PRELIMINARY IWM ISSUES AND OPPORTUNITIES REPORT

BANNOCKBURN SOUTH EAST PRECINCT

DECEMBER 2024

PREPARED FOR VICTORIAN PLANNING AUTHORITY

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EXECUTIVE SUMMARY

Integrated Water Management (IWM) opportunities 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 then compiled into two recommended portfolios. Both 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 are compared against their contributions to meeting the strategic outcome areas of the Barwon IWM Forum.

The core IWM servicing constraints and opportunities are outlined below in Figure 1.

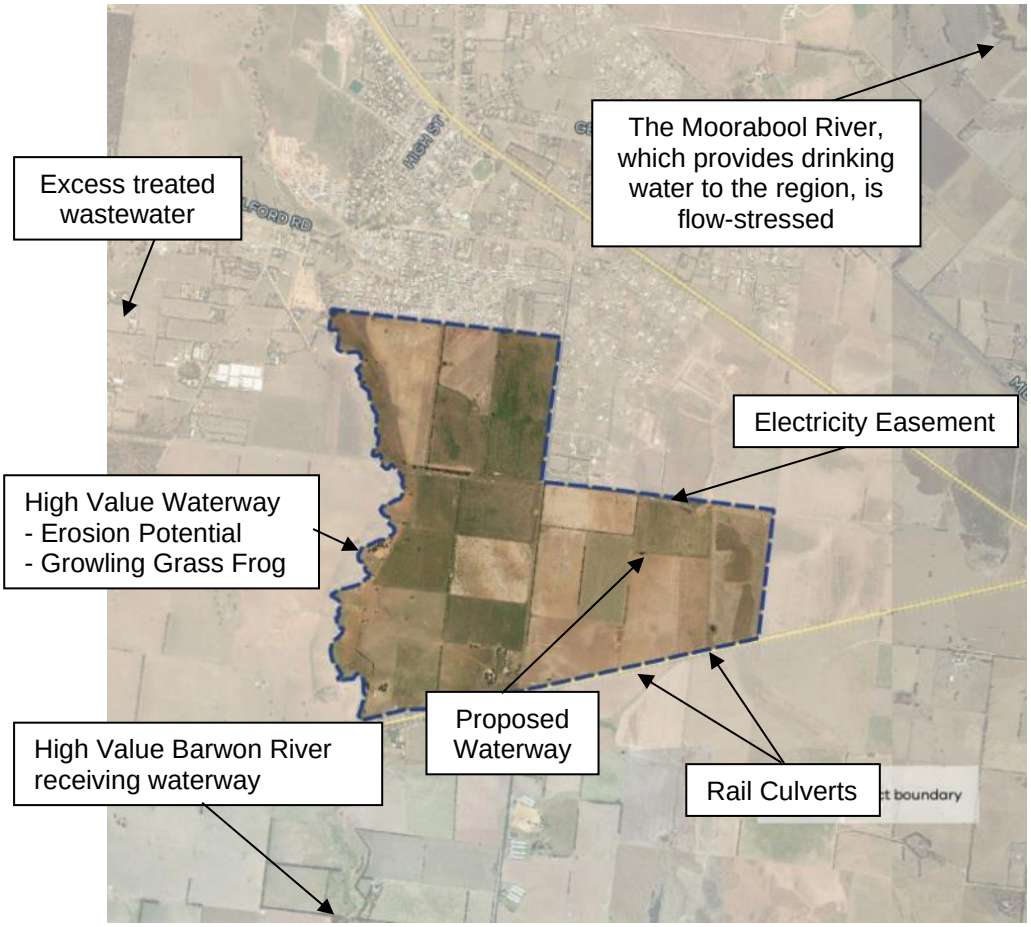

Figure 1: Future Bannockburn South East Precinct issues and constraints

1. INTRODUCTION

Spiire Australia Pty Ltd have been engaged by the Victorian Planning Authority (VPA) to explore Integrated Water Management (IWM) Issues and Opportunities for the future Bannockburn South East Precinct Structure Plan (PSP), currently in the planning phase.

The main tasks for the IWM Issues and Opportunities project are:

1. Inception Meeting
2. (a) Existing Situational Analysis Report, including Site Inspection and Observation Record

   (b) Stormwater Management Assessment Memo
3. IWM Issues and Opportunities Report.

This Draft Preliminary IWM Issues and Opportunities report forms the first draft of Deliverable 3 of the project and outlines results of stakeholder engagement identifying potential IWM issues and opportunities for the precinct, options analysis and portfolio development.

This report follows on from the Existing Situational Analysis Report.

2. SITUATIONAL ANALYSIS REPORT SUMMARY

This Existing Situational Analysis forms the first stage of the Integrated Water Management Issues and Opportunities - Bannockburn South-East Precinct project. An assessment of the Bannockburn South-East Precinct site existing conditions, including review of previous studies and assessments and a site inspection, has been undertaken to inform this Existing Situational Analysis.

Relevant authority policy and strategies regarding IWM, stormwater and the environment was reviewed and summarised to provide specific goals and objectives to the project. The Barwon IWM Strategic Directions Statement provides the broad IWM Strategic Outcomes for the region, which are supported by organisational strategies, and more specific targets and initiatives.

Understanding the regional context and desired outcomes for the Barwon Region water cycle, and how development of Bannockburn South-East might contribute to these, is critically important to this project and the growth of Bannockburn. Water security and recycled water management are significant challenges that an IWM approach may be able to contribute to resolving. Furthermore, additional water for environmental and cultural entitlements across the Moorabool and Barwon Rivers is needed to support the long term ecological health of these important waterways and downstream wetlands.

Closer to Bannockburn itself, Bruce Creek is an important existing feature. The background studies and site inspection suggest this waterway contains high biodiversity and cultural values, as well as having potential to provide significant recreation and amenity value. Emerging science regarding waterways in urban areas suggests that stormwater discharge, even when treated to remove nutrient pollutants, significantly degrades waterway ecology. The Melbourne Water Healthy Waterways Strategy suggests that to protect waterway from urban development, within the rainfall band Bannockburn resides in, would mean harvesting 74% of stormwater, and infiltrating 8%. How these ambitious targets can be realised, and how this solution is able to contribute to other regional outcomes, will be the focus of the issues and opportunities study.

3. IWM PARTNER DISCUSSIONS AND INITIAL OPTIONS

3.1 IWM DESIGN SPRINT

In September 2020, in recognition of the significant growth forecast for Bannockburn, and the opportunities and constraints for water cycle management across the township, Barwon Water and Golden Plains Shire Council participated in a IWM Plan Design Sprint to quickly develop high level IWM thinking to input into the Bannockburn Growth Plan being developed by the VPA at the time. A range of opportunities were identified through this exercise, these being outlined in below in Figure 2.

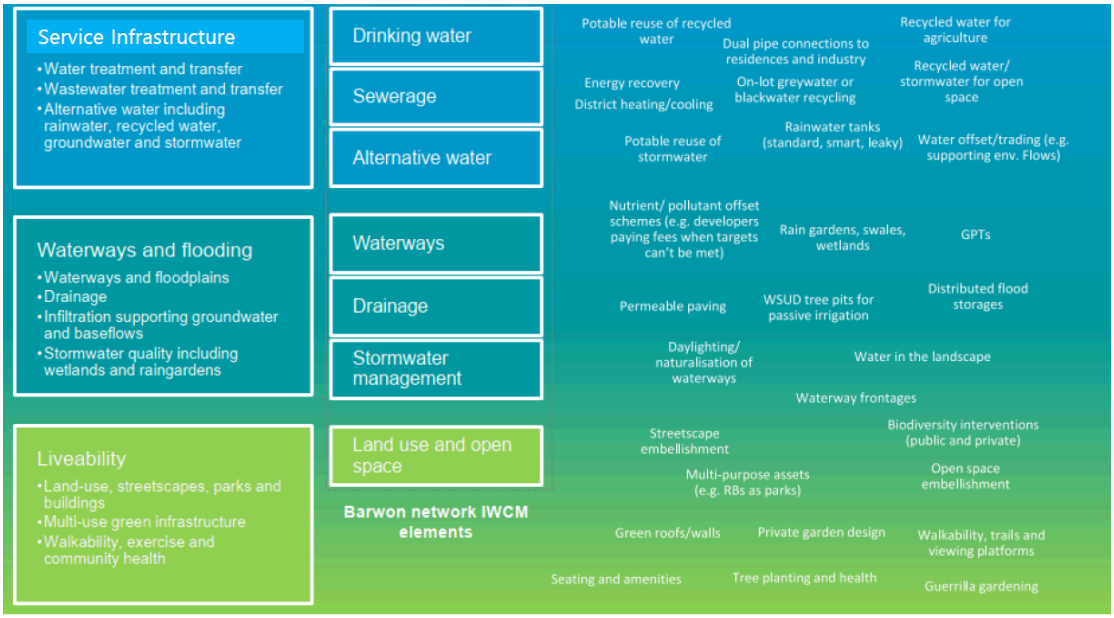

Figure 2. Design Sprint examples of solutions

Many of the opportunities identified through the design sprint are crucial for consideration in the PSP development, such as the regional solutions. Others can be further explored outside the PSP process in detailed design of infrastructure.

This work focuses on initiatives that will have impact on the PSP process, and identifies how these can work within the PSP to better realise implementation. It is also acknowledged that Golden Plains Shire Council will shortly initiate an IWM Plan for Bannockburn which would be the appropriate process to explore IWM options more specific to Golden Plains Shire Council land uses.

The Design Sprint document is shown in Appendix I.

3.2 VISION AND PURPOSE WORKSHOP AND STAKEHOLDER DISCUSSIONS

VPA hosted a Vision and Purpose Workshop for the Bannockburn South East PSP on 19 May, 2022. The workshop was well attended by servicing authorities, land owners and consultants. Integrated Water Management was a recurring theme across the conversations, with a focus on how water can be managed to support environmental outcomes across the PSP area.

Additional follow-up discussions were held between servicing authorities and Spiire on 22 and 23 May, 2022, to begin to explore potential water management interventions. These discussions led to the development of the initial IWM opportunities list as shown in Table 1.

Table 1. Initial IWM Opportunities

Opportunity	Description	Outcome Areas
Lot Scale		

Opportunity	Description	Outcome Areas
Rainwater Tanks	Installation of rainwater tanks at each lot to harvest roofwater for toilet flushing and garden irrigation. Variants could include supply to laundry, and smart control systems	Safe and Secure Water Supply Healthy and Valued Waterways
Passively Irrigated Street Trees	Installation of an underground watering system for each street tree, harvesting stormwater from the road catchment. Variant could include roof water catchment instead of road.	Healthy and Valued Waterways Healthy and Valued Landscapes
Smart Meters	Installation of smart meters to allow residents to track water usage digitally and identify water wastage. Variant could include connection to smart control systems.	Safe and Secure Water Supply
Precinct Scale		
Modified Kerbing	Redesign of stormwater kerb abutting open space to allow stormwater to flow onto open space. Variant could include centre medians if present.	Healthy and Valued Waterways Healthy and Valued Landscapes
Stormwater Harvesting	Collection of stormwater runoff through pumpstations and rising mains from constructed wetlands to a stormwater storage basin outside the PSP area. Variant could include gravity collection if feasible.	Safe and Secure Water Supply Healthy and Valued Waterways
Recycled Water Supply for Open Space	Utilising Class C recycled water to irrigate active and passive Open Space across the precinct, including schools. Management controls would need to be in place to limit human contact. Variant could include treatment to Class B or Class A.	Safe and Secure Water Supply Effective Wastewater Systems Healthy And Valued Landscapes
Stormwater Supply for Open Space	Utilising harvested stormwater to irrigate active and passive Open Space across the precinct, including schools. Management controls would need to be in place to limit human contact.	Safe and Secure Water Supply Healthy and Valued Waterways Healthy and Valued Landscapes

Opportunity	Description	Outcome Areas
Eastern Waterway	Investigation into the potential role for the eastern waterway to contribute to the stormwater management strategy, open space strategy and transport strategy.	Flood Risks and Impacts Healthy and Valued Waterways Healthy and Valued Landscapes
Wetland / Waterway location	Wetlands / waterway may be located within the high voltage electricity easement. This would improve the amenity value of this corridor. This may also allow for land that is currently allocated to wetlands to be made developable. This will require consultation with AusNet.	Healthy and Valued Waterways Healthy And Valued Landscapes
Regional		
Recycled Water Supply for Agriculture	Utilising Class C recycled water to provide to agriculture, potentially reducing need for surface water extraction.	Safe and Secure Water Supply Healthy and Valued Waterways Economic Growth
Stormwater for passing and/or environmental and/or cultural flows	Transfer harvested stormwater to She Oaks diversion weir and replacing passing flows for increased potable water extraction. Additional water for environmental and/or cultural flows. Variant could utilise existing pipeline, combining Bannockburn stormwater with stormwater harvested from Northern and Western Geelong growth areas.	Safe and Secure Water Supply Healthy and Valued Waterways Traditional Owner Values

3.3 STAKEHOLDER WORKSHOP

The IWM options outlined in this list were discussed with VPA, Barwon Water and Golden Plains Shire Council on 7 October, 2022. There was broad support for the majority of the options outlined, with no significant issues to remove any specific option from the list identified.

As these options were further explored in detail, the *stormwater harvesting* option was merged with the *stormwater for passing and/or environmental and/or cultural flows* option, and the *Eastern Waterway* was merged with the *Wetland / Waterway Location* option. An additional option *infiltration wetlands* has also been added in.

The minutes of the workshop are outlined in Appendix II.

3.4 IWM ISSUES AND OPPORTUNITIES ASSESSMENT

An assessment and exploration of the identified IWM Options relevant to the Bannockburn SE PSP were assessed and explored through a range of considerations. Descriptions of the various consideration are outlined below. The assessments of the options are presented in Appendix III.

3.5 KEY DESIGN ELEMENTS

Each opportunity involves built infrastructure designed to manage water at some point in the water cycle. The Key Design Elements outlines the context for the opportunity, the infrastructure required and approach to determine its optimal sizing. It also outlines how the option operates to achieve and outcome over an above the typical business as usual servicing approach.

3.6 OTHER DESIGN ELEMENTS FOR FURTHER CONSIDERATION

In many instances there can be variations to the defined opportunity outlined in the Key Design Elements. These may be additional pieces of infrastructure to achieve added benefits, or a different configuration of the infrastructure to collect water from a different location or use it for different end uses. The other design elements will typically be opportunities that a more innovative or leading than that described and assessed.

3.7 OPTIONS ASSESSMENT FRAMEWORK

An options assessment framework was developed to quickly assess the opportunity against a several critical metrics. A rating of green for a positive impact, orange for a marginal or unknown impact and red for a negative impact was made, with narrative provided supporting the rating. This framework was presented at the stakeholder workshop and agreed to be fit for purpose. The framework is presented in Table 2.

Table 2: Options Assessment Framework

	Assessment Description
Targets	Contributes to established authority targets/outcomes
Value	Qualitative potential for economic feasibility
Technical	Technical precedent
Policy Regulation	Regulatory precedent
Risk	Qualitative potential for high or extreme associated risks

3.8 VISUALISATION

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

3.9 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.

3.10 ASSEST 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.

3.11 WATER BALANCE

A range of assumptions were made regarding the make up of the PSP 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 assumptions 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.

3.12 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.

3.13 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.

4. RESULTS AND RECOMMENDED OPTIONS

The detailed assessment of the Base Case and ten IWM options is outlined in Appendix III. The summary of the Options Assessment Framework is shown in Table 3.

Of the options explored only the Stormwater Supply for Open Space option was not recommended for inclusion in one of the two portfolios. This was because of its incompatibility with the recycled water supply for open space option (which is more reliable), and regional stormwater harvesting scheme to manage the increase in stormwater runoff to receiving waterways.

The analysis showed that small scale options typically were lower value, but also had less risk. The larger regional scale options are needed to achieve the ultimate outcomes but may not have been done before and so would need significantly more investigation and business case development.

Table 3: Options Assessment Framework Results

Option	Targets	Value	Technical	Policy / Regulation	Risk	Include in Portfolio
0. Business As Usual						
1. Rainwater Tanks						
2. Passively Irrigated Street Trees						
3. Digital Water Meters						
4. Modified Kerbing						
5. Recycled Water Supply for Open Space						
6. Stormwater Supply for Open Space						
7. Infiltration Wetlands						
8. Eastern Waterway						
9. Recycled Water for Agriculture						
10. Stormwater Harvesting to SheOaks						

5. IMPLEMENTATION ASSESSMENT

5.1 WATERWAY PROTECTION – LOWEST COST

This portfolio seeks to meet the waterway protection targets with the least risks, complexity and cost. This portfolio would comprise of:

- Infiltration Wetlands
- Stormwater Harvesting to She oaks

Under this option the development would be built as per a business as usual approach for water supply, sewerage and drainage services, excluding some slight variations in stormwater infrastructure and wetlands design and management. These variations would include slightly deeper wetlands and some additional road reserve and easement requirements for stormwater harvesting pipelines. Wetlands would be configured to enable infiltration of stormwater into the groundwater system. Of the remaining stormwater exiting the wetland, a portion (to realise 77% of the mean annual impervious runoff harvesting and evaporation target) would be directed to an offsite storage either through gravity, or through a wetwell, pump and rising main. The harvested stormwater would be transferred to the SheOaks weir where it would be used for environmental flows, cultural flows, passing flows (to allow increased extraction for drinking, or with treatment and a change in policy, for direct potable use.

This approach would significantly contribute to the Water Supply and Healthy Waterways strategic outcomes. It would also contribute to improved economic benefits and community values. This assessment is shown in Figure 3.

This option is designed to be as simple as it can be, while still effectively addressing the highly complex challenge of reaching runoff targets. Its simplicity is achieved through its centralised and uniform method of implementation.

Developers will be required to build new wetlands to an agreed specification, ensuring infiltration and harvesting will be incorporated. Barwon Water and Golden Plains Shire Council will coordinate to ensure the design of these wetlands is appropriate, and developers will submit designs for approval prior to breaking ground. Existing wetlands, some of which need restoration, can also be retrofitted according to this agreed design utilising funding from State Government grants or stormwater management offset charges gathered from developers. The harvesting network will be outlined as part of the servicing strategy for the development, with additional pipe allowed for in the road reserve.

A similar scheme has already been integrated as a requirement into the Sunbury South PSP and is currently being delivered through a collaborative design and governance process between Authorities, Council and Developers.

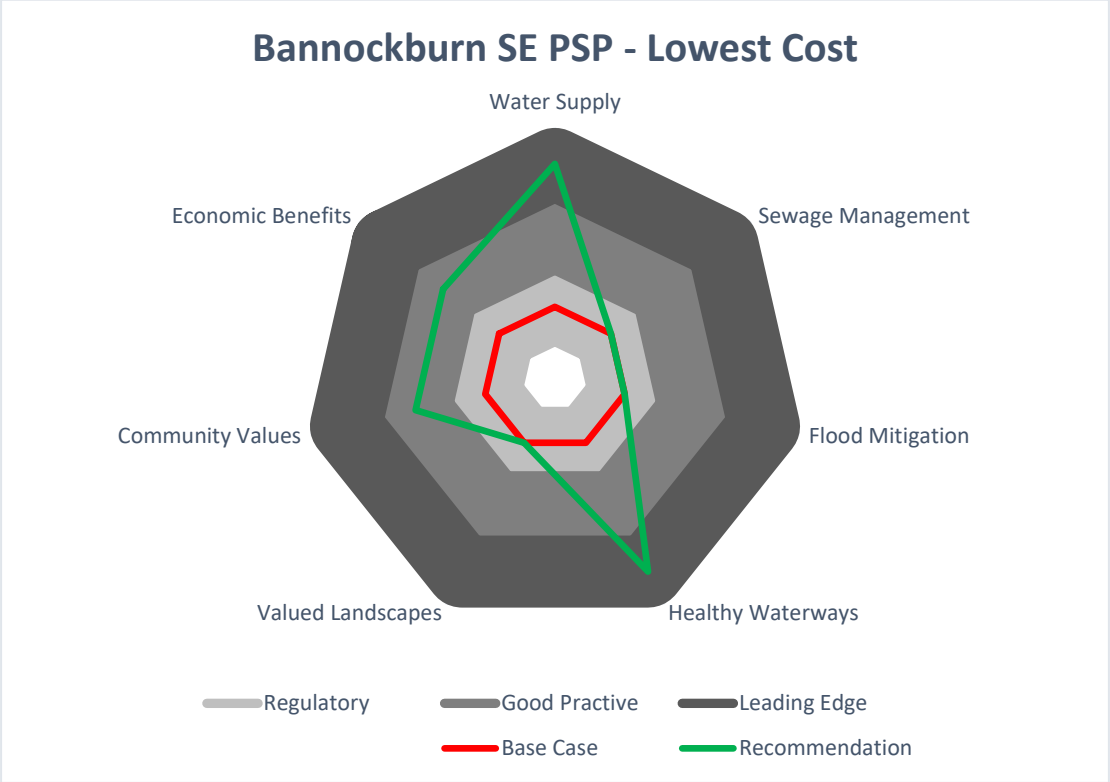

Figure 3. Waterway Protection with Lowest Cost portfolio

5.2 WATERWAY PROTETCTION – LEADING EDGE

The implementation of the below options seeks to meet the waterway protection targets and enhance a range of other metrics including water security, agricultural productivity and community literacy. This portfolio would comprise of:

- Rainwater Tanks
- Passively Irrigated Street Trees
- Digital Water Meters
- Modified Kerbing
- Recycled Water for Open Space
- Infiltration wetlands
- Eastern Waterway
- Recycled Water for Agriculture
- Stormwater Harvesting to She oaks

Water efficiency is improved through the rainwater tanks and digital water meters, landscapes supported through passively irrigated street trees, modified kerbing, the eastern waterway and recycled water for open space. The economy is supported through improved agricultural productivity with supplying recycled water for agriculture and the waterways are protected through the infiltration wetlands and regional harvesting scheme.

Additional complexity is expected in the delivery of the leading edge options due to the diversity of infrastructure required. Each option will require its own stakeholder engagement plan, with touchpoints across all stakeholders, to establish the rules of operation, minimum standards for construction and agreement of cost sharing.

While significant work would be required to realise this portfolio, this outcome would make a significant step toward Bannockburn becoming a water sensitive city. The assessment is shown in Figure 4.

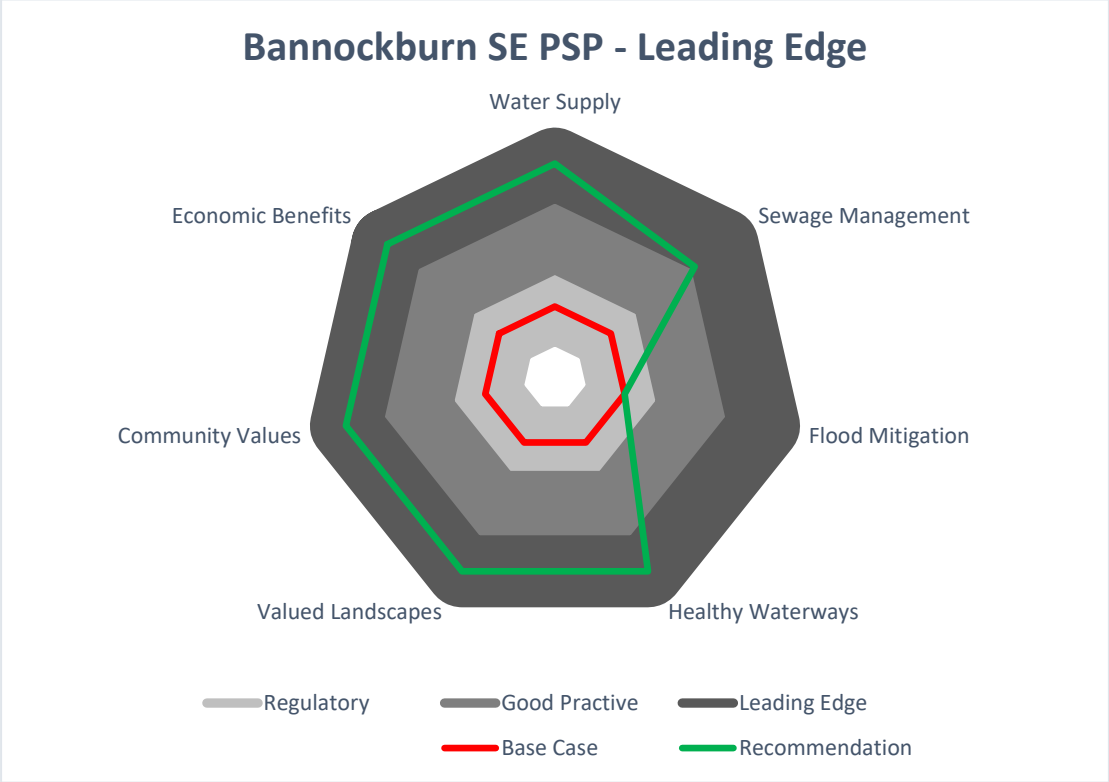

Figure 4. Waterway Protection with Leading Edge portfolio

6. CONCLUSION AND RECOMMENDATIONS

Through reviewing strategic and site specific information, engaging with local authorities and using learnings from other projects across Victoria and beyond, IWM issues and Opportunities have been identified to inform land use planning for the Bannockburn South-East PSP.

The *Situational Analysis Report* outlined the strategic and physical contexts for the PSP area and included a compiled list of potential IWM options. These options were explored in a stakeholder workshop, and a detailed assessment undertaken in this *Draft Preliminary Issues and Opportunities Report*.

The IWM workshop has guided the IWM vision for the precinct, with “Protection and enhancement of valued waterways in the region” identified early as an important consideration in exploring IWM Options. Following the detailed assessment, two water cycle servicing portfolios have been identified to achieve this outcome, both of which utilise similar options to infiltrate and harvest urban stormwater runoff. In these options, the harvested water is intended to support regional water security and environmental and cultural outcomes, utilisation of water at SheOaks Weir has been used as a strawman example, but further analysis into this option will be required prior to inclusion in the PSP.

All options need further exploration with the responsible authorities, with a high level water and pollutant water balance required to inform the base case. Following an assessment of long list options to determine a potential action plan, a short listing process will be required to determine what elements to include in the PSP to support the IWM Vision of the Bannockburn South East Growth Area stakeholders and instruct developers on minimum requirements. .

Following the shortlisting of options, authorities will need to pursue further investigations and design to determine the quantum by which the IWM outcomes are met by these options when development commences.

These investigations, along with stakeholder feedback through workshops and commentary, will be utilised to determine the optimal locations of assets and infrastructure and gain stakeholder commitment.

7. REFERENCES

Barwon Water (2021), *Draft Urban Water Strategy: Water for our Future,* *https://www.barwonwater.vic.gov.au/__data/assets/pdf_file/0025/271654/Draft-WFOF-Strategy_FINAL.pdf*

DELWP (2016), *Integrated Water Framework for Victoria*, https://www.water.vic.gov.au/__data/assets/pdf_file/0022/81544/DELWP-IWM-Framework-FINAL-FOR-WEB.pdf

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APPENDIX I

STAKEHOLDER WORKSHOP MINUTES

MEETING MINUTES

Meeting Title:	IWM Issues and Opportunities Stakeholder Workshop		
Project Name:	Bannockburn South-East PSP	**Project No:**	310288
Meeting Date:	Friday, 7 October 2022		
Location:	Microsoft Teams		
Meeting Chair:	Nigel Corby, Spiire		
Attendees:	Sarah Salem, VPA Chris Braddock, VPA April Chan, VPA Monique So, VPA Lachlan Buck, VPA Rhys Bennet, BW	Laura Murphy, GPSC David Collins, GPSC Daniel Murrihy, GPSC Jacob Meehan, Spiire Nigel Corby, Spiire	

Discussion Point	**Action By**
Welcome and introductions	
Welcome Introductions ▸ Apologies from David and Greg, Wadawurrung, and Laura Taylor, DELWP	NC All NC
Situational analysis report	
Strategic and Site-Specific Context ▸ Moorabool identified in multiple studies as being significantly flow stressed ▸ Laura attended site visit with Alan – Lee also joined representing landowner with Joe Wallace from DELWP ▸ Alan blown away by form of the creek and the potential values ▸ EPA released a guidance document which identified 2 levels of priority (priority and non-priority) ▸ **FUTURE ACTION** - Consideration of what level of protection is assigned to Bruce Creek ▸ If priority, over 1 GL of SW per year expected to need to be harvested at full development	All

Discussion Point	Action By
Options Assessment	
Assessment Framework ▸ Currently includes targets, value, technical, policy regulation, and risk ▸ NOTE – The group responded positively to the listed proposed assessment framework categories and descriptions.	NC
Long List of Options ▸ Opportunities identified through individual discussions with stakeholders ▸ **Lot Scale** 1. **Rainwater tanks** **Question** - is the rainwater tank mandatory or optional? **LM**: council unlikely to mandate rainwater on a long-term basis **DC**: Value of rainwater tanks **RB**: trial with rainwater tanks in the quay estate, deakin uni PHD student has looked at the data over the last 10 to 15 years and there is minimal benefit. **RB**: Is the purpose of the RW tank to save drinking water or to reduce stormwater management loads? **NC**: Yes its to save DW, levelized cost over 30 years the tank is an expensive solution. RW tanks only a contributor to managing SW loads. BW needs to drive community acceptance and utilisation **CB**: VPA can mandate very little in a PSP sense, what target is it contributing to? Wannon Waters roof water harvesting project is driven by a requirement for drinking water supply which provides a strong basis for mandating NC: with the size of the lots and gardens, the viability of rainwater tanks is more significant 2. **Passively Irrigated Street Trees** Can be road or roof runoff, encourages 25-30% greater canopy cover **DC:** Wants a noticeable difference between areas with and without good IWM, need to consider maintenance RC: Northern-Western Geelong are looking to implement this, developers of Lovely Banks are working on trials to test other technologies for PIST, especially if they contribute to SW reduction loads CB: VPA eager to see examples to provide evidence base, tree canopy targets, VPA still considers PIST a mystery NC: Doesn't remove a huge volume, tree has demand of ~8kL/year, with rainfall variability this will only be partially met. AC: Has literature to show water demand 3. **Smart Meters** **NC**: Smart meter trials are ongoing; expectation is that smart meters will be the new norm. **RB**: Barwon Water has budget allocation for 17,000 new digital meters, not aware of any current plans to look at growth area rollout	NC

Discussion Point	Action By
NC: Potential to link smart meter to rainwater tank to manage SW loads through an externally controlled actuator valve **Lot Scale opportunities can work together in an integrated smart system** **CB:** VPA requirement of PIST to be applied where possible could drive this. New EPA guidelines – authorities and developers can work together to drive outcomes **ACTION –** Water Authority or council to consider the control "beyond the meter". ▸ **Precinct Scale** 4. **Modified Kerbing** **RB**: Already in action in North – Western Geelong **DC**: How does the look and feel benefit the overall community, what are the operational impacts **LM**: Will not be a disruptive change to the status quo **NC**: Low cost in terms of maintenance, design and layout considerations is the major cost **CB**: Canopy tree requirements will again be a driver **AC**: Low-tech, low-cost option to achieve a lot of benefits. Seeking on the ground examples with evidence base **NC**: This approach is most in place in informal areas. **LM**: Matches existing look and feel of Bannockburn **RB**: Grand lakes estate – Lara, The Point – Point Lonsdale, The Quay – Torquay 5. **Stormwater Harvesting** **NC**: To be discussed again item 10 6. **Recycled Water Supply for Open Space** RB: No talk of getting from Class C to Class B, class C water currently used by the golf course and local farms, mention of expanding Bannockburn RWS to footy oval, access is significant barrier. Subsurface irrigation not considered. **ACTION** – RB to update on status of Class C to Class B. **LM**: is the developer responsible for costs for treatment upgrade **NC**: Interesting mechanism explored elsewhere is to look at cost difference between the 2 water supplies and propose a solution which is cost neutral for the Water Authority **RB**: Class A cost is 70% of Potable, Class B/C could be as low as $70/ML. **NC**: Elsewhere the council has paid Class A rate to pay off capital of upgrade Class A would not be considered due to the scale of the Bannockburn treatment plant. **RB:** Bringing recycled water from an agricultural area to open space may be counterintuitive due to the requirements to infiltrate SW that is already in the area. The current rate for Class C recycled water from Bannockburn is $97 per ML and is going up to $109/ML for next price submission. 7. **Stormwater Supply to Open Space**	

Discussion Point	Action By
Even with PIST, SW for Open Space we'd still only get to maybe 50% of the target. Is it better to invest in upgrade of treatment plant or SW storages? 8. **Eastern Waterway** May not need an open water way to move water, however the region will need a wetland to met some of the regulatory requirements and this could be an optimal location. Maybe a linear wetland. **LM**: Council has been vocal about wanted something along these lines 9. **Wetland / Waterway Location** Different electricity companies have different requirements about what can be done in their easements **ACTION** - Spiire to explore precedents ▸ **Regional Scale** 10. **Recycled Water Supply for Agriculture** **RB**: Considering expansion and use of emergency purposes, recently came to an agreement with land holder to the north 11. **Stormwater for Passing and/or environmental and/or cultural flows** Utilising stormwater after treatment, existing infrastructure not currently available. Pipe runs between She Oaks and Geelong which has drinking water in it. Useful that there is an alignment existing currently. Report should consider future easement. **RB**: BW interested in continuing this thought process, already exploring this through the North-West Geelong development **LM**: In regard to change in the EPA guidelines around flows, is there state funding potential? **ACTION** – Nigel to follow up with Laura Taylor regarding state funding support.	
Discussion and Potential Shortlisting ▸ No options ruled out, all will be further described in the report. ▸ Spiire will also outline two potential portfolios of solutions show complementary options.	All
Next Steps	
▸ Spiire to provide Options and Portfolios analysis to VPA in the Draft Preliminary Issues and Opportunities Report.	NC
Workshop Close	

APPENDIX II

2020 IWM DESIGN SPRINT OUTPUT

Bannockburn IWM Plan - Design Sprint

17/09/2020

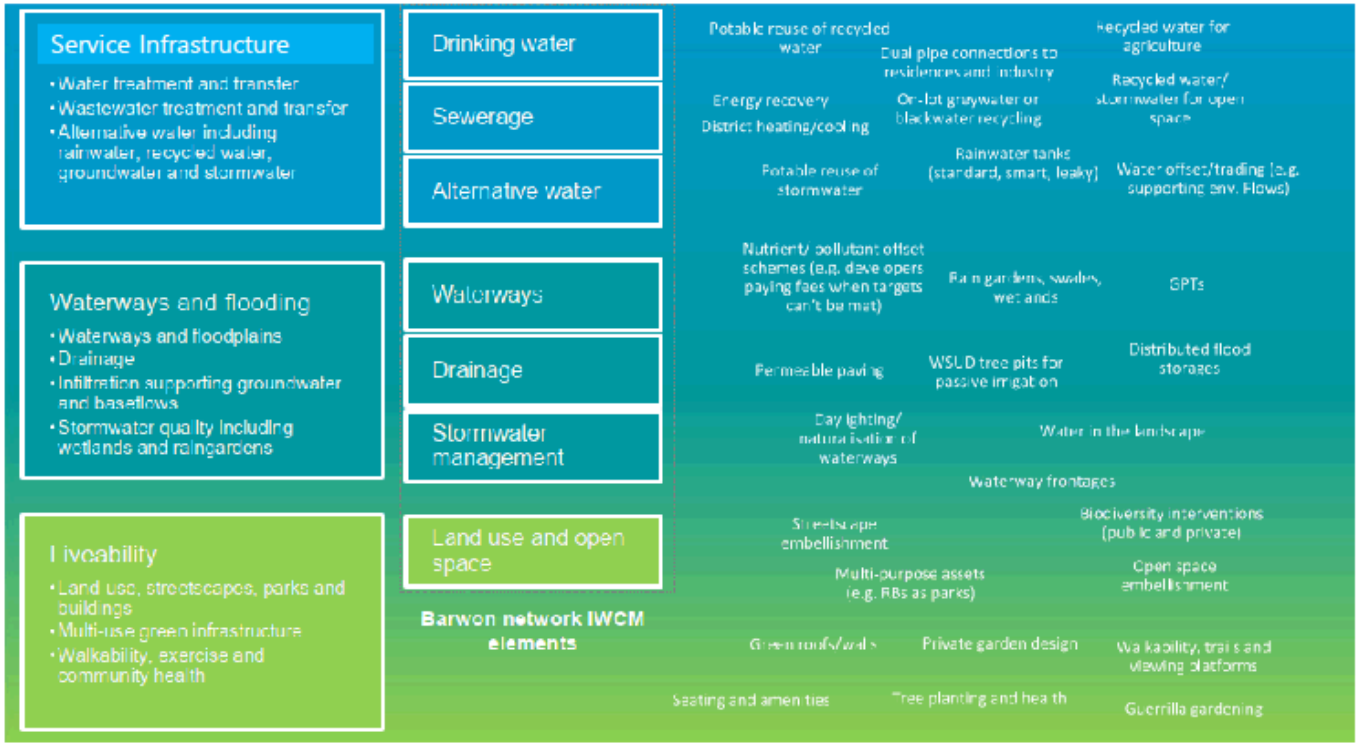
Barwon Water

Design Sprint

- **Why a Sprint?**
  - Insufficient time or funding available to complete a full IWM Plan now
  - To quickly develop high level Bannockburn IWM Plan to input into the Bannockburn Growth Plan being developed by the VPA for Golden Plains.
- **Prep**
  - Gather a sprint team & align on intention
- **Activities**
  - 1- Strategic Landscape mapping
  - 2 – Opportunities & options
  - 3 – Stakeholders and Drivers
  - 4 – Deliverables
- **Outcomes**
  - Key messages, Principles and Potential Projects
  - Likely actions and owners
  - Risks and mitigation
  - Resources and commitment

Bannockburn Key Features

Examples of solutions



Activity 1 – Strategic Landscape

Existing *What's already in place?*	**Concurrent** *What's currently being developed?*	**Future** *What's coming up?*
• Golden Plains Planning scheme • Stormwater management plan • Open Space Strategy • Bannockburn Water Reclamation Plant Upgrade Strategy • GPS Environment Strategy	• Water for our Future (BW) • Bannockburn Growth Plan • Barwon River MAC	• Water for our Future (BW) • Central Region Sustainable Water Strategy • Council Vision and Plan • Climate change action plan • Growth plan developer contributions scheme
Where can an IWM approach add value to the desired outcomes?		
Build on existing and concurrent strategies, identify and prioritise additional opportunities that can be incorporated into future strategies. In particular feeding alternative water opportunities into future PSPs and feeding urban design opportunities into the council plan and Shire vision. Growth plan developer contributions scheme offers a potential avenue for implementing some opportunities.		

Activity 2 – SWOT Analysis

Element	Strengths	Weaknesses	Threats	Opportunities
Service Infrastructure • Drinking water distribution • Sewerage collection and transfer • Wastewater treatment • Recycled Water reuse	• Relative capacity and reliability in water and sewer network • Recycled water disposal site established	• Rural properties on septic system (although benefit of greening lot)	• Climate change reducing water reliability (regional scale) • Cost of services • Deteriorating septics • Capacity of WRP • Difficulty of behaviour change	• WRP upgrades • Recycled water reuse (urban and agriculture) • Water efficiency
Waterways and flooding • Waterways and floodplains • Stormwater and drainage • Stormwater quality including Blue-Green (WSUD)	• Low incidence of damage from flooding • Stormwater system not complex • Community has a love of and use Bruce's Creek	• Some flooding without damage • Limited WSUD infrastructure, so operational knowledge and understanding low • Waterway health in some areas quite poor • Bruce's Creek access difficult, steep slopes on edges, erosion, limited vegetation.	• Limited knowledge of operation • Quality of stormwater runoff to waterways • Development impacting on creek.	• Improved stormwater systems and treatment • Combined blue-green infrastructure • Revitalise and rehabilitate Bruce's Creek corridor • Opportunities for constructed waterways and wetlands • Additional flow release and improved quality to Bruce's Creek
Liveability • Urban land use • Street scapes • Parks and Open space • Blue-Green Infrastructure • Suitable open space (i.e. connected, walkable, safe, exercise and health)	• Larger lots allows more greenery • Some established vegetation in town	• Hot, dry landscape, lack of irrigation of active open spaces • Lack of wetlands and raingardens • Not overly walking friendly, lack of green links	• Not enough water to keep parks green • Developments not resilient to climate change • Missed opportunities for open space links, liveable spaces etc. • Difficulties of council to maintain new open space	• Improving WSUD and broader greenery in future development • Add walking links with existing and new development • Performance targets for tree canopy cover • Mechanisms for private tree canopy on lot • Private lot raingarden/rainwater tanks • Develop local environmental citizenship through creation of "Friends of Bruce's Creek" group

Activity 3 – Stakeholders

Collaborators *We need their insights and ideas*	**Influencers** *We need their support*	**Decision makers** *We need their approval*

• Golden Plains Shire
  • Planning
  • Engineering
  • Open Space
• Barwon Water
• Victorian Planning Authority
• CCMA & SRW
• Traditional Owners
	• Developers
	• Council/BW Executive
	• Golden Plains Shire Staff
	• The broader community
		• Councillors
		• DELWP
		• CCMA

Activity 4 – Deliverables

Stakeholder *Key Stakeholders*	**Deliverable** *What is the output?*	**Communication channel** *How would this information reach them*	**Burning Platform** *What are the key messages*
• Golden Plains Shire • Victorian Planning Authority	• High level IWM plan with future actions to include in Bannockburn growth plan	• IWM Plan sprint document	• IWM Outcomes will be driven by a bold IMW Plan for Bannockburn

Outcomes

Key Messages	Likely actions and owners	Risks and Mitigation	Resources and Commitment

• Bannockburn IWM Sprint conducted to quickly develop high level high level principles and projects to input into the Bannockburn Growth Plan being developed by the VPA for Golden Plains.
• It is acknowledged that a detailed IWM Plan is required at a later date to feed into the PSP process for growth and improve the liveability of existing areas.
• Opportunities to be explored include increased utilisation of recycled water within the town, and better IWM practices in new greenfield areas;
• Bruce's Creek is seen as a critical element to this town, not only from a water cycled perspective, but from what it can provide in terms of liveability, recreation, open space amenity etc.
• IWM critical to future liveability of Bannockburn
	• Bannockburn IWM Sprint write up – BW
	• Incorporation of IWM Sprint principles, key projects etc. in the Bannockburn Growth Plan – VPA
	• Development of a detailed IWM Plan after the Growth Plan is completed – BW/GPS
		• Need to ensure action and projects are delivered, not just included in a plan. Full IWM plan to include delivery strategy, likely to include costs and benefits suitable for council decisions.
		• Risk that GPS cannot effectively maintain all new open space areas. Strategies needed to consider this. i.e. How can we all raise the bar?
		• Need to manage the perception around trees/vegetation and bushfire risks
		• Need to manage the expectation from the community around open space and how is it maintained? And to what level? What does that open space look like. i.e. more 'natural' open space, native vegetation, not necessarily manicured grass.
		• Consider how carbon neutrality can be incorporated into the IWM Plan
			• To be determined. Will include time from:
			  • Barwon Water
			  • Golden Plains Shire
			  • Corangamite CMA
			  • Victorian Planning Authority
			  • DELWP
			  • Traditional Owners

Bannockburn IWM Plan – Potential Principles

Element	Potential Principles

Water for our Future
• Drinking water distribution
• Sewerage collection and transfer
• Wastewater treatment
• Recycled Water reuse
	Water system to be resilient and efficient
	• Minimise potable water import to the area through efficient use of all water
	• Harness and maximise use of all alternative water in or near the growth areas, including:
	  • Recycled water
	  • Stormwater
	  • Rainwater
	• Ensure the water system is resilient in a range of future climate scenarios.

Waterways and flooding • Waterways and floodplains • Stormwater and drainage • Stormwater quality including Blue-Green (WSUD)	**Ensure healthy waterways, landscapes and neighbourhoods** • Improve water quality and ecology of local waterways and receiving environments. • Avoid or minimise any existing or future flood risks • Use Blue-Green infrastructure to reduce the urban heat island effect • Celebrate and enhance Bruce's Creek • Traditional Owners cultural and spiritual values (in particular around water) reflected in place based planning
Liveability • Urban land use • Street scapes • Parks and Open space • Blue-Green Infrastructure • Suitable open space (i.e connected, walkable, safe, exercise and health)	**Provide liveable, healthy landscapes and neighbourhoods** • Ensure urban design is clever and creative, encompassing natural water flows through the development, aiding retention and movement of all water sources, i.e. suburbs designed with water as the first priority • Support the creation of healthy, liveable, open space and recreational areas • Support a minimum of 30% tree canopy cover • Use water to create attractive and desirable place to live • Consider a systems thinking approach for how private and public space interacts to provide liveable, healthy landscapes

Bannockburn IWM Plan – Potential Projects

Element	Potential Projects
Water for our Future • Drinking water distribution • Sewerage collection and transfer • Wastewater treatment • Recycled Water reuse	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 5. Smart meters and water efficiency projects
Waterways and flooding • Waterways and floodplains • Stormwater and drainage • Stormwater quality including Blue-Green (WSUD)	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 incorporating the growth areas with existing trails 3. Bruce's Creek Improve and Enhance 4. 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 o Tree pits, rain gardens, swales, etc. o Streetscape, lot scale WSUD; o More permeable areas (I.e. car parks etc.) 5. Blue Green Infrastructure opportunities maximising stormwater retention in the residential areas still to be built; o naturalisation of major waterways and flow paths; o new waterways designed to incorporate linear infiltration/evaporation swales; 6. Roof water harvesting (town scale or localised, i.e. from new GPS office or Woolworths)
Liveability • Urban land use • Street scapes • Parks and Open space • Blue-Green Infrastructure • Suitable open space (i.e. connected, walkable, safe, exercise and health)	1. Investigate and prepare detailed IWM plan for input to PSP process 2. Review the Infrastructure Design manual, and align with revised IWM Objectives 3. Smart Irrigation Trial of key public space 4. Tree canopy cover review of existing urban areas. 5. Set targets for tree cover in new growth areas 6. Set targets for private canopy cover on lots in greenfield areas 7. Integrate Traditional Owner sites and customs into the IWM plan 8. Investigate environmental citizenship opportunities for key assets such as Bruce's Creek

APPENDIX III

DETAILED OPTIONS ASSESSMENT

Option 0: Base Case

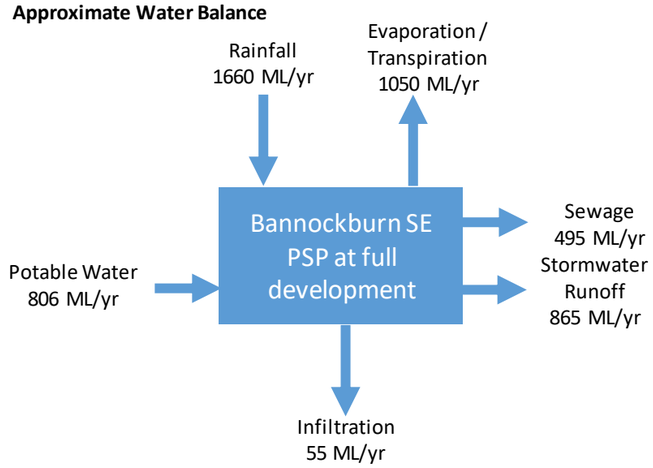
Scale: Lot, Precinct and Regional

Key Design Elements

- The PSP would be serviced in a typical urban development approach, meeting regulatory requirements only.
- Potable water will be sourced from the Yarra Thomson system, likley from desalination
- Sewage will be treated at the Bannockburn Reclamation Plant, with treated effluent managed through land disposal.
- Stormwater from all impervious surfaces is captured in wetlands and treated to Best Practice Environmental Management requirements. Treated storwater is discharged to Bruce Creek and ultimatley the Barwon River.
- All water demands within the PSP are servcied with potable water.

Visualisation

Approximate Water Balance



Other Design Elements for Further Consideration

- All options explored are compared to thsi Business As Usual servicing approach.

Implementation Pathway

- Typical greenfield development with only regulatory requirements as dictated by the Victorian Planning Provisions to be followed.

Discussion

Pros
- Minimal involvement from authorities to drive innovation
- Potentailly low cost

Cons
- Does not meet strategic targets
- Does not engage teh community in water management

Options Assessment

Metric	Comments
Targets	A typical servicing approach does not meet water efficiency, open space, waterway health, community values or economic targets.
Value	This approach will have the lowest infrastructure of the majority of options, however the limited benefits reduces its value.
Technical	Strightforward from a technical perspective
Policy and Regulation	Working work policy makers to secure additional water entitlements within the Yarra Thomson system could be a challenge.
Risk	Major risk that high value waterways and wetalnds will be degraded due to the stormwater runoff.
Include in Portfolio	n/a

Asset Ownership and Operation

- Barwon Water to own and operate water supply and sewerage management infrastructure.
- Golden Plains Shire Council to own and operate drainage infrastructure and wetlands.

Recommendation and Actions

OPTION NOT RECOMMENDED

Option 1: Rainwater Tanks
Scale: Lot

Key Design Elements

- Household roofs provides a relatively clean catchment from which water may be harvested through gravity into a standard tank, particularly 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. It is recommended that rainwater is used for:
  - Toilet Flushing
  - Laundry
  - Lawn and garden Irrigation
  - Street tree irrigation
- Water is provided to household demands through a pump and rainwater reticulation.
- Water can also be provided to the street tree through a manual release of rainwater to the drainage system (see passively irrigated street tree option).

Other Design Elements for Further Consideration

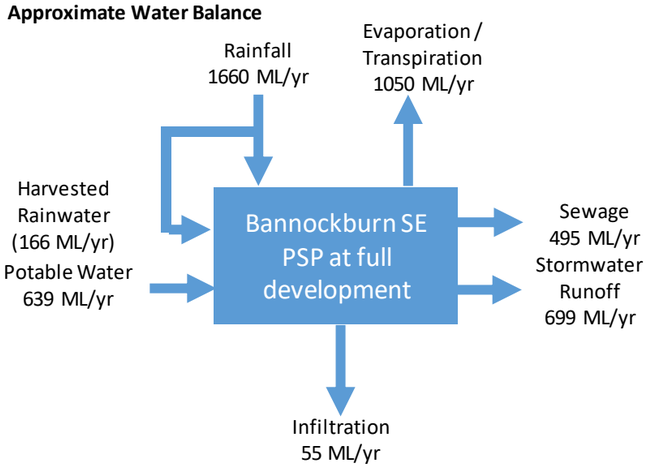
- Smart water meter and smart controlled tank release, this could better support street trees and downstream wetlands with stormwater harvesting through centrally controlled release from tanks.
- Roof water to hot water as demonstrated in Aquarevo, requires a disinfection system at each tank.
- If a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

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.
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. Principle risk is involved in supporting systems 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.

Visualisation

Approximate Water Balance



Implementation Pathway

- All new homes must have a 6-star energy rating and a rainwater tank or solar hot water system.
- Typically, developers would encourage or require rainwater tanks to be installed, these would normally be plumbed to toilet flushing and garden irrigation as a minimum. There may however be other pathways.
- 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 Plain Shore Council can require stormwater connection to a street tree as opposed to directly to the stormwater drain.

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.

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 maintain 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.

Recommendation and Actions

OPTION RECOMMENDED

- Develop plumbing specification for rainwater tank to street tree
- Determine optimal tank size
- Explore council and/or Barwon Water desire to require plumbed rainwater tanks at each lot
- Explore developer willingness to require tanks as per building requirements.

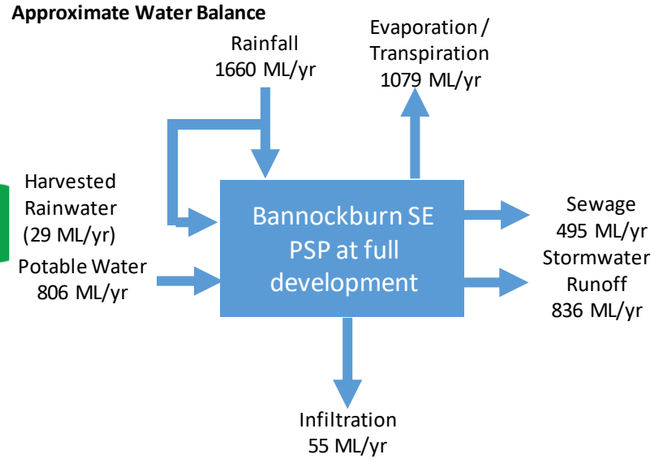
Option 2: Passively Irrigated Street Trees
Scale: Lot

Key Design Elements

- Street trees are planted with an underground water tank, around 400L in capacity, that can supply water to the tree root zone.
- Street trees have a demand of 4kL - 8 kL per annum, this can be supplied from the roof, with downpipes directing water to the tree instead of directly to the drainage system.
- Should the tree water tank be full, then the overflow will go to the stormwater drain.
- Supply to the tree can be further supported by the on lot rainwater tank which supplies toilets and garden irrigation. A tap at the base of this tank can allow irrigation of the street tree during dry periods by letting some of the tank water drain.
- Irrigation of the street tree with this source of water is estimated to increase the canopy cover of the tree by 30%.

Visualisation

Approximate Water Balance



Other Design Elements for Further Consideration

- A smart control system on the drainage tap on the tank could allow release of water to be controlled centrally by council.
- Moisture sensors next to the tree could allow automatic release of tank water to the drainage system, ensuring optimal conditions for the tree if water is available.

Implementation Pathway

- Golden Plains Shire Council to decide whether this is an asset they would be comfortable owing. Suggest engaging with Melton City Council and reviewing their detailed drawings.
- Produce detailed drawings specifying preferred configuration.
- Also, need to specify timing surrounding when the tree is planted. Typically trees are planted when the street is established, to better support the tree, could the tree be planted when the house is built, then the roof water can be provided during tree establishment.
- Developers and builders need to be informed of this requirement early in the development process. If council are happy this could be defined in the PSP.
- After construction, information materials should be provided to the homeowner, so that they are aware of the irrigation system and potential to provide water from the tank during dry periods.

Discussion

Pros

- Low tech solution to provide extra water to street trees, increases canopy cover
- Uses good quality roof water, better quality than road runoff
- Removes additional stormwater from waterways
- Allows homeowner to provide water to tree through turning on a tap at the tank

Cons

- Depending on how the tree is valued, this could be considered an expensive investment
- Systems are still evolving, still an emerging option
- Tree should be planted during house construction, not the typical method
- Most existing systems utilise road runoff, this configuration may be less well conceptualised

Options Assessment

Metric	Comments
Targets	Improved canopy cover, reduced urban heat, reduced stormwater discharge.
Value	Major cost is the underground tank, estimated around $1000 per tree. Possibly good value depending on how tree is valued.
Technical	While some systems collecting road runoff are extensively implemented, there are no known precedents for this configuration.
Policy and Regulation	There are no policy or regulatory barriers.
Risk	There are no significant risk concerns.
Include in Portfolio	Can be implemented independently of other options and could work well with rainwater tanks.

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 street tree and underground tank are owned and maintained by Golden Plains Shire Council.

Recommendation and Actions

OPTION RECOMMENDED

- Develop plumbing specification for rainwater tank to street tree.
- Develop street tree planting protocol to build underground tank and plant tree during house build instead of street build.
- Develop information sheet for homeowner.

Option 3: Digital Water Meters
Scale: Lot

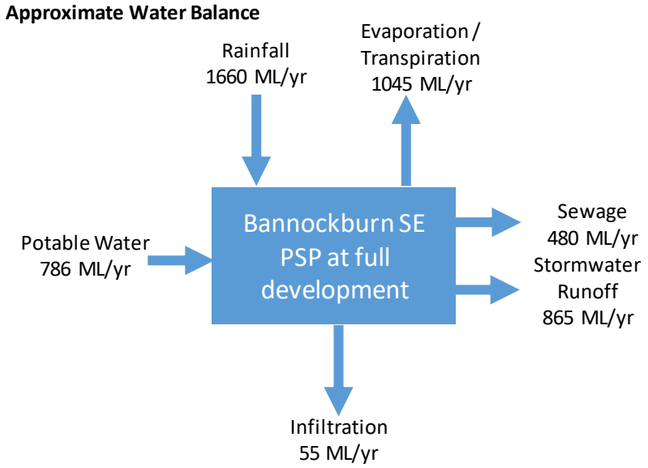
Key Design Elements

- The typically mechanical meter used to measure water use into the property is replaced with a digital meter.
- Digital meters can send information in essentially real time, enabling detailed water usage information through a customer portal through a PC or smartphone.
- The portal can be configured to provide leak alerts, so that the home owner can be notified when a leak is present within their property.

Visualisation

Photo from southeastwater.com.au

Approximate Water Balance



Other Design Elements for Further Consideration

- A digital meter could facilitate the smart control system on the rainwater tank, to allow controlled release of stored rainwater.
- A digital meter could also identify when a rainwater tank pump is not working, supporting Barwon Water to contact the customer and potentially fix the issue.

Implementation Pathway

- Water meters are owned by the water corporation, and so the decision lies with Barwon Water whether to roll out digital meters to Bannockburn.
- Roll out would not be dissimilar to the typical water supply connection process, however, additional information may be needed to outline to the home owner how to access the water usage information and set up alerts.

Discussion

Pros

- Established technology, likely to be the typical installation in coming years
- Alerts the home owner to high water usage and or leaks
- Could also alert the home owners and Barwon Water to faulty rainwater tank systems.

Cons

- Cost, still more expensive than mechanical meters

Options Assessment

Metric	Comments
Targets	Provides an estimated 3% reduction in potable water through early identification of leaks
Value	Major cost is the meters themselves, and the software support system. From potable water savings perspective it is expensive water.
Technical	Digital meters are being rolled out by Barwon Water in some locations, technically understood
Policy and Regulation	There are no policy or regulatory barriers.
Risk	There are no significant risk concerns.
Include in Portfolio	Can be implemented independently of other options and would work well with rainwater tank options.

Asset Ownership and Operation

- Digital meters would be owned and operated by Barwon Water

Recommendation and Actions

OPTION RECOMMENDED

- Barwon Water to explore whether to require Digital Meters as part of the Bannockburn South-East PSP development
- Develop the customer portal and information pack for new home owners.

Option 4: Modified Kerbing
Scale: Precinct

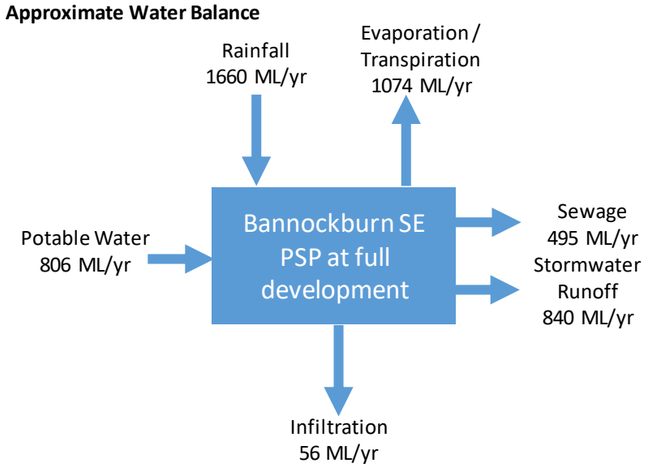
Key Design Elements

- 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 these areas are managed by council.
- 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.

Visualisation

Photo from www.environment.act.gov.au

Approximate 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 the 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 and articulated as such.
- The PSP could identify that roads abutting all open space areas are to direct stormwater runoff to the open space areas.
- Golden Plains Shire Council would then 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.

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	Disconnects impervious surfaces, contributing to protecting waterways.
Value	Likely to be a cheaper installation than a traditional kerb and channel drainage treatment as there is less underground infrastructure.
Technical	This option would need to be explored by council from a technical perspective, and a specification developed.
Policy and Regulation	There are no policy or regulatory barriers, however council may need to modify standards.
Risk	If too large a catchment is directed to a gap, flowrate in high rainfall events could cause erosion.
Include in Portfolio	Can be implemented independently of other options.

Asset Ownership and Operation

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

Recommendation and Actions

OPTION RECOMMENDED

- Golden Plains Shire Council to explore concept internally, develop a specification, and identify areas in which the modified kerbing can be installed.

Option 5: Recycled Water Supply for Open Space

Scale: Precinct

Key Design Elements

- Class C recycled water is currently generated at the Bannockburn Water Reclamation Plant. This water is used for irrigation of agriculture.
- This option would involve installing additional plant at the Bannockburn Water Reclamation Plant to produce Class B recycled water. This water would be kept in a storage tank and piped to active and passive open spaces throughout the south east PSP.
- There are regulations surrounding Class B recycled water use. This would involve night time irrigation of active open spaces and installation of signage. Irrigation would also have to take place a certain distance from housing.
- For passive open spaces, non-aerosol irrigation techniques such as wicking beds may need to be employed.

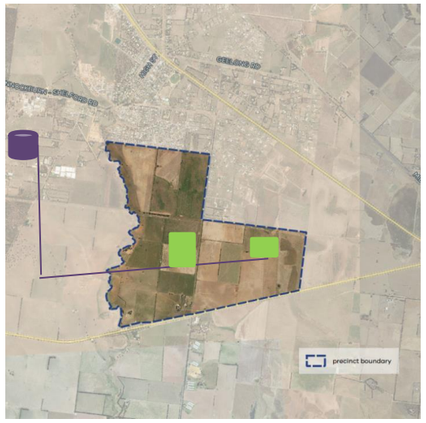
Other Design Elements for Further Consideration

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

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.

Visualisation



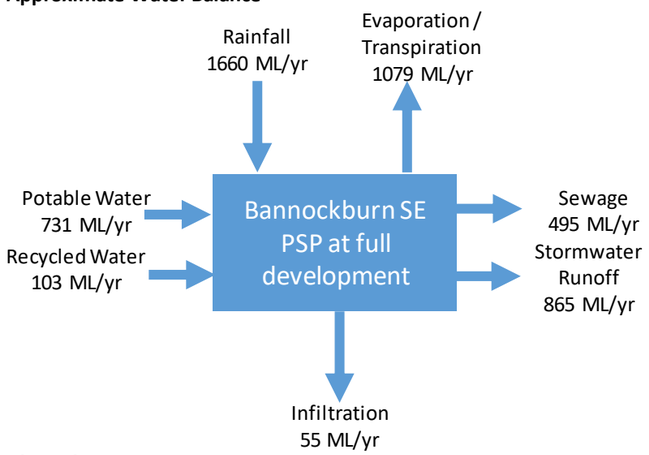
Implementation Pathway

- Discussion with Golden Plains Shire Council regarding demand for recycled water and supply price. Compare with stormwater.
- Undertake conceptual design including pipe alignments.
- Include in PSP the intent to undertake the recycled water scheme, and include mention of pipelines in PSP documentation, including indicative alignments if available.
- Undertake a functional design, to better firm up infrastructure sizing, storage and timing.
- Confirm funding mechanisms, including potential contributions from developers.
- Develop a business case with the various funding contributors and schedule construction.
- Detailed design of the scheme for Bannockburn SE PSP area.
- Golden Plains Shire Council to include in planning permits need for developers to install pipeline infrastructure for open space irrigation with Class B recycled water.
- Barwon Water may be able to recover costs through a specific water supply tariff for the scheme.

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 Class B scheme.

Approximate Water Balance



Discussion

Pros

- Well understood system, Class B does not involve much more infrastructure than Class C.
- Provides additional, high reliability, water to open space areas
- Potentially cost effective supply if compared to desalination Long Run Marginal Cost ($3,000-$4,000 per ML).
- 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.

Recommendation and Actions

OPTION RECOMMENDED

- Barwon Water to explore concept internally, and engage with Golden Plains Shire Council to explore funding mechanisms.

Option 6: Stormwater Supply for Open Space

Scale: Precinct

Key Design Elements

- This option would involve directing treated stormwater from treatment wetlands to adjacent storages. This water would be kept in the storage and pumped and piped to active and passive open spaces throughout the south east PSP.
- The pumps could provide sufficient pressure for irrigation systems.
- There are guidelines surrounding harvested stormwater use. This would involve night time irrigation of active open spaces and installation of signage. Irrigation would also have to take place a certain distance from housing.
- For passive open spaces, non-aerosol irrigation techniques such as wicking beds may need to be employed.
- Potable back-up would be required at the irrigation sites for times when stormwater is unavailable.

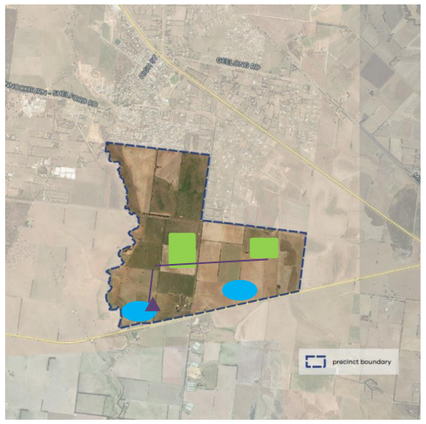
Other Design Elements for Further Consideration

- Smaller pipes and pumps could supply an onsite storage which would provide the irrigation pressure.
- A small treatment system could provide additional risk management on top
- Potential to leverage from the regional stormwater harvesting scheme.

Options Assessment

Metric	Comments
Targets	Contributes to potable water use reduction and reduced stormwater discharge.
Value	Potentially cost effective in the context of a growing Bannockburn and potable water augmentations costs.
Technical	Fairly straight forward understanding of such systems, they are widespread.
Policy and Regulation	There are no policy or regulatory barriers, guidelines are well defined.
Risk	There are some risks associated with stormwater use, however these are managed. Not as reliable as recycled water.
Include in Portfolio	Would not be implemented with recycled water for open space irrigation. Do not include.

Visualisation



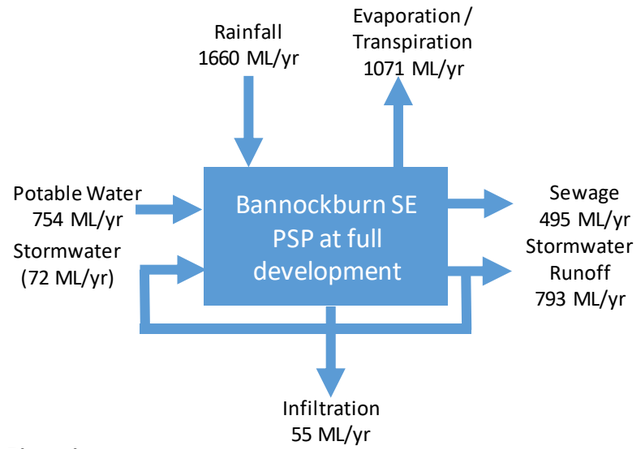
Implementation Pathway

- Discussion with Golden Plains Shire Council regarding want for stormwater and supply price. Compare with recycled water.
- Undertake conceptual design including pipe alignments.
- Include in PSP the intent to undertake the stormwater supply scheme, and include mention of pipelines and storages in PSP documentation, including indicative alignments if available.
- Undertake a functional design, to better firm up infrastructure sizing, storage and timing.
- Confirm funding mechanisms, including potential contributions from developers.
- Develop a business case with the various funding contributors and schedule construction.
- Detailed design of the scheme for Bannockburn SE PSP area.
- Golden Plains Shire Council to include in planning permits need for developers to install pipeline infrastructure for open space irrigation with stormwater.

Asset Ownership and Operation

- Golden Plains Shire Council own the wetlands and opens spaces.
- Barwon Water own pipes and pumps across the region.
- For stormwater harvesting is might make sense for Council to own the storage, and Barwon Water the pipes and pumps. Barwon Water can recover costs through a calculated service charge.

Approximate Water Balance



Discussion

Pros

- Water is provided locally, low energy requirements
- Water is kept from waterways
- Potentially low cost

Cons

- Does not meet the waterway protection targets, therefore further stormwater harvesting investment is still required
- Storages may require developable land
- Treatment and/or management practices will be required

Recommendation and Actions

OPTION NOT RECOMMENDED

- Only pursue should the recycled water option and the regional stormwater harvesting option off take prove not viable

Option 7: Infiltration Wetlands

Scale: Precinct

Key Design Elements

- In predevelopment conditions, a portion of rainfall infiltrates to the groundwater system, which would provide valuable baseflow to Bruce Creek.
- The increase in imperviousness reduces the potential for infiltration.
- For rainfall observed in Bannockburn, the EPA Stormwater Management Guidance, a target of 5% of impervious runoff is identified to be infiltrated.
- Wetlands are typically constructed with a clay liner to hold water, to support vegetation and the nutrient removal process.
- Through creating wetland cells without clay liner, a portion of runoff may be infiltrated.
- Understanding the infiltration rate of the natural soil profile is critical in assessing how to realise the infiltration target.
- Nutrient removal would still need to be realised so as not to bring nutrient into the groundwater and waterways systems.

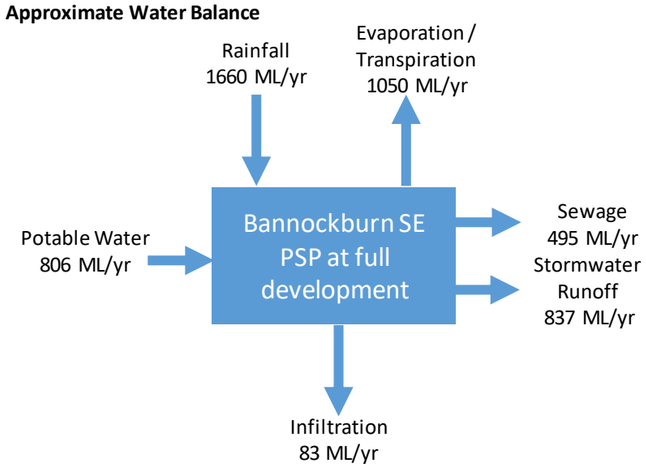
Other Design Elements for Further Consideration

- Water could be held after the treatment wetlands to infiltrate. This however would add land take.
- If wetlands were too dry for an extended period, recycled water may be supplied to support vegetation.

Visualisation

Image: Thornhill Park Wetlands

Approximate Water Balance



Implementation Pathway

- Analysis of receiving waterways, namely Bruce Creek and the Barwon River, to determine what standard of stormwater management would be required.
- Identify within the PSP potential for the infiltration of stormwater as part of the drainage scheme.
- Include infiltration as a desired out for the development of the drainage scheme. This would involve ascertaining potential to infiltrate through understanding ground conditions and infiltration rate, and modelling with MUSIC model to understand wetland performance with infiltration.
- If conceptual assessment is satisfactory, undertake detailed design of wetlands incorporating an infiltration element.

Discussion

Pros

- Protects waterways from harmful stormwater volume.
- Provides valuable base flows for Bruce Creek.
- Utilises existing land take as part of the drainage scheme.
- Potential cost saving through reduced need for clay liner.

Cons

- Untested concept

Options Assessment

Metric	Comments
Targets	Contributes to waterway health through removing stormwater runoff and providing base flows.
Value	The cost of incoproating infiltration will be minimal, potentially a cost saving.
Technical	There are no precedents, some studies would be required to demonstrate effectiveness.
Policy and Regulation	Any discharged stormwater, whether to waterway or groundwater, should still meet BPEM.
Risk	The concept is still being explored. Approval may be difficult to receive in time for the wetland design.
Include in Portfolio	With limited other opportunities to realise the infiltration target, this options is worthwhile exploring.

Asset Ownership and Operation

- Golden Plains Shire Council would own and maintain the drainage system, including wetlands and infiltration systems

Recommendation and Actions

OPTION RECOMMENDED

- Has the potential to achieve the EPA Guidance outcomes, without significant extra cost or land take. Worthwhile exploring further.

Option 8: Eastern Waterway
Scale: Precinct

Key Design Elements

- A minor ridge line running north-south through the centre of the South East PSP area creates two distinct drainage catchments, one draining to Bruce Creek, the other to informal drainage lines and railway culverts. South of the railway culverts, the runoff (from the wider catchment) is collected in a farm dam.
- The informal drainage line can be formed into an open waterway, to convey stormwater runoff from the new development areas.
- Current concepts suggest this constructed waterway would be designed with off stream sediment and potentially nutrient removal. Such an approach would require significant land take an may not be supported by developers. Furthermore, the catchment size is unlikely to be significant enough to require an open waterway to provide sufficient flood protection.
- This option proposes to create an open drainage system with online treatment systems, reducing footprint while maintaining the hydraulic function and amenity value of a constructed waterway.

Other Design Elements for Further Consideration

- The constructed waterway would be ephemeral, it would need to be designed with appropriate planting and maintenance access.
- The width of the reserve is critical to understand, as the developable land take will challenge developers. If it can be achieved within a BAU footprint, there is opportunity to partner with developers to see implemented. Potential to use the electricity easement.
- If harvesting, water from the Bruce Creek wetlands can be transferred to this drainage line, for conveyance to a storage.

Options Assessment

Metric	Comments
Targets	Contributes to flood protection and a significant contribution to amenity.
Value	Will potentially increase land take and operation and maintain costs above a typical enclosed drain approach.
Technical	Detailed assessment of the catchment and topography, and the draft urban form, will be required.
Policy and Regulation	If additional developable land take is required, this could be challenged by developers.
Risk	Developers may not support the option.
Include in Portfolio	The increase in amenity value justifies exploring further in the Portfolio.

Visualisation

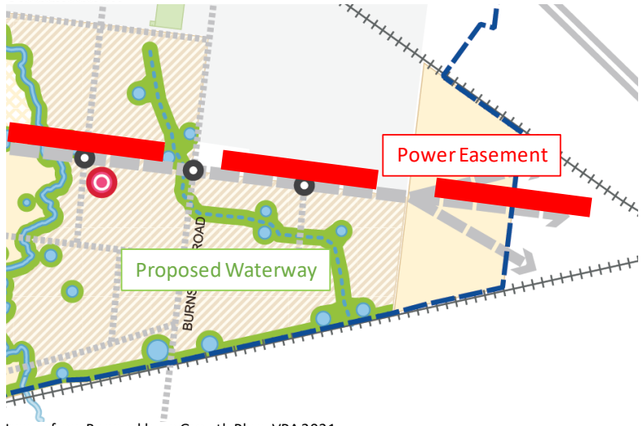


Image from Bannockburn Growth Plan, VPA 2021

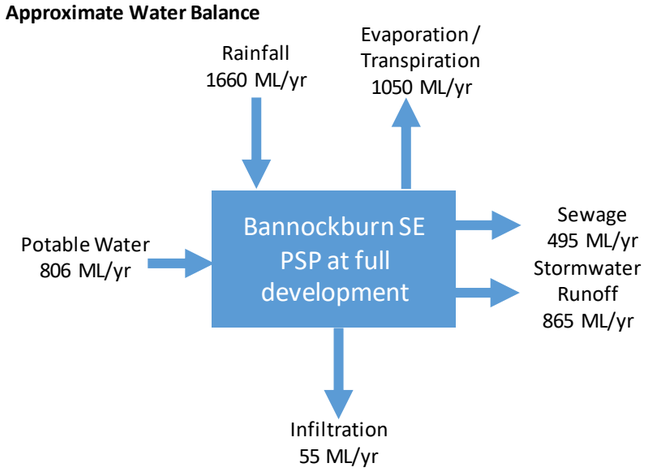
Implementation Pathway

- The Growth Plan already identifies the Eastern Waterway, and it is suggested it remain in the PSP, pending further engagement and design.
- The detailed drainage strategy for the PSP will explore the existing topography, model the developed state, and determine flood management and water treatment requirements. Downstream impacts before and after the railway culverts would also be assessed.
- Two options should be explored, that of an enclosed drain with a drainage easement end of line wetland, and that of an open drain with treatment incorporated.
- A discussion with Ausnet, the electricty provider, shoudl alos be undertaken to understand potential to utilise the power easement.
- Depending on the stormwater harvesting and infiltration targets to be met, these outcomes could also be incorporated into the design.
- Golden Plains Shire Council can then decide on the preferred approach, with would be articulated in a drainage strategy for developers to follow and contribute to.

Asset Ownership and Operation

- Golden Plains Shire Council would own and maintain the drainage system
- If located within the power easement, there may need to be a spcific sommittee of management established to ensure risks are appropriately managed.

Approximate Water Balance



Discussion

Pros

- Creation of an open waterway/drain will create a unique feature for the development, providing amenity value and improving urban cooling.
- If the treatment function can be incorporated into the footprint, then there is no need for the end of line wetland.
- Could be designed cleverly with a harvesting/infiltration scheme.
- Could utilise encumbered land associated with the power easement.

Cons

- Drainage easements for open waterways are typically wider than enclosed drains.
- Potentially not supported by developers, particularly if developable land is required.

Recommendation and Actions

OPTION RECOMMENDED

- Has multiple benefits the enclosed drain option would not have, needs further design work to demonstrate these.

Option 9: Recycled Water Supply for Agriculture
Scale: Precinct

Key Design Elements

- Class C recycled water is currently generated at the Bannockburn Water Reclamation Plant. This water is currently used for irrigation of agriculture, though would likely need expansion with the increase in sewage to be treated from the growth areas.
- This option involves identifying additional agricultural demands and potential expansion of treatment plant, storage and piping.
- More recycled water is produced in colder months (primarily due to inflow and infiltration in the sewer networks), however this is when irrigation demand is at its lowest. Irrigators can install their own storages to better manage water availability.
- It is recommended to create a mini water market form the Bannockburn reclamation plant, using smart meters and an app to provide daily recycled water prices depending on water availability. This will encourage users to take water when Barwon Water has it in abundance, reducing infrastructure needs.

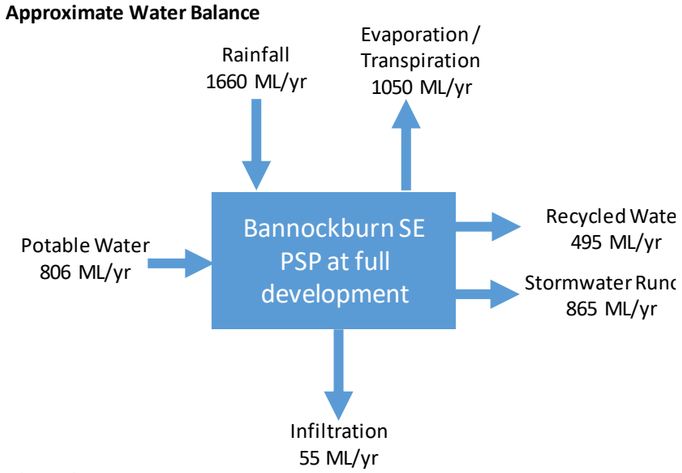
Other Design Elements for Further Consideration

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

Visualisation

Example: Melton Recycled Water Plant with nearby centre pivot irrigation.

Approximate Water Balance



Implementation Pathway

- Forecast recycled water production, and explore internally a range of commercial options, such as typical supply agreements, including penalties for not taking water or establishing a floating price for recycled water.
- Initiative a discussion with existing users and explore additional supply concepts regarding volume, reliability and quality.
- Undertake an expression of interest to other agricultural users in the region, including preferences regarding supply volumes, quality and onsite investment in infrastructure such as storages, laser grading and/or centre pivot irrigation systems.
- Based on feedback develop business case and supply agreements taking into account how growth will roll out.
- Detailed design of infrastructure and plant upgrades
- Implement and expand as growth takes place.

Discussion

Pros

- Productive and effective outlet for treated sewage
- Many agricultural applications do not need high quality water.
- There is space.
- Adaptive approach shares opportunity and risk across multiple users.
- Keep recycled water out of Bruce Creek.
- Barwon Water does not need to purchase additional land for land application.

Cons

- Unknown soil type, is soil suitable for crops such as lucerne?
- Might need extensive pipework to get to demands
- Digital solution needs to be developed for this application.

Options Assessment

Metric	Comments
Targets	Contributes to wastewater management and the local economy through more intensive and productive farming practices.
Value	Likely cost effective in the context of a growing Bannockburn and recycled water management constraints.
Technical	Need to explore the specifics of the digital solution, no known precendents for this particular application.
Policy and Regulation	There are no policy or regulatory barriers, regulations are well defined. Contractual arrangements with users needs definition.
Risk	There are some risks associated with recycled water use, however these are managed through following well defined regulations.
Include in Portfolio	Likley provides better value to the community than Barwon Water managing the majority of recycled water on their own land.

Asset Ownership and Operation

- Barwon Water currently and would continue to own and operate the treatment plant and provide recycled water to agriculture users.

Recommendation and Actions

OPTION RECOMMENDED

- Barwon Water to explore concept internally, and engage with current and potential users to determine viability.

Option 10: Stormwater Harvesting to Sheoaks
Scale: Regional

Key Design Elements

- The EPA Guidance for stormwater management outlines significant harvesting requirements for priority waterways, and Bruce Creek could be identified as such due to being within the Barwon River Catchment and its local values.
- Harvesting of the order of 77% of stormwater generated from impervious surfaces would involve collecting BPEM treated stormwater from treatment wetlands into a wet well, and pumping this water to a storage basin outside the growth area.
- Water would then be pumped from this storage up to the Moorabool Water Treatment Plant, a stormwater polishing treatment plant would further treat the stormwater to a quality suitable for discharge.
- This water could be provided for environmental or cultural flows on top of existing flows, or substitute passing flows allowing more water to be removed for potable use.
- Water could be further treated to be used directly as potable water.

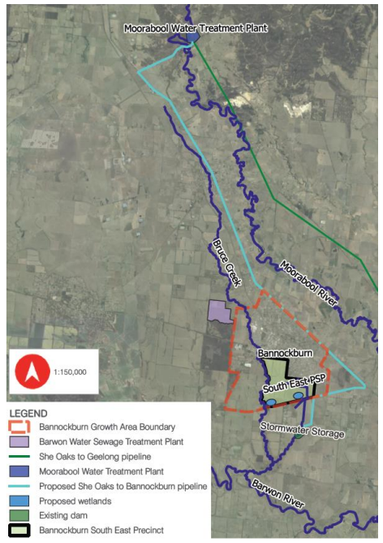
Other Design Elements for Further Consideration

- This option should consider all growth areas, not just the SE PSP.
- An off trace could supply open spaces.
- An adaptive pathway may be developed to support the environment, traditional owners and regional water security.
- When policy allows, recycled water could be added to the stormwater for reuse.
- An interface with servicing the Northern and Western Geelong Growth Areas may be prudent.

Options Assessment

Metric	Comments
Targets	Infrastructure (pipes, pumps, storages) designed to meet the waterway protection targets. Also contributes to water security.
Value	Difficult to determine, infrastructure needs further design, if potable water supply is supported option could be economically viable.
Technical	This option would involve significant design work, including stormwater treatment. No implemented precedent.
Policy and Regulation	Substituting passing flows with treated stormwater is not currently undertake, would need policy review.
Risk	Significant investment would be required for this innovative solution, which carries some risk.
Include in Portfolio	No other options are able to meet the waterway protection outcomes. Needs further exploration.

Visualisation



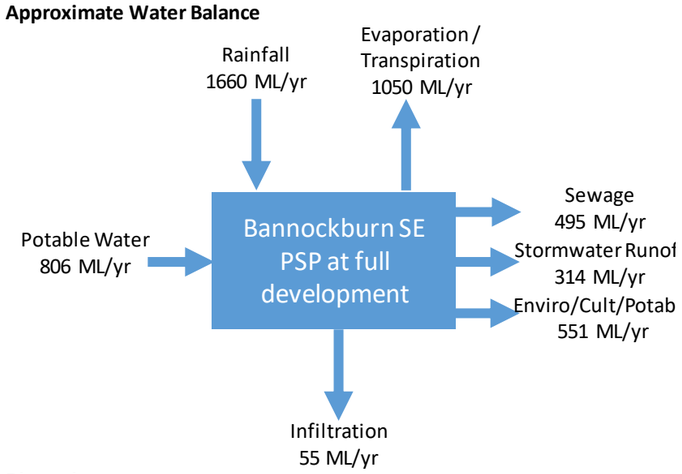
Implementation Pathway

- Analysis of receiving waterways, namely Bruce Creek and the Barwon River, to determine what standard of stormwater management would be required.
- Develop concept incorporating all growth areas. This will include infrastructure sizing and location, including rising main alignments and storage.
- Include in PSP the intent to undertake the harvesting scheme, and include mention of pump stations and rising mains in PSP documentation, including indicative alignments if available.
- Undertake a functional design, to better firm up infrastructure sizing, storage location, timing and organisational responsibilities.
- Confirm funding mechanisms, including potential contributions from developers.
- Develop a business case with the various funding contributors and schedule construction.
- Detailed design of the scheme for Bannockburn SE PSP area.
- Work with wetland designers to incorporate harvesting into design
- Work with regulators to determine optimal end use and treatment requirements.

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 the infrastructure, however would need to recover costs. If Barwon Water operates, they are likely best positioned to own the infrastructure too.
- Barwon Water would recover some costs if there was a potable water benefit.
- Shortfalls may need Vic Government funding.

Approximate Water Balance



Discussion

Pros

- Protects waterways from harmful stormwater volume.
- Provides a valuable resource in a flow stressed waterway.
- Reduces the need for importation of potable water, say from a desalination plant
- Potential to provide additional water for the environment and traditional owners.

Cons

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

Recommendation and Actions

OPTION RECOMMENDED

- Barwon Water have engaged Spiire to explore a similar concept for the Northern and Western Geelong Growth Areas. This project will incorporate application for Bannockburn.