannockburn, a business-as-usual (BAU) approach to water cycle management will deliver a system that is unreliable and inefficient, and misses opportunities to protect and enhance environmental values and improve community wellbeing.

Specifically regarding stormwater volumes, the EPA Victoria Urban Stormwater Management Guidance highlights the risk to waterways and bays through the creation of sealed (impervious) surfaces and its resultant increased runoff and reduced infiltration.

Figures 16 and 17 present the estimated water balance for Bannockburn in 2023 and 2050 respectively. The 2050 projections are estimated for a traditional water management system, developed from a BAU approach. These water balances have been informed by data from Barwon Water, GPSC, and Jacobs, and developed using stormwater management software, MUSIC.

6.1.1 2023 WATER BALANCE

Water demands in Bannockburn are currently serviced by potable water supply. The only notable exception is the Class C recycled water supply that services irrigation demands at the Bannockburn Golf Course.



Given that Bannockburn is only partially sewered, the volume of reticulated sewage generated is significantly less than the volume of water usage, as shown in Figure 17. Reticulated sewage loads are managed by the Bannockburn WRP through evaporation (~10%), and irrigation practices at the Bannockburn Golf Course and lands owned by Barwon Water.

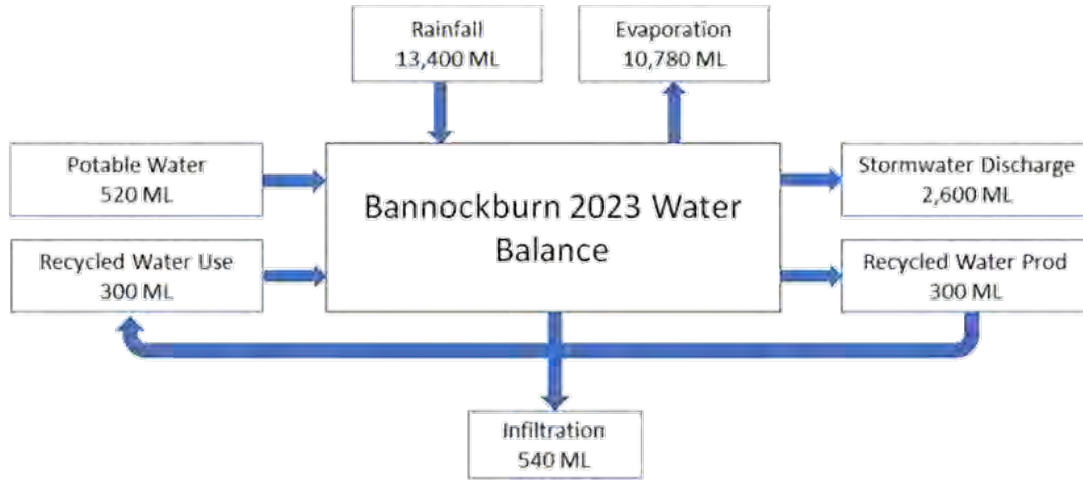


Figure 17: Approximate business as usual Bannockburn water balance

6.1.2 2050 WATER BALANCE

Figure 18 shows the projected water balance, should BAU water management continue. based on BAU practices. Changes are associated with development with increased potable water demand and imperviousness leading to increased stormwater generation. No climate change impacts are factored in. Red arrows show the detrimental change to BAU, green arrows a beneficial change.

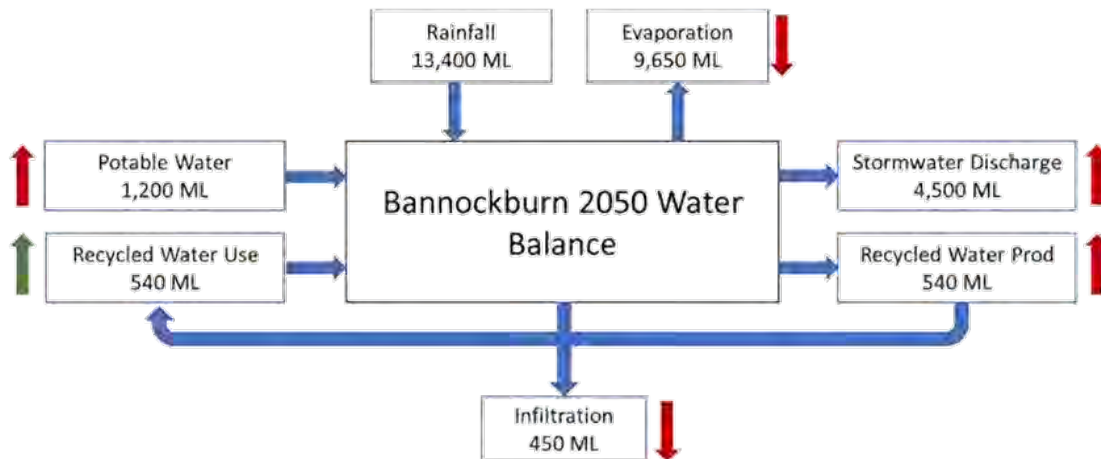


Figure 18: Approximate BAU 2050 Bannockburn water balance



The modelled 2050 water management system includes the following practices and assets:

- ▶ Potable water fulfils practically all water demands.
- ▶ Bannockburn is partially sewerred, all new development is sewerred.
- ▶ Bannockburn WRP has an increased treatment capacity.
- ▶ More Barwon Water owned lands are irrigated using Class C recycled water.
- ▶ Stormwater is managed using typical stormwater infrastructure to meet regulatory outcomes.
- ▶ Stormwater in growth areas is treated to the minimum required standards.
- ▶ Stormwater is not harvested to fulfil any notable water demands.
- ▶ Recycled water is used only to fulfil water demands at the Bannockburn Golf Club.
- ▶ Stormwater volume runoff increases significantly with residential development leading to irreversible damage to local waterways, flora and fauna. Bruce's Creek significantly impacted.
- ▶ All open space areas including active and passive are reliant on rainfall (or potable water) to stay green, which, in a drying climate is more difficult leading to a degradation of the public realm.



7. LEGACY WATER MANAGEMENT ISSUES

7.1. TRADITIONAL STORMWATER MANAGEMENT

A traditional approach to stormwater management is focused on drainage and aiming to ensure that developed areas are not subject to flooding from high rainfall events.

Most of the historic stormwater management infrastructure across Bannockburn has been designed primarily to mitigate flooding events and impacts, prevent nuisance flows and does not incorporate features that provide stormwater treatment or limit discharge volumes. As a result, local waterways and landscapes are subject to degradation. It should be noted that current stormwater management approaches are being implemented to a regulatory standard in newer development areas, and these provide better waterway health outcomes when implemented effectively.

While such infrastructure is consistent with the strategy and design standards of former generations of stormwater management, this approach is now recognised as insufficient to mitigate the impacts of projected urbanisation and growth. Better management of stormwater to protect waterways will require retroactive upgrades consistent with the contemporary state of knowledge for stormwater management strategies.

7.2. DECENTRALISED WASTEWATER MANAGEMENT

Bannockburn is partially sewered, requiring a significant percentage (>50%) of properties to rely on septic tanks for the management of wastewater. GPSC is responsible for overseeing the planning and operational compliance of these septic tanks with residents and property owners responsible for the maintenance and performance of these on-site septic tanks. Septic tanks systems can degrade over time leading to operational issues such as effluent leaving the property boundary and discharging to waterways. Council-led audits of the condition and performance of septic tanks can be undertaken however this can be difficult and expensive. Current EPA regulations require new systems to have a 3-monthly service agreement to be in place. Older systems are self-auditing. Faulty septic systems and discharges are very quickly reported to GPSC by neighbours and Environmental Health officers ensure rectification and compliance.

Onsite domestic wastewater systems (ODWM), when not managed appropriately, present risks to the health of waterways, landscapes and the public. GPSC has an ODWM Plan in place to manage these risks. Based on the ODWMP Bannockburn's 'septic tanks would be considered low risk, as unlike other towns, higher risk small lots are all sewered. Only lots that are unsewered are LDRZ and 4000m² or bigger. The DWMP states "Existing onsite systems in sewered areas are not a major domestic wastewater risk"

7.3. UNDERPERFORMING WATER SENSITIVE URBAN DESIGN (WSUD) ASSETS

GPSC owns and operates a range of constructed Water Sensitive Urban Design (WSUD) assets across Bannockburn including wetlands and raingarden systems.

GPSC has indicated that these assets are underperforming, and in some cases, are of inappropriate construction. This assessment was confirmed by a site visit attended by Spiire and GPSC staff. Figures 19 to 21 present the assets that are inappropriately constructed and consequently underperforming.

Figure 19 shows a detention system that services the adjacent residential area. This system is inaccessible for scheduled maintenance and consequently the asset will degrade, both in aesthetics and efficacy, as required maintenance is not delivered.



Figure 19: A stormwater detention basin that has no access track for maintenance activities

Figure 20 shows a constructed swale that drains directly into the Bruce Creek Reserve, servicing the adjacent residential area. Due to the steepness of the land, GPSC is unable to conduct the required maintenance with available maintenance equipment. As a result, the swale is over vegetated and silt is unable to be removed, so function is impacted



Figure 20: A vegetated swale that is inaccessible for maintenance activities due to the cross-sectional grade of the asset

Figure 21 shows what appears to be a stormwater raingarden within the Bruce Creek Reserve east of Rosemond Way. Following a site inspection, it appears as though the pipe connection from Rosemond Way passes directly beneath the raingarden, with the inlet to the raingarden being open directly to Bruce Creek. It appears the raingarden is disconnected from stormwater inlets, and so receives no stormwater inflows. As a result, it is believed that the raingarden provides no waterway health benefit in its current state.



Figure 21: A stormwater raingarden basin with dry inlet and wet outlet to Bruce Creek.



This IWM Plan establishes an Action Plan that aims to ensure existing and future stormwater management strategies, infrastructure and planning processes are designed and developed to deliver the targeted IWM Outcomes.



8. VISION AND OBJECTIVES

As outlined in Sections 3 and 4, there is a significant body of work providing direction for how the water cycle should be planned for to improve liveability and resilience. Applying this strategic context to the planning of the water cycle in the growing township of Bannockburn resulting the following specific Vision, Objectives and Targets.

8.1. VISION

The vision for the Bannockburn IWM Strategy was developed through the Golden Plains Shire Council IWM working group. It builds on the language and intent of the various visions of documents outlined in Section 4.

The arrived at vision is outlined below.

Bannockburn will grow as a water sensitive township, with water supporting liveability and resilience within the community, and a thriving environment.

This vision for Bannockburn and Bruce Creek, recognises the role of water in our communities, landscapes and environment. Water is important for our health and wellbeing, and to support and attract agriculture, businesses and industry. The water cycle for Bannockburn needs to provide for the needs of the community and environment, even in times of scarcity and in the face of climate change.

Water management across Bannockburn requires collaborative planning that contributes towards enhancing environmental flows and systems, considers alternative water use, storm water management, and supports a liveable, sustainable and healthy community.

8.2. IWM OBJECTIVES

Similarly, the objectives of the Bannockburn IWM Strategy built on the strategic themes of the GPSC Council Plan 2021-25. These themes were made water cycle specific leading to the following objectives and associated outcomes.

8.2.1 OBJECTIVE 1: COMMUNITY VALUES ARE REFLECTED IN THE WAY WATER IS USED AND MANAGED

Outcomes:

- Reduction in potable water usage
- Increased usage of fit-for-purpose alternative water supplies in households
- Traditional owner values are considered in water cycle management
- The community is informed and educated on the water cycle

8.2.2 OBJECTIVE 2: WATER ENABLES A GREEN AND LIVEABLE BANNOCKBURN

Outcomes:

- Open spaces are supported through alternative water supplies
- Street tree canopy is supported through alternative water provision
- Water cycle management is promoted through highly visible projects



8.2.3 OBJECTIVE 3: THE SUSTAINABILITY OF WATERWAYS AND LANDSCAPES IS SUPPORTED BY WATER

Outcomes:

- Waterways are protected from the detrimental impacts of development and supported through improved water cycle management, including stormwater harvesting and beneficial release
- WSUD infrastructure are built and managed to provide benefits into the long term

8.2.4 OBJECTIVE 4: WATER CREATES OPPORTUNITY AND ECONOMIC PROSPERITY OF BANNOCKBURN

Outcomes:

- Agriculture and industry are supported by alternative water supplies

8.3. IWM TARGETS

The measurable targets outlined in Table 9, developed by the GPSC IWM working group, align with the IWM Objectives. These are proposed to guide investment and monitor the implementation of the IWM Plan.

Table 9: Bannockburn IWM Plan Objectives and Targets

#	Objective	#	Targets	Timeframe
1	Community values are reflected in the way water is used and managed	1.1	100% of public buildings and sports pavilions fitted with rainwater tanks and plumbed to toilets	10 years
		1.2	Rainwater tanks, connected to toilets, laundry and gardens, installed across 100% new residential properties	10 years
		1.3	New water management infrastructure, such as wetlands and alternative water supply schemes, referred to Wadawurrung Traditional Owners Aboriginal Corporation for input into design, construction and ongoing maintenance	5 years
		1.4	IWM education signage installed on 100% of new WSUD assets	5 years
2	Water enables a green and liveable Bannockburn	2.1	100% of active public open spaces irrigated with alternative water supplies	10 years
		2.2	100% of new street trees supported through passive stormwater irrigation	10 years
		2.3	Blue-green infrastructure installed on 3 high priority streetscapes	10 years
3	The sustainability of waterways and landscapes is supported by water	3.1	Bruce Creek predevelopment volumes and flow rates restored through managed stormwater harvesting.	20 years
		3.2	WSUD assets designed, built and operated to industry best practice (100%)	5 years
4	Water creates opportunity and economic prosperity of Bannockburn	4.1	50% increase in beneficial use of alternative water supplies by agriculture and industry	10 years
		4.2	100% excess stormwater generated across Bannockburn is beneficially reused	20 years



How these targets are proposed to be met through the range of identified IWM options is shown in Table 13, Section 10.

The initial actions to commence implementing the identified IWM options is outlined in the Action Plan in Section 12.



9. OPTIONS ANALYSIS

The Action Plan presented in this document outlines the implementation pathway for recommended IWM Opportunities. The analysis conducted to determine the recommendations was delivered in three stages: (1) identify, (2) review, and (3) assess the IWM Opportunities. Details of the analysis method are outlined below. Stakeholder engagements supported the delivery of each analysis stage, and key engagements are also detailed in this section.

9.1. STAGE ONE: IDENTIFY IWM OPPORTUNITIES

An initial 'long-list' of IWM Opportunities was developed to establish a comprehensive understanding of available IWM actions, and identify pathways to advancing the IWM Targets and IWM Objectives. This 'long-list', and its subsequent qualitative assessment, is presented in Table 9.

The 'long-list' was informed by the *Bannockburn IWM Design Sprint (2020)*, the findings of the *Context Review*, engagements with stakeholders, and Spiire's IWM expertise. Key stakeholder engagements are outlined below.

9.1.1 WORKSHOP 1 – PROJECT INITIATION

A workshop was held on the 29 May 2023 to initiate the collaborative exploration of IWM initiatives across the Bannockburn township and growth areas. The workshop was held at Golden Plains Shire Council offices in Bannockburn, with participants listed below in Table 10.

Discussions focused on the Bannockburn context and opportunities for improved water cycle outcomes. Details relating to an IWM vision and associated outcomes were also discussed, though no articulated vision or outcomes were established.

Table 10: Project initiation workshop attendees

Organisation	Attendees
Golden Plains Shire Council	Kate Milburn, Luke Purcell, Marina Desa, Laura Murphy, Dale Smithyman, Vicki Shelton, Brayden Lane, Peter Ridsdale
Barwon Water	Rhys Bennett
Victorian Planning Authority	Patricia Ocampo, Morris Edwards
Spiire	Nigel Corby, Milly Taylor, Alan Davison

9.1.2 TRADITIONAL OWNER DISCUSSION

Spiire separately engaged Greg Robinson and Claire Mennen from the *Wadawurrung Traditional Owners Aboriginal Corporation*. The discussions focused on the role and development of this IWM Plan, in addition to a range of other IWM projects in the Geelong and Ballarat region.

Wadawurrung indicated that this project is considered a high priority for them and requested that engagement details be outlined such that the Wadawurrung can provide the required resourcing. Wadawurrung indicated that they have a good relationship with Golden Plains Shire Council (Kate Milburn) and that they will resource Working Group.

Wadawurrung Traditional Owners Aboriginal Corporation are considered a key part of the Working Group, included in engagement invitations, and receive all the significant minutes and reports delivered in developing this IWM Plan.



9.2. STAGE TWO: REVIEW IWM OPPORTUNITIES

9.2.1 ASSESSMENT FRAMEWORK

The assessment criteria that was adopted to conduct the two-stage options assessment process, the *initial assessment* and the *refined assessment*, is shown in Table 11. Each opportunity identified in Workshop 1 were assessed against these criteria. The evaluations are represented by a colour-coded rating system.

- ▶ Green indicates support for the implementation of the IWM Opportunity under that category.
- ▶ Amber indicates marginal or neutral support for the implementation of the IWM Opportunity under that category.
- ▶ Red indicates that the IWM Opportunity is not supported under that category.

Table 11: The assessment framework for considered options

Category	Initial Assessment	Refined Assessment
Targets	Contribution to established authority targets/outcomes	Quantified contribution to established authority targets/outcomes
Value	Qualitative potential for economic feasibility	Comparison of cost/benefit to BAU
Technical	Identify Technical precedent	Qualitative assessment of technical feasibility within local context and timeframes
Policy and Regulation	Identify Regulatory precedent	Qualitative assessment of regulatory feasibility within local context and timeframes
Risk	Qualitative potential for high or extreme associated risks	Qualitative assessment of risk mitigation within local context and timeframes

The assessment was conducted in two phases: an 'Initial Assessment' of the IWM Opportunities Long List as shown in Table 12, and a 'Refined Assessment' of the IWM Opportunities Short List as outlined in the detailed assessments undertaken in Section 10, and summarised in

Table 14.

9.2.2 WORKSHOP 2 – REVIEW OF IWM OPPORTUNITIES

A second workshop was held to review the 'long-list' of IWM Opportunities and produce the 'short-list' that was subject to further investigation and assessment. GPSC members, as well as other relevant stakeholders, were consulted in conducting the review.

The results of the *initial assessment*, conducted by Spiire, were presented and detailed for workshop attendees, and stakeholder questions and comments informed the final selection of the 'short-list'.



9.3. STAGE THREE: ASSESS IWM OPPORTUNITIES

9.3.1 KEY DESIGN ELEMENTS

Water cycle outcomes are achieved through infrastructure interacting with water moving through the urban area. This section of the detailed assessment outlines the principal infrastructure and its functionality to achieve the outcomes of the opportunity.

The option outlined is typically the most implemented throughout the water management sector, or the most straight forward to implement.

9.3.2 OTHER DESIGN ELEMENTS FOR CONSIDERATION

There can be variants to the opportunity being assessed which may, through different management or design, be able to provide additional outcomes. These variants are identified however are not assessed.

9.3.3 OPTIONS ASSESSMENT

The presentation of the results of the refined options assessment using the Options Assessment Criteria.

9.3.4 VISUALISATION

A visual for the option shows a stylised schematic, a photo example or a map based schematic to illustrate the opportunity.

9.3.5 IMPLEMENTATION PATHWAY

Opportunities identified through an IWM approach usually will involve additional infrastructure and a business case to be developed to demonstrate value, this is on top of business as usual servicing, but needs to interface with the business as usual infrastructure.

An implementation pathway outlines steps required to realise the identified option. This typically starts with obtaining internal buy in from the organisations with likely ultimate responsibility, investigations and design work, and could also include stakeholder and community consultation.

Servicing with an IWM approach is more complex than a business as usual approach due to the integrated nature of analysis and collaboration amongst multiple parties, as such significantly more time is needed to plan for these options. The implementation pathway illustrates this complexity.

9.3.6 ASSET OWNERSHIP AND OPERATION

When creating interfaces in the urban water cycle between water supply, sewage management and drainage, the organisational responsibilities for the ownership and infrastructure can need exploration. A suggested asset ownership and operation model for each of the options is proposed for further discussion amongst project partners.

9.3.7 APPROXIMATE WATER BALANCE

A range of assumptions were made regarding the make up of the future Bannockburn urban form to determine estimated water supply, for both households and open spaces, and sewage management. Assumptions were also made to estimate imperviousness and stormwater runoff. These assumption were developed into a simple MUSIC model, and a BPEM wetland added. This provided the Base Case water balance. Further analysis was undertaken in Excel to explore the impact of each option on the water balance. The change to the base case for each option is highlighted by a red or a green arrow depending on whether the change is recognised as a positive or negative change.



9.3.8 DISCUSSION

Pros and cons of each of each option are briefly explored based on previous projects and discussion with stakeholders. This discussion is intended to summarise the preceding considerations in a few dot points to support the recommendation.

9.3.9 RECOMMENDATION AND ACTIONS

A recommendation is provided to suggest whether an option should be further explored. Initial actions are also identified to start progressing the option.

10. ANALYSIS RESULTS

10.1. INITIAL OPPORTUNITY ASSESMENT

The Long List of Options identified in Workshop 1, and their subsequent assessment through the Opportunity Assessment Criteria, are presented below in Table 12.

- ▶ Green indicates support for the implementation of the IWM Opportunity under that category.
- ▶ Amber indicates marginal or neutral support for the implementation of the IWM Opportunity under that category.
- ▶ Red indicates that the IWM Opportunity is not supported under that category.

Table 12: Long List Options assessment

Option	Targ	Val	Tech	Reg	Risk	Rec	Discussion
1. Rainwater tanks for toilet flushing, laundry and irrigation	Green	Amber	Green	Green	Green	Green	Explore, simple for GPSC to require. Conflict with dual reticulation.
2. Class A recycled water for toilet flushing, laundry and irrigation	Green	Red	Amber	Green	Green	Amber	Consider. Potential conflict with rainwater tanks.
3. Digital meters, with an app for real time water usage monitoring	Amber	Green	Green	Green	Green	Amber	Consider. Digital meter are BAU, app might be extra.
4. Smart control systems on rainwater tanks	Amber	Amber	Amber	Amber	Green	Amber	Consider. Dependant on digital meters and rainwater tanks.
5. Passively irrigated street trees – roof catchment	Green	Amber	Green	Green	Green	Green	Explore. Could be enhanced through smart control systems.
6. Passively irrigated street trees – road catchment	Green	Amber	Green	Green	Green	Green	Explore.
7. Nature strip infiltration gardens	Green	Amber	Amber	Green	Green	Red	Do not explore, significant modification of nature strip required.
8. Infiltration Wetlands	Green	Green	Amber	Green	Green	Green	Explore. Though not currently part of Melbourne Water design.
9. Class C recycled water for active and passive open space irrigation	Green	Green	Amber	Green	Amber	Green	Explore. Likely volume available from treatment plant.
10. Class C recycled water for main street via subsurface irrigation	Amber	Red	Amber	Green	Amber	Red	Do not explore. Infrastructure cost likely high for volumes supplied.
11. Stormwater for active and passive open space irrigation	Green	Green	Amber	Green	Amber	Green	Explore.

Option	Targ	Val	Tech	Reg	Risk	Rec	Discussion
12. Kerb-cut outs disconnecting road imperviousness to open space	Yellow	Green	Green	Green	Green	Green	Explore. Will need council approved designs.
13. Stormwater harvesting to She Oaks Weir for Passing Flows/Env	Green	Green	Yellow	Yellow	Green	Green	Explore. Dependant on wetlands, so relevant for GPSC
14. Biosolids Reuse for agriculture	Red	Green	Green	Green	Green	Red	Do not explore. More relevant for Barwon Water.
15. Stormwater harvesting to Moorabool Treatment Plant for potable use	Green	Yellow	Yellow	Red	Yellow	Red	Against government policy, do not explore.
16. Recycled water to She Oaks Weir for Passing Flows/Env/TOs	Green	Yellow	Yellow	Yellow	Green	Yellow	Consider. More relevant for Barwon Water.
17. Trial of on-lot greywater recycling systems	Green	Red	Yellow	Green	Green	Yellow	Consider. Located on private property.
18. Review and rectify existing WSUD	Green	Yellow	Yellow	Green	Green	Green	Explore. Important for existing assets.
19. Blue green infrastructure along High St, Pope St, Burnside Rd	Yellow	Yellow	Yellow	Green	Green	Green	Explore.
20. Roof water harvesting from Commercial areas. Storage under carparks.	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Consider. Assets on private property for use outside, so complicated.
21. Urban Orchards/Community Gardens	Yellow	Green	Green	Green	Green	Green	Explore.
22. Review Infrastructure Design Manual	Yellow	Green	Green	Green	Green	Green	Explore.
23. Educate Staff on IWM	Yellow	Green	Green	Green	Green	Green	Explore.
24. Educate Community on IWM	Yellow	Green	Green	Green	Green	Green	Explore.
25. Smart Irrigation Trial	Yellow	Green	Yellow	Green	Green	Green	Explore.
26. Innovative onsite domestic wastewater	Yellow	Green	Green	Green	Green	Green	Explore.
27. Recycled water/ stormwater for agriculture/ industry	Yellow	Green	Yellow	Green	Green	Green	Explore.

Option	Targ	Val	Tech	Reg	Risk	Rec	Discussion
28. Restore flow regime of Bruce Creek							Explore.

The outcome of this assessment led to further discussion in Workshop 2 of which options should proceed to the next stage of assessment in the short list. The rationale for those options not selected are as follows:

Option 2. Class A recycled water for toilet flushing, laundry and irrigation – The plant upgrade to Class A and cost of dual reticulation was deemed too high.

Option 3. Digital Meters – Barwon Water considers the installation of digital meters as business as usual. No further analysis required.

Option 4. Smart Control on Rainwater Tanks – Likely low contribution to targets and challenges in assigning control system ownership and maintenance responsibilities.

Option 7. Nature Strip Infiltration Gardens – Significant modification of streetscapes would be required, particularly considering the low permeability of soil across Bannockburn. These outcomes can likely be better provided by other opportunities.

Option 9. Class C irrigation for main street irrigation – The cost of supplying these demands would be high, for a relatively small volume of water. Also, recycled water supply can't be safely managed with current controls.

Option 14. Biosolids reuse for agriculture – Less relevant for GPSC, Barwon Water to pursue if relevant.

Option 15. Stormwater Harvesting to Moorabool Treatment Plan for potable use – Currently against government policy. Revised as manage stormwater for waterway protection.

Option 16. Stormwater Harvesting to She Oaks Weir for passing flows/env flows – Revised as *Manage stormwater for waterway protection*. Replacing passing flows to the Moorabool with stormwater to realise increased extraction for potable water is not aligned with traditional owner values.

Option 17. Trial of on-lot greywater systems – Quite expensive for only non-potable demands, unknown funding pathway.

Option 20. Roof water harvesting from Commercial areas. Storage under carparks – Assets in the private realm and likely small demands make this option too complex to recommend.

Option 21. Urban Orchards / Community Gardens – Expensive to undertake with an alternative water supply in the short term. If the recycled water pipeline is provided to open spaces, explore again then.

Option 26. Innovative Onsite Domestic Wastewater – Growth not recommended in non-sewered part of the township.

Option 28. Restore Bruce creek flow regime – Revised as Managed Stormwater Flows for waterway protection.

The resultant shortlisted opportunities, and their alignment with IWM Plan targets, council plan themes and IWM Forum Strategic outcomes, are outlined in Table 13.

Table 13: Shortlisted IWM Plan opportunities

No.	Opportunity	Relevant IWM Plan Targets	Council Plan Theme	IWM Forum Strategic Outcome
1.	Managing stormwater volumes to protect waterways	3.1, 4.2	Sustainability Prosperity	Healthy Waterways Economic Opportunity
2.	Rainwater tanks for toilet flushing, laundry and irrigation	1.1, 1.2, 3.1, 4.2	Community Sustainability Prosperity	Water Supplies Healthy Waterways
3.	Passively irrigated street trees	2.2, 3.1, 4.2	Liveability Sustainability Prosperity	Healthy Landscapes Healthy Waterways
4.	Class C recycled water for public open space irrigation	2.1, 4.1	Liveability Prosperity	Water Supplies Wastewater Systems Healthy Landscapes
5.	Kerb cut-outs disconnecting road imperviousness	2.2, 3.1, 4.2	Liveability Sustainability Prosperity	Healthy Waterways Healthy Landscapes
6.	Review and rectify existing WSUD assets	3.1, 3.2	Sustainability	Healthy Waterways
7.	Recycled water\stormwater for agriculture/industry	4.1	Prosperity	Wastewater Systems Economic Opportunity
8.	Stormwater for public open space irrigation	3.1	Sustainability	Healthy Landscapes Healthy Waterways
9.	Infiltration wetlands to support waterway base flows	3.1	Sustainability	Healthy Waterways
10.	Review Infrastructure Design Manual	3.2	Sustainability	Healthy Waterways
11.	Educate staff on IWM principles and practices	1.4	Community	Community Values
12.	Educate community on IWM principles and practices	1.4	Community	Community Values
13.	Priority Blue-Green Infrastructure (High St, Pope St, Burnside Rd)	1.3, 1.4, 2.2, 2.3	Community Liveability Sustainability	Healthy Waterways Healthy Landscapes

10.2. REFINED OPPORTUNITY ASSESSMENT

The shortlisted opportunities were subsequently assessed in more detail in the following one page assessments as per the categories outlined in Section 9.3.



Bannockburn IWM Options Assessment

Option 1: Managing stormwater volume to protect waterway values
Scale: Regional

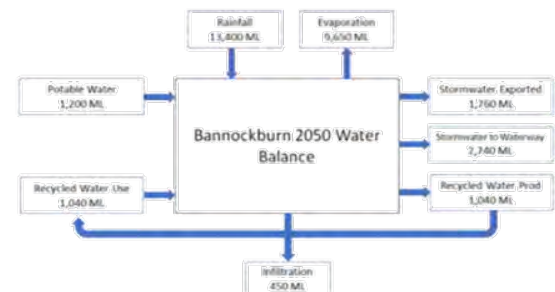
Key Design Elements

- The EPA Guidance for stormwater management outlines significant harvesting and infiltration targets for the protection of priority waterways. Bruce Creek could be identified as such due to being within the Barwon River Catchment and because of its local values.
- In this option upstream farm dams capturing water from the Bruce Creek catchment will be offset by treated stormwater release until stormwater flows increased by development meet the threshold to which Bruce Creek is longer flow stressed.
- Once this threshold has been met, water would then be pumped from the storage to a proposed regional stormwater management scheme as part of the Northern and Western Geelong Growth Areas.
- This water could eventually be provided for use in a range of residential, agricultural, environmental and potable reuse

Visualisation



Approximate Water Balance



Option 1: Managing stormwater volume to protect waterway values

Other Design Elements for Further Consideration

- This option should consider all growth areas.
- An adaptive pathway should be developed with Barwon Water to support the environment and regional water security.
- An interface with servicing the Northern and Western Geelong Growth Areas is required.

Implementation Pathway

- Analysis of receiving waterways, namely Bruce Creek and the Moorabool River, to determine what stormwater volume management would be required in the context of upstream catchments.
- Develop the servicing concept incorporating the water sensitive urban design infrastructure across all growth areas. This will include sizing and location of rising mains, pumpstations and storages.
- Include in PSP the intent to undertake the harvesting scheme and concept infrastructure layout.
- Undertake a functional design, to better firm up infrastructure sizing, storage location, timing and organisational responsibilities.
- Work with wetland designers to incorporate harvesting into design.
- Work with EPA and Barwon Water to determine optimal end uses and if further treatment is required.
- Detailed design of the scheme for the Bannockburn growth areas.
- Assuming Barwon Water as the lead authority, Barwon Water to develop a business case with funding contributions from State Government, Barwon Water and developers and schedule construction.

Discussion

Pros

- Protects waterways from harmful stormwater volume.
- Provides a valuable resource in a flow stressed waterway.
- When policy allows, reduces the need for importation of potable water from a desalination plant.
- Potential to provide additional water for the environment.

Cons

- No precedent at this scale
- Needs regional thinking, not just Bannockburn growth areas
- Unclear funding mechanisms

Options Assessment

Metric	Comments
Targets	Achieves the restoration of flows to Bruce Creek, and meets the EPA Guidance targets for priority waterways.
Value	The management of stormwater volume will support the ecology of Bruce Creek. Excess water could provide a potable water benefit.
Technical	This option would involve significant design work. Sunbury stormwater harvesting provides a precedent.
Policy and Regulation	Utilising treated stormwater for environmental flows and potable uses would require enabling policy.
Risk	Some risks involved, particularly for higher value uses. These can be managed.
Include in Portfolio	No other options are able to meet the waterway protection outcomes. Needs further exploration.

Asset Ownership and Operation

- Golden Plains Shire Council own the drainage system and wetlands.
- Asset ownership and operation of the harvesting scheme should fall to the organisation best positioned to manage the infrastructure and receive a benefit.
- Barwon Water would be best positioned to operate, and therefore own, the infrastructure, however would need a mechanism to recover capital and operational costs.
- Barwon Water would recover some costs if there was a potable water benefit.
- Shortfalls may need Vic Government or Developer funding.

Recommendation and Actions

OPTION RECOMMENDED

- Engage with Corangamite Catchment Management Authority to determine flow needs for Bruce Creek and Moorabool River.
- Engage with Barwon Water to develop concept, including infrastructure ownership and operation.
- Embed requirement for stormwater harvesting from wetlands in PSP/Planning Schemes

Bannockburn IWM Options Assessment

Option 2: Rainwater tanks for toilet flushing, laundry and irrigation
Scale: Lot



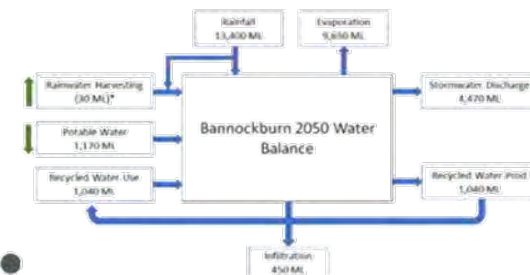
Key Design Elements

- Household roofs provide a relatively clean catchment from which water may be harvested through gravity into a tank
- Quality can be further improved with first flush diverters installed.
- Typically, about half the roof catchment can be plumbed to a single tank.
- Size of the tank is determined by what end uses the water will be used for. In an urban context it is recommended that rainwater is used for:
 - Toilet Flushing
 - Laundry
 - Lawn and garden Irrigation
- Water is provided to household demands through a pump and non-potable plumbing.
- Water can also be provided to the street tree through a manual release of rainwater to the drainage system (see Option 3).
- Typically constructed on new builds however can be retrofitted.

Visualisation



Approximate Water Balance



Option 2: Rainwater tanks for toilet flushing, laundry and irrigation
 *(Rainwater Volume not included in water balance)

Other Design Elements for Further Consideration

- Smart water meter and smart controlled tank release, this could better support street trees and downstream wetlands with stormwater harvesting through centrally controlled release from tanks.
- Roof water to hot water as demonstrated in Aquarevo, requires a disinfection system at each tank.
- If a pump failure is identified by a smart meter, Barwon Water could facilitate a repair service, for a fee that recovers costs.

Implementation Pathway

- Initially focus on facilitating installation in growth areas.
- As per the national construction code, a rainwater tank must be installed in a Class 1 building in accordance with the regulations made under the Building Act 1993 (Victoria).
- Tanks are to be installed and plumbed to toilet flushing and garden irrigation as a minimum.
- Golden Plains Shire Council could potentially require plumbed rainwater tanks on all lots as a condition of a planning permit.
- Barwon Water could potentially require plumbed rainwater tanks on all lots as a condition of water and sewer supply, similar to recycled water supply requirements.
- Golden Plains Shire Council could require developers to compile an IWM Plan as a condition of a planning permit, with an expectation that Rainwater Tanks will be installed.
- Golden Plain Shire Council can require stormwater connection to a street tree as opposed to directly to the stormwater drain.
- Golden Plains Shire Council to explore support programs for retrofit installation.

Discussion

- Pros**
- Tried and tested option, widely accepted by home owners
 - Contributes to potable water use reduction
 - Contributes to stormwater volume discharge reduction
 - Directing roof water to street tree increases canopy cover and reduces urban heat
 - Highly visible and increases water literacy within the household
- Cons**
- Quite costly from a purely water supply perspective
 - Benefits are dependent on the home owner maintaining gutters, downpipes and the pump. If the pump fails and the home owner is not aware or does not repair the fault, potable water will supply all demands
 - Tanks will typically supply only ~70% of the non-potable demands due to rainfall distribution, and water is typically most needed when it isn't raining and the tank is empty.

Options Assessment

Metric	Comments
Targets	Reduction in potable water use and stormwater volume discharge
Value	Relatively expensive solution to reducing potable water use and stormwater volume reduction, but good for water literacy.
Technical	Well established technology and widely implemented.
Policy and Regulation	There are no policy or regulatory barriers to installation. Less clear are the mechanisms to mandate installation.
Risk	Risks associated with operating the system are low. Principal risk lies in supporting systems for pumps to be maintained.
Include in Portfolio	Rainwater tanks are compatible with most other options except Class A dual reticulation, which is not in any portfolio.

Asset Ownership and Operation

- Rainwater tanks, and associated infrastructure including downpipes, first flush diverters, pump and plumbing, are all owned by the home owner.
- The home owner is also responsible for maintenance of the system.

Recommendation and Actions

OPTION RECOMMENDED

- Embed requirement for rainwater tank installation on all lots in PSP/Planning Schemes
- Develop plumbing specification, including optimal tank size
- Engage with developers to develop process to enable compliance with rainwater tank installation
- Explore support programs for retrofitting rainwater tanks on existing properties.

Bannockburn IWM Options Assessment

Option 3: Passively irrigated street trees
Scale: Precinct



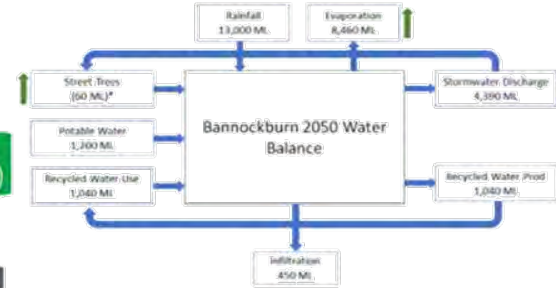
Key Design Elements

- Stormwater harvested from roof and/or road catchments can support tree canopy cover through passive irrigation of street trees.
- Underground water storage and irrigation systems can be installed for each street tree enabling passive water supply.
- The storage structure is offset from the kerb allowing room for root development.
- For a roof catchment, the stormwater drainage pipe fills the storage and then spills into the stormwater drainage system. Grade of the stormwater pipe needs to facilitate this design. Trees would be planted at house construction, not all together along the street.
- For a road catchment, the kerb directs runoff to the underground storage, and then spills to the stormwater drainage system. Ensuring solids to not enter the storage can be a challenge, especially during construction.

Visualisation



Approximate Water Balance



Option 3: Passively Irrigated Street Trees
 *(Street Trees Volume not included in water balance)

Other Design Elements for Further Consideration

- Specification of a tree canopy target for both public and private realm within PSPs and planning schemes
- Although roof catchments are preferable for passively irrigated street trees, road catchments are more widely implemented.

Implementation Pathway

- An assessment needs to be undertaken by council as to the preferred configuration of the passive irrigation system, roof catchment or road catchment.
- The passive irrigation system to be designed to council specifications.
- Engage with VPA / internal planning dept to detail requirement in PSPs and planning schemes.
- Golden Plains Shire Council could also require passively irrigated street trees on all lots as a condition of a planning permit.
- Golden Plains Shire Council could also require developers to compile an IWM Plan as a condition of a planning permit, with an expectation that Passively Irrigated Street Trees will be installed.

Discussion

- Pros**
- Contributes to urban cooling
 - Increase neighbourhood amenity
 - Decreases stormwater volume discharge to waterways
 - If connected to rainwater tanks, rainwater can be used to also provide water to trees
- Cons**
- Will require ongoing maintenance, though this is not well understood.
 - Still and emerging technology, while Melton City Council and Hume City Council are requiring in their growth areas, these have not been in the ground for particularly long periods. As such, long term effectiveness is questionable.

Options Assessment

Metric	Comments
Targets	Contributes to canopy cover, amenity, fauna habitat and reduced urban heat. Reduces stormwater volumes to waterways.
Value	Structure will cost approx. \$1500 to install. Canopy cover expected to increase by around 30%.
Technical	Option will require a council endorsed design. System will require routine maintenance.
Policy and Regulation	There are no policy or regulatory boundaries associate with this option.
Risk	Low risk associated with implementing this infrastructure.
Recommendation	Passively irrigated street trees support other options. Explore further.

Asset Ownership and Operation

- As the street tree would be owned by council, the passive irrigation system would also be owned by council.
- The system would be specified by council and delivered by developers. The asset would then be gifted to council following the warranty period.
- If a roof catchment, delineation of resident and council responsibilities in the roof water drainage pipe will need definition.
- GPSC will be responsible for maintenance requirements

Recommendation and Actions

- OPTION RECOMMENDED**
- Determine preferred configuration and design
 - Embed requirement for passive street tree irrigation system installation for all street trees in PSP/Planning Schemes
 - Engage with developers to develop process to enable compliance with passive irrigation system installation

Bannockburn IWM Options Assessment

Option 4: Class C recycled water supply for public open space irrigation
Scale: Precinct



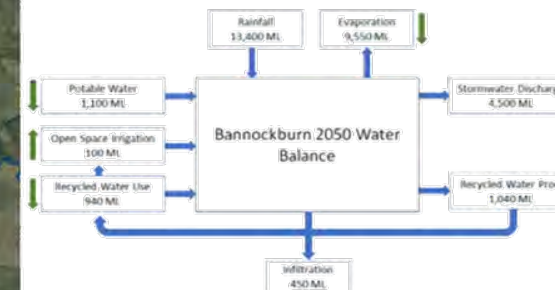
Key Design Elements

- Class C recycled water is currently produced at the Bannockburn Water Reclamation Plant, which has no waterway discharge (except for wet weather flows). This recycled water is used for agriculture.
- This option involves supply to active open spaces throughout the existing township and new growth areas.
- Typically an onsite tank would be constructed at a capacity to provide one irrigation cycle. This tank would be filled by Barwon Water at a low pressure. A pump would provide irrigation pressure to the irrigation system with water from the tank.
- There are regulations surrounding Class C recycled water use. This would involve night time irrigation of active open spaces, fencing and installation of signage. Irrigation would also have to take place a certain distance from housing.

Visualisation



Approximate Water Balance



Option 4: Class C recycled water supply for public open space irrigation

Other Design Elements for Further Consideration

- Water could be treated to a Class B or A quality, which would reduce the management requirements.
- Agriculture may prefer the Class B or A quality and may be willing to pay more for it, so a plant upgrade may be sized for both open space and agricultural demands.

Implementation Pathway

- Determine demand for recycled water and engage with Barwon Water on supply price.
- Undertake conceptual design including pipe alignments.
- Include the intent to undertake the recycled water scheme in PSP and planning scheme. Include mention of pipelines and indicative alignments.
- Undertake a functional design, to better firm up infrastructure sizing, storage and timing.
- Confirm funding mechanisms. Developers would typically construct pipelines within the development and gift these to Barwon Water. Other pipelines would need to be funded by council and Barwon Water, funding from State Government may be available.
- Develop a business case with the various funding contributors and schedule construction.
- Golden Plains Shire Council to include in growth area planning permits need for developers to install pipeline infrastructure for open space irrigation with Class C recycled water.

Discussion

- Pros**
- Well understood system
 - Provides high reliability, alternative water to open space areas
 - Potentially cost effective supply, particularly if compared to desalination Long Run Marginal Cost (\$3,000-\$4,000 per ML).
 - Supply cheaper for council than potable.
- Cons**
- Potentially competes with agricultural demands
 - Is not compatible with stormwater for open space irrigation
 - Management practices need to be employed as the water is not potable or Class A quality.

Options Assessment

Metric	Comments
Targets	Contributes to potable water use reduction and management of recycled water.
Value	Potentially cost effective in the context of a growing Bannockburn and recycled water management constraints.
Technical	Fairly straight forward understanding of such systems, they are widespread.
Policy and Regulation	There are no policy or regulatory barriers, regulations are well defined.
Risk	There are some risks associated with recycled water use, however these are managed through following well defined regulations.
Include in Portfolio	Would not be implemented with stormwater harvesting for open space irrigation.

Asset Ownership and Operation

- Barwon Water currently own and operate the treatment plant and provide Class C recycled water to agriculture. Barwon Water would continue to own and operate the supply scheme to GPSC.
- GPSC would own and operate the open space recycled water tank and irrigation pump.
- GPSC would be required to implement a User Site Management Plan to use the recycled water for open space irrigation.

Recommendation and Actions

- OPTION RECOMMENDED**
- Collaborate with Barwon Water to explore concept, and explore funding mechanisms.

Bannockburn IWM Options Assessment

Option 5: Kerb cut-outs
Scale: Precinct



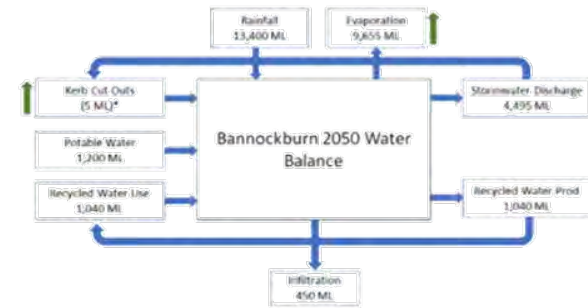
Key Design Elements

- Kerbing may be modified to disconnect impervious surfaces from the stormwater drainage system. This then reduces the requirement for active harvesting and infiltration to protect downstream waterways.
- Modified kerbing would typically be installed where road runoff could be directed to a pervious surface, such as a nature strip, centre median or open space. Open space is likely the easiest to implement as there is plenty of space.
- The surface of the road would be level or slightly higher than the surface level behind the kerb.
- The kerb itself could be castellated, with stormwater directed to cut outs, this would continue to provide the traffic barrier between the road and the open space.
- The kerb could also be flat, however bollards or another traffic management device might then be necessary.
- This could fit in well with the rural feel of Bannockburn.

Visualisation



Approximate Water Balance



Option 5: Kerb Cut Outs
 *(Kerb Cut Out Volume not included in water balance)

Other Design Elements for Further Consideration

- Swale drains in certain locations could also be considered, such as along a centre median boulevard. This configuration could also be planted with trees, which would receive the stormwater runoff, supporting canopy cover.
- Nature strip gardens are in place in various locations across Melbourne.

Implementation Pathway

- Locations to disconnect road surfaces and direct stormwater to pervious surfaces such as open spaces needs to be identified.
- The PSP/planning scheme could identify that roads abutting all open space areas are to direct stormwater runoff to the open space areas.
- Golden Plains Shire Council would develop a specification for developers, demonstrating how roads and open space levels either side of the modified kerbing would be constructed.
- Vegetation may also need to be defined, such as grass or shrubbery.
- This option would need further definition and exploration in the landscape masterplan for developments, which could be touched on in Developer IWM Plans, if required.

Discussion

- Pros*
- Low tech solution, product is typically available
 - Provides additional water to open space areas
 - Less infrastructure than a traditional approach as there could be less underground infrastructure, and therefore this option provides cost savings.
 - Very cost effective \$/ML management of stormwater.
- Cons*
- Not suitable for all locations, therefore the practical contribution to the overall targets is only small. Needs to be combined with a regional solution for the targets to be met.

Options Assessment

Metric	Comments
Targets	Reduce stormwater volume to waterways. Support vegetation with alternative water. Only a small impact.
Value	Cheaper installation than a traditional kerb and channel drainage treatment as there is less underground infrastructure.
Technical	Options will require engineered design, however little ongoing maintenance will be necessary.
Policy and Regulation	There are no policy or regulatory barriers, however council may need to modify standards.
Risk	Low risk option, will require considered design approach.
Include in Portfolio	Can be implemented independently of other options.

Asset Ownership and Operation

- Golden Plains Shire Council own the roads, kerbing and open spaces, and would need to monitor effectiveness.

Recommendation and Actions

- OPTION RECOMMENDED**
- Explore concept internally and identify areas in which the modified kerbing can be installed.
 - Embed requirement for kerb cut-out installation for appropriate areas in PSP/Planning Schemes.
 - Develop kerb specification
 - Engage with developers to develop process to enable compliance with kerb-cut out installation.



Bannockburn IWM Options Assessment

Option 6: Review and rectify existing WSUD
Scale: Precinct

Key Design Elements

- Several existing WSUD assets across Bannockburn are inefficient and require rectification.
- Priorities are:
 1. Rosemond Way North Raingarden/Wetland - Stormwater does not appear to be being directed to the treatment area.
 2. Moreillon Boulevard and Rosemond Way South Raingardens - Plantings are overgrown and difficult to maintain.
 3. Waterview Lane pond - Maintenance of pond and riparian zone along Bruce Creek is difficult due to space constraints.
- These infrastructures need detailed review and potential redesign and rectification.

Visualisation



Other Design Elements for Further Consideration

- Asset rectification could be considered in the context of the whole of Bannockburn water cycle servicing. While typically WSUD treats catchments, there may be integrations with other elements of this plan that could provide additional values, e.g. stormwater harvesting from rectified WSUD assets.
- Option 10 explores review of the WSUD standards outlined in the Infrastructure Design Manual and whether these need to be reviewed in the context of Bannockburn.

Implementation Pathway

- An assessment of the performance of all WSUD infrastructure within Bannockburn against design specifications should be undertaken. It is would be recommended to engage a consultant to review background information and undertake this assessment.
- The assessment should identify all existing assets, their catchments, design objectives and an assessment of performance. i.e. is the asset functioning.
- The assessment should also identify how the asset can be rectified, estimated costs for design and rectification works, and modelling supporting the outcomes that will be realised through the asset's rectification. A prioritisation and next steps should also be undertaken. i.e. which of the assessed assets offers best value in its rectification.
- Funding may be needed to support this investment. Applications should be made to suitable funding rounds as they become available.

Discussion

- Pros*
- Investment has already been made
 - Improve public amenity
- Cons*
- Works may be expensive to be able to sufficiently rectify some assets

Options Assessment

Metric	Comments
Targets	Contributes to water quality targets. Enhance and support surrounding environment.
Value	Rectification may be expensive depending on the extent of works that will be required to improve performance.
Technical	Option will require asset audit and assessment, redesign and construction.
Policy and Regulation	This option does not conflict with any policy or regulations.
Risk	Low risk as assets are existing.
Include in Portfolio	Explore. Important for existing assets.

Asset Ownership and Operation

- Assets will continue to be owned and maintained by GPSC.
- If integration with water supply systems, such as stormwater harvesting, are undertaken, there may be a role for Barwon Water in asset ownership.

Recommendation and Actions

- OPTION RECOMMENDED**
- Conduct audit on assets
 - Determine method for asset rectification
 - Begin concept designs and seek funding

Bannockburn IWM Options Assessment

Option 7: Recycled water/ stormwater for agriculture/ industry
Scale: Regional



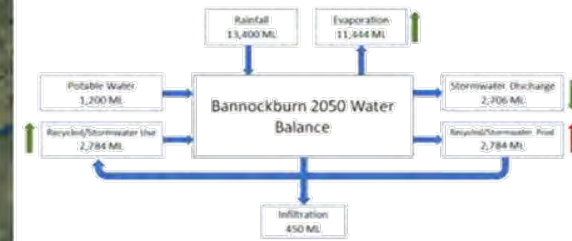
Key Design Elements

- Utilising Class C recycled water and/or harvested stormwater for agricultural and/or industrial purposes.
- The Bannockburn WRP does not have a waterway outfall (except under wet year conditions), and as Bannockburn grows the volumes of sewage will also grow. This additional recycled water can be provided to agriculture and industries such as broiler farms, to help manage recycled water volumes.
- Excess stormwater being harvested and stored to protect waterways could also be used for agriculture and industry.
- The assumption is that separate supply pipelines will be required.
- Whether using recycled water or stormwater, users will need to ensure the water is suitable for its end use, and that the water is used as per existing guidance.

Visualisation



Approximate Water Balance



Option 7: Recycled Water / Stormwater for Agriculture and Industry

Other Design Elements for Further Consideration

- Recycled water and/or stormwater could be treated to a higher quality to expand opportunities for reuse. Some industries might prefer Class A and be willing to pay for it.
- Recycled water could be mixed with stormwater, e.g. stormwater could be supplied to the recycled water supply storage. Barwon Water would need to ensure quality risks are managed.

Implementation Pathway

- A growing excess of recycled water could present a challenge for Barwon Water into the medium term as existing recycled water users may not have the capacity to utilise additional volumes.
- Barwon Water to actively engage with farmers, industry and land owners across the region to explore use of recycled water. Class C water from the Bannockburn WRP could for example be provided to broiler farm to the south of Bannockburn. Where good soils are present, irrigated agriculture with centre pivots might be considered good value for farmers, increasing regional economic productivity.
- If demand exceeds supply, consider also introducing stormwater into the system to provide additional volumes,
- On the basis of these discussions, a business case would be built to enable Barwon Water to invest in infrastructure while also recouping costs to build and operate.
- Agreements with farmers would need to be entered into to ensure water is taken when Barwon Water needs it to be used.

Discussion

- Pros**
- Recycled water volumes produced by a growing Bannockburn are responsibly managed, and kept from a waterway discharge.
 - Economic productivity of the region is increased, also increasing employment and investment.
 - Potential for waterways to also be protected from stormwater discharge.

- Cons**
- Demands may be some distance from the WRP, and so there is potential that the initiative will be costly.
 - Some end uses may be limited by the Class C quality being provided, and an unwillingness from users to treat the water to a suitable quality.

Options Assessment

Metric	Comments
Targets	Increase the use of alternative water. Reduce discharges of stormwater to waterways.
Value	Good for the economy is realising improved value from improved productivity.
Technical	Quite straightforward. Could become more complex if stormwater is included in the concept.
Policy and Regulation	This option does not conflict with any policy or regulation.
Risk	This option presents medium risk, primarily related top commercial matters with end users.
Include in Portfolio	This is best option to manage significant recycled water volume that will be generated as Bannockburn grows.

Asset Ownership and Operation

- Barwon Water would own and operate the recycled water pipelines and pumps, as they currently do.
- Farmers may need to invest in on-site storages, treatment plants (for the chicken farms for example), irrigation systems such as centre pivots, control systems.

Recommendation and Actions

- OPTION | RECOMMENDED**
- Approach broilers and other local farmers to determine willingness to utilise recycled water, and what they may be willing to pay.
 - Undertake a concept design and build a business case for the recycled water supply system.

Bannockburn IWM Options Assessment

Option 8: Stormwater harvesting for active open space irrigation
Scale: Precinct



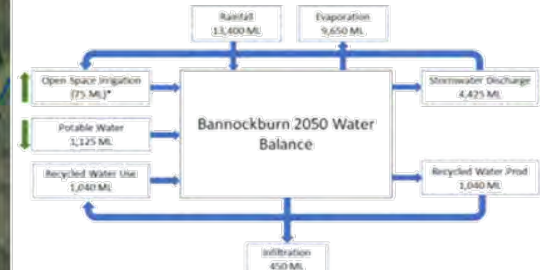
Key Design Elements

- To reduce use of potable water to irrigate open spaces, stormwater from local wetland assets can be used.
- Stormwater can be harvested, treated in wetlands, and stored to provide a non-potable water source to irrigate recreational areas.
- Typically, the extended detention depth of the wetlands would be increased to allow greater time to pump out stormwater volumes. These would normally be stored in an adjacent open water storage, ideally filled by gravity.
- Water from this storage would be pumped through a media filter to remove any solids and provided to the irrigation system at irrigation pressure.
- Nighttime irrigation, signage and potentially fencing would be employed to reduce human contact with stormwater.

Visualisation



Approximate Water Balance



Option 8: Stormwater harvesting for active open space irrigation
 *(Stormwater Harvested not included in water balance)

Other Design Elements for Further Consideration

- Irrigation could be extended to include passive open space areas or surrounding vegetation.
- Additional treatment, such as UV, could be employed to provide additional risk management of water quality.
- This would not be implemented if recycled water supply was being implemented.

Implementation Pathway

- A localised stormwater harvesting concept at a single location should be developed by council, in consultation with Barwon Water, to compare this option against recycled water supply.
- Should the comparison be favourable, Golden Plains Shire Council could work with VPA to ensure that stormwater harvesting for active open space irrigation is included as part of PSPs and planning schemes.
- Council could require developers to compile an IWM Plan as a condition of a planning permit, with an expectation that stormwater harvesting for open space irrigation will be installed.
- Council should then develop a specification for wetland/storage/wet-well/pump/filter/irrigation system. This specification should then be provided to developers to guide the design for their developments. This could be undertaken in collaboration with Barwon Water, who may be able to advise on pipes, pumps and control systems.
- Management systems internal to council would need to be developed to ensure the operation of the harvesting schemes.

Discussion

- Pros**
- Save money reducing potable water usage
 - Preserve potable water resources
 - Reduce discharge of stormwater to waterways
 - Typically a cost effective solution if designed upfront.
- Cons**
- As storage is required within the urban footprint, there may be resistance from developers for this initiative
 - If Barwon Water are unwilling to own and operate pipes and pumps

Options Assessment

Metric	Comments
Targets	Reduction in potable water use. Decrease in discharge of harmful stormwater to waterways.
Value	A cost effective water to supply non-potable water to open spaces. Does not however meet the stormwater discharge target.
Technical	Quite straightforward design, widely employed elsewhere.
Policy and Regulation	This option does not go against any policy or regulation.
Risk	Stormwater availability may require temporary switch to potable water. Quality is expected to be able to be managed.
Include in Portfolio	Explore to compare with recycled water supply.

Asset Ownership and Operation

- While the wetlands and storages are expected to be GPSC owned and operated, pumps and pipelines may be up for discussion with Barwon Water.
- Barwon Water operate these types of assets and may be willing to operate these schemes as well as long as Barwon Water is able to recoup their costs from council.

Recommendation and Actions

- OPTION RECOMMENDED**
- Collaborate with Barwon Water to explore concept in comparison with Class C Recycled Water Supply.

Bannockburn IWM Options Assessment

Option 9: Infiltration wetlands
Scale: Precinct



Key Design Elements

- Urban areas and their imperviousness reduces the ability of rainfall to infiltrate into the subsoil, replenishing shallow groundwater, and provide baseflows to waterways.
- Infiltration (leaky) wetlands can be implemented to mitigate this outcome and in doing so support waterway health.
- Typically constructed wetlands are lined with a clay liner, which acts as an impervious layer between the water in the wetland and the groundwater system.
- This initiative involves a different design to a traditional wetland liner whereby the subsurface soil would be assessed and the extent of clay liner reduced to facilitate a percentage of water inflows into the wetland infiltrating into the ground. This should be undertaken to emulate natural conditions.

Other Design Elements for Further Consideration

- Infiltration basins may also be implemented, infiltrating treated stormwater from traditional wetlands. These systems will increase land take though.
- There is an increased chance that wetlands will dry out and vegetation could be affected in extended dry periods if infiltration is facilitated. This could be mitigated with an occasional recycled water top up.

Options Assessment

Metric	Comments
Targets	Contributes to treatment of stormwater quality entering Bruce Creek.
Value	Infiltration is expected to be able to be implemented at low cost. There is potentially a cost saving with less clay liner required.
Technical	This option will require engineering design, there are no known precedents.
Policy and Regulation	Does not conflict with any known policy or regulations.
Risk	This option entails some risk as there are no precedents, however, these risks would not outweigh the benefits.
Include in Portfolio	Explore, this is the lowest cost option to realise the infiltration target.

Visualisation



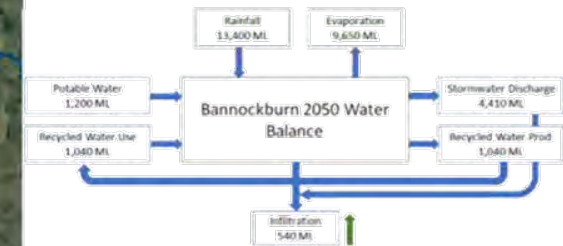
Implementation Pathway

- The implementation of this option is dependent on GPSC stating the requirement for developers to deviate from the typical design approach. GPSC need to review the concept and decide whether this is something to require.
- CCMA should also be engaged to make sure the outcome and approach aligns with their ambitions for Bruce Creek.
- Golden Plains Shire Council could then require infiltration functionality in all wetlands as a condition of a planning permit.
- Golden Plains Shire Council could require developers to compile an IWM Plan as a condition of a planning permit, with an expectation that infiltrating Wetlands will be installed.
- Developers would need to engage a consultant with this capability to design in this functionality.
- Developers would need to engage contractors to build in this functionality.

Asset Ownership and Operation

- Stormwater assets required to facilitate newly developed areas are to be funded by the developer as instructed by the SWMS.
- The asset would be owned and maintained by the council.
- There are no additional expected maintenance requirements.

Approximate Water Balance



Option 9: Infiltration wetlands to support waterways baseflows

Discussion

Pros

- Realises outcomes for the waterway associated with groundwater derived baseflows
- Low cost, can conceptually be easily realised
- No additional land take
- No additional maintenance requirements

Cons

- No precedents, would require design work to realise desired outcomes
- Increased risk of wetland vegetation drying out
- Risk of nutrients being carried by stormwater into the ground water

Recommendation and Actions

OPTION RECOMMENDED

- Engage with CCMA to understand outcome alignment
- Review design specifications
- Engage with developers to develop process to enable compliance with infiltration wetland installation

Bannockburn IWM Options Assessment

Option 10: Review infrastructure design manual
Scale: Township

Key Design Elements

- The Infrastructure Design Manual (IDM) is a joint initiative of Victorian rural and regional Councils to formulate and maintain a set of consistent requirements and standards for the design and development of infrastructure.
- This initiative involves reviewing the water sensitive urban design elements of the IDM and exploring its application in the Bannockburn context, and in the context of this IWM Strategy.
- The review should also consider how current GPSC systems and processes are used to ensure assets are appropriately designed, constructed and maintained.

Visualisation



Other Design Elements for Further Consideration

- A range of supporting documents may be incorporated into this review, such as Melbourne Water's Constructed Wetlands Design Manual.
- Case studies of innovative initiatives may also be explored, such as Melton City Council's passive street tree irrigation specification.

Implementation Pathway

- Hold an internal workshop between environment, open space, engineering and planning teams to explore the IDM and its applicability in delivering the various elements of the Bannockburn IWM Plan.
- Explore engaging an external party to support should internal resources be insufficient.
- Once review is complete, communicate outcomes with developers and contractors to ensure infrastructure is delivered effectively.

Discussion

- Pros*
- IDM reviewed in the specific context of Bannockburn
 - Develops staff in better understanding water management infrastructure
 - Is foundational to the effective implementation of the IWM Plan
- Cons*
- Some cost, either internal time or for a consultant
 - There may be a lack of materials across the broader sector to guide some innovative initiatives

Options Assessment

Metric	Comments
Targets	This initiative supports realisation of targets rather than delivering them.
Value	This review will provide a foundation on which effective implementation of the IWM Plan can be realised.
Technical	Technical expertise will be required, particularly for innovative initiatives.
Policy and Regulation	The option does not conflict with any policy or regulation.
Risk	This is a risk mitigation measure.
Include in Portfolio	Explore.

Asset Ownership and Operation

- Assets explored through this initiative would typically be owned and operated by Golden Plains Shire Council
- If developers deliver the asset, there will typically be an establishment and handover period associated with that asset before council take ownership. This process should also be an element of the review.

Recommendation and Actions

- OPTION RECOMMENDED**
- Engage with internal teams and explore the benefits

Bannockburn IWM Options Assessment

Option 11: Educate staff on IWM
Scale: Township



Key Design Elements

- Water literacy across council is an important enabler of water cycle outcomes. The more council officers understand the projects outlined in the IWM Plan, the more effective the delivery will be.
- By educating council on the IWM strategy, water literacy will improve, while also supporting an important council initiative of internal engagement.
- This engagement may also encourage wider council officers to get involved and take ownership of the different assets and projects that are proposed to be implemented.

Visualisation



Other Design Elements for Further Consideration

- Could be tailored for different segments of council, i.e. one session for councillors and execs, another for officers.
- Could be delivered in partnership with a community group such as the local Landcare group.
- Could also involve a walk along Bruce Creek and tour of well functioning assets.

Implementation Pathway

- Hold an internal workshop between environment, open space, engineering and planning teams to explore what an internal IWM Education session may look like, and who is best positioned to present.
- Explore engaging an external party to support should internal resources be insufficient.
- Ensure councillors are engaged and supportive. Their participation would also support GPSC commitment to the IWM Plan.

Discussion

- Pros*
- Encourage community to be more water wise
 - Promote the IWM Plan to the community
 - Encourage participation in water cycle management
- Cons*
- May be challenging to realise community attendance
 - Could involve staff time and consultant costs

Options Assessment

Metric	Comments
Targets	This initiative supports realisation of targets rather than delivering them.
Value	Quite low cost, and engagement within council importantly demonstrates commitment to the IWM Plan.
Technical	The IWM Plan contains the relevant information. Council staff may seek assistance to deliver from a consultant.
Policy and Regulation	This option does not conflict with any policy or regulation.
Risk	There is no risk associated with this option.
Include in Portfolio	Include.

Asset Ownership and Operation

- This program/ asset will be property of GPSC
- GPSC will be responsible for keeping this program updated and relevant to the town of Bannockburn.

Recommendation and Actions

- OPTION RECOMMENDED**
 Engage internally on the preferred approach.

Bannockburn IWM Options Assessment

Option 12: Educate Community on IWM
Scale: Township



Key Design Elements

- Water literacy across the community is an important enabler of water cycle outcomes. The community can undertake behavioural changes to realise improved water cycle outcomes, with economic, environmental and cultural benefits.
- By educating the community on the IWM strategy, water literacy will improve, while also supporting and important council initiative of community engagement.
- This engagement may also encourage the community to get involved and take ownership of the different assets that are proposed to be implemented.

Visualisation



Other Design Elements for Further Consideration

- Could be delivered in partnership with a community group such as the local Landcare group.
- Could also involve a walk along Bruce Creek and tour of well functioning assets.

Implementation Pathway

- Hold an internal workshop between environment, open space, engineering and planning teams to explore the what an IWM Community Education session may look like, and who is best positioned to present.
- Explore engaging an external party to support should internal resources be insufficient.
- Ensure councillors are engaged and supportive. Their attendance would also demonstrate GPSC commitment to the IWM Plan.
- Explore social media promotion of the event and post event to engage with the broader community not in attendance.

Discussion

- Pros*
- Encourage community to be more water wise
 - Promote the IWM Plan to the community
 - Encourage participation in water cycle management
- Cons*
- May be challenging to realise community attendance
 - Could involve staff time and consultant costs

Options Assessment

Metric	Comments
Targets	This initiative supports realisation of targets rather than delivering them.
Value	Quite low cost, and engagement with the community importantly demonstrates the value of the IWM Plan.
Technical	The IWM Plan contains the relevant information. Council staff may seek assistance to deliver from a consultant.
Policy and Regulation	This option does not conflict with any policy or regulation.
Risk	There may be a risk of raising expectations within the community on what will be delivered. This can be managed.
Include in Portfolio	Include.

Asset Ownership and Operation

- No creation of assets in this option

Recommendation and Actions

- OPTION RECOMMENDED**
- Engage internally on the preferred approach.

Bannockburn IWM Options Assessment

Option 13: Priority blue-green infrastructure
Scale: Lot

Key Design Elements

- Raingardens and bio-swales are a versatile form of water sensitive urban design infrastructure, and they may be installed in a range of contexts.
- GPSC have expressed interest in seeing such blue-green infrastructure installed in highly visible areas, such as the Bannockburn town centre.
- Raingardens can be constructed in centre medians, parking lanes or nature strips. Typically solids removal such as a sediment forebay would precede the raingarden.
- The size of the raingarden is determined by the inflow catchment, the larger the catchment, the more water is able to be treated and the more pollutants removed.
- Levels are an important consideration, it is preferred that the raingarden receive stormwater through gravity as pumps can be expensive. This can be challenging in an already built context.

Other Design Elements for Further Consideration

- Construction of high profile assets within a high traffic area would involve significant engagement with the community, during design, construction and operation.
- It might make sense to install signage to explain how the systems work.

Options Assessment

Metric	Comments
Targets	Contributes to waterway protection targets and amenity outcomes.
Value	Identified options could be expensive due to the retrofit and high profile of the installations.
Technical	Challenges can arise from retrofit installations.
Policy and Regulation	This option does not conflict with any policy or regulation.
Risk	There are a range of risk that might challenge success of this option, relating to existing conditions and cost.
Include in Portfolio	This option would enable engage with the entire Bannockburn community, and is recommended for further investigation.

Visualisation



Implementation Pathway

- An assessment of the various potential locations should be undertaken, considering catchment, levels, ease of construction and ease of maintenance.
- Internal engagement on which of the identified locations would be the priority.
- Engage a design consultant to design the asset.
- Funding may be needed to support this investment. Applications should be made to suitable funding rounds as they become available.

Asset Ownership and Operation

- Assets would be owned and maintained by GPSC.



Discussion

Pros

- Improve the quality stormwater being discharged to waterways
- Improve public amenity
- Increase water literacy through the high profile location and interpretive signage.

Cons

- Works may be expensive
- There may be public opposition to the location of asset

Recommendation and Actions

OPTION RECOMMENDED

- Internal engagement to explore locations and how these may be funded.

Based on this detailed analysis all options are recommended for further exploration. A summary of the results following application of the assessment criteria in the refined assessment are shown in Table 14.

Table 14: Summary of refined assessment criteria of the shortlisted options

Option	Tar	Val	Tech	Reg	Risk	Rec	Discussion
1. Managing stormwater volumes to protect waterways							No other options are able to meet the full waterway protection outcomes.
2. Rainwater tanks for toilet flushing, laundry and irrigation							Rainwater tanks are compatible with other opportunities.
3. Passively irrigated street trees							Passive irrigation supports other options.
4. Class C recycled water for public open space irrigation							Would not be implemented with stormwater harvesting for open space irrigation.
5. Kerb cut-outs disconnecting road imperviousness							Only a small impact but cost effective and easy to implement.
6. Review and rectify existing WSUD assets							Important to realise value from existing investment.
7. Recycled water/stormwater for agriculture/industry							The best option to manage the recycled water volume. Compatible with Option 4.
8. Stormwater for public open space irrigation							Explore to compare with recycled water supply.
9. Infiltration wetlands to support waterway base flows							The lowest cost option to realise the infiltration target.
10. Review Infrastructure Design Manual							Offers good value, needed to support other initiatives.
11. Educate staff on IWM principles and practices							Aligns well with the intent of the IWM Plan.
12. Educate community on IWM principles and practices							Aligns well with the intent of the IWM Plan.
13. Priority Blue-Green Infrastructure (High St, Pope St, Burnside Rd)							Highly visible, supports engagement with the community.

The recommended options are a mix of management practices, lot scale interventions and regional scale infrastructure projects. The recommended regional scale options were developed further and are presented in Section 11 as concept designs to illustrate the extent of infrastructure involved.

10.3. IWM SERVICING PORTFOLIOS

An IWM servicing portfolio is proposed for comparison against a business as usual approach.

As the shortlisted options are all deemed worthwhile exploring further through implementation of the IWM Plan actions, and as all options though are compatible, the IWM Portfolio must be explored with an adaptive pathway approach.

1. The portfolio is comprised of the following elements:
2. Managing stormwater volumes to protect waterways
3. Rainwater tanks for toilet flushing, laundry and irrigation
4. Passively irrigated street trees
 - a. Class C recycled water for public open space irrigation
 - b. Locally harvested stormwater for public open space irrigation
5. Kerb cut-outs disconnecting road imperviousness
6. Review and rectify existing WSUD assets
7. Recycled water\stormwater for agriculture/industry
8. Infiltration wetlands to support waterway base flows
9. Review Infrastructure Design Manual
10. Educate staff on IWM principles and practices
11. Educate community on IWM principles and practices
12. Priority Blue-Green Infrastructure (High St, Pope St, Burnside Rd)

The adaptive element of the IWM Portfolio relates to the provision of an alternative water supply for public open space. Both recycled water and stormwater options should be further investigated, and the preferred option embedded in PSPs and implemented.

The IWM portfolio would need significant buy-in from Barwon Water, the Corangamite Catchment Management Authority and the Wadawurrung Traditional Owners Aboriginal Corporation to realise as this portfolio's focus is on protecting and enhancing local waterways.

Another focus of this portfolio is the provision of alternative water for open space irrigation, and the regional management of stormwater to protect Bruce Creek and downstream the Barwon River and Lake Connewarre.

The portfolio was qualitatively compared with a business as usual approach on a triple bottom line basis. This assessment is outlined in Table 15.

Table 15: IWM Servicing Portfolio Qualitative Assessment

IWM Portfolio	Benefits	
<p>Business as Usual:</p> <ul style="list-style-type: none"> - All urban demand met with potable water - 100% recycled water use for golf course and agriculture - New stormwater runoff treated to best practice quality standards 	Environmental	Regulatory only waterway environmental outcomes realised
	Social	Bruce Creek not supported beyond stormwater quality. No reduction in potable water use
	Economic	Lowest local infrastructure costs Likely significant desalination costs for new water supply
<p>Enhanced IWM Outcomes:</p> <ul style="list-style-type: none"> - Residential demands supported by rainwater tanks - Streetscapes supported with passively irrigated street trees and kerb cut-outs - Open space demands supported by recycled water supply or stormwater harvesting - New stormwater runoff treated to best practice quality standards with stormwater harvesting and infiltration functionality to support waterways 	Environmental	Non-potable water demands met by local sources. Less desal. Some benefits provided to the waterway, though EPA guidance targets not met.
	Social	Integrations at the street scale demonstrate management to the community. Improved potable water management with rainwater tanks and stormwater to open space.
	Economic	Additional infrastructure for rainwater tanks, street trees and stormwater harvesting. These would likely provide a positive economic benefit over the long term.

11. CONCEPT DESIGNS OF REGIONAL SCALE OPTIONS

Of the range of options explored in Section 10, several of these are of a scale that justifies further analysis and description. The following concept designs build on the high level assessment and demonstrate further consideration to be taken in subsequent investigation and design to be undertaken in implementing this IWM Plan.

11.1. OPTION 1: MANAGING STORMWATER VOLUME TO PROTECT WATERWAYS

11.1.1 DESCRIPTION

This option explores the harvesting/evapotranspiration of 77% of stormwater from impervious surfaces to meet requirements outlined for priority waterways in the *EPA Publication 1739.1: Urban stormwater management guidance*, equating to 1,744 ML per annum at full development.

In this option the excess stormwater flows are collected and treated in wetlands throughout the growth areas of Bannockburn. Stormwater is then harvested from these wetlands using a triple baffle offtake chamber, and pumped to a location outside of the Bannockburn growth area where it can be stored and if required treated prior to an appropriate end use. The identified end uses are back to Bruce Creek to offset water being removed by farm dams upstream, or transferring to a stormwater management system being considered for the Northern and Western Geelong Growth Areas, from where stormwater could be provided to the Moorabool River for environmental flows, for use through the proposed Class A dual reticulation scheme or for eventual potable use through Wurdee Buloc. The collection network will require at least 4 pump stations within the growth areas to transfer flows to a storage and discharge point back to Bruce Creek the northwest of Bannockburn.

The process diagram for this options is outlined in Figure 22 and the infrastructure layout is shown in Figure 23.

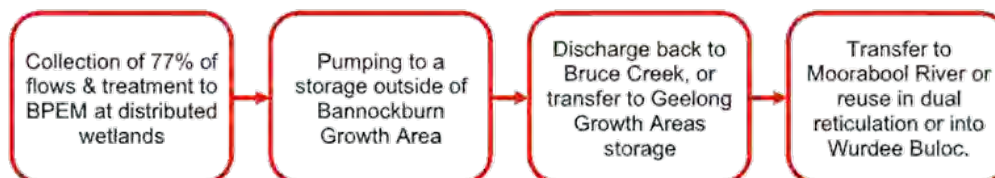


Figure 22: Process diagram for Regional Stormwater Harvesting to protect waterway health

11.1.2 IMPLEMENTATION AND OWNERSHIP

Critical to the successful implementation of this initiative is to first understand the optimal flow regime of Bruce Creek. The Bruce Creek catchment above Bannockburn is agricultural and the water cycle has been modified extensively through the construction of farm dams removing flows from Bruce Creek. Furthermore, the Bannockburn township creates significantly impervious area, which increases stormwater runoff but reduces infiltration and base flows. An assessment of the pre and post development Bruce Creek flow regime and the benefits that could be provided through active stormwater management requires undertaking before progressing this option further.

Should the benefits be demonstrated, a potential storage has been identified on private land south of Bannockburn. Alternatively, the storage and potential treatment facility could be co-located at the Bannockburn WRP, avoiding the requirement for land acquisition adjacent to both the Bannockburn Growth Area and Bruce Creek. Responsibility for the construction of

storages, treatment facilities and pipelines outside of the Growth Area would likely be the responsibility of Barwon Water.

Wetlands should be constructed by developers and transferred to GPSC, while pump stations and pipe networks should be constructed by developers and transferred to Barwon Water.

Table 16: Stakeholder responsibilities for Regional Stormwater Harvesting to protect waterway health

Stakeholder	Responsibilities
Golden Plains Shire Council	Ownership and maintenance of harvesting wetlands
Barwon Water	Ownership and maintenance of harvesting network, treatment facility and storage
Corangamite Catchment Management Authority	Responsible for advising on waterway requirements



Figure 23: Concept layout of the managing stormwater for waterway health option

11.2. OPTION 4: CLASS C RECYCLED WATER SUPPLY FOR PUBLIC OPEN SPACE IRRIGATION

11.2.1 DESCRIPTION

As Bannockburn continues to grow and additional recycled water volumes are generated, it may make economic sense for this recycled water to be supplied to the township to irrigate public open spaces. Existing demands are present at the active open space sites within Bannockburn Town Centre. This option also involves open spaces in each precinct being supplied with Class C recycled water. Typically recycled water would not be supplied at irrigation pressure for the open spaces. As such recycled water tanks at each location would be required to provide the water for an irrigation cycle, a pump would supply the irrigation system at suitable pressure.

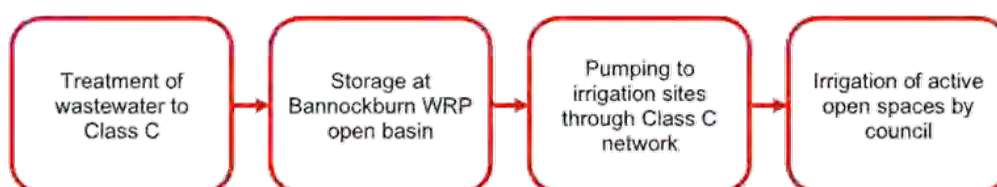


Figure 24: Process diagram for Class C Recycled Water Supply

Class C recycled water will require management practices in its usage to protect public health. For Class C recycled this would involve limiting human contact, typically through nighttime irrigation, withholding periods, signage and fencing. Barwon Water would also require a User Site Management Plan to administer the recycled water's use and management practices. The process flow diagram for this option is shown in Figure 24 and the spatial extent in Figure 25.

11.2.2 IMPLEMENTATION AND OWNERSHIP

Barwon Water will be responsible for upgrading the treatment plant and storage at Bannockburn WRP, this can be funded by New Customer Contributions from the Growth Area as it begins to be developed.

The Class C network in the Growth Area can be constructed by developers and transferred to Barwon Water. Retrofitting a Class C recycled water network to reach the existing open spaces in Bannockburn will be the responsibility of Barwon Water, as will any extension beyond the boundaries of the Growth Area. A commercial arrangement with GPSC could realise this infrastructure, funding may also be available.

Table 17: Stakeholder responsibilities for Class C Recycled Water Supply

Stakeholder	Responsibilities
Golden Plains Shire Council	Irrigation of Open Space and water use reporting.
Barwon Water	Ownership and maintenance of Recycled Water Treatment Plant and distribution network including water quality monitoring and compliance monitoring.
EPA Victoria	Provide guidelines for appropriate irrigation and monitoring. Issuing breach notices if General Environmental Duty is not observed.



Figure 25: Concept layout of the Class C recycled water to open space irrigation option

11.3. OPTION 7: RECYCLED WATER / STORMWATER FOR AGRICULTURE / INDUSTRY

11.3.1 DESCRIPTION

This option also explores the management of stormwater to meet *EPA Publication 1739.1: Urban stormwater management guidance*, which also managing recycled water volumes. The excess stormwater flows are collected from treatment wetlands using a triple baffle offtake chamber, and pumped up to a storage at the Bannockburn WRP. These stormwater volumes are then combined with Class C recycled water generated at the Bannockburn WRP. This water would be supplied to agriculture and industry through an expanded recycled water supply network. With a sufficiently large network, this option could manage both excess stormwater and recycled water for beneficial reuse. It is also compatible with open space reuse.

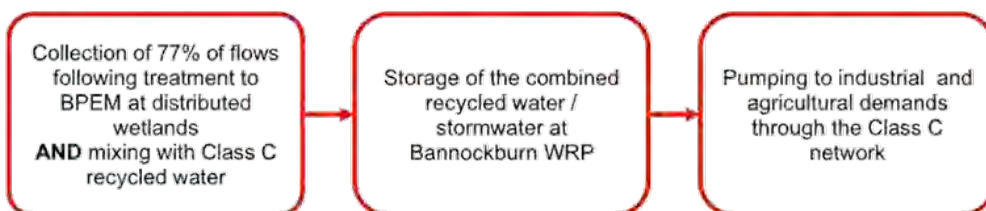


Figure 26: Process diagram for Recycled Water / Stormwater for Agricultural / Industry

The process diagram for this option is shown in Figure 26 and supply infrastructure layout in Figure 27. The stormwater harvesting component of this option is shown by Figure 23.

11.3.2 IMPLEMENTATION AND OWNERSHIP

Barwon Water will be upgrading the existing plant as Bannockburn grows, which should include sufficient storage for the combined resource. There is also potential for existing storage on site of the potential industrial and agricultural water users which could also be utilised.

Table 18: Stakeholder responsibilities for Recycled Water / Stormwater for Agricultural / Industry

Stakeholder	Responsibilities
Golden Plains Shire Council	Ownership and maintenance of harvesting wetlands.
Barwon Water	Ownership and maintenance of harvested stormwater transfer network, Recycled Water Treatment Plant and distribution network including water quality monitoring and compliance monitoring.
EPA	Provide guidelines for appropriate irrigation and monitoring. Issuing breach notices if General Environmental Duty is not observed.
Industrial and Agricultural Partner	Appropriate irrigation and reporting. Operation and maintenance of onsite storage and distribution

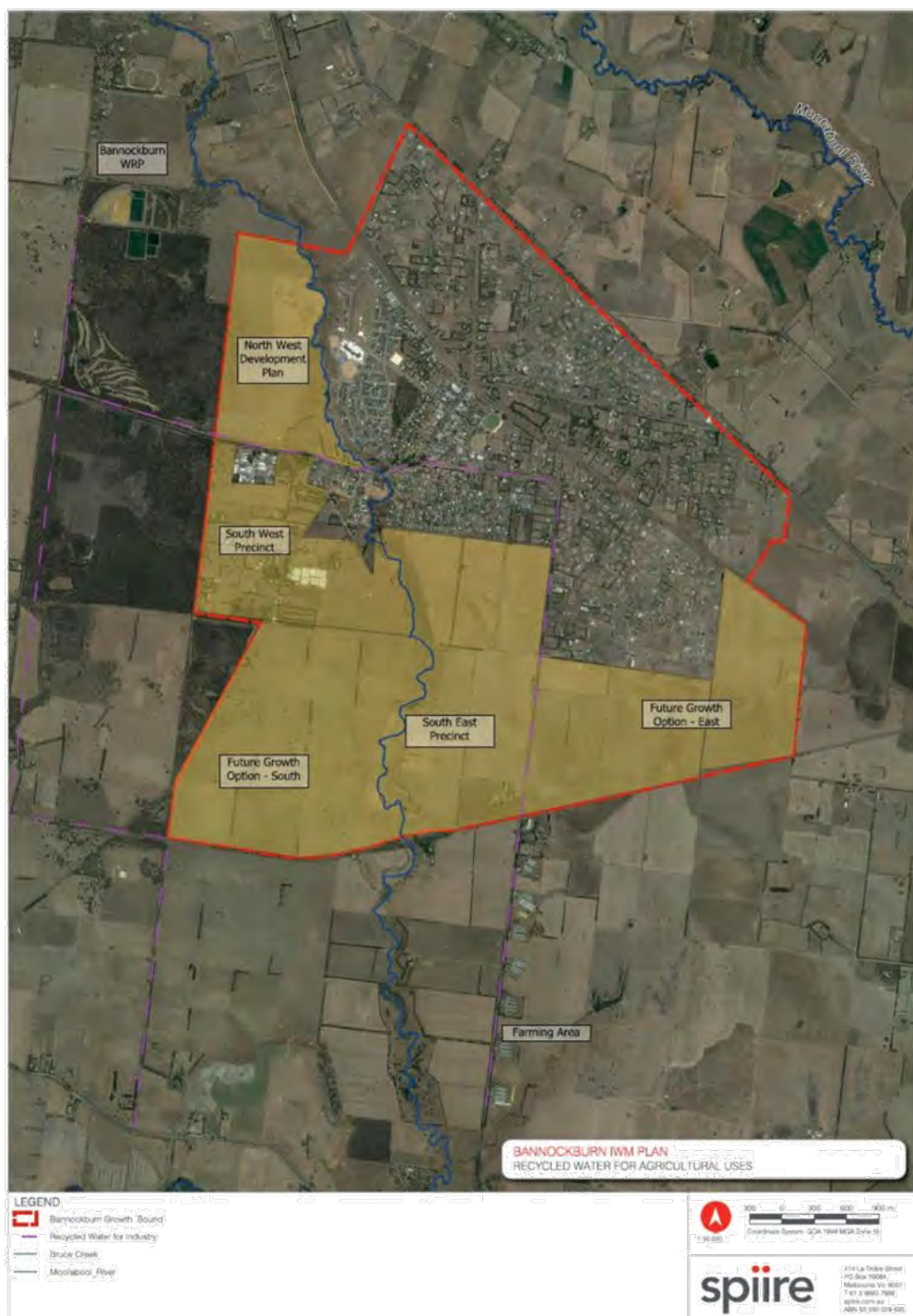


Figure 27: Concept layout of the Recycled Water / Stormwater for Agricultural / Industry supply option.

11.4. OPTION 8: STORMWATER HARVESTING FOR ACTIVE OPEN SPACE IRRIGATION

11.4.1 DESCRIPTION

This option explores utilising stormwater generated from impervious area across Bannockburn to irrigate open spaces. Stormwater flows are collected and treated in wetlands spread throughout the development. Stormwater is treated and conveyed by gravity to an open water storage adjacent to the wetland or open space. Water would be pumped from this storage, be filtered and supplied at irrigation pressure to the open space irrigation system.

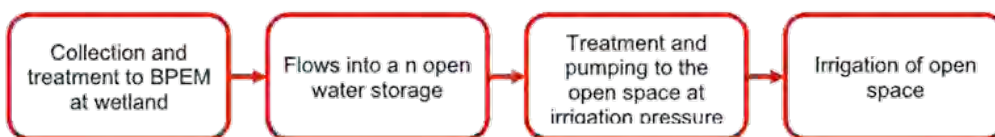


Figure 28: Process flow for stormwater harvesting for active open space

This option has the benefit of reducing the capital and operational network costs of a stormwater harvesting network, by localising the use of irrigation water. However, reliability is reduced when compared to a recycled water supply. This option would utilise approximately 75 ML/year of harvested stormwater at full development. While useful, this is much less than the target of 1,744 ML/year sought under the EPA Stormwater Guidance.

The process diagram for this option is shown in Figure 28 and the potential infrastructure layout is shown in Figure 29.

11.4.2 OWNERSHIP AND MAINTENANCE

As this harvesting and use is from and to council infrastructure, these schemes could be constructed by developers and transferred to GPSC to own and operate.

However, should GPSC feel these assets would be too difficult to maintain, pump stations and pipe networks could, by agreement, be managed by Barwon Water.

Table 19: Stakeholder responsibilities for stormwater harvesting for active open space

Stakeholder	Responsibilities
Golden Plains Shire Council	Ownership and maintenance of harvesting wetlands and irrigation systems.
Barwon Water	Potential ownership and maintenance of harvesting network, treatment facility and storage.



Figure 29: Potential concept layout of localised stormwater harvesting option

12. ACTION PLAN

	Action Description	Option	Outcome / Target	Timing	Priority	Resources Required	Collaborative Partners
1	Establish internal governance structure for the implementation of the Bannockburn IWM Plan actions. This includes formation of a cross-disciplinary working group and regular reporting mechanisms.	All	All	2024	High	Environment and Open Space Planning Asset Services	-
2	The Bannockburn IWM Plan is supported by Barwon IWM forum with participation from collaboration partners to provide direction and advocate for resources for its delivery.			Ongoing	High	Environment	Barwon IWM Forum Members
2	Finalise growth areas wide IWM approach with BW and communicate to VPA for inclusion in PSPs, and incorporate into planning schemes	All	All	2025	High	Planning Environment	Barwon Water Victorian Planning Authority
3	Develop stormwater harvesting concept including: 3.1- Analyse flows within Bruce Creek and determine optimal flow regime 3.2 - Determine infrastructure requirements and management 3.3 - Build a business case for initial and future investment	1	3.1 4.2	2026 2026-27 2027	High High High	Consultant Environment Asset Services Planning	Corangamite Catchment Management Authority Barwon Water
4	Enable rainwater tank installation: 4.1 - Embed requirement for rainwater tank installation on all lots in PSP/Planning Schemes 4.2 - Develop plumbing specification, including optimal tank size	2	1.1 1.2 3.1 4.2	2025 2026	High High	Consultant Environment Asset Services Planning	Developers

	Action Description	Option	Outcome / Target	Timing	Priority	Resources Required	Collaborative Partners
	4.3 - Engage with developers to Develop process to enable compliance with rainwater tank installation			2026-27	High		
5	Enable passive street tree irrigation installation including:- 5.1- Embed requirement for passive street tree irrigation system installation for all street trees in PSP/Planning Schemes- 5.2 Develop design specification for passively irrigation system 5.3Engage with developers to enable requirement and process for passive irrigation system installation.	3	2.2 3.1 4.2	2026 2026 2026-27	High High High	Consultant Environment Asset Services Planning	Developers
6	Collaborate with Barwon Water to explore recycled water supply for existing and new public open spaces across Bannockburn and explore funding mechanisms. Engage with Barwon Water to understand how GPSC can support Barwon Water to increase provision of recycled water for industry and agriculture. Should the option proceed, ensure development of necessary community education and awareness campaigns around safety/assurance of recycled water.	4, 7	2.1 4.1	2026	High	Environment and Open Space Asset Services Planning	Barwon Water
7	Enable kerb cut-out installation including: 7.a - Embed requirement for kerb cut-out installation for appropriate locations in PSP/Planning Schemes 7.b - Develop design specification for kerb cut-out infrastructure 7.c - Engage with developers to enable requirement and process for kerb cut-out installation	5	4.1	2025 2026 2026-27	High High High	Consultant Environment Asset Services Planning	Developers

	Action Description	Option	Outcome / Target	Timing	Priority	Resources Required	Collaborative Partners
8	Undertake review of functionality of existing WSUD infrastructure. Also explore options to independently review/assess engineering solutions submitted to Council.	6	3.1 3.2	2026	Medium	Consultant Environment Asset services	-
9	Engage with internal teams and explore the benefits of educating staff in Integrated Water Management, and if viewed as worthwhile, engage a consultant to design a program run a session(s) with council staff.	11	1.4	2027	Medium	Consultant Environment	-
10	Engage with internal teams and community groups to explore educating the community in Integrated Water Management, and if viewed as worthwhile, develop a program for community engagement.	12	1.4	2027	Medium	Environment Community development	Community Groups - Friends of the Barwon - People for A Living Moorabool
11	Develop localised stormwater harvesting for public open space irrigation concept, and compare with recycled water supply proposal.	8	3.1	2026	Medium	Consultant Environment and Open Space Asset services Planning	Barwon Water
12	Enable infiltration wetlands installation including: 12.a - Embed requirement for infiltration functionality for all treatment wetlands in PSP/Planning Schemes 12.b - With reference to Melbourne Water's wetlands design guidelines, develop design specification for infiltrating functionality 12.c - Engage with developers to enable requirement and process for infiltrating wetland installation	9	3.1	2025 2026 2026-27	High High High	Consultant Environment Asset services	Melbourne Water Corangamite Catchment Management Authority

	Action Description	Option	Outcome / Target	Timing	Priority	Resources Required	Collaborative Partners
13	Engage with internal teams and explore the benefits of reviewing the WSUD design specifications outlined in the Infrastructure Design Manual within the context of the Bannockburn IWM Plan.	10	3.2	2027	Medium	Environment Asset services Planning	-
14	Engage with Regional Stormwater Management programs including the Northern and Western Geelong Bannockburn Growth Areas Adaptive Stormwater Volume Management Project to improve the understating of waterway health and identify potential stormwater interventions in the growth areas.	1	3.1,4.2	2025-26	Medium	Environment Asset services Planning	Barwon Water
15	Engage with internal teams and community groups to explore the potential for high profile blue green infrastructure within the Bannockburn town centre.	13	1.3 1.4 2.2 2.3	2027	Medium	Environment	Community Groups - Friends of the Barwon - People for A Living Moorabool
16	Update Action Plan to incorporate findings from the first 12 months of plan implementation and resources available.	All	All	2026	High	Environment	

13. MERI FRAMEWORK

The ultimate value of any plan or strategy lies in its implementation. The vision, objectives, targets and actions that comprise this IWM Plan will only be realised through commitment from GPSC and support through governance systems to monitor, evaluate, report and improve its implementation.

As projects are implemented, GPSC should utilise the Monitoring, Evaluation, Reporting and Improvement (MERI) framework to ensure outcomes are progressing and stakeholders are receiving value for participating. The MERI framework is designed to fit within councils existing project management, reporting and prioritisation structures. The four stages are shown in Figure 30.

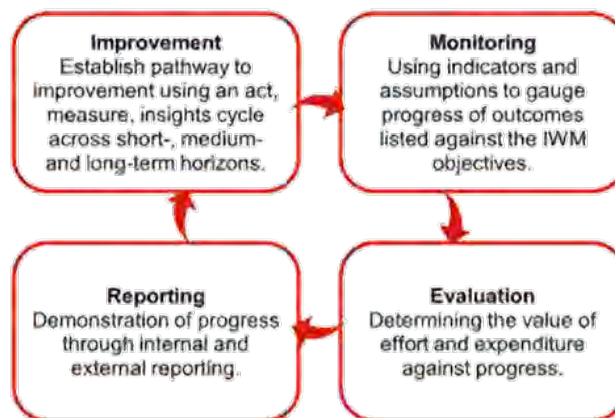


Figure 30: The four stages of the MERI Cycle

13.1. MONITORING

Monitoring inputs, activities, and outputs of IWM implementation over predetermined and temporally appropriate intervals. Progress indicators can be divided into **leading** and **lagging** indicators. Lagging indicators assess the current state. While Leading indicators predict future conditions. A mix of both indicator methods will enable GPSC to have a robust understanding of risks and opportunities throughout the IWM project delivery.

Lagging indicators show what happened and when, and can include financial performance, water resource allocation, irrigation water supplied, delivery of infrastructure and performance against objectives.

Leading indicators are derived from processing data with the application of appropriate insights. An example of a leading indicator would be the expected irrigation water supplied under various climate scenarios, or the delivery of an IWM objective by extrapolating previous progress over time considering future resource allocation.

13.2. EVALUATION

Summary of monitoring outputs against program objectives. Confirming that IWM implementation is being carried out according to the defined scope of the option.

13.3. REPORTING

Once committed to, the progress of the implementation of this plan should be reported on through the Annual Report for Council, in a similar manner to other strategic initiatives and sustainability activities.

13.4. IMPROVEMENT

The improvement phase draws on findings from the monitoring, evaluation and reporting phase to trigger, influence and drive project changes.

Proper implementation of the MERI framework and improvement process is represented as an S-Curve, with IWM Implementation progressing at different rates throughout the process. The full MERI cycle, culminating in the successful execution of the improvement phase, shifts the organisation from one S-curve to the next over, ensuring continuous improvement.

The rate of improvement during the monitoring phase is generally a slow incline, with robust observation of actions providing incremental benefits. Significant benefits are expected during the evaluation phase, where inefficiencies can be identified early and addressed by the project team where appropriate. Reporting provides an opportunity to communicate progress and discuss challenges, preparing the organisation for the decision-making processes required in the improvement phase.

The improvement phase can be broken down into the below sub-cycle:

Act: Implementing changes over the short-term to improve IWM implementation prior to the next phase, while identifying projects for the medium- to long-term improvement of the process.

Measure: Reflect on what is working and could improve. Determine success / expected benefits of improvement actions against the outcomes and targets

Insights: Optimise program activities and improvement process

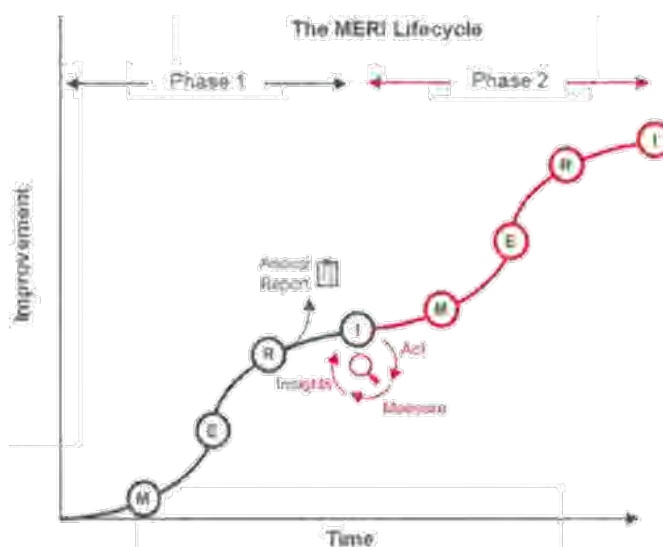


Figure 31: The MERI Lifecycle

13.5. A MERI FRAMEWORK FOR THE BANNOCKBURN IWM PLAN

The objectives and targets outlined in Section 8 combined with the Actions outlined in Appendix A comprise the components required to follow the MERI framework.

A baseline status for each target should be established. This baseline might be defined as shown in Table 20.

Table 20: Potential 2025 Baseline Target Values

#	Targets	2025 Baseline	Data Owner
1.1	100% of public buildings and sports pavilions fitted with rainwater tanks and plumbed to toilets	0%	GPSC
1.2	Rainwater tanks, connected to toilets, laundry and gardens, installed across 100% new residential properties	0%	GPSC
1.3	New water management infrastructure, such as wetlands and alternative water supply schemes, referred to Wadawurrung Traditional Owners Aboriginal Corporation for input into design, construction and ongoing maintenance	0	GPSC
1.4	IWM education signage installed on 100% of new WSUD assets	0	GPSC
2.1	100% of active public open spaces irrigated with alternative water supplies	0%	GPSC
2.2	100% of new street trees supported through passive stormwater irrigation	0%	GPSC
2.3	Blue-green infrastructure installed on 3 high priority streetscapes	0	GPSC
3.1	Bruce Creek predevelopment volumes and flow rates restored through managed stormwater harvesting	TBD	GPSC/ CCMA
3.2	WSUD assets designed, built and operated to industry best practice (100%)	TBD	GPSC
4.1	50% increase in beneficial use of alternative water supplies by agriculture and industry	TBD	BW
4.2	100% excess stormwater generated across Bannockburn is beneficially reused	0%	BW/ GPSC

Monitoring is undertaken of the progress of Actions committed to in Appendix A. After 12 months it is suggested that each action is assessed with respect to its success in achieving its objective.

For example Action 1 relates to establishing a Governance Structure for the implementation of the IWM Plan, monitoring relates to whether this Governance Structure is in place. Once operational over the first 12 months, a qualitative evaluation of its effectiveness in supporting the implementation of the IWM Plan should be undertaken. The successful completion of the action should be reported internally in a council report as a minimum, alternatively, reporting could be undertaken to the public through GPSC's Annual Report. The Governance Body should then review its functioning and determine whether its structure needs to be changed to improve its functioning.

14. CONCLUSIONS AND RECOMMENDATIONS

Bannockburn exhibits many characteristics that are inherent to liveable and resilient communities. It is situated within a productive agricultural region, within close proximity to both the regional centre of Geelong and the city of Melbourne. As Victoria's population grows, Bannockburn is a logical location to accommodate a share of this growth. Identifying initiatives to manage this growth from a water cycle management perspective is the purpose of this IWM Plan.

A range of IWM options have been identified and assessed through this work, leading to the recommendation to further explore thirteen integrated water management initiatives. Two portfolios of options have also been developed, one from the perspective of council implementing on their own, the other from the perspective of partnering with other water cycle authorities to implement. There are many common elements between these portfolios, with the interfaces with the recycled water supply network and protection of Bruce Creek the two the critical elements requiring collaboration.

To realise the vision identified in this work, effort and expertise need to be applied to further exploring the benefits and resources required to implement the identified opportunities. Some of these are in conflict, such as whether to use stormwater or recycled water to irrigate public open space, the majority however are complementary, and can be delivered as new developments are built.

An Action Plan has been developed to support GPSC and its stakeholders in delivering this IWM Plan. Undertaking these actions will provide the information required to guide investment and planning decisions, and in doing so create the community of the future that Bannockburn deserves to be. It is recommended that GPSC undertake the actions in the Action Plan, and systematically work through which options are best for Bannockburn, its community and its environment for the long term.

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