ARUP

Victorian Planning Authority (VPA)

Integrated Water Management Opportunities in the Parwan Employment PSPs

Parwan Employment Precinct Integrated Water Management Opportunities Report

Reference:

VERSION 5 | January 2026

Job number 292585-00

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Glossary of terms

BMID	Bacchus Marsh Irrigation District
BPEM	Best Practice Environmental Management
CGRSWS	Central Gippsland Regional Sustainable Water Strategy
DEECA	Department of Energy, Environment and Climate Action
EPA	Environment Protection Authority
GWW	Greater Western Water
IWM	Integrated Water Management
ktpa	Kilo-Tonnes per Annum
MW	Melbourne Water
PEP	Parwan Employment Precinct
PSP	Precinct Structure Plan
RWH	Rainwater Harvesting
TN	Total Nitrogen
TSS	Total Suspended Solids
UGF	Urban Growth Framework
VPA	Victorian Planning Authority
WID	Werribee Irrigation District
WIN	Werribee Irrigation Network

Disclaimer

This report is an Integrated Water Management (IWM) opportunities paper prepared for the Victorian Planning Authority. It examines IWM opportunities within the Parwan Employment PSP. It is important to note that this report focuses on exploring IWM within this precinct. The options presented herein should be regarded as suggestions and are not definitive. Further investigation, public consultation, and policy amendments may be necessary to enable these opportunities.

Executive Summary

The three Precinct Structure Plan (PSP) areas in Bacchus Marsh – Merrimu, Parwan Station and Parwan Employment Precinct – provide an opportunity to showcase Integrated Water Management (IWM) planning, building on work that has already been completed and is underway. **This strategy is for the Parwan Employment Precinct.** In the Melbourne context where policy and targets around IWM are evolving rapidly, these PSP areas could be an exemplar for testing how to contribute to the broader catchment targets at a precinct scale and a catalyst for broader IWM initiatives in the catchment.

There are many unique regional opportunities in the area with the proximity of the Bacchus Marsh Irrigation District (BMID) and Werribee Irrigation Network (WIN), the Werribee River, Melton and Merrimu Reservoir and a possible recycled water supply. There are also some exciting precinct level opportunities to link to urban greening, amenity and cooling, integrated drainage design and provision of alternative supplies to both residents and business. There is significant IWM work being undertaken across Melbourne's West, to develop it into an exemplary region as population grows and Melbourne expands. However, to deliver the potential, there are also some significant site constraints to be consideration, including the integration of sodic soil considerations, topography and the escarpment, and the local waterway and development needs.

This report sets out the methodology undertaken to shortlist IWM opportunities for the Parwan Employment Precinct, and to determine a final recommended portfolio of IWM solutions.

The report outlines the context, policy drivers and requirements for IWM, summarises the site context, explains how a long list of options were shortlisted, how each shortlisted option was appraised, and recommendations and next steps.

This report is for Parwan Employment PSP, however the description of site context and shortlisting of options considered the wider Bacchus Marsh region, which also includes Merrimu PSP and Parwan Station PSP.

The shortlisted IWM options, following a stakeholder workshop with VPA, DEECA, Moorabool Shire Council, Greater Western Water and Melbourne Water, is shown below.

Shortlisted Option	Precinct relevance for opportunity
1. Precinct-scale rainwater harvesting for non-potable supply of industrial areas	✓
2. Passive irrigation of street trees with stormwater	✓
3. Stormwater infiltration into Alluvium formation	✓
4. Class A recycled water supply to PSP	✓
5. Transfer stormwater to Melton Reservoir and then to Merrimu Reservoir for potable supply	✓

The criteria used to assess each shortlisted option has been adapted from the Werribee IWM plan, as well as bespoke criteria. A full list of criteria can be found in Appendix A.

For the Parwan Employment PSP, it is recommended precinct scale solutions are further investigated and integrated in the planning and development process. This includes:

- **Option 1:** Rainwater harvesting for non-potable supply to industry (lot-based or shared)*
- **Option 2:** Passive irrigation of street trees with stormwater

- Further development dependant opportunities for increased permeability or infiltration/evapotranspiration of stormwater at a lot scale should be explored at a development scale to decrease runoff from the PSP.

**Pending the results of the Werribee System Reconfiguration currently being investigated by stakeholders, if the supply of Class A recycled water is found to be desirable and deliverable for the Parwan Station PSP area, this, ould be delivered as an alternative to rainwater tanks (Option 4). The IWM planning within the PSP should retain flexibility until this decision is made.*

Complimenting this, it is also recommended that authorities work together in the wider catchment to further investigate and implement regional stormwater harvesting outside of the PSP area, utilising excess stormwater from the PSP:

- **Option 3: Stormwater infiltration into alluvium plains downstream**
- **Option 5: Treated stormwater transferred to the Melton Reservoir and then eventually to Merrimu Reservoir for potable reuse**

The outcomes of this opportunity assessment have recommended lot and precinct scale solutions as well as continued work on regional initiatives. This has been based on available information and a qualitative and quantitative opportunity assessment of benefits. The estimated infrastructure requirements and benefits identified through this project have been developed based on a number of assumptions, and further investigation and consultation will be needed to refine and optimise outcomes, particularly costing and detailed design of the options within the developments in the PSPs.

Integrated Water Management is a continuous process and is led by different stakeholders at different phases throughout the entire 'IWM journey', from high level strategic directions through to conceptual analysis, to functional design, funding, and implementation. The development of this report was led by the VPA and the analysis is at the conceptual level, but IWM investigations and stakeholder collaborations continue post PSP process. The 'next phase' will be led by a different (or a consortium of) authority to further investigate the concepts developed by this process. As understanding of the options improve, further details such as timelines, adaptive pathways, costs, benefits, and design details can be established.

The following recommendations for next steps are:

- Inclusion of the IWM recommendations in the PSP documentation, and a requirement for developers within the PSP to document their integration of the IWM strategy as part of the planning application process, demonstrating integration of the recommended portfolio, or alternative options that would achieve equivalent outcomes.
- Continued and regular stakeholder engagement between Council, Melbourne Water and Greater Western Water, Traditional Owners, DEECA and local developers post PSP gazettal to understand the outcomes of any IWM investigations and to align agency positions on preferred IWM solutions. The Bacchus Marsh IWM working group should be maintained and a lead agency should be appointed to coordinate collaboration and engagement. In particular, updates should be made to the stakeholder group at key points regarding:
    - The evolving drainage solution under the drainage scheme, and implications for stormwater harvesting on or near site.
    - The outcomes of the recycled water optimisation study for the Werribee catchment and any proposals for recycled water networks from Bacchus Marsh RWP. Engagement may lead to identifying potential opportunities for joint business cases and synergies between projects, such as offtakes from proposed networks. Any changing priorities and policy, particularly as to how it affects any options that are not yet possible.
    - Implementation and adoption pathway for the recommended IWM options.
    - Engagement with interested developers to ensure a shared understanding of IWM requirements and outcomes from the outset.

1. Introduction

Arup has been engaged by the Victorian Planning Authority to review the Integrated Water Management (IWM) Opportunities for the Merrimu, Parwan Station and Parwan Employment Precincts, within Bacchus Marsh. This Opportunities Report has been developed in conjunction with completed and current work underway by stakeholders and takes a holistic approach to designing with water, considering all aspects of the water cycle and how they interact with urban design, infrastructure planning and place-making.

This strategy is for the **Parwan Employment PSP**.

1.1 What is Integrated Water Management?

Integrated Water Management (IWM) recognises the interconnected nature of the water cycle, seeking to manage water across the whole water cycle in a coordinated manner and improve its interactions with the built and natural environment. Traditionally, three 'areas' of the water cycle have been managed separately: water supply, wastewater, and stormwater. Roles and responsibilities have similarly focused on the different areas of water management.

Integrated water management recognises the interrelationships between different sources of water, and also views water cycle management within a specific environmental, social, cultural and economic context – recognising the needs of local catchments and waterways, communities and industries.

The three Precinct Structure Plan (PSP) areas in Bacchus Marsh – Merrimu, Parwan Station and Parwan Employment Precinct – provide an opportunity to showcase IWM planning, building on work that has already been completed and is underway. In the Melbourne context where policy and targets around IWM are evolving rapidly, these PSP areas could be an exemplar for testing how to contribute to the broader catchment targets at a precinct scale and a catalyst for broader IWM initiatives in the catchment.

There are many unique regional opportunities in the area with the proximity of the Bacchus Marsh Irrigation District (BMID) and Werribee Irrigation Network (WIN), the Werribee River, Melton and Merrimu Reservoir and a possible recycled water supply. There are also some exciting precinct level opportunities to link to urban greening, amenity and cooling, integrated drainage design and provision of alternative supplies to both residents and business. There is significant IWM work being undertaken across Melbourne's West, to develop it into an exemplary region as population grows and Melbourne expands. However, to deliver the potential, there are also some significant site constraints to be consideration, including the integration of sodic soil considerations, topography and the escarpment, and the local waterway and development needs.

In a greenfield environment, such as these PSPs, it is important to recognise how the water cycle could be affected by urbanisation as significant growth occurs. In these PSPs, the growth is forecasted to be a combination of residential, non-residential and industrial. As urban development occurs, there is an opportunity to protect the natural environment and water cycle as it transitions to an 'urban water cycle'. The urban water cycle encompasses water supplies extracted from or imported to a local catchment, wastewater and stormwater generated locally, and the catchments and receiving environments affected by those water cycle interactions. As urban settlements grow, additional water demands and changes in generation of wastewater and stormwater will have knock-on effects on the natural water cycle, requiring forethought and understanding of the environmental, economic and social influences and sensitivities in the system.

1.2 What does this study consider?

The aim of this IWM Opportunities Report is to bring together previous IWM options proposed, with new targets, objectives and work underway, to recommend proposed IWM options for each PSP.

It explores and prioritises opportunities to maximise outcomes across the water cycle, including consideration of:

- Water supply (potable and non-potable)

- Wastewater management
- Stormwater management
- Green-blue infrastructure

Waterway health

The study also naturally connects directly with the ecology, landscape, cultural and infrastructure plans for the site. This study includes a baseline analysis of the site and broader area context, building on literature reviews and stakeholder interviews, examines an initial long list of options, proposes and assesses shortlisted options to recommend a consolidated portfolio of options for each PSP, to deliver integrated water management objectives.

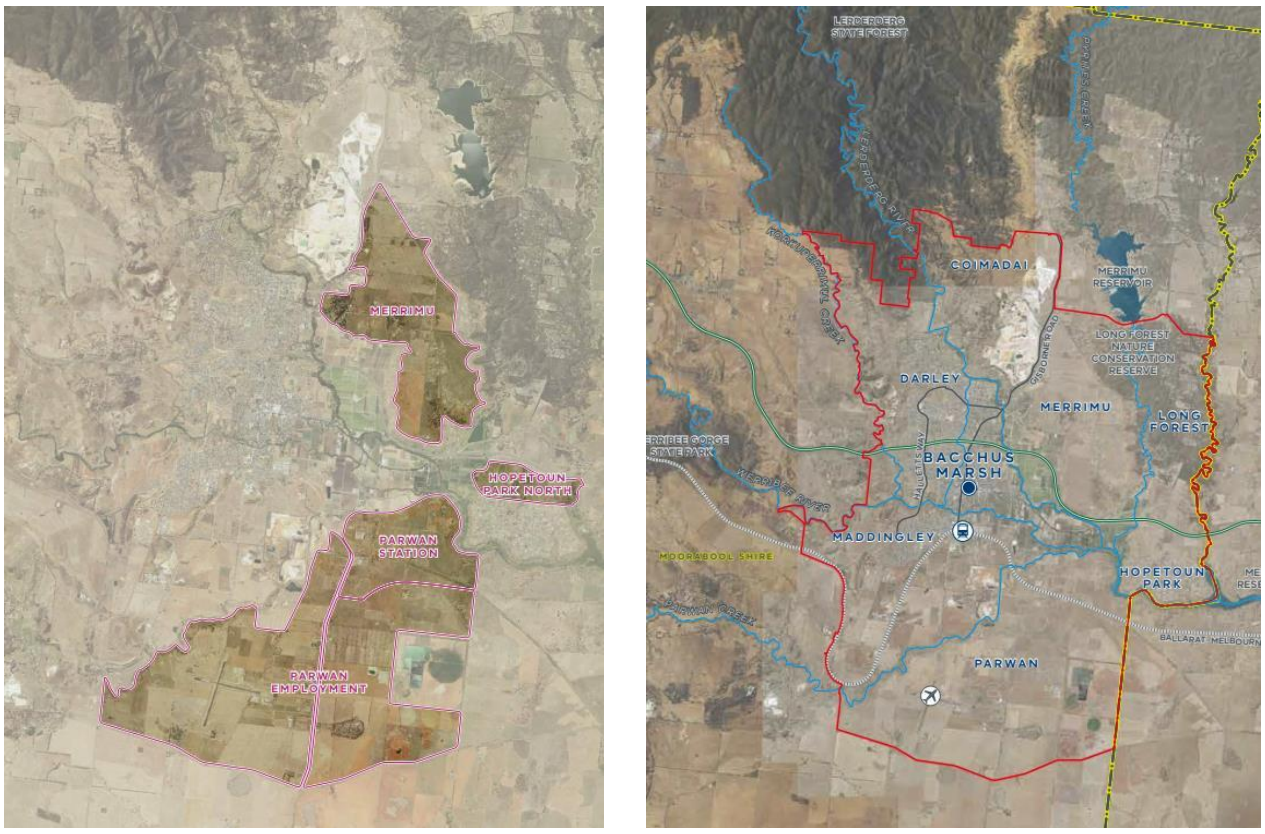


Figure 1-1 Merrimu, Parwan Station & Parwan Employment PSP location plans in relation to Bacchus Marsh (Arup, 2023)

This study is built from a holistic and continual exploration of IWM that has been developed alongside stakeholder investigations and concurrent projects, with the intent of informing and feeding from evolving land use and IWM proposals to maximise outcomes, create opportunities and minimise risks.

Accordingly, a layered approach has been taken from the ‘bottom-up’ as demonstrated in the figure below, whereby the key spatial and infrastructural opportunities to embed IWM have been explored from first to inform the development of the masterplan and to drive synergistic place-making outcomes at a strategic planning level, before then exploring recommendations the development and facility scale which can be driven through subsequent planning and design processes. This strategy is focussed primarily on the three base layers to set the foundation for IWM, but also makes recommendations for subsequent design stages.

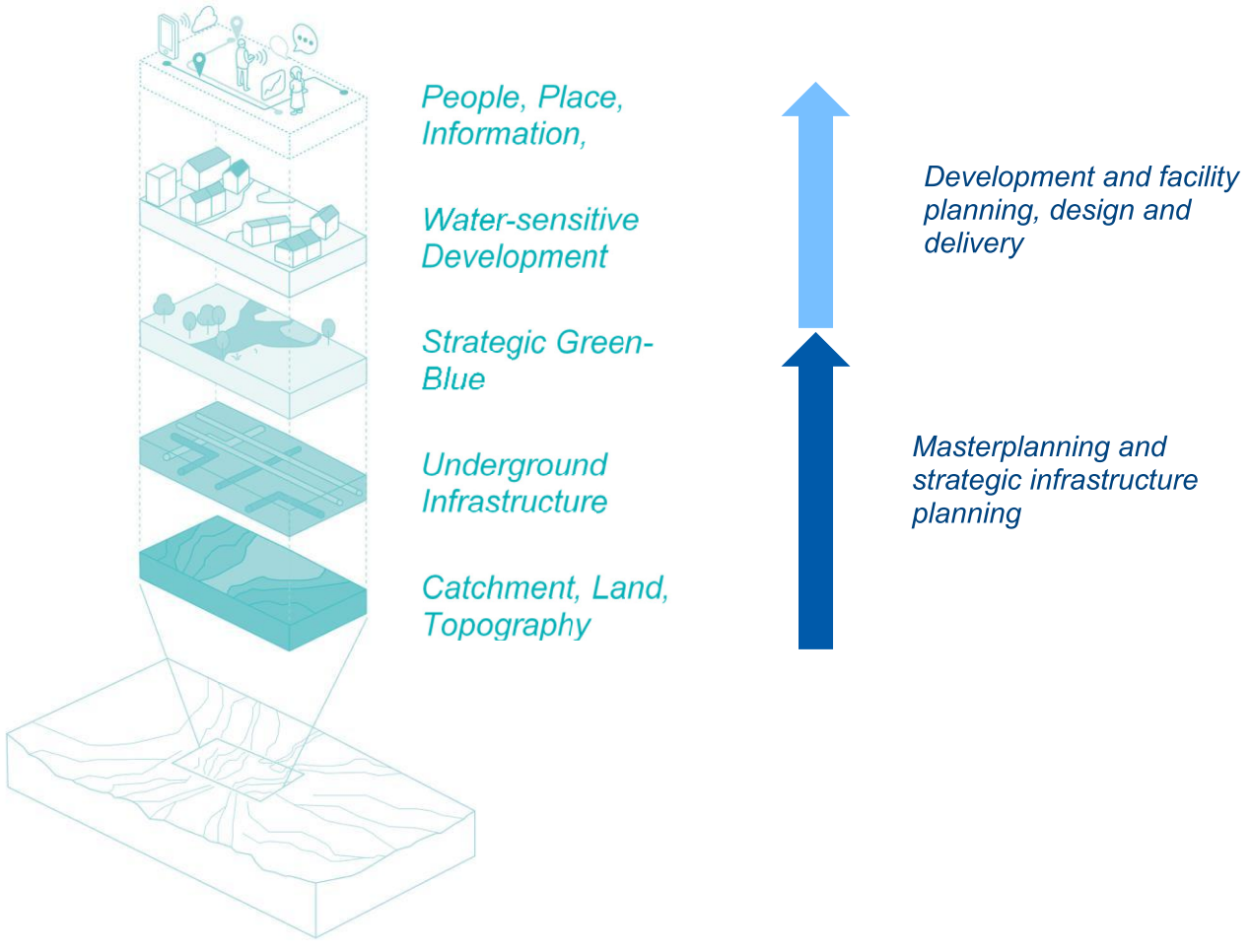


Figure 1-2 Layered approach to IWM (Arup)

1.3 IWM Opportunities methodology

This study is based on information collected through previous assessments provided by VPA, including the Bacchus Marsh IWM Strategy, prepared for Moorabool Shire Council (September, 2021), a series of interviews conducted with key stakeholders to inform additional work underway, a site visit and a stakeholder workshop to prioritise options.

Following this, the shortlisted options were further developed and assessed using an IWM Options Preliminary Assessment Method (DELWP, 2016). Options were then prioritised into recommended portfolios for each PSP.

The methodology undertaken is illustrated below.

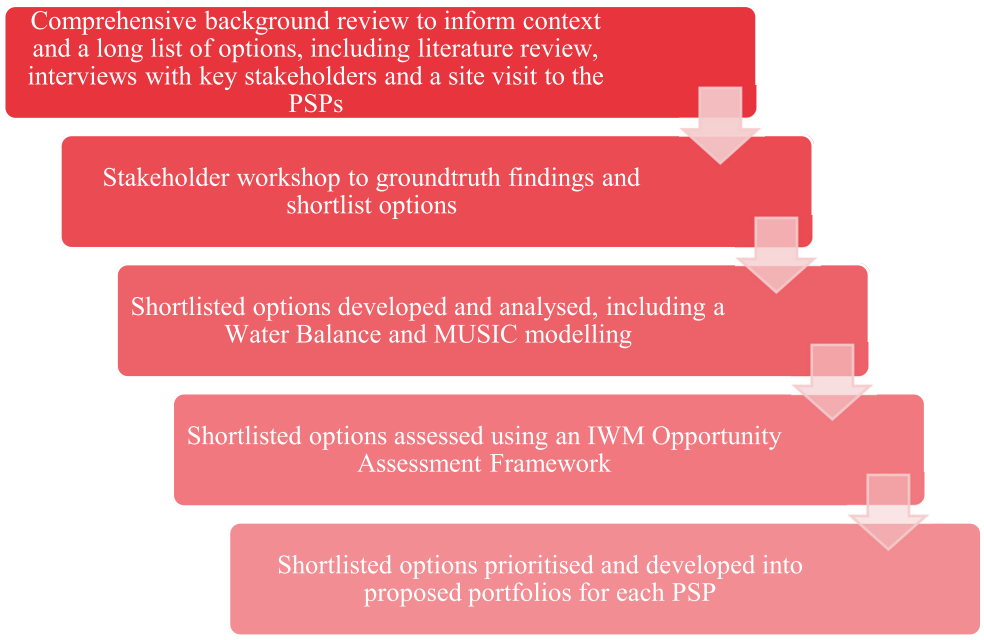


Figure 1-3 Methodology (Arup, 2023)

1.4 Key stakeholders

Stakeholders were consulted in the development of this study as outlined above. There is extensive work underway across the water cycle, with multiple stakeholder touch points. The purpose of this study is to bring together all of the work underway, identify opportunities and consolidate it in this Opportunities report. The key stakeholders consulted as part of this study are listed below.

- VPA
- Melbourne Water
- Greater Western Water
- Moorabool Shire Council
- DEECA

2. Policy drivers and requirements for IWM

2.1 Overarching IWM strategies and frameworks

Water for Victoria (Victorian State Government, 2016) is a "framework to guide smart water management, bolster the water grid and support more liveable Victorian communities". *Water for Victoria* identified eight themes and associated actions to implement the policy. One of those themes is "resilient and liveable towns and cities" and State Government provided a commitment to:

- "Adopt integrated water planning across Victoria, with place-based planning supporting community values and local opportunities", and
- "Put integrated water management into practice, working with water corporations to develop a common economic evaluation framework, promoting exemplar projects, building the capacity of the water sector and local government to participate, and continuing research to improve urban water management."

In September 2017, the Department of Environment, Energy and Climate Action (DEECA) released a document titled *Integrated Water Management (IWM) Framework for Victoria.* The IWM framework provides guidance aimed at helping government, the water sector and the community to work together to better plan and deliver solutions for water management across Victoria's towns and cities.

The IWM framework supports the establishment of IWM forums in each region to drive coordinated delivery of IWM. The IWM Forums have been established across the state to identify, prioritise and oversee the implementation of collaborative water opportunities. The Forums bring together all organisations with an interest in water cycle, recognising that each has an important role to play in the management of our most vital resource.

The Bacchus Marsh PSPs are part of the Werribee Catchment and the strategic objectives and IWM Plan for the catchment have been developed by a collaborative union of relevant authorities brought together in the Werribee Catchment IWM Forum.

2.1.1 Monitoring, Evaluation, Reporting and Improvement (MERI) Plan

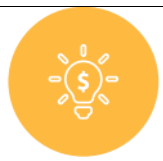
Alongside the Catchment Scale IWM Plans and Action Plans developed under the aforementioned IWM Framework, the MERI Plan is being developed collaboratively to track progress against the performance targets and prioritised actions. The MERI Plan aims to support each metro IWM Forum to demonstrate accountability by monitoring and transparently reporting on progress towards the 2030 and 2050 performance targets set out in the CSIWM Plans, and other performance measures nominated for monitoring only. The MERI Plan also helps understand how prioritised actions have contributed to achieving the 2030 and 2050 catchment performance targets, as well as evaluating the appropriateness, effectiveness, efficiency, impact and legacy of the implementation of the Catchment Scale IWM Plans and Action Plans.

Monitoring and evaluation is essential as it provides feedback to decision-makers on how well a project or program is performing, whether it is on track, or whether changes need to be made. Therefore, the MERI collects evidence to demonstrate the level of investment needed to improve IWM outcomes across each catchment and to inform policy reform, is intended to help share lessons and achievements to continuously improve the performance of IWM programs, initiatives and projects and improves capacity to analyse and report on performance. Finally, the MERI is intended to inform review and update the CSIWM Plans and Action Plans in response to new evidence and evaluation findings.

The MERI is currently being piloted for 2021/22 data, which will inform finalisation of the MERI Plan in early 2024. The relevant measures and targets for this area are outlined in the following section.

2.1.2 Werribee Catchment IWM Forum Strategic Directions Statement and IWM Plan

The Werribee Catchment IWM Forum has developed a Catchment-specific vision based on the opportunities and challenges specific to the Catchment. The vision, along with the Catchment context, are captured in the *Strategic Directions Statement* (2022) which outline seven strategic outcomes for IWM. These outcomes provide a framework that recognises the multiple benefits that IWM delivers and drives the creation of holistic solutions. Some of the key outcomes are highlighted below.

	– 16 Gigalitres/year of alternative water sources that substitute potable mains supply by 2030 for the catchment – 53 Gigalitres/year of alternative water sources that substitute potable mains supply by 2030 for the Greater Melbourne Region
	– 85 Gigalitres/year of recycled water delivered to customers by 2030 for the Greater Melbourne Region
	– 100% of projects cross-consider IWM and flood mitigation opportunities as part of their design by 2030 and maintained by 2050 for the catchment and Greater Melbourne Region
	– 46 Gigalitres/year and 197 Gigalitres/year of mean annual urban runoff volume reduction by 2050 for the catchment and Greater Melbourne Region respectively – Remove TSS and TN to achieve the marine pollutant load objectives for the Port Phillip Bay and Western Port
	– 14% and 30% of street trees are supported with permanent irrigation from an alternative water supply by 2030 and 2050 respectively, for the catchment – 22% and 50% of active public open space (sports fields and organised recreation) is supported by an alternative water source by 2030 and 2050 respectively, for the catchment – 9% and 25% of passive public open space (parklands and gardens) is supported by an alternative water source by 2030 and 2050 respectively, for the catchment
	– Rating of 5 out of 5 for water as a key element in city planning and design processes by 2030 and maintained by 2050 for the catchment
	– 41 Gigalitres/year of alternative water is supplied to agricultural production in the catchment by 2030 – 60 Gigalitres/year of alternative water is supplied to agricultural production in the catchment by 2050
	– Rating of 5 out of 5 for vision, leadership and long-term commitment through vision statement and objectives articulated in corporate documents by 2030 and maintained by 2050, for the catchment – Rating of 5 out of 5 for knowledge, skills and organisational capacity by 2030 and maintained by 2050, for the catchment – Rating of 5 out of 5 for cross-sector institutional arrangements and processes by 2030 and maintained by 2050, for the catchment

Performance measures have been developed for each of the outcomes and for a set of enabling factors that underpin all outcomes in the *Werribee Catchment IWM Plan* (2022), as shown in Figure 2-1. **This has also been incorporated into the assessment framework for the shortlisted options.**

Figure 2-1. Werribee Catchment IWM Outcomes and Measures (Werribee Catchment IWM Plan, 2022)

2.1.3 Central Gippsland Regional Sustainable Water Strategy, 2022

The Central Gippsland Regional Sustainable Water Strategy (CGRSWS) sets policy direction and outlines actions for securing the region's long-term water supplies to protect the jobs, farms, ecosystems, communities, and Traditional Owners that rely on them.

The proposals which are relevant to the Werribee region include:

- Proposal 5-4: It is proposed that water returned to rivers and creeks as a result of substitution by alternative water sources will be shared equally between the environment (the Victorian Environmental Water Holder) and Traditional Owners.
- Proposal 5-5: It is proposed that the business case for the recycled water substitution project in the Werribee and Bacchus Marsh irrigation districts include the benefits to Traditional Owners of receiving an equitable proportion of water saved as a result of water substitution.

The following actions and policy directions are set to address the above proposals:

- Action 4-10: Reconfiguring the Werribee system to provide climate-resilient water sources for non-drinking purposes and better use of existing water and reservoirs in the system.
- Action 4-3: Substituting river water with manufactured water in the longer term.

2.1.4 Water for Life: The Greater Melbourne Urban Water Systems Strategy

Water for Life (2022) sets out the strategy for the future of Melbourne's water supply. Importantly, the strategy recognises and prioritises IWM with the aim of diversifying water supplies for Melbourne as part of an adaptable and resilient future water supply. Integration of opportunities for recycled water supply, stormwater and rainwater harvesting in combination with other water supply resilience measures were shown to deliver the greatest benefits to the community, due to the co-benefits these alternative water supplies deliver in terms of waterway health, circular economy outcomes, landscape amenity and community well-being. Actions 4.2, 6.2, 6.5 and 6.6 seek to enhance investment in alternative water supplies.

2.1.5 Water is Life: Traditional Owner Access to Water Roadmap, 2022

Water is Life is a framework to create and maintain a careful and considered balance between Traditional Owner self-determination in water access and management, and the rights and entitlements of a range of stakeholders. The strategy outlines actions to deliver meaningful outcomes to Traditional Owners to enable deeper involvement with decisions around water management.

The outcomes from the strategy include:

- Increased role in determining how environmental water is used for the purpose of healing Country
- Increased involvement in public land management
- Recognition of Traditional Owners as waterway managers for specific locations
- Recognition of Traditional Owners as environmental water holders

2.1.6 VPA guidelines for PSPs, October 2021

In October 2021, VPA prepared Precinct Structure Planning Guidelines for new communities in Victoria. The objective of the VPA was to "lift the bar" by encouraging higher standards of design and development. One way in which the guidelines do this is by "improving outcomes for the whole water cycle by referencing regional integrated water management plans to resolve development-related water balance challenges". General principles followed by a method for application is outlined in this document. With respect to IWM, the following targets were included:

- T14 - All streets containing canopy trees should use stormwater to service their watering needs
- T17 - IWM solutions should meaningfully contribute towards the actions and targets from the relevant Catchment Scale Public Realm & Water Plans and any relevant water-related strategies, plan, or guideline.

2.2 Key policies and legislation

2.2.1 Urban Stormwater Best Practice Environmental Management (BPEM) Guidelines

The *Urban Stormwater 'BPEM' Guidelines* (1999) were produced to assist in the protection of stormwater quality. The BPEM included best practice performance objectives (at the post construction phase) of:

- 80% retention of the typical urban annual load for suspended solids,
- 45% retention of the typical urban annual load for phosphorous,
- 45% retention of the typical urban annual load for nitrogen,
- 70% reduction of typical urban annual load for Litter; and
- Flows: maintain discharges for 1.5 year Average Recurrence Interval (ARI) at pre-development levels.

The BPEM guidelines are included within Victorian Planning Schemes, within the Victorian Planning Provisions (VPPs), although it is noted that they were not introduced into the planning provisions until 2006.

2.2.2 Victorian Planning Provisions

Clause 56.07 Integrated Water Management provides objectives and discretionary standards in relation to drinking water supply, reused and recycled water, waste water management, and stormwater management for subdivisions, including meeting the stormwater quality performance objectives in the Urban Stormwater BPEM Guidelines outlined above. For apartments, Clauses 55.03 and 55.07 also encourage the use of alternative water sources, facilitate stormwater collection, utilisation and drainage; and reduce the impact of stormwater run-off. Amendment VC154 also recently introduced Clause 53.18 which extends the stormwater management requirements for residential subdivision and apartment development to all commercial and industrial and subdivision development, all public use development and all residential multi-dwelling developments.

Amendment VC224 which was gazetted by Victorian Government on 28 October 2022. The amendment updates the policy document reference to Melbourne Water's Healthy Waterways Strategy (at Clause 12.03-1S), from the outdated 2013 strategy to the current 2018 strategy. This is an important change ensuring the VPP is current, and supports better waterway outcomes through strategic planning processes and statutory decision-making.

Amendment VC224 also makes changes to Clause 53.18 (Stormwater management in urban development) to clarify that the stormwater management provisions for commercial, industrial and public use development (in particular) are applied equally in growth areas (where a Precinct Structure Plan applies) as in established areas. This change removes ambiguity that existed in the application of relevant stormwater standards to non-residential land in growth areas.

2.2.3 Urban Stormwater Management Guidance, EPA, 2021

EPA Victoria published urban stormwater management guidelines in 2021, which aims to help improve the management of urban stormwater by highlighting the risk of harm caused by stormwater and helps developers who create new impervious surfaces to minimise risks to human health and the environment. The guideline sets out a hierarchy of hazard reduction, which prioritises eliminating the hazard as far as reasonably practicable as the most favourable solution. This includes eliminating specific impervious surfaces, using permeable or porous paving, capturing and infiltrating stormwater, eliminating pollutants from stormwater from entering waterways etc.

Figure 2-2 Hierarchy of controlling hazards in Urban Stormwater Guideline, 2021

Quantitative performance objectives are set in this Guideline, where MUSIC modelling should be carried out to assess performance against these objectives. The water quality objectives remain unchanged from those referenced in the Victorian Planning Provisions and state there should be a;

- 80% reduction in mean annual load[1] of suspended solids
- 45% reduction in mean annual load of total Phosphorus
- 45% reduction in mean annual load of total Nitrogen
- 70% reduction in mean annual load of litter

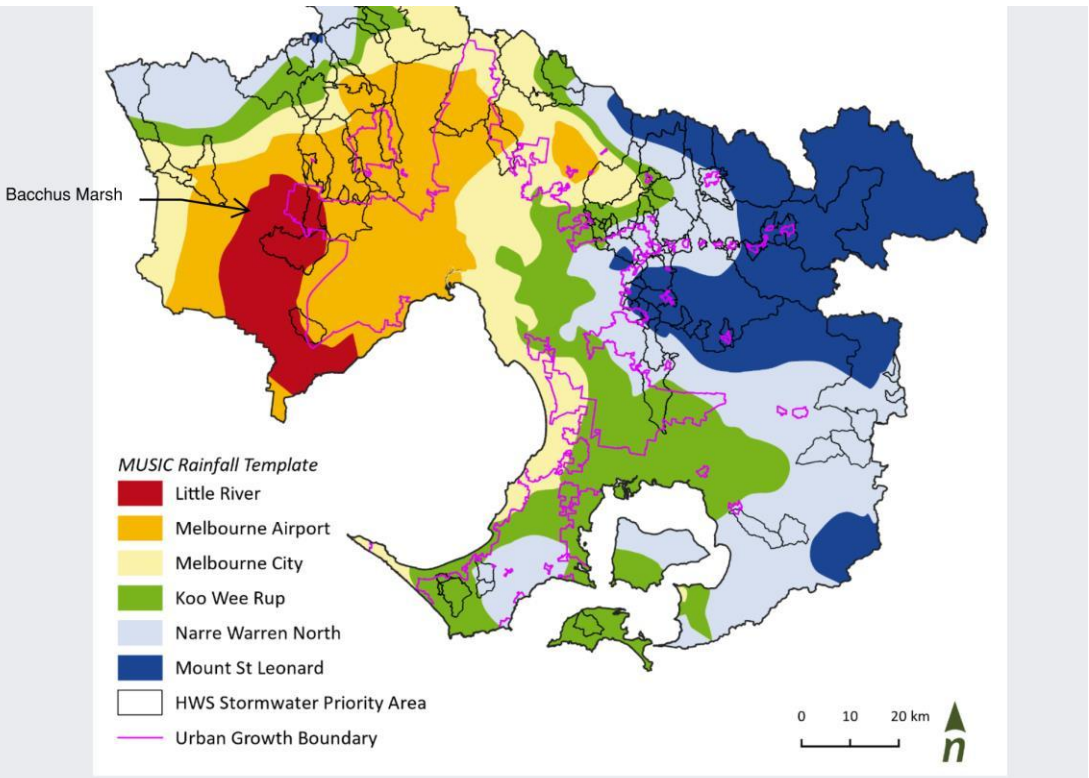
Significantly, the guidance introduced objectives for mean annual run-off reduction, whereby the target reduction is based on mean annual rainfall, and differs for priority and non-priority areas. Previously, Melbourne Water set a preferred target of a 50% runoff reduction to recognise the sensitivity of the Werribee and the downstream platypus population. Subsequent advice from Melbourne Water is that the target should now be in line with that defined by the Urban Stormwater Management Guideline, and the subsequent Healthy Waterways Strategy Stormwater Targets - Practitioner's Note (see below).

2.2.4 Healthy Waterways Strategy Stormwater Targets - Practitioner's Note, July 2021

Melbourne Water in collaboration with the EPA developed this note to develop a consistent framework, whereby the targets in the EPA guideline and in the Healthy Waterway Strategy are aligned. This document included the Figure below, which provides stormwater runoff targets for areas based on MUSIC Modelling Targets.

This document clarifies that the targets for the Bacchus Marsh region is 29-32% for stormwater harvesting, and 3-6% for infiltration (Bacchus Marsh bridges two rainfall templates as shown in Figure 2-3).

[1] Reduction in the load discharged from the managed development compared to pre-development levels without management



Template Name	Annual rainfall range	Model annual rainfall	Runoff	Priority areas				Other Areas			
				Harvesting target		Infiltration target		Harvesting target		Infiltration target	
	(mm)	(mm)	ML/year from 1 impervious ha	ML/year from 1 impervious ha (and %)							
Little River	400 - 500	472	3.7	2.9	(79 %)	0.1	(4 %)	1.2	(32 %)	0.1	(3 %)
Melbourne Airport	500 - 650	575	4.6	3.4	(74 %)	0.4	(8 %)	1.4	(29 %)	0.3	(6 %)
Melbourne City	650 - 750	708	5.8	3.9	(67 %)	0.7	(12 %)	1.6	(27 %)	0.5	(9 %)
Koo Wee Rup	750 - 850	769	6.3	4.1	(65 %)	0.8	(13 %)	1.6	(26 %)	0.7	(10 %)
Narre Warren North	850 - 1100	932	7.8	4.6	(59 %)	1.3	(16 %)	1.8	(23 %)	1.0	(13 %)
Mount St Leonard	1100 - 2100	1221	10.6	5.3	(50 %)	2.2	(21 %)	2.1	(20 %)	1.8	(17 %)

Figure 2-3 Mean annual runoff objectives (Healthy Waterways Strategy, 2021)

To meet these targets, it depends on the scale of the development, i.e., Allotment / street scale, Precinct scale, or regional / catchment scale.

It's acknowledged that while initiatives such as rainwater tanks and wetlands represent an important contribution to infiltration and harvesting targets, they are unlikely to be sufficient in isolation to meet the Healthy Waterway Strategy stormwater targets. Meeting the targets therefore likely requires a focus on harvesting and interventions across a range of scales. Examples of interventions at each scale are listed in Figure 2-4.

Scale	Description	Typical interventions (examples)
Allotment / street scale	Typically a smaller residential, commercial or industrial development. Relies on landscape design to enable infiltration in the streetscape Assumed to have little to no public open space and limited potential for stormwater irrigation.	• Lot scale rainwater tanks ('leaky tanks') • Lot scale raingardens • Street scale infiltration including passive irrigation for street trees
Precinct scale	A larger greenfield development or area covered by a precinct structure plan (PSP) Include features like community facilities, active open space and passive space for relaxation. May include a natural or (proposed) constructed waterway, stormwater treatment wetland or headwater stream May also include commercial areas and one or more schools	Allotment / street scale interventions plus • Stormwater harvesting for the irrigation of open space • Leaky wetlands for infiltration • Infiltration trenches in open space / garden beds • Large roof rainwater harvesting
Regional / catchment scale	An area defined more by regional than development or precinct boundaries Would include a number of precincts that would incorporate a number of open spaces and treatment wetlands Likely to include minor and potentially major waterways.	A stormwater network, collecting outflows from treatment wetlands for conveyance to meet a large demand (e.g. water for an irrigation district). Plus precinct and allotment scale interventions as required.

Figure 2-4 Interventions to meet targets at the 3 scales (Healthy Waterways Strategy, 2021)

2.2.5 National Construction Code requirements regrading rainwater tanks

The *Building Act* sets out the framework for the regulation of building construction, building standards and building safety features in Victoria. Nested beneath the Building Act, as subordinate pieces of legislation, are the *Building Regulations 2018* and the *Plumbing Regulations 2018*.

The National Construction Code (NCC) 2019 in Schedule 2 of the plumbing regulations also notes that "the Victorian variation to the energy efficiency provisions of the Building Code of Australia (as incorporated by the Building Regulations) provides that the energy efficiency performance requirement for a new Class 1 building is satisfied if either a rainwater tank is connected to all sanitary flushing systems, or a solar water heater is installed in accordance with these Regulations." A recycled water connection is also accepted as an alternative to a rainwater tank. The NCC 2022 will replace the NCC 2019 provisions on the 1 October 2022, whereby this requirement is superseded.

The Victorian Government proposes to implement stronger state building and plumbing regulations for water efficiency, to improve the water efficiency of all buildings, subject to a regulatory impact statement and stakeholder and community consultation. As such, there is currently no specific requirement for rainwater tanks within NCC 2022. Instead, NCC 2022 refers practitioners to regulations made under the Act to provide for water efficiency requirements that may be set in future.

2.2.6 Ministerial Direction 22: Climate Change Consideration

Ministerial Direction 22 requires planning authorities to consider climate change when preparing planning schemes or amendments, in accordance with *section 12(2A) of the Planning and Environment Act 1987*. The direction focuses on two requirements: minimising greenhouse gas emissions (clause 5) and increasing resilience to climate change risks (clause 6).

Clause 5 outlines the requirements by prioritising infill development, improving public and active transport, enabling solar-oriented design, planning for zero-emissions vehicle infrastructure and supporting renewable energy infrastructure at a precinct scale. Clause 6 describes the requirements by accessing climate-related risks (such as bushfire, flooding, heatwaves, erosion and drought), avoiding or mitigating exposure of new development to these hazards, presenting increased risks to others, and ensuring protection measures are proportionate and practical.

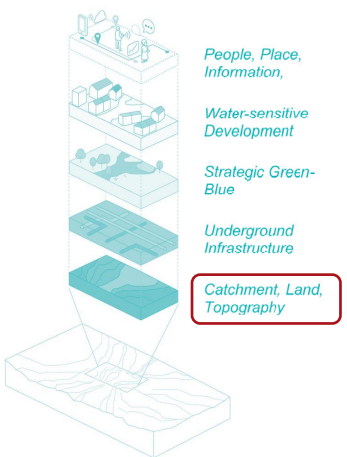
As per the *Ministerial Direction 22*, matters related to clauses 5 and 6 must be included in a Climate Change Consideration Report, outlining how the requirements are being met for the proposed planning scheme or amendment. For the purposes of this report, we have outlined how the recommended IWM options for Parwan Employment PSP could support these requirements in section 9.3 The report does not assess or recommend whether the Parwan Employment PSP complies with the Direction, nor prepare a Climate Change Consideration Report.

3. Project context

The following section outlines the key project context. This context is drawn from the background review and the stakeholder interviews. The detailed findings from the background review and stakeholder interviews can be found in Appendix B and Appendix C. It includes the existing state, anticipated changes due to growth in the PSPs and work underway by stakeholders.

3.1 Catchments, Land, Topography

Consideration of the functionality of the landform, waterways, and their catchments should inform the location and density of development to ensure that waterway health, ecological health and flood resilience outcomes can be supported.



3.1.1 Site Analysis

Figure 3-1 shows some of the key features and constraints in the region.

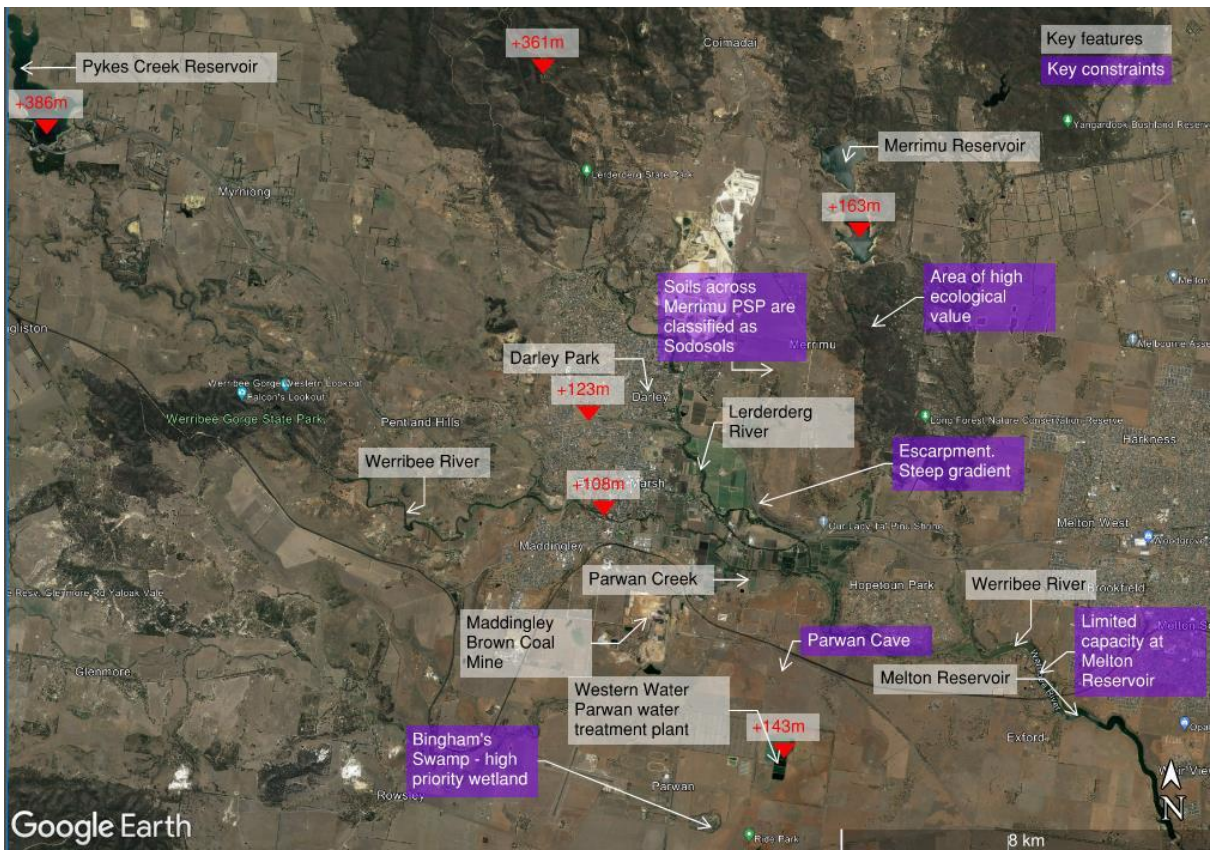


Figure 3-1 - Key features in the Bacchus Marsh region (Arup, 2023)

Regional catchment context

Bacchus Marsh is the largest urban area in the government area of the Moorabool Shire and is set to grow significantly over the coming decades. The Bacchus Marsh Urban Growth Framework 2018 (UGF) was jointly prepared by Moorabool Shire Council and the Victorian Planning Authority (VPA) and provides a vision for development, including coordinated infrastructure delivery.

Parwan Employment PSP

The Parwan Employment Precinct (PEP) is an area of approximately 2,480ha, incorporating over 80 separate properties (including the existing Bacchus Marsh aerodrome) and located south of Bacchus Marsh. Much of the land within the precinct is currently used for agriculture and rural residential uses, with a limited range of commercial, recreation and utility uses. The PEP holds significant economic and employment growth potential for Bacchus Marsh, with the ability to attract high levels of new industrial investment. This land is most suited to agriculture and related uses due to its soil quality, proximity to the BMID and ability to be serviced with potable or non-potable water depending on industry needs and availability of supply.

PEP also contains the Bacchus Marsh Recycled Water Plant which currently delivers Class C recycled water to agriculture and industry. Limitations to this area include areas of significant ecological and cultural value such as the Bingham swamps and Parwan Caves.

Topography

For Parwan Employment PSP, the topography is generally low-lying, but provides the precinct with unique view lines including key viewpoints to Brisbane Range and You Yangs. For PEP, the topography is difficult for gravity sewers, with rising mains and pump stations expected.

Bingham Swamp

Bingham Swamps was identified by Melbourne Water as a high priority wetland in Healthy Waterways Strategy 2018 in Parwan Employment PSP and should be retained. There is no clear guidance from an ecological perspective but ecohydrological regime must be assessed and met with drainage planning for the precinct. It was noted that an assessment is being undertaken by DEECA for additional natural wetlands in this PSP which may require ecohydrological assessments and intergration into the drainage planning.

Parwan Lava Cave

Parwan Lava Cave is understood to be located 8 m to 10 m below the level of the land surface and has a single entrance that is 1.5m wide. It lies within the Parwan Employment PSP. An assessment of the cave was carried out by WSP Golder in 2022 which recommended that a 10m buffer is applied to the cave extent which should be a ‘cave protection zone’.

Ecology

At a regional level, growling grass frogs, platypus, and significant fish species are present in the Werribee, Lerderderg and Parwan waterways. Conservation of these species is a priority. Updated assessments are recommended for Parwan Employment Precincts to confirm the current quality and extent for native flora and fauna.

Traditional Owner values

Bacchus Marsh is on the borders of the Wurundjeri Woiwurrung and Wadawurrung territories of the Kulin Nation. The Wadawurrung name for the area is Pullerbopulloke with 'buluk' meaning lake.

The Waterways of the West Discussion Paper recognises the importance of Traditional Owner values and practices, which are reflected through two of the seven key directions for the Waterways of the West:

- **Key Direction 1:** Embedding Traditional Owners and their values and culture in waterway planning and management.
- **Key Direction 3:** Providing water for the environment and Country.

The VPA report summarising key issues and opportunities for managing future development whilst protecting Aboriginal cultural heritage, post-colonial heritage and biodiversity as an issue. Additionally, the high sensitivity of Aboriginal cultural heritage and post-colonial heritage can be protected and incorporated into the precinct as passive open space with pedestrian/bike paths connecting biodiversity and landscape features.

3.1.2 Anticipated changes

Industry and agriculture

The Bacchus Marsh Irrigation District (BMID) was established on the fertile alluvial soils in Bacchus Marsh. It consists of 1,000 ha of high value agricultural land for production of a range of fruits and vegetables. Water supply is managed by Southern Rural Water who recently completed upgrade works on BMID's irrigation network, vastly improving the efficiency of supply.

Bacchus Marsh is also home to significant local industry, some of which hold extraction licences for river water supply. Bacchus Marsh, and the west of Melbourne generally, is a fast growing industrial and innovation hub. Parwan employment precinct is proposed for development in the future, but the vision for the precinct includes the creation of agribusiness and complementary businesses that could support upwards of 1,500 jobs. The area has also been flagged for new industries, such as hydrogen production.

Both industry and agriculture present opportunities for IWM. It was recommended in previous background studies, that once planning is further progressed for the Precinct, that the impact of the development of the area on the local water cycle is evaluated, and appropriate initiatives are put in place.

Environmental flows for the Werribee River

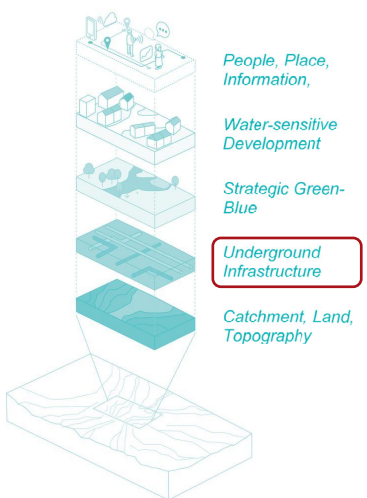
Previous IWM related studies indicated concerns that there will not be enough capacity in Melton Reservoir to provide adequate storage for environmental flows, and that focus should be on creating new environmental flow allocations in existing storages (e.g. Pykes Creek Reservoir or Merrimu Reservoir).

Options such as using recycled and harvested stormwater to serve the BMID, and making full use of the high permeability of the alluvium formation by using swales to capture treated stormwater would positively contribute to increasing environmental flows from the Merrimu reservoir and recharging river baseflows respectively.

It was also identified that environmental flows could be beneficial for the Lerderderg and Parwan Rivers.

3.2 Water Utility Infrastructure

This section considers the water utility infrastructure that is already in place on site for water supply, wastewater management and underground drainage, and identifies any constraints or opportunities to improve those networks to prepare for development and drive IWM outcomes.



3.2.1 Site analysis

Figure 3-2 below shows the key water infrastructure in the region.

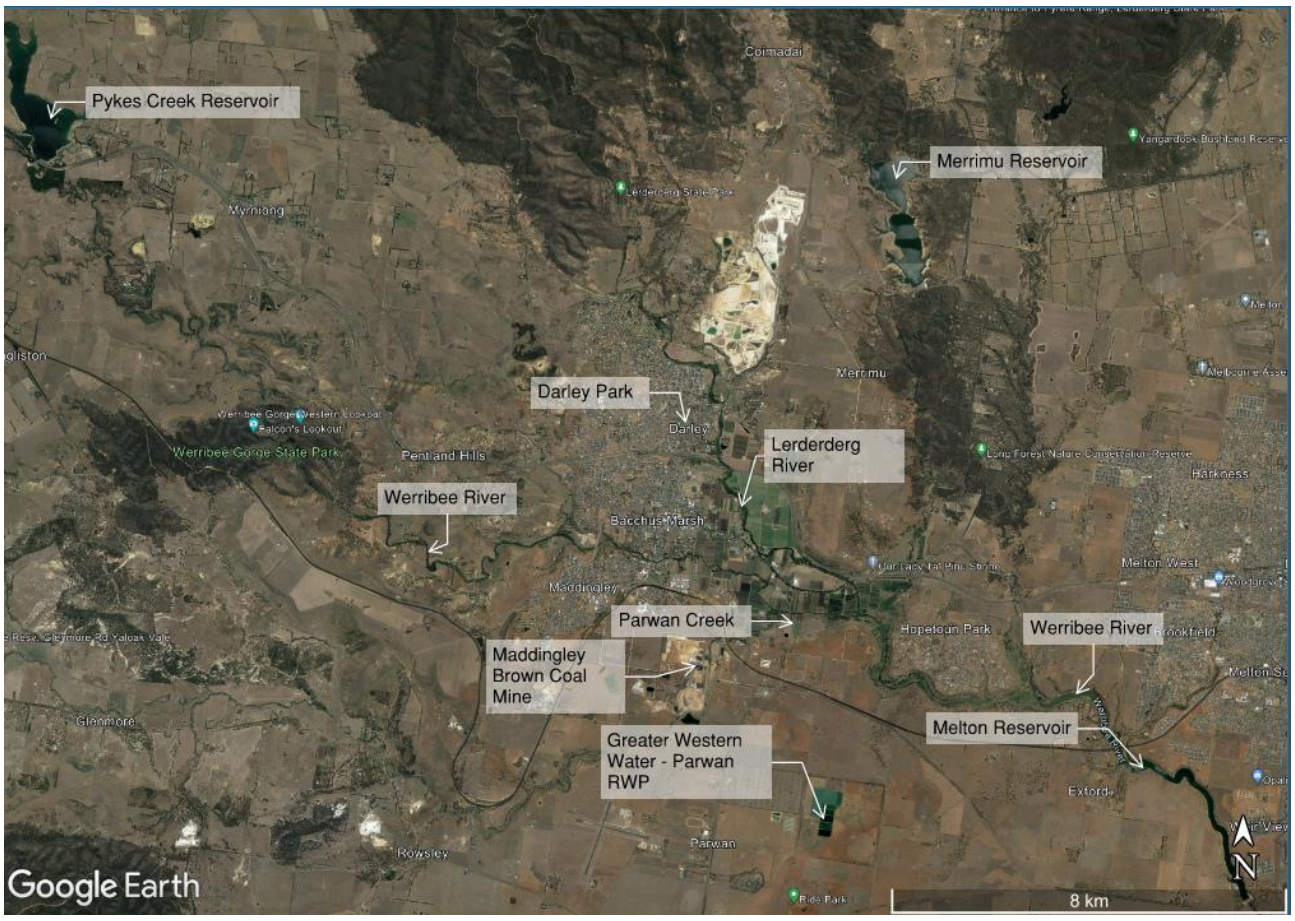


Figure 3-2 Existing key water features (Arup, 2023)

Existing services

The existing Bacchus Marsh drinking water is primarily supplied from Merrimu Reservoir with connection to the Greater Melbourne water supply system. Wastewater generated in the existing Bacchus Marsh area is managed by Bacchus Marsh Recycled Water Plant (RWP), also known as Bacchus Marsh RWP.

3.2.2 Anticipated changes

Water Demands

With growing population, water demand is expected to nearly double between 2020 and 2065 according to previous studies. Based on the water balance calculations as part of this study, it's estimated that total water demands for Parwan Employment Precinct will be approximately 2.5GL/y.

Stormwater flows

As development increases, and the impervious area in each catchment grows, as will stormwater flows. Based on the water balance calculations as part of this study, it is expected that stormwater flows will increase by up to 3 times the pre-development scenario for Parwan Employment Precinct.

Wastewater treatment plant and recycled water

The Bacchus Marsh recycled water scheme has existed as a standalone scheme, located at the Bacchus Marsh RWP, treating sewage collected from Bacchus Marsh to Class C standard and recycling it locally for agricultural irrigation on the adjacent farmland. Urban growth in Bacchus Marsh has seen a corresponding increase in the volume of recycled water available so Greater Western Water has progressively expanded the treatment capacity.

The reconfiguration of the Werribee catchment water system, and, and the creation of a Western Irrigation Network (WIN) at a regional scale, presents opportunities for innovative IWM solutions for irrigation provision and population growth. Currently, Class B/C water is available from Bacchus Marsh Recycled Water Plant, which is linked to the Western Irrigation Scheme. A potential upgrade to supply Class A recycled water (to Bacchus Marsh Irrigation District) and other local users is currently being considered as part of the Werribee System Reconfiguration.

3.2.3 Current investigations

Potable water supply

GWW is responsible for funding trunk infrastructure and shared assets. The existing water supplies systems are insufficient to meet its growing demand, and Bacchus Marsh will need to import water from Melbourne Water supply systems and expand its supply capacity through accessing entitlements from other systems.

Recycled water supply

DEECA advised that a non-potable (purple pipe) network could be beneficial for the region. There are existing opportunities for synergy, such as potential upgrades to the Bacchus Marsh Recycled Water Plant to supply Class A recycled water to service BMID and the creation of a Western Irrigation Network (WIN) at a regional scale as part of the broader Werribee System Reconfiguration.

The Werribee System Reconfiguration Project is exploring the feasibility of making better use of river water along with alternative water sources to meet future water demands. Water resource modelling has been undertaken on reconfiguration options to assess the benefits predicted from converting BMID and WID to recycled water.

The options that were proposed that could be considered include:

- Supplying BMID from the Bacchus Marsh Recycled Water Plant (Class A recycled water).
- Supplying the Werribee Irrigation District (WID) with recycled water from Bacchus Marsh via the wider WIN network (though an alternative connection from Western Treatment Plant is also being tested) (Class B recycled water)
- Supplying the PSPs (Class A recycled water)
- Supplying open space irrigation throughout the PSPs (Class B recycled water)

The feasibility of recycled water use in the precincts is currently unknown. There are challenges with supplying the PSP with recycled water as the pipeline alignment would need to cross a highway and two rivers. The quantity of recycled water availability is uncertain at this stage given the other priorities. This results in challenges in confirming potential end uses within the PSP, as residential and industrial non-potable uses will require Class A, whereas open space irrigation can use Class B treated effluent.

Moorabool Council advised that Parwan Employment will comprise agribusiness, industry, commercial and maybe even hydrogen production, therefore Class A recycled water would be beneficial. If recycled water availability is not consistent, this could also be a deterrent to customers. It is important that any option development is undertaken in close collaboration with GWW, to align the objectives, feasibility and business cases.

Rainwater tanks

Rainwater tanks are a viable opportunity as identified previously and by the VPA 2.0 guidelines. They are important in reaching the harvesting targets and provide a flexible option for servicing of development with an alternative water source.

Storage capacity of Melton Reservoir and possible connection to Merrimu Reservoir

There is work underway looking at a stormwater harvesting scheme for Melton Reservoir (which is a non-potable supply reservoir for agricultural use). Possible options would be for this source to supply environmental flows and eventually transfer to Merrimu for indirect potable reuse.

Stormwater harvesting was also trialled from Toolern to Melton Reservoir however resulted in spilling of Melton Reservoir due to limited capacity. There is the potential for environmental damage if the reservoir continues to spill. Melton Reservoir capacity will limit options to transfer stormwater for reuse, unless a pumped connection can be made with Merrimu Reservoir for potable substitution.

An image of the Melton Reservoir from the site visit undertaken can be seen below.

Figure 3-3 - Photo of Melton Reservoir (Arup, 2023)

4. Long list of IWM Options

A long list of options was identified based on:

- Bacchus Marsh IWM Strategy prepared for Moorabool Shire Council (September, 2021)
- Previous IWM project experience
- Industry best practice
- Stakeholder interviews
- Desktop review

These options are categorised based on if they are “local” or “regional” options. Local options are at the lot scale and regional options are at a precinct scale.

Section 4.3 provides an overview of the additional options identified.

4.1 Local options

Local options include rainwater tanks and increased permeability at a lot scale. An overview of the options, as well as key findings from the policy review, interviews and stakeholder workshop, are outlined below.

Rainwater tanks in all new homes

Rainwater tanks would be installed for new homes in the to supplement non-potable household water demands such as water for toilets, gardens, and laundry. Rainwater tanks offered a flexible solution as they can be delivered on a lot-by-lot basis. Although ongoing maintenance is required which can impact their long-term viability. A more successful management model could be created if coordinated and supported by an external party.

This option is still seen as viable as it is a flexible alternative water supply and can be implemented in combination with any other option. It aligns with the EPA guidelines and IWM plans for the Werribee Catchment in that it is a substitute for potable water as well as reducing runoff and contaminants to waterways.

In the interview with Moorabool Council it was noted that rainwater tanks work well if they are implemented as designed, i.e. across the whole precinct. There are potential challenges when rainwater tanks are a requirement and Council are not involved in the decision making or implementation. Moorabool Council is looking at how rainwater tanks can be implemented in a way that is manageable.

It was noted in the Situational Analysis Workshop that this is a good opportunity to reduce potable demands for areas which may not be serviced by recycled water. Additional variations were also discussed, such as larger rainwater tanks for industrial areas and a lot to regional scale option (collective rainwater harvesting servicing the region) and rainwater for potable reuse.

Therefore, this option is still deemed viable however it is important to ensure all stakeholders, particularly Council, are engaged throughout the planning process.

Increased permeability and stormwater capture

This option involves increasing permeability in developed areas in order to reduce runoff in the water ways with two available sub-options. This option focusses on residential areas.

1. In previous work undertaken, it was highlighted that “leaky” rainwater tanks would be combined with improved on lot permeability. This would meet the 25% reduction target in total mean annual runoff, as proposed in the draft Urban Stormwater Management Guidelines at that time.
2. In addition to this, the alternative was to meet the previously outlined target of 50% reduction in mean annual flow from new impervious areas by Melbourne Water and a combination of on lot and precinct scale measures were proposed:

- Stormwater treatment wetlands (base case)
- On-lot leaky tanks
- Improved lot permeability from 20% to 30% (larger garden area or permeable paving)
- Passively irrigated street trees
- Stormwater harvesting for active open space in the greenfield areas.

Since the previous studies that were undertaken, the Urban Stormwater Management Guidelines were published by EPA Victoria. The previous draft guidelines proposed a 25% reduction target in total mean annual runoff. A target of 50% reduction was discussed with Melbourne Water due to there being areas of ecological significance. Both were considered for the Bacchus Marsh IWM Strategy (September, 2021).

Both targets are no longer relevant, and it is the targets in the final Urban Stormwater Management Guidelines that are to be adhered to (as outlined in Section 2.2.4). For the Little River rainfall template area, where Bacchus Marsh is located, there is a harvesting target of 32% and infiltration target of 3%.

Therefore, in progressing this option the analysis will consider this updated target and adjusting the infrastructure required and targets accordingly. The option will have significantly less infrastructure than the option meeting the previous Melbourne Water target of 50%.

Similarly, to the above option, this is a viable and flexible option, aligning with the guidelines and plans for the area. It was noted in the Council interview that stormwater harvesting is favoured at a local scale.

This was also flagged in the Situational Analysis workshop (refer to Section 5) as a good opportunity to reduce potable demands for areas which may not be serviced by recycled water. The additional variations are also applicable for this option. It will be important to ensure all stakeholders, particularly Council and Melbourne Water, are engaged throughout the planning process to mitigate challenges in implementation.

4.2 Regional options

The regional options include large scale stormwater harvesting and recycled water supply to various regional water demands. An overview of the options, as well as key findings from the policy review, interviews and stakeholder workshop, are outlined below.

End of line infiltration of stormwater runoff from new precincts

This option investigated the potential to infiltrate stormwater runoff from new development areas into the alluvium formation which has a higher permeability. Swales in this area would have the capacity to slow and store stormwater to then recharge river baseflows.

The option was previously seen to be both passive and simple in design which could be easily deliverable with the main constraint being the finding and securing low-cost land for infiltration.

This option will be taken further for analysis, since from the interviews and site visit, the feasibility and desirability of the option need to be considered as further constraints have been identified.

Bacchus Marsh Class A recycled water scheme

This option explored the opportunity to utilise recycled water in the Bacchus Marsh area. It includes the creation of a Class A recycled water treatment facility at the Bacchus Marsh Recycled Water Plant and a distribution network to service the PSP areas, and potentially also connect to BMID in the future. As the feasibility of upgrading the Bacchus Marsh RWP is currently under assessment, the possibility of this option would depend on whether GWW decides to decommission Bacchus Marsh RWP.

Moorabool Council have stated their preference for Class A water for the likely business and industry in the Parwan Employment PSP. Therefore, this option is still possible and it is recommended alternative configurations are also investigated (e.g. Class B or C supply to open space, Class A supply to industrial demands). It is also recommended that as this option progresses, it is done so in close collaboration with GWW and the existing work underway.

A variant to this option was raised at the Situational Analysis Workshop (refer to Section 5), which is a combined stormwater and recycled water reuse option. This could include a combined third pipe network, or for other regional uses.

Stormwater for BMID irrigation supply

This option explored using stormwater from the new development areas for irrigation in the BMID, replacing current river water use for irrigation. As part of this option, stormwater would flow to Melton Reservoir for storage and mixing with river flows, before being pumped back to BMID for irrigation via a piped transfer. There were two options examined.

The treated stormwater from the development areas is released to the Lerderderg and the Werribee Rivers and flows in river into Melton Reservoir

There were some challenges identified in the situational analysis regarding this option. Firstly, initial assessments have shown that Melton Reservoir has limited storage capacity. If spilling occurs, this could have adverse impacts on the environment. Water balance modelling has been undertaken by DEECA for Melton Reservoir which will be required for further updates.

The treated stormwater from the development areas is transferred via a pipe to Melton Reservoir, thereby protecting the downstream section of waterway from 50% of new urban runoff flows (based on the previous target)

A transfer pipeline from the development areas to Melton Reservoir will have constructability challenges based on the topography which may escalate the costs beyond those estimated in the high-level analysis outlined in previous studies. This would be a challenging escarpment to build a transfer pipeline, as well as the area adjacent to the river. This could also have adverse impacts on the waterway health during construction. Further, additional pipe and pumping infrastructure back to BMID would be required and poses further challenges.

As identified in the interviews with GWW, recycled water supply for BMID and WID are being reconfigured. Therefore, an alternate supply is already being provided and the stormwater supply may not be required.

If shortlisted, the above is imperative to consider in further development and analysis of this option. Similarly to the other options, it is important any progression of this option is done in close collaboration with GWW and Melbourne Water.

Figure 4-1 Bacchus Marsh Irrigation District (Arup, 2023)

Stormwater to supplement regional water resources

This option examined the opportunity to transfer treated stormwater from new development areas in Bacchus Marsh to Melton Reservoir and then transfer the stormwater to Merrimu Reservoir to supplement regional potable water supplies.

The Melton-Merrimu connection is being considered by GWW. The modelling does consider stormwater, and it was noted that Melton may need to be connected to Merrimu Reservoir to optimise stormwater harvesting and reuse. Further, in the interview with DEECA, it was noted that there is source modelling being undertaken in regard to Melton Reservoir, to quantify benefits for the Werribee River. The interim concept is that the Melton Reservoir could supply environmental flows with the final concept being that it could transfer to Merrimu Reservoir. However, in this interview the technical challenges of using Melton as a storage (as aforementioned) were also flagged. Further, given that currently there is a lack of enabling policy, an interim option or an adaptive plan would be required, to identify the short term demands and transfer for the stormwater.

Two variations were considered for a transfer of stormwater from growth areas in Bacchus Marsh to Melton Reservoir, as discussed below.

Stormwater is released to the Werribee River whereby it flows to Melton Reservoir

Like the previous option, viability was based on farmers being interested in this supply of water and that irrigation entitlements could be purchased or negotiated. This option did present a more attractive water source, since recycled water would be mixed with the river source. Since the supply would be connected to the Werribee River, further investigation into the reliability and timeliness of the water supply is required.

A dedicated piped transfer to the reservoir is delivered to protect the waterway between Bacchus Marsh and Melton Reservoir from the majority of excess urban stormwater flows

Upon further investigation similar challenges arose to the previous option as there are challenges in the constructability of a transfer pipeline that is adjacent to the waterways. If the stormwater harvesting is built but then the Melton and Merrimu Reservoirs do not get connected, this could have adverse effects on the environment. The Melton Reservoir sizing and spillage will need to be considered in the future option details.

Given the work underway already for this option, it is an option worth further consideration. It would need to be decided whether it is still desirable to test a dedicated transfer to Melton Reservoir and recognise constructability challenges, or alternatively to transfer via the Werribee River (potentially in combination with flow reduction measures within the precincts).

Further, given that currently there is a lack of enabling policy, an interim option or an adaptive plan would be required, to identify the short term demands and transfer for the stormwater.

Figure 4-2 Merrimu Reservoir (Arup, 2023)

Recycled water to supplement regional water resources

This option explored treating the Class C recycled water at Bacchus Marsh Recycled Water Plant to a potable standard and pumping it back to the Merrimu Reservoir, from where it would indirectly supplement the raw water resources and potable water network for the PSPs.

Potable reuse involves treating effluent from wastewater treatment plants to an advanced standard and then either transferring it to a waterway, storage or injecting it into groundwater (in the case of 'indirect' potable reuse) or sending it directly to a Water Filtration Plant or to distribution (in the case of 'direct' potable reuse). Potable reuse is an emerging water source in Australia due to it being (mostly) rainfall independent and therefore independent of climate stressors and shocks. There are other benefits, including the significant quantities of wastewater available and contributing to a circular economy, as well as being a resilient water source in drought. There are many examples overseas where this has been adopted and water utilities across Australia are investigating this as an option for the future, with growing populations and a changing climate. For example in Perth, a Managed Aquifer Recharge (MAR) scheme, using indirect potable reuse, has been in place since 2017. This is the largest MAR operation in Australia and uses wastewater from the nearby Beenyup Wastewater Treatment Plant treated to drinking water standards and injects it into the aquifer. The water is recovered by Water Corporation to supplement Perth's public drinking water supply. In Victoria, in the 'Water for Life' strategy, 'Manufactured Sources' of water is flagged as a potential future opportunity. In all adaptive planning cases, 'Manufactured Sources' as a proportion of total available water is expected to increase beyond 50% in 2070 to meet growing population demands.

For the Bacchus Marsh areas, it has been predicted that by 2035-40, the potable water demand will exceed the capacity of the Merrimu Reservoir (which is currently the sole supply of potable water for the area). GWW stated that there are no plans to expand the existing Water Treatment Plant, as the yield at Merrimu is limited.

Although in the longer term, potable reuse may be possible, it is unlikely that in the short term it will be possible given the current regulatory context. An adaptive plan is required if it is to be progressed.

4.3 Additional opportunities identified

In the desktop review and interview process, several new options arose. These options are outlined briefly below and will be progressed further in the options analysis if shortlisted.

Passive irrigation of street trees with stormwater

Irrigation of street trees is a priority for Council, as well as the following specific targets:

- From the IWM plans for Werribee Catchment: *14% and 30% of street trees are supported with permanent irrigation from an alternative water supply by 2030 and 2050 respectively, for the catchment*
- From the VPA Guidelines for PSPs 2.0: *T14 - All streets containing canopy trees should use stormwater to service their watering needs*

Passively irrigated street trees have been included in the "Increased permeability and stormwater capture" option, however it is recommended that either the revision of the existing options include irrigation of street trees from stormwater harvesting or recycled water supply, or the addition of options that specifically considers irrigation of street trees.

Class B/C recycled water open space irrigation within PSPs

In the interviews with Greater Western Water, a potential option raised was the provision of Class B or Class C recycled water for open space irrigation within the PSPs.

This aligns with the following targets from the IWM plans for the Werribee Catchment:

- 22% and 50% of active public open space (sports fields and organised recreation) is supported by an alternative water source by 2030 and 2050 respectively, for the catchment
- 9% and 25% of passive public open space (parklands and gardens) is supported by an alternative water source by 2030 and 2050 respectively, for the catchment

A variant to this option was raised at the Situational Analysis Workshop, which is a combined stormwater and recycled water reuse option for open space irrigation.

Class B/C recycled water open space irrigation to Bacchus Marsh town

An additional variant to the Class B/C supply was raised at the Situational Analysis Workshop, which is the option to provide recycled water for irrigation to open spaces in Bacchus Marsh town. The proximity to Bacchus Marsh town from Parwan Employment make this a viable option.

Stormwater storages utilising previous mine site

The Maddingley Brown Coal Mine is an old mine site that now is an EPA landfill site, within the Parwan Employment Precinct. There is work undertaken at the site to rehabilitate the disused Star Dam into a habitat for endangered species. A potential option could be tying in stormwater harvesting with the existing site and utilising it for stormwater storage.

Precinct-scale rainwater harvesting

An additional option was raised in the workshop which is the potential to explore a precinct scale rainwater harvesting solution. This could include industrial areas, with large roof areas, such as the Parwan Employment Precinct connected with a number of collective rainwater tanks and a third pipe network for the rainwater.

Recycled water and stormwater combined servicing

Recycled water and stormwater combined servicing was mentioned at the workshop as a potential option. This is currently being explored in growth areas in Sydney. Harvested stormwater is used to supplement recycled water in a third pipe network, meeting non-potable demands for residential, non-residential and open space users. This option would require additional investigation, particularly regarding treatment requirements, infrastructure requirements, costs, policy, geographical constraints and location. The combination of supplies could be further considered based on the demands in the PSP areas.

4.4 Summary

The below table outlines a summary of the opportunities, findings from the desktop review, interviews and site visit, next steps and a 'traffic light assessment' of the current potential of the opportunities.

The traffic light assessment is qualitative and based on findings from the interviews and workshop. They are representative of the stakeholder perspectives of the options.

Table 4-1 - Summary of options

Option	Summary	Findings	Next steps	Potential
Local opportunities				
Rainwater tanks	Rainwater tanks for non-potable demands.	• Flexible option that aligns with local strategy • May be challenge in implementation – stakeholder engagement important	Updated analysis of rainwater tanks with updated land use plans and targets.	High potential given flexibility and objectives
Increased permeability and stormwater capture	Leaky rainwater tanks combined with on lot permeability, stormwater harvesting and street tree irrigation.	• Flexible option that aligns with local strategy • Designed for previous flow target • May be challenge in implementation – stakeholder engagement important • Must consider outcomes of latest sodic soil assessment	Updated analysis with updated land use plans and targets.	High potential given flexibility and objectives
Regional opportunities				
End of line infiltration of stormwater runoff	Infiltrate stormwater runoff into alluvium formation.	• May be desirable to avoid transfer of stormwater down escarpment (but may be unavoidable) • Existing analysis underway on alternate local option	Re-evaluate option in light of assessments underway. Upon analysis, incorporate design risks in any costing and assessments.	Suitable option however design complexities may pose challenges.
Bacchus Marsh Class A recycled water scheme	Reuse of Class A recycled water for BMID, residential non-potable use and industrial use.	• Existing analysis underway to provide recycled water to BMID • Recommended to include alternatives	Update for new land use plans. Consider offtakes from planned recycled water network. Collaboration with Greater Western Water.	High potential option and in line with existing work underway by stakeholders.
Stormwater for BMID irrigation supply	Transfer of stormwater to Melton Reservoir for reuse for irrigation in the BMID.	• Assessments have shown challenges in capacity of Melton Reservoir and potential environmental damage	Consider flow balance of Melton Reservoir in updated analysis. Upon analysis, incorporate design risks in any costing and assessments.	Not a preferred option particularly given likelihood of supplying BMID with

		• Challenging transfer pipeline • Difficult to distinguish stormwater from river water in terms of allocations • Recycled water for BMID is already a priority	Review priority for stormwater for BMID given recycled water is already likely.	recycled water.
Stormwater harvesting to supplement regional water resources	Transfer of stormwater to Melton Reservoir and then transfer to Merrimu Reservoir for indirect potable reuse.	• Assessments have shown challenges in capacity of Melton Reservoir and potential environmental damage • Challenging transfer pipeline • Mentioned as an optimised option in existing work underway	Consider flow balance of Melton Reservoir in updated analysis. Upon analysis, incorporate design risks in any costing and assessments. Need to confirm infrastructure requirements with GWW including challenging pipeline (and construction methodology required), pump sizing and installation, as well as ongoing operating and maintenance costs and energy requirements.	Option still has high potential however may not be possible in short term given regulatory context.
Recycled water to supplement regional water resources	Upgrade of Bacchus Marsh Recycled Water Plant to potable standard and transfer to Merrimu Reservoir	• Regulatory challenges	Consider tying this option into existing plans. Review of regulation changes required.	Option still has high potential however may not be possible in short term given regulatory context. Stormwater to potable more likely in short term.
Additional opportunities				
Passive irrigation of trees with stormwater	Tying into existing or a new option, stormwater harvesting for street tree irrigation.	• Raised as potential new option given local targets	Analysis of new option required or an “add on” to an existing option.	Flexible option that can be achieved in combination with other options.

Class B/C open space irrigation	Additional option reviewing targeted open space irrigation using Class B or Class C recycled water. This could include within PSPs or to Bacchus Marsh town.	• Raised as alternative to Class A recycled water and residential reuse	Analysis of new option required.	Likely option and in line with existing work underway by stakeholders.
Stormwater storages at previous mine site	Rehabilitation of previous mine dam as a stormwater storage with stormwater harvesting.	• Potential option raised from interviews	Likely to be major constraints to viability.	Unlikely given site constraints
Precinct-scale rainwater harvesting for local use	Collective, larger rainwater tanks for a region scale, third pipe network serviced by rainwater.	• Raised as a potential variation to rainwater harvesting in the Situational Analysis workshop.	Potential for areas with industrial land uses.	Option has potential but requires additional analysis.
Precinct scale stormwater harvesting for local use	Harvesting stormwater following wetland treatment in a precinct and transferring to a storage for distribution and reuse for open space irrigation or in-home use	• Raised as a potential option to assist with reduction of stormwater in Situational Analysis workshop.	Potential as a third pipe feed source (if recycled water not deliverable) which would also assist with runoff reduction	Option has potential but requires additional analysis.
Recycled water and stormwater combined servicing for open space irrigation	A combined stormwater harvesting and Class A or Class B/C third pipe network.	• Raised as a potential option in the Situational Analysis workshop.	Requires significant further investigation and depends on quantum of demand. May not be cost effective. To be considered further following individual option analysis.	Option has potential but requires significant additional analysis and may be a high cost option.

5. Stakeholder workshop and shortlisted options

5.1 Stakeholder Workshop

A workshop was held on the 15th of February 2023 from 9am to 11:30 am with members from VPA, DEECA, Melbourne Water, Greater Western Water, and Moorabool Shire council to discuss IWM opportunities for the region and provide input to the situational analysis. The workshop was facilitated by Arup and held online. The workshop included:

- A review of IWM constraints and opportunities for the region, and within Parwan Employment PSPs.
- A review of shortlisted options presented in previous IWM studies for this region.
- A presentation of current conditions for the project including information gathered from updated studies and guidelines, stakeholders involved, and a site visit.
- A discussion on the viability of the original shortlisted options from the previous work, as well as additional ones identified.

A summary of the key constraints, drivers and opportunities identified from the workshop are presented in Appendix D and have been integrated throughout the report.

Refer to Appendix E for the complete Miro board from the workshop.

5.2 Shortlisted options

The following options have been shortlisted for further investigation. These options have been shortlisted based on the assessment above and the feedback in the Situational Analysis workshop.

The precincts in which the options are applicable are provided below.

Table 5-1 Shortlisted options

Shortlisted Option	Parwan Employment Precinct
Precinct-scale rainwater harvesting for non-potable supply of industrial areas	✓
Passive irrigation of street trees with stormwater	✓
Stormwater infiltration into Alluvium formation	✓
Class A recycled water supply to PSPs (and BMID)	✓
Transfer stormwater to Melton Reservoir and then to Merrimu Reservoir for potable supply	✓

6. Establishing the base case

To inform the analysis of the shortlisted options, a base case is required for comparison. This section details the water balance calculations and pollutant modelling results based on land use budgets received from VPA and no stormwater or IWM interventions.

6.1 Parwan Employment Precinct

6.1.1 Proposed development and base water case

The Parwan Employment Precinct is the only PSP that is not proposed for residential or community spaces. 43% of the PSP area is attributed to heavy industry, followed by 27% for light industry, 8% of general industry and 6% medium industry. 9% of the land is attributed as "uncredited open space" which conservation area land use budget estimate provided by the VPA on 27/03/2023.

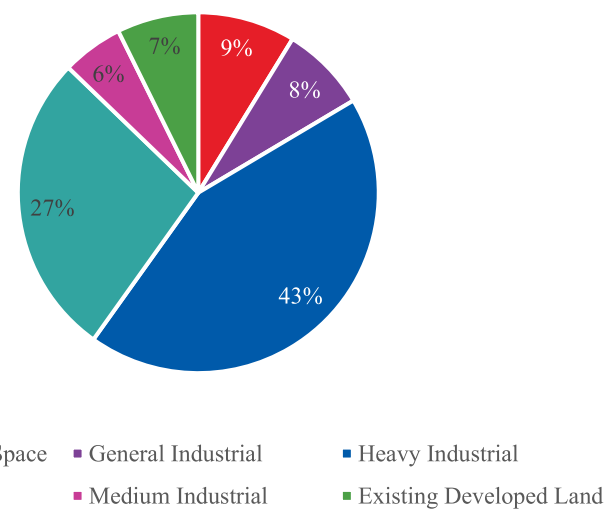


Figure 6-1 - Parwan Employment land use budget (VPA)

6.1.2 Base case water demands

Water demands for potable, non-potable water, and wastewater generation in the Parwan Employment Precinct were estimated. Key assumptions made include:

Table 6-1 Parwan Employment base case water demand assumptions

Assumption	Unit	Value	Source
Industrial			
General Industrial water demand	kL/ year	50,000	General Industrial has been assumed to be meat processing with a demand of 50ML/y. This is based on "Agribusiness Analysis" Report prepared for Moorabool Shire Council by CBRE, page 93.
Heavy Industrial water demand	kL/ year	780,000	Heavy Industry is assumed to be Green Hydrogen production. An estimate 0.78GL/year of non-potable water has been assumed, which is based on Arup's estimations of hydrogen demand in the Melbourne region (up until 2050).

Light Industrial water demand	kL/ year	1,000	Light Industrial has been assumed to be bulk distribution with a demand of 1ML/y. This is based on "Agribusiness Analysis" Report prepared for Moorabool Shire Council by CBRE, page 93.
Medium Industrial water demand	kL/ year	1,630,439	Medium Industrial has been assumed to be hydroponics and mushroom production with a demand of 12ML/ha. This is based on "Agribusiness Analysis" Report prepared for Moorabool Shire Council by CBRE, page 93.
General Industrial Jobs	#	400	General Industrial has been assumed to be meat processing. No. jobs is based on "Agribusiness Analysis" Report prepared for Moorabool Shire Council by CBRE, page 92.
Heavy Industrial Jobs	#	150	150 jobs estimated fir 100MW facility (source)
Light Industrial Jobs	#	10	Light Industrial has been assumed to be bulk distribution. No. jobs is based on "Agribusiness Analysis" Report prepared for Moorabool Shire Council by CBRE, page 92.
Medium Industrial Jobs	#	600	Medium Industrial has been assumed to be hydroponics and mushroom production. No. jobs is based on "Agribusiness Analysis" Report prepared for Moorabool Shire Council by CBRE, page 92.
Potable water demand per employee	L/p/day	30	Assumed as 20% of an average 150L/p/day
Wastewater generation	% employee water demands	80	Industry assumption for water to wastewater conversion based on experience
Open space			
Credited Open space Area	Ha	0	No Credited Open Space was assigned to this PSP – VPA Land use budget.
Uncredited Open space Area	Ha	216.75	No water demands have been associated with uncredited open space

Results of predicted water demands based on the land use budget is shown in Table 6-2 and Figure 6-2.

Table 6-2 - Parwan Employment Precinct water demands

ML/year	General Industrial	Light Industrial	Medium Industrial	Heavy Industrial
Potable	50	0.3	18	5
Non-potable	0	1.0	1,630	780
Total water demand	50	1.3	1,648	785
Wastewater generated	40	0.2	14	4

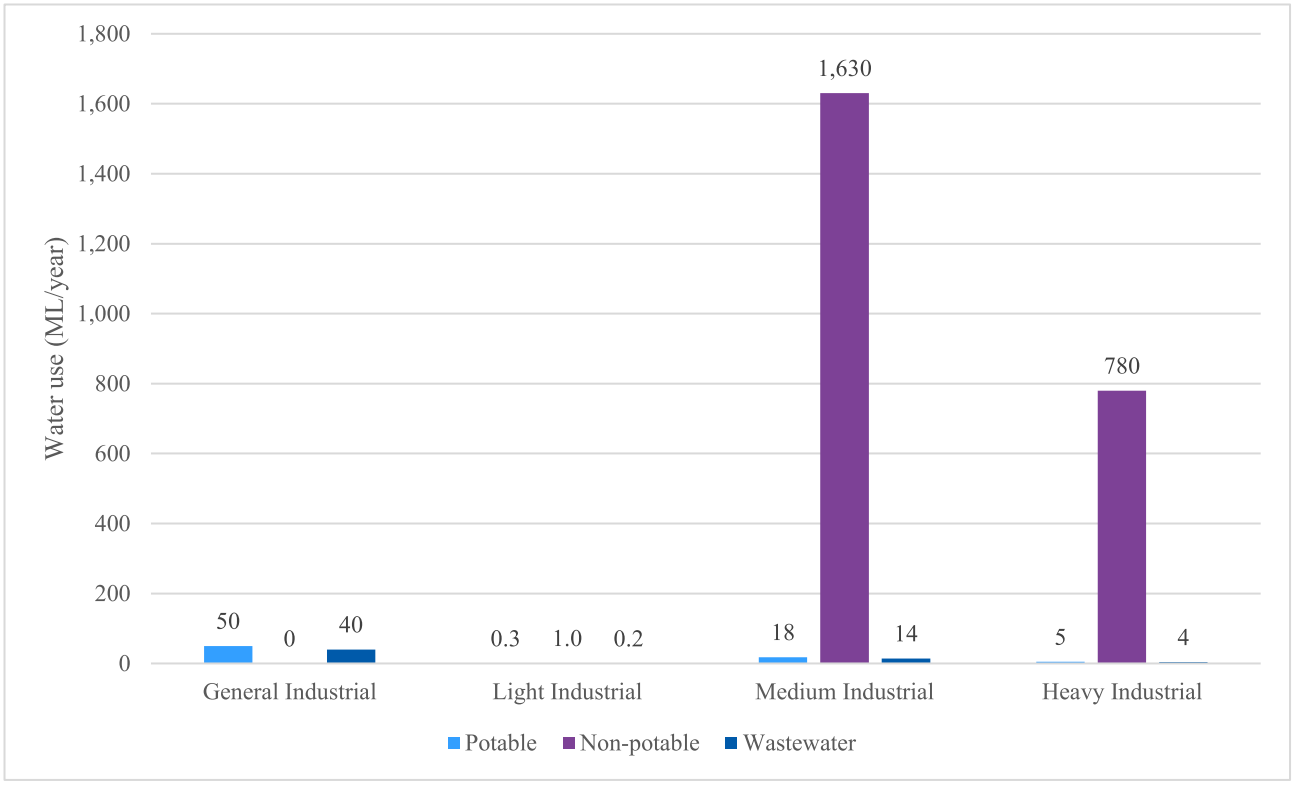


Figure 6-2 - Parwan Employment water demands (Arup, 2023)

6.1.3 Stormwater base case

To analyse the base case stormwater generation, a MUSICX model was set up for this PSP. Table 6-3 shows the flow, TSS and TN generated as a result of the proposed development.

Table 6-3 Parwan Employment Precinct Stormwater base case

Source Node	Impervious Stormflow Out (ML/y)	Impervious Stormflow out TSS kg/yr	Impervious Stormflow out TN kg/yr
Open Space	100.5	8,872	97
Industrial	8670.1	1,604,912	19,129
Existing Developed Land	503.3	104,105	1,466
Total	**9,274**	**1,717,889**	**20,692**

In addition, two scenarios were modelled to show a predevelopment scenario, and a scenario to meet BPEM targets;

1. A pre-development scenario to understand flow and pollutants if there was no development at all; and
2. A post development scenario using the areas provided in the land use budget. For each of these land uses, Melbourne Water MUSIC guidelines were used to allocate fraction impervious values and soil parameters (Soil Storage Capacity = 120mm and Field Capacity = 50mm). This scenario assumed the presence of a wetland before discharge into the Parwan Creek, which has a surface area of 50ha (this represents 2% of the total PSP area) and an extended detention depth of 350mm. This wetland was added to meet Best Practice Environmental Management (BPEM) as set out by the EPA.

Table 6-4 shows the results of the stormwater base case modelling.

Table 6-4 Parwan Employment Precinct Stormwater base case comparison with pre-development

	Flow (ML/y)	TSS (kg/y)	TP (kg/y)	TN (kg/y)	Gross Pollutants (kg/y)
Pre-development	2,678	122,000	161	2,304	45,010
Post development (no IWM interventions, only wetland)	8,965	247,700	909	12,230	9,294
% reduction with wetland	**6.6**	**85.8**	**67.5**	**42.1**	**97.4**

7. IWM measures and criteria

Comprehensive and holistic criteria have been used to assess the opportunities and constraints of each option. This assessment of IWM options combines performance measures from the Werribee IWM Plan, the VPA brief and option delivery considerations, to bring together the intent and strategic objectives of the state and local policy framework and focus on the outcomes which can be driven through a precinct scale approach.

These are summarised below and have been used in the opportunity assessment of shortlisted options in Section 8.

7.1 Performance measures used to assess IWM

The scoring criteria is on a scale of 0 (not applicable), 1 (worst) and 5 (best) and can be found in Appendix A.

Table 7-1 Performance measures

Performance measure	Unit	Description and calculation	Scoring method
Alternative water sources that substitute potable mains water supply	ML/year	Using the water balance for each option, the total alternative water use (rainwater, stormwater and recycled water) is calculated.	Using the qualitative assessment, ranges for 1-5 were defined and used for scoring.
Recycled water delivered to customers	ML/year	Using the water balance for each option, recycled water supply is calculated.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
Impact on fluvial flood mitigation	High/Medium/Low	The contribution of each option towards fluvial flood mitigation is qualitatively estimated relative to other options as the impact on fluvial flood mitigation cannot be determined with a water balance.	Low = 1, Medium = 3, High = 5
Mean annual runoff volume reduction	ML/year (and % reduction)	The mean annual runoff reduction is calculated using the water balance for each option.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
Total Suspended Solids (TSS) prevented from discharging to receiving waters	kg/year	TSS reduction is calculated using MUSICX modelling.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
Total Nitrogen (TN) prevented from discharging to receiving waters	kg/year	TN reduction is calculated using MUSICX modelling.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.

Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways	ML/year	Volume of water entering a waterway to increase environmental flows is calculated for each option.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
New total number of passively irrigated trees	No. trees	New number of passively irrigated trees based on tree density assumptions.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
New area of public open space supported by an alternative water source	hectares	New area of public space supported by an alternative water source is calculated by accounting for new areas irrigated by stormwater or recycled water, or if there is a wetland.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
Opportunity to embed Traditional Owner values in the delivery of solution	High/Medium/Low	Based on the complexity of the solution and the opportunities for engagement with Traditional Owners.	Low = 1, Medium = 3, High = 5
Blue-green infrastructure created by integrated water management as a proportion of total area	% of total area	Proportion of area for blue-green infrastructure. Based on wetland area assumptions	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
Contribution to community literacy	High/Medium/Low	Based on the prominence of the option in community on the justification that visibility will associate with community literacy.	Low = 1, Medium = 3, High = 5
Alternative water supplied to agricultural production	ML/year	Volume of water supplied to agricultural production by rainwater, stormwater or recycled water.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
Alternative water supplied to businesses and industry	ML/year	Volume of water supplied to businesses and industry by rainwater, stormwater or recycled water.	Using the qualitative assessment and defined ranges, each option is scored 1 to 5.
Implementation and complexity	High/Medium/Low	An estimation based on the general implementation requirements of the option. Higher complexity options score lower than low complexity options.	Low = 5, Medium = 3, High = 1

Resilience to extreme climate events caused by climate change	High/Medium/Low	Based on the options relative impact to the PSP's climate resilience compared with each other.	Low = 1, Medium = 3, High = 5
Relative land take	High/Medium/Low	Based on the options land take, relative to other options. High land take scored lower and low land take scored higher.	Low = 5, Medium = 3, High = 1

8. Opportunity Assessment of Shortlisted Options

The shortlisted IWM options have been assessed against the measures and criteria set out in Section 7 to quantify the benefits of each option. The scoring criteria is on a scale of 0 (not applicable), 1 (worst) and 5 (best). The scoring methodology is described in Section 7. The detailed results for each option can be found in Appendix A. It should be noted that costing for these solutions is not included as part of this study, however is discussed in the results and discussion section.

The following sections provide a description of each option, assumptions, and the results of the scoring.

8.1 Parwan Employment Precinct

Option 1 : Precinct-scale rainwater harvesting for non-potable supply to industry

Description

Rainwater from the impermeable areas of the PSP is harvested and stored in an attenuation tank below ground. This water is then pumped into a third-pipe network, centralised non-potable network to serve the non-potable industrial demands of the precinct.

Source: ACO

Key assumptions

- Assume roof area totalling 5% of the PSP can be captured. This is highly dependant on the types of industry and proportion of roof cover.
- Storage tank is 1% of the PSP area (24.8ha), 0.5m deep, and invert of outfall pipe is 500mm above the base of the tank.
- Estimated possible total daily non-potable water demand is 6,607 kL/day, but is highly dependant on the types of industrial uses that locate in the PSP.

Stormwater targets

Stormwater harvesting volume achieved: 5% (+7% from base case wetlands) (Target is 29-33%)

Stormwater infiltration volume: 0% (Target is 3-6%)

Indicators (Scale 1-5)

	Value	Units	Individual score
Alternative water sources that substitutes potable mains water supply	438	ML/year	2

Recycled water delivered to customers	NA	ML/year	0
Impact on fluvial flood mitigation	H	H/M/L	5
Mean annual runoff volume reduction	438	ML/year	2
Total Suspended Solids (TSS) prevented from discharging to receiving waters	80,000	kg/year	1
Total Nitrogen (TN) prevented from discharging to receiving waters	959	kg/year	1
Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways	NA	ML/year	0
New total number of passively irrigated trees	NA	trees	0
New area of public open space supported by an alternative water source	NA	ha	0
Opportunity to embed Traditional Owner values in the delivery of solution	L	H/M/L	1
Blue-green infrastructure created by integrated water management as a proportion of total area	NA	%	0
Contribution to community literacy	M	H/M/L	3
Alternative water supplied to agricultural production	NA	ML/year	0
Alternative water supplied to businesses and industry	438	ML/year	2
Implementation and complexity	H	H/M/L	1
Resilience to extreme climate events caused by climate change	M	H/M/L	3
Relative land take	H	H/M/L	1
	Total score:		22

Required infrastructure

- Installation of storage tank
- Screening to remove solids from water.
- Pump and reticulation pipework to serve industry.

Constraints and benefits

Sodic soil compatibility

The excavation for attenuation tanks has the potential to disrupt the sodic and dispersive soils. Geotechnical and site investigations should inform the location of the underground tanks. An impermeable geotextile should be laid beneath the tanks to prevent water coming into contact with subsoils.

Implementation and governance

Implementation of this solution could require excavation for installation of underground storage, treatment to remove larger solids, and a pump and pipe network to open spaces. Roads should

allow for a non-potable pipe network in the utility/service corridor. The tank, pipes and pump would need to be adopted and maintained by a water retailer or landowners.

Climate Resilience

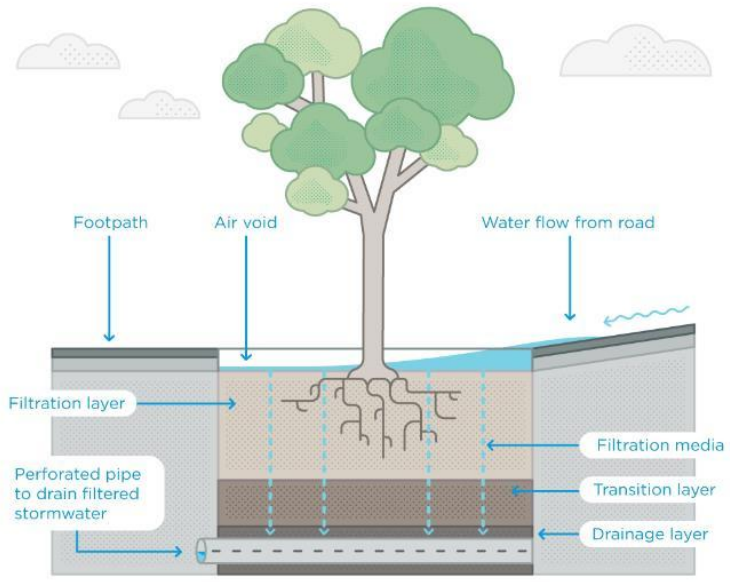
Harvesting rainwater for reuse reduces the freshwater demand of the PSP. In case of a water outage in the potable network, having an independent non-potable network enhances the resilience of the town's water infrastructure. In the case of drought, this climate is less resilient as it's directly affected by rainfall.

Land take

The storage tank can be sized to demand and is a flexible solution for the PSP. It should be noted that the larger the tank, the more rainwater is captured and prevented from entering the watercourse and can be reused in the PSP.

Option 2: Passive irrigation of street trees with stormwater

Description
Street trees are passively irrigated using stormwater. This option aligns with Council priorities and targets.



Source: Melbourne Water

Key assumptions

- 5 street trees per ha of developed area
- Runoff into tree pits is from roads only.
- Tree pits are 1m deep with 30% porosity. Size of a tree pit is 2.2 x 2.2m (City of Melbourne)
- Inlet capture efficiency is 50%
- Flow reductions are associated with stormwater attenuated in a tree pit, assuming no infiltration

Stormwater targets
<u>Stormwater harvesting volume achieved:</u> 1% (+7% from base case wetlands) (Target is 29-33%)

Stormwater infiltration volume: 1% (Target is 3-6%) Assuming half of the flow reduction is due to infiltration.

Indicators (Scale 1-5)

	Value	Units	Individual score
Alternative water sources that substitutes potable mains water supply	NA	ML/year	0
Recycled water delivered to customers	NA	ML/year	0
Impact on fluvial flood mitigation	L	H/M/L	1
Mean annual runoff volume reduction	188	ML/year	1
Total Suspended Solids (TSS) prevented from discharging to receiving waters	61,733	kg/year	1
Total Nitrogen (TN) prevented from discharging to receiving waters	109	kg/year	1
Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways	NA	ML/year	0
New total number of passively irrigated trees	10,393	trees	5
New area of public open space supported by an alternative water source	NA	ha	0
Opportunity to embed Traditional Owner values in the delivery of solution	L	H/M/L	1
Blue-green infrastructure created by integrated water management as a proportion of total area	0.7	%	1
Contribution to community literacy	M	H/M/L	3
Alternative water supplied to agricultural production	NA	ML/year	0
Alternative water supplied to businesses and industry	NA	ML/year	0
Implementation and complexity	L	H/M/L	5
Resilience to extreme climate events caused by climate change	L	H/M/L	3
Relative land take	L	H/M/L	5
	Total score:		27

Required infrastructure

- Tree pits and associated outflow pipework
- Penetrated kerb inlets

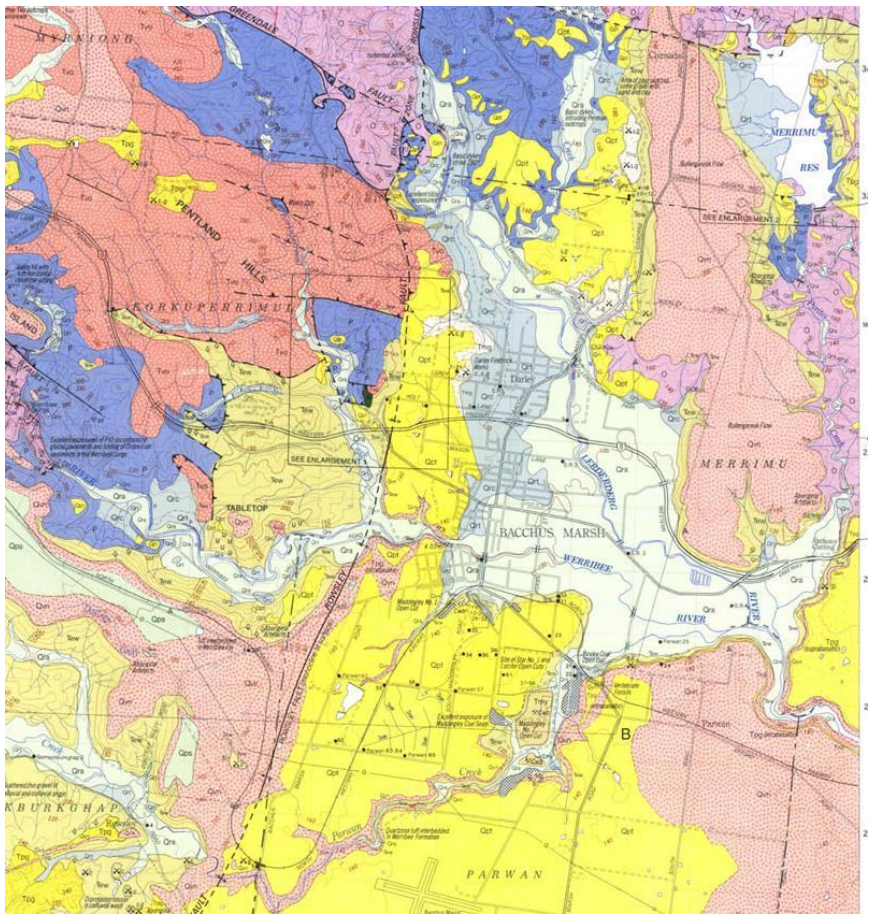
Constraints and benefits

Sodic soil compatibility

Analysis of passively irrigated trees in sodic soil areas has shown there should be no adverse impact provided flow infiltrates vertically and is well distributed.
Implementation and governance Passively irrigated street trees are relatively simple to implement and cooling and greening is a priority for the Council. Standard designs could be developed for the area to aid implementation.
Climate Resilience Using stormwater to irrigate trees provides a cooling effect to surrounding areas in the summer, which adds to the resilience of a PSP in the face of climate related shocks and stresses.
Land take No land take impacts, as passive irrigation can be included within standard street cross-sections

Option 3: Stormwater infiltration to alluvium formation

Description
Stormwater runoff from new development areas has the potential to be infiltrated into the alluvium formation, which has a high permeability. This could be done through swales, which has the capacity to slow and store stormwater and recharge river baseflows. For this to be delivered, stormwater must be transferred down to the alluvium formation around Parwan Creek or Werribee River for infiltration.



Highly permeable alluvium formation adjacent to the Werribee River in the study area (shown in light green)

Key assumptions
• It is assumed 60% of flow from the is impermeable areas of new development can be practically intercepted and directed to infiltration swales to promote infiltration into the highly permeable alluvium soils in the valley below the development area. • It is assumed that the majority of flow reduction is through infiltration, with a smaller proportion lost through evaporation and evapotranspiration which is characterised as harvested water.
Stormwater targets
Stormwater harvesting volume achieved: 10% (+7% from base case wetlands) (Target is 29-33%) Stormwater infiltration volume: 50% (Target is 3-6%)
Indicators (Scale 1-5)

	Value	**Units**	**Individual score**
Alternative water sources that substitutes potable mains water supply	NA	ML/year	0
Recycled water delivered to customers	NA	ML/year	0
Impact on fluvial flood mitigation	H	H/M/L	5
Mean annual runoff volume reduction	5,564	ML/year	5
Total Suspended Solids (TSS) prevented from discharging to receiving waters	1,030,734	kg/year	4
Total Nitrogen (TN) prevented from discharging to receiving waters	12,475	kg/year	5
Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways	1,113	ML/year	5
New total number of passively irrigated trees	NA	trees	0
New area of public open space supported by an alternative water source	NA	ha	0
Opportunity to embed Traditional Owner values in the delivery of solution	H	H/M/L	5
Blue-green infrastructure created by integrated water management as a proportion of total area	NA	%	0
Contribution to community literacy	L	H/M/L	1
Alternative water supplied to agricultural production	NA	ML/year	0
Alternative water supplied to businesses and industry	NA	ML/year	0
Implementation and complexity	M	H/M/L	3
Resilience to extreme climate events caused by climate change	L	H/M/L	1

Relative land take	M	H/M/L	3
	Total score:		37

Required infrastructure

- Stormwater swales
- Conveyance pipe infrastructure to the alluvium formation soil

Constraints and benefits

Sodic soil compatibility

Infiltration through the topsoil would minimally impact sodic and dispersive soils. Careful consideration should be given if excavating to construct swales or infiltration basins near where there are sodic soils.

Implementation and governance

The complexity of implementing this option is high, as there is a steep gradient and level drop between the PSP and alluvium formation. It would require flows to be conveyed down a steep escarpment. Drop structures may be required to dissipate velocities. Stormwater swales would need to be managed by the Council or Melbourne Water.

Climate Resilience

The effect of infiltrating stormwater into the alluvium would recharge the aquifer flow as well as river base flows. Groundwater resources are less responsive to climate events, and therefore provide higher levels of resilience to extreme climate events. Enhancing base flows in rivers can be beneficial in the long-term, especially when abstraction rates are likely to increase in the future.

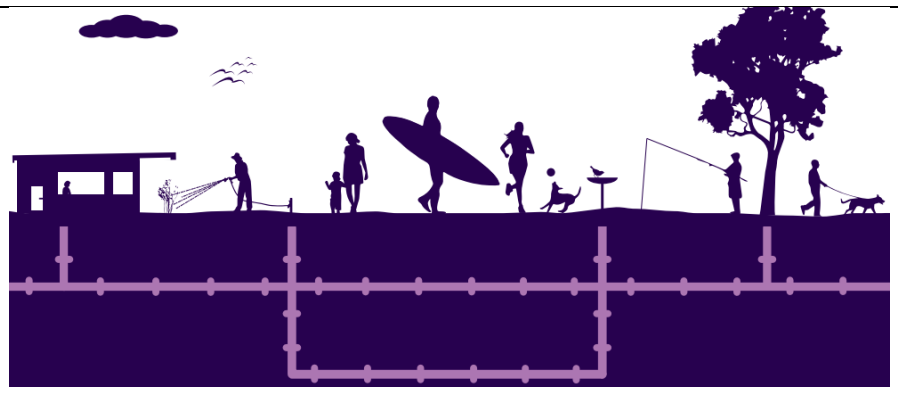
Land take

Land take would be required for the infiltration basins / swales, which could be planned within open space areas or creek corridors within the development and downstream within the Werribee River valley. Land would need to be purchased or infiltration areas would need to be identified on public land or within the waterway corridor.

Option 4: Using Class A recycled water for non-potable demands

Description

The generation of a Class A water would be from Bacchus Marsh Recycled Water Plant and a distribution network would service heavy industry in Parwan Employment PSP. Servicing of the PSP area could be an extension of a possible Class A scheme to service Bacchus Marsh Irrigation District, which is currently being considered by Greater Western Water as part of the Werribee Catchment Reconfiguration Project.



Source: Westernport water

Key assumptions
• Class A recycled water is used for Heavy Industry in the PSP, which is assumed at 780ML/y and Medium and Light industry non-potable demands are 1,631 ML/y. Confirmation of the class of water required for non-potable uses will depend on the industries present. • The recycled wastewater treatment plant will have capacity to provide the non-potable demand.
Stormwater targets
Not applicable

Indicators (Scale 1-5)

	Value	Units	Individual score
Alternative water sources that substitutes potable mains water supply	2,411	ML/year	5
Recycled water delivered to customers	2,411	ML/year	5
Impact on fluvial flood mitigation	L	H/M/L	1
Mean annual runoff volume reduction	NA	ML/year	0
Total Suspended Solids (TSS) prevented from discharging to receiving waters	NA	kg/year	0
Total Nitrogen (TN) prevented from discharging to receiving waters	NA	kg/year	0
Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways	NA	ML/year	0
New total number of passively irrigated trees	NA	trees	0
New area of public open space supported by an alternative water source	NA	ha	0
Opportunity to embed Traditional Owner values in the delivery of solution	L	H/M/L	1
Blue-green infrastructure created by integrated water management as a proportion of total area	NA	%	0

Contribution to community literacy	M	H/M/L	3
Alternative water supplied to agricultural production	NA	ML/year	0
Alternative water supplied to businesses and industry	2,411	ML/year	5
Implementation and complexity	M	H/M/L	3
Resilience to extreme climate events caused by climate change	H	H/M/L	5
Relative land take	L	H/M/L	5
	Total score:		33

Required infrastructure

- Upgrade to Bacchus Marsh Recycled Water Plant to produce Class A water
- Reticulation (third-pipe) network

Constraints and benefits

Sodic soil compatibility

Sodic and dispersive soils may be affected during the installation of pipework and pumps. To overcome this, the levels and earthworks strategy can be designed so that finished surface levels are well above the dispersive sub-soil, and any pipes are laid in clean imported soil.

Implementation and governance

Implementation of Class A recycled water treatment is dependent on Greater Western water, as the asset owner of the WWTP. Therefore, the timelines for construction and upgrade would need to be coordinated. with broader upgrades as part of the vision for the Werribee catchment and its recycled water resources. Parwan Employment is located adjacent to the Bacchus Marsh Recycled Water Plant and could be serviced easily.

Climate change

Supplying recycled water would reduce freshwater demand in the PSP. Energy and cost required to treat and reticulate the water should be considered.

Land take

There would be minimal land take within the PSP area for reticulated recycled water. Balancing tanks may be required along with easements for distribution infrastructure. Roads should allow for a non-potable pipe network in the utility/service corridor.

Option 5: Transfer stormwater to Melton Reservoir then to Merrimu Reservoir for potable supply

Description

Treated stormwater would be transferred from new development areas in the PSP to Melton Reservoir and then to Merrimu Reservoir to supplement the regional potable water supply.

Source: VicScreen

Key assumptions

- Stormwater from the PSP enters a wetland, which is sized as 2% of the PSP area.
- Treated outflow from the wetland is released into the Werribee River where it flows to Melton Reservoir. From there, it's pumped up to Merrimu Reservoir via a new piped connection which is being explored by Greater Western Water as part of broader system resilience measures.
- It is assumed that 50% of the volume transferred to Melton could be pumped to Merrimu Reservoir to supplement potable supply and 50% could be retained in Melton Reservoir to supplement an environmental water reserve.
- Future regulatory environment enables the user of stormwater for potable supply.

Stormwater targets

Stormwater harvesting volume achieved: 0% (+7% from base case wetlands) (Target is 29-33%). Flow reduction benefits would be delivered downstream of Melton reservoir.

Stormwater infiltration volume: 0% (Target is 3-6%)

Indicators (Scale 1-5)

	Value	**Units**	**Individual score**
Alternative water sources that substitutes potable mains water supply	4,483	ML/year	5
Recycled water delivered to customers	NA	ML/year	0
Impact on fluvial flood mitigation	L	H/M/L	1
Mean annual runoff volume reduction	NA	ML/year	0

Total Suspended Solids (TSS) prevented from discharging to receiving waters	NA	kg/year	0
Total Nitrogen (TN) prevented from discharging to receiving waters	NA	kg/year	0
Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways	4,483	ML/year	5
New total number of passively irrigated trees	NA	trees	0
New area of public open space supported by an alternative water source	NA	ha	0
Opportunity to embed Traditional Owner values in the delivery of solution	L	H/M/L	1
Blue-green infrastructure created by integrated water management as a proportion of total area	NA	%	0
Contribution to community literacy	L	H/M/L	1
Alternative water supplied to agricultural production	NA	ML/year	0
Alternative water supplied to businesses and industry	NA	ML/year	0
Implementation and complexity	H	H/M/L	1
Resilience to extreme climate events caused by climate change	H	H/M/L	5
Relative land take	L	H/M/L	5
	Total score:		24

Required infrastructure

- Base case wetlands
- Outfall connection pipe from PSP wetland to Werribee River
- Pump and pressurised pipe to transfer water from Melton Reservoir to Merrimu Reservoir

Constraints and benefits

Sodic soil compatibility

The excavation of a wetland has the potential to disrupt the sodic and dispersive soils. Geotechnical and site investigations should inform the location of any wetland(s), and wetlands should be lined to prevent water coming into contact with subsoils.

Implementation and governance

Releasing stormwater to the Werribee River without the Melton-Merrimu connection could have adverse effects on the downstream environment. The Melton-Merrimu connection is already being considered by Greater Western Water. The interim concept is that Melton Reservoir could supply environmental flows and the final concept is that it could transfer to Merrimu Reservoir, however there are concerns about the lack of capacity in the Melton Reservoir to provide the required storage, which requires further investigation. There is a current lack of enabling policy

for use of stormwater for potable supply, so an interim option or adaptive plan would be required to identify the short term demands and transfer for the stormwater.	
Climate change This option could enhance water security in the region by topping up potable water supplies. There are also possible benefits of environmental flows within the Werribee River if stormwater is held into Melton Reservoir and allocated as an environmental flow.	
Land take There would be no land take within the PSPs for this option.	

9. Parwan Employment PSP

9.1 Results and discussion

The combined scores for the IWM options for Parwan Employment PSP are shown in Table 9-1.

Table 9-1 - Scores for Parwan Employment PSP

Parwan Employment	Alternative water sources that substitutes potable mains water supply	Recycled water delivered to customers	Impact on fluvial flood mitigation	Mean annual runoff volume reduction	Total Suspended Solids prevented from discharging to receiving waters	Total Nitrogen prevented from discharging to receiving waters	Additional ML/yr of water allocated to environmental water reserve that	New total number of passively irrigated trees	New area of public open space supported by an alternative water	Opportunity to embed Traditional Owner values in the delivery of	Blue-green infrastructure created by integrated water management as a	Contribution to community literacy	Alternative water supplied to agricultural production	Alternative water supplied to businesses and industry	Implementation and complexity	Resilience to extreme climate events caused by climate change	Relative land take	Total
1 Precinct scale rainwater harvesting for non-potable supply of industrial areas	2	0	5	2	1	1	0	0	0	1	0	3	0	2	1	3	1	22
2 Passive irrigation of street trees with stormwater	0	0	1	1	1	1	0	5	0	1	1	3	0	0	5	3	5	27
3 Stormwater infiltration into alluvium	0	0	5	5	4	5	5	0	0	5	0	1	0	0	3	1	3	37
4 Class A recycled water to PSP	5	5	1	0	0	0	0	0	0	1	0	3	0	5	3	5	5	33
5 Transfer of stormwater to Melton and then Merrimu Reservoir for potable supply	5	0	1	0	0	0	5	0	0	1	0	1	0	0	1	5	5	24

The key insights from the comparative analysis of options for the PSP are:

- The highest scoring option for Parwan Employment PSP is the transfer of stormwater from the PSP to infiltration areas in the alluvium formation that runs through the Werribee River valley. The relatively high scoring of this option is due to the fact that there are limited options identified to manage stormwater from the site, and the potential runoff from the area is very large. The opportunities for reuse of stormwater from the site are uncertain at this stage, and highly dependant on the industries that choose to locate in the PSP. The use of rainwater tanks (either communal or individual) would be beneficial, but would need to be considered on a case by case basis. As an initiative to improve outcomes for local waterways and manage the large volume of stormwater that could arise from the large impervious areas on-site, the infiltration opportunity provides a precinct scale option with merit and flexibility. Locations and delivery options for infiltration require further investigation in partnership with Melbourne Water and Moorabool council. Infiltration into the highly permeable alluvium formation would need to occur outside the psp on the plains adjacent to the Werribee River or Parwan Creek. As an alternative, opportunities for increased permeability or infiltration/evapotranspiration of stormwater at a lot scale should be explored at a development scale to decrease runoff from the PSP.

- The second highest scoring option is the provision of a Class A recycled water supply to the precinct. Class A recycled water could be available to the precinct if the Bacchus Marsh Recycled Water Plant is upgraded to deliver Class A to Bacchus Marsh Irrigation District and other PSPs in the area. However, the business case to do so is highly dependent on the type of industry, its water demand and quality requirements. However, these could be significant and proactive planning should be undertaken with Greater Western Water to service the area and plan in key infrastructure.

- The option to capture stormwater for to support tree irrigation scored well and offer greening and liveability benefits. This could be delivered in combination with wetlands and infiltration initiatives in the PSP to meet flow volume reduction targets for the catchment. Passive irrigation of street trees with stormwater scored points for the provision of street trees being irrigated by an alternative source of water, and also directly align with VPA's guideline for PSPs.

- The transfer of stormwater to Melton Reservoir and then Merrimu Reservoir for potable supply is also an option worthy of further investigation at a regional level which could deliver environmental flow and water resource benefits by capturing excess stormwater from the PSP downstream.

9.2 Recommended portfolio for further consideration

For the Parwan Employment PSP, the following solutions are recommended for further investigation through the development process:

- **Option 1:** Rainwater harvesting for non-potable supply to industry (lot-based or shared)*
- **Option 2:** Passive irrigation of street trees with stormwater
- Further development dependant opportunities for increased permeability or infiltration/evapotranspiration of stormwater at a lot scale should be explored at a development scale to decrease runoff from the PSP.

**Pending the results of the Werribee System Reconfiguration Investigation currently being investigated by stakeholders, if the supply of Class A recycled water is found to be desirable and deliverable for the Parwan Employment PSP area, this could be delivered as an alternative to rainwater tanks (Option 4). The IWM planning within the PSP should retain flexibility until this decision is made.*

Portfolio options were selected based on the following:

- Meeting stormwater harvesting and infiltration targets for the area (29-32% for stormwater harvesting, 3-6% for infiltration)

- Scoring highly in the Opportunities assessment (which considers performance measures and VPA specific objectives)

Costs were not considered in selecting the portfolios.

To strategically contribute to the targets in the wider Werribee IWM Catchment Plan, it's recommended that a regional scale stormwater harvesting and infiltration solutions is also pursued and further investigated:

- **Option 3: Stormwater infiltration into alluvium.** Prior to discharge to the Werribee River, there is an opportunity to lessen flow impacts on the rivers and to recharge baseflows through infiltration into the highly permeable alluvium fields in the Werribee River valley. This initiative would involve collaboration with adjacent land owners, and partnerships to establish and manage the infiltration assets.
- **Option 5: Treated stormwater transferred to the Melton Reservoir and then eventually to Merrimu Reservoir for potable reuse.** Option 5 is only possible in the long term as it involves regulatory change, therefore it is not selected as a short-term solution. This option could be delivered with the preferred portfolio, as the residual stormwater from the development can still meaningfully contribute to regional water resource management from Melton Reservoir

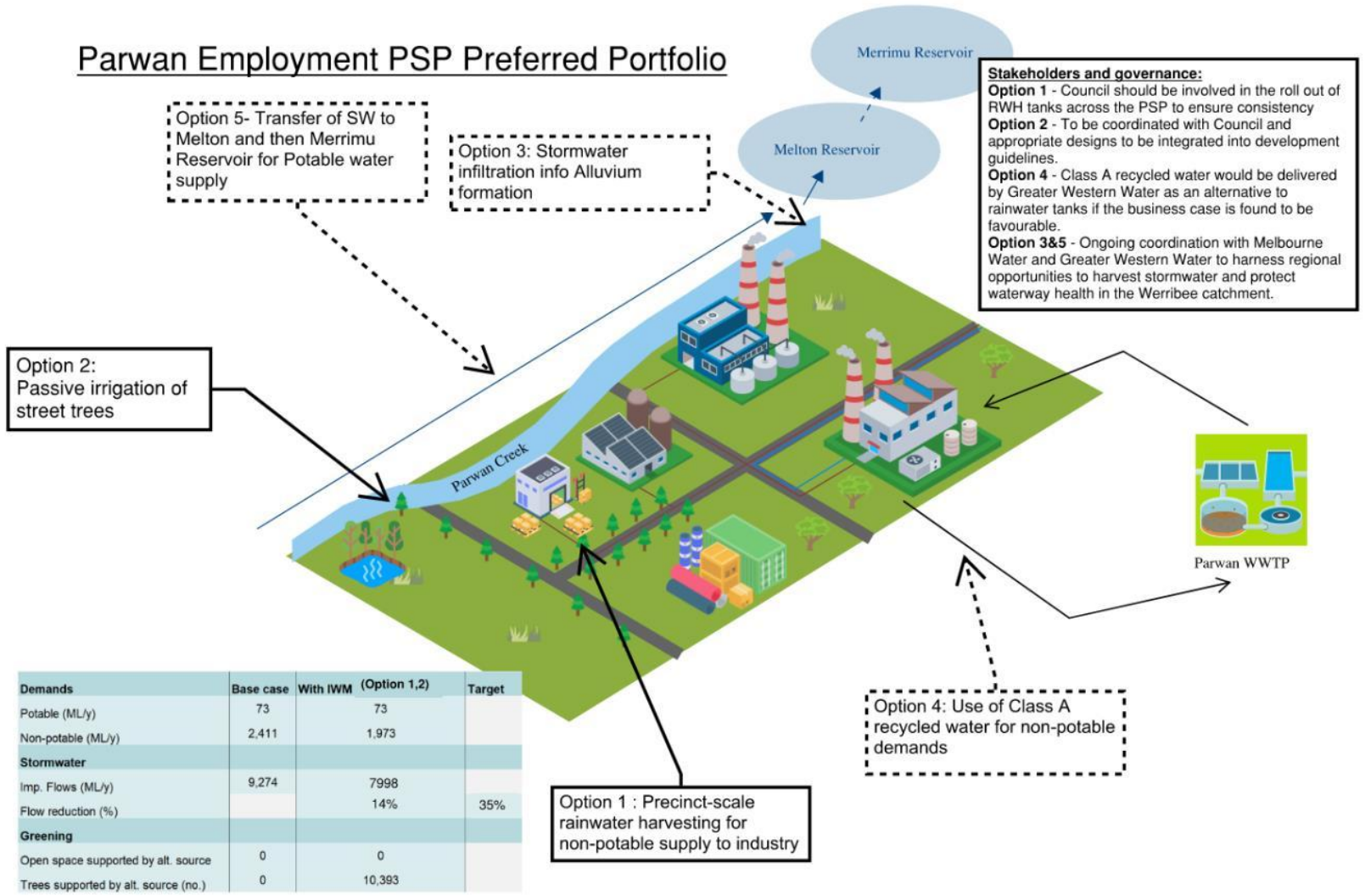
9.3 How the IWM opportunities support Ministerial Direction 22: Climate Change Consideration

As mentioned in the options assessment, the recommended options support climate change mitigation and resilience. This section identifies how the recommended IWM options (Options 1 and 2) could support the Ministerial Direction 22 requirements (summarised in section 2.2.6) for climate change consideration, and also where there may be limitations. Table 2 below summarises how these options support the requirements for clauses 5 and 6.

Table 2

Parwan Employment PSP IWM Options	How the Option supports Ministerial Direction 22: Climate Change Consideration
Option 1: Precinct-scale rainwater harvesting for non-potable supply to industry	**Clause (5): Minimising greenhouse gas emissions:** Precinct-scale rainwater harvesting is primarily a water-efficiency measure, and based on the requirements under clause 5, it does not directly support the objective. However, it can indirectly contribute to minimising greenhouse gas emissions by reducing demand on high-energy potable water supply systems and by enabling the potential use of renewable-powered pumps or controls. These indirect benefits would only be feasible if this option is intentionally designed to integrate renewable energy as part of the precinct-scale rainwater harvesting scheme. **Clause (6): Increase resilience to climate change risks:** This option meets various aspects of this requirement, as precinct-scale rainwater harvesting for industry contributes to climate-change resilience by reducing reliance on potable water supply. While it does not directly address hazards such as bushfire, erosion, landslip, or coastal, it can offer marginal benefits in managing localised flooding by reducing stormwater runoff. In relation to clause 6(b), this option does not influence the location of development and therefore cannot avoid exposure to natural hazards; however, it is not expected to exacerbate existing risks and can be designed to remain operational during extreme weather events. With respect to

	clauses 6(c) and 6(d), the option aligns with these requirements as it is consistent with relevant State and regional planning policies and reflects the advice of water and natural resource management agencies.
Option 2: Passive irrigation of street trees with stormwater	**Clause (5): Minimising greenhouse gas emissions:** Passive irrigation of street trees using stormwater is primarily an urban greening approach and does not directly support with minimising greenhouse gas emissions. However, this option can provide indirect emissions-reduction benefits by improving tree canopy cover, which can reduce urban heat island effects and subsequently lower demand for energy-intensive cooling across the precinct. Overall, this option offers environmental and liveability benefits but only contributes marginally and indirectly to minimising greenhouse-gas emissions. **Clause (6): Increase resilience to climate change risks:** Passive irrigation of street trees using stormwater runoff supports climate resilience by enhancing urban tree canopy, which provides cooling benefits during heatwaves and reduces the severity of drought impacts on vegetation. As this option does not directly address hazards such as bushfire, erosion, landslip or coastal, it can contribute to clause 6 indirectly through mitigating localised flooding by slowing and dispersing stormwater runoff through retention in tree pits. Furthermore, this option aligns with the relevant State and regional planning policies promoting IWM, urban greening and climate adaptation, and is supported by natural resources and water management agencies due to its contribution to healthier and more resilience urban landscapes. Overall, this option enhances climate resilience in a way that is proportionate, practical and consistent with the requirements of clause 6.



Demands	Base case	With IWM (Option 1,2)	Target
Potable (ML/y)	73	73	
Non-potable (ML/y)	2,411	1,973	
Stormwater			
Imp. Flows (ML/y)	9,274	7998	
Flow reduction (%)		14%	35%
Greening			
Open space supported by alt. source	0	0	
Trees supported by alt. source (no.)	0	10,393	

Figure 9-1 Schematic of IWM solutions for Parwan Employment PSP

9.4 Next steps

The outcomes of this opportunity assessment have recommended a precinct scale solutions as well as continued work on regional initiatives. This has been based on available information and a qualitative and quantitative opportunity assessment of benefits. The estimated infrastructure requirements and benefits identified through this project have been developed based on a number of assumptions, and further investigation and consultation will be needed to refine and optimise outcomes, particularly costing and detailed design of the options within the developments in the PSPs.

Integrated Water Management is a continuous process and is led by different stakeholders at different phases throughout the entire 'IWM journey', from high level strategic directions through to conceptual analysis, to functional design, funding, and implementation. The development of this report was led by the VPA and the analysis is at the conceptual level, but IWM investigations and stakeholder collaborations continue post PSP process. The 'next phase' will be led by a different (or a consortium of) authority to further investigate the concepts developed by this process. As understanding of the options improve, further details such as timelines, adaptive pathways, costs, benefits, and design details can be established.

The following recommendations for next steps are:

- Inclusion of the IWM recommendations in the PSP documentation, and a requirement for developers within the PSP to document their integration of the IWM strategy as part of the planning application process, demonstrating integration of the recommended portfolio, or alternative options that would achieve equivalent outcomes. Council should refer develop IWM plans to Greater Western Water to review in accordance with their Developer IWM Guidance. Council should refer develop IWM plans to Greater Western Water to review in accordance with their Developer IWM Guidance.

- Continued and regular stakeholder engagement between Council, Melbourne Water and Greater Western Water, Traditional Owners, DEECA and local developers post PSP gazettal to understand the outcomes of any IWM investigations and to align agency positions on preferred IWM solutions. The Bacchus Marsh IWM working group should be maintained and a lead agency should be appointed to coordinate collaboration and engagement. In particular, updates should be made to the stakeholder group at key points regarding:

    - The evolving drainage solution under the drainage scheme, and implications for stormwater harvesting on or near site.

    - The outcomes of the recycled water optimisation study for the Werribee catchment and any proposals for recycled water networks from Bacchus Marsh RWP. Engagement may lead to identifying potential opportunities for joint business cases and synergies between projects, such as offtakes from proposed networks. Any changing priorities and policy, particularly as to how it affects any options that are not yet possible.

    - Implementation and adoption pathway for the recommended IWM options.

    - Engagement with interested developers to ensure a shared understanding of IWM requirements and outcomes from the outset.

Appendix A

Assessment Criteria

	Alternative water sources that substitutes potable mains water supply (ML/y)	Recycled water delivered to customers (ML/year)	Impact on fluvial flood mitigation (H/M/L)	Mean annual runoff volume reduction (ML/y)	Total Suspended Solids (TSS) prevented from discharging to receiving waters (kg/year)	Total Nitrogen (TN) prevented from discharging to receiving waters (kg/year)	Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways	New total number of passively irrigated trees	New area of public open space supported by an alternative water source (ha)	Opportunity to embed Traditional Owner values in the delivery of solution (H/M/L)	Blue-green infrastructure created by integrated water management as a proportion of total area (%)	Contribution to community literacy (H/M/L)	Alternative water supplied to agricultural production (ML/y)	Alternative water supplied to businesses and industry (ML/y)	Implementation, and complexity (H/M/L)	Resilience to extreme climate events (flood or drought) caused by climate change (H/M/L)	Relative land take (H/M/L)
0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	0-300	0-300	L	0-300	0-250,000	0-2,500	0-600	0-5,000	0-15	L	0-1	L	0-300	0-300	H	L	H
2	301-500	301-500		301-500	250,001-500,000	2,501-5,000	601-1,200	5,001-10,000	16-30		2-3		301-500	301-500			
3	501-1,000	501-1,000	M	501-1,000	500,001-1,000,000	5,001-7,500	1,201-1,800	10,001-15,000	31-45	M	4-5	M	501-1,000	501-1,000	M	M	M
4	1,001-2,000	1,001-2,000		1,001-2,000	1,000,001-1,500,000	7,501-10,000	1,801-2,400	15,001-20,000	46-60		6-7		1,001-2,000	1,001-2,000			
5	>2,000	>2,000	H	>2,000	>1,500,000	>10,000	>2,400	>20,000	>60	H	>7	H	>2,000	>2,000	L	H	L

Appendix B

Literature Review

The following table outlines work currently in progress or undertaken between the completion of the previous IWM strategy and now.

Name and year of document or workshop	Summary and key points
Parwan Employment Precinct Key Issues and Opportunities Paper by VPA (July 2022).	This VPA report summarised the key issues and opportunities for the Parwan Employment PSP. These are listed below Issues: • Ecological communities, wetlands and native vegetation of significance will require protection • Sensitive areas of aboriginal and historic cultural heritage significance should be retained in their current forms and rehabilitated • Existing drainage only cater for farming activities • Need for connectivity to local and regional businesses in Bacchus Marsh Irrigation District and the future Western Irrigation Network for greater synergy Opportunities: • High sensitivity of Aboriginal cultural heritage and post-colonial heritage can be protected and incorporated into the precinct as passive open space with pedestrian/bike paths connecting biodiversity and landscape features • Unique biodiversity features and values can be preserved and incorporated into the precinct. Notable landscape and visual features include wetlands and bushlands. • Council received fast-tracked funds for undertaking the service network planning study for electricity, water and sewer connections • VPA is undertaking the integrated water management study to inform the drainage strategy • Connectivity to local and regional businesses in Bacchus Marsh Irrigation District and the future Western Irrigation Network for greater synergy
Parwan Lava Cave Assessment by Golder (December 2022).	Golder Associates prepared a Geotechnical assessment of the Parwan Lava Cave on behalf of the VPA. The cave is 8 to 10m below level of land surface, is important for the occurrence of a newly described mineral and is of geological heritage significance. The key recommendation is a 10-meter buffer for any development or works, as a 'cave protection zone'. Activities causing vibration to the ground may require a larger buffer. Within the buffer, any development is to be assessed on impact to the cave. Voids were also found which may also be found in the PSP.
Recycled water network modelling by Greater Western Water – in progress	Greater Western Water is currently undertaking modelling for recycled water and stormwater across their servicing area, in order to assess the existing uses, demands, supply and optimise recycled water reuse. This is of particular importance as the BMID and Werribee Irrigation District (WID) will continue to grow and Greater Western Water is looking for a transition plan for both irrigation districts to recycled water.

The following studies have also been undertaken however were not provided or have not been reviewed as part of this study:

- Preliminary land use budgets for the PSP areas
- Land capability assessment by SMEC
- Water innovation ideas– work currently underway by Melbourne Water and Greater Western Water
- Priority wetland assessments by DEECA for Parwan Employment PSP
- Planning for Green Wedge and Agriculture is a study currently in progress by DEECA

Appendix C

Stakeholder Interviews

Arup undertook stakeholder interviews in December 2022 with the following organisations to seek updates on IWM options and actions arising from the Bacchus Marsh IWM Strategy (2021) across all the three PSPs:

- Melbourne Water
- Greater Western Water (and Colac Consulting regarding the Werribee system reconfiguration)
- Moorabool Council
- DEECA

Key findings from the interviews, that influence the options and their development, are outlined below.

Stakeholder	Summary and key points
Melbourne Water	• Melbourne Water is currently undertaking drainage plans for Merrimu PSP. Due to the difficulty in removing water from the escarpment, options for infiltration (combined with local ponds) are being investigated. MUSIC models have been set up and Melbourne Water are awaiting groundwater data. • Outfalls have been investigated. Outfalls towards the eastern side would be a high risk as there is a conservation area, impacting on ecological and cultural heritage values. Outfalls towards the southwest could impact an area with significant environmental and cultural values, including the presence of river blackfish and platypus. • Stormwater harvesting is an option, however it's important that downstream environments are protected. • Parwan Station and Parwan Employment areas are less challenging than Merrimu. It has a deeper basalt covering with an underlying Werribee formation. • Regarding Parwan Station PSP, there are no flow paths off of it. There are all piped flows down to the Werribee River or Parwan Creek. There is an option to outfall at the confluence of the Parwan Creek and Melton Reservoir • Infiltration, wetlands and depressions have not been investigated at Parwan Station. • Bingham Swamp is a high priority and should be retained. There is no clear guidance from an ecological perspective.
Greater Western Water (supplemented with an additional interview with Colac Consulting concerning the Werribee system Reconfiguration)	• Greater Western Water advised that they are currently undertaking detailed analysis and modelling to investigate where recycled water priorities are and what the plan is for recycled water in their service area. • The reconfiguration of the Werribee water system, and the optimal plan for recycled water supply across the region is currently being modelled by Greater Western Water. The options that could be considered include: ○ Supplying BMID from the Bacchus Marsh Recycled Water Plant (Class A recycled water). ○ Supplying the Werribee Irrigation District (WID) with wastewater from Parwan via the wider WIN network (though an alternative connection from Western Treatment Plant is also being tested) (Class B recycled water) ○ Supplying the PSPs (Class A recycled water) ○ Supplying open space irrigation throughout the PSPs (Class B recycled water) • An interview was also undertaken with Colac Consulting who is undertaking a modelling project for Greater Western Water, covering their sewer and recycled water infrastructure and optimising the recycled water network across the Werribee catchment. This includes looking at a transition plan for BMID and WID to recycled water. • Stormwater harvesting was trialed from Toolern to Melton Reservoir. This illustrated that there was limited capacity at Melton and stormwater was spilling.

Stakeholder	Summary and key points
	Whilst there is an opportunity to pump harvested stormwater back into the Merrimu reservoir the capacity of Melton Reservoir is to be considered. • Regarding potable supply, Merrimu Reservoir currently supplies Bacchus Marsh, however the existing WTP will exceed its capacity in 2035-2040. There are two options currently proposed for potable water supply. This includes: ○ Connecting the existing Pykes Reservoir to Merrimu – Pykes Reservoir is currently used for environmental flows and irrigation. It has a large catchment however is a small online reservoir and weir, just used locally. An existing small connection exists however a large pipeline would be needed to connect the two. ○ Connecting to the Melbourne drinking water system (via Pykes) – connect the two reservoirs to the Melbourne drinking water system to supply the growth areas.
Moorabool Council	• Moorabool Council advised that Parwan Employment will comprise agribusiness, industry, commercial and maybe even hydrogen production. Therefore its desired to have a reliable water supply here. Class A recycled water would be beneficial. • The Eastern Link could impact waterways in Parwan Employment and Parwan Station PSPs. Whilst IWM is supported, developers are hoping to get this approved first. • It was noted that east of Merrimu is long forest which is significant conservation park area. Any solutions should be mindful of water quality impacting area. • Council noted the difficulty with sodic soil. • Council noted their support of stormwater harvesting at a local scale and supportive of alternative supplies for open space irrigation. • Currently the strategy for the PSPs and the direction is not yet fixed. Council are keen to find a solution that balances a climate resilient supply, costs and operational and maintenance requirements. • A Landscape Design Manual has been adopted which includes street trees. • Regarding PSPs, Council's objective are regarding place making and greening, to bring basins into the centre and link stormwater harvesting to end uses. • Whilst rainwater tanks are supported there is also difficulty in implementation. Council is investigating how to best implement rainwater tanks.
DEECA	• It was highlighted in this meeting that all options are on the table currently. DEECA are not currently undertaking the discussed investigations however are engaged and involved in them. • DEECA advised that a non-potable (purple pipe) network would be beneficial for DEECA and Greater Western Water. • Greater Western Water are in the process of undertaking a sewer and recycled water mass balance for this whole region (as described above). • There is work underway looking at a stormwater harvesting scheme for Melton Reservoir. Possible options would be for this source to supply environmental flows and eventually water transfer to Merrimu for indirect potable reuse. • One key challenge raised was funding of IWM projects with multiple monetizable and non-monetizable benefits and beneficiaries.

Appendix D

Workshop outcomes

IWM constraints, drivers and opportunities identified from workshop

	Constraints	Drivers	Opportunities
Regional	• Presence of sodic soils will impact options for infiltration • Escarpment in the area • Declining inflows into Merrimu Reservoir • Storage constraints at Pykes Reservoir • Several small natural wetlands throughout Parwan Employment • Werribee, Lerderderg and Parwan waterways have Growling Grass Frogs, platypus, and significant fish species present	• Region supports BMID is key to Melbourne's food industry • Werribee and Lederderg River, and Parwan Creek experience significant environmental flow shortfalls and would benefit from increased baseflows • Returning water to the environment and/or Traditional Owners • Increased flow reduction target from the EPA stormwater guidelines (from 35% to 50%)	• Supplying Merrimu Reservoir with alternative flows • Entitlement exchanges between surface water and environment or Traditional Owners • Protecting and maintaining ecological values by controlling or providing additional flows (if required) • Increased infiltration and harvesting opportunities
Parwan Employment	• Industrial growth and water demand unknown • Area of imperviousness and hence, volume of stormwater runoff is unknown • Natural wetlands in addition to Bingham Swamp require further advice on values and retention • Some areas are distant from waterways, making stormwater discharge difficult • Bingham Swamp has high ecological value • Potable water network will be expensive to implement due to crossing rivers and a trainline • Infiltration will not be viable around the lava cave	• High non-potable demand in Parwan employment to maximise • Close proximity to Parwan Treatment Plant which can produce Class A water recycled water • High water demands from agribusinesses	• Allocate treated stormwater to the natural wetlands and Bingham Swamp for ecological outcomes • Supplying the zone with Class A recycled water from Parwan Treatment Plant • Reuse more stormwater onsite as discharge locations may be distant and expensive to implement • Large rooftop surfaces to harvest rainwater

Appendix E

Stakeholder Workshop Miro Board

ARUP

Victorian Planning Authority

Bacchus Marsh
IWM Opportunities

Wednesday 15th February 2023 9am - 11.30pm

2.5 hours

ARUP

THIS SESSION IS RECORDED

The recording is used only for the purposes of this project, so that we can check our notes, and share this material with people who couldn't be in the session.

Acknowledgement of Country

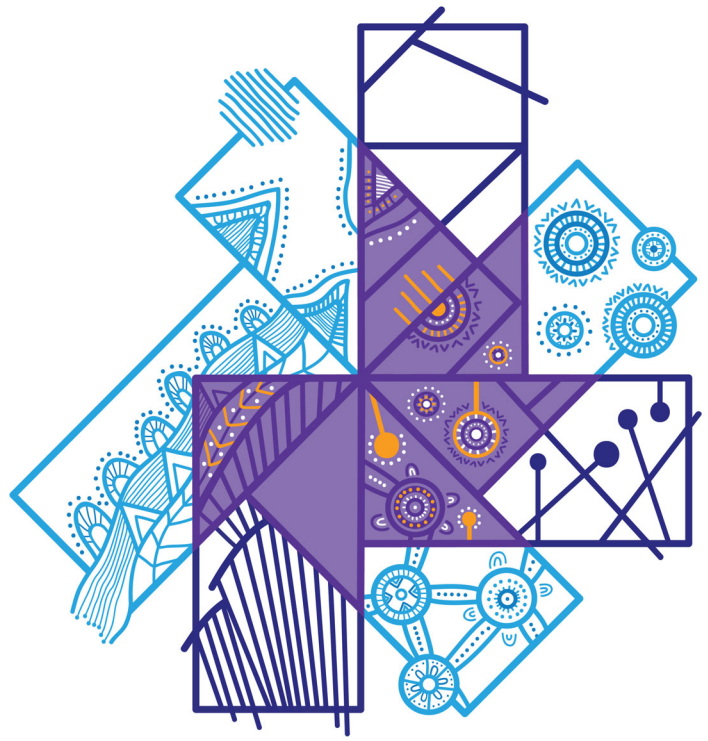
ARUP

We acknowledge the Traditional Custodians of the lands where we work and live, and of the places we will discuss together today.

We celebrate the diversity of Aboriginal peoples and their ongoing cultures and connections to the lands and waters of this country.

We pay our respects to Elders past and present, and acknowledge the Aboriginal and Torres Strait Islander people here, and their cultures and nations.

We acknowledge that Aboriginal and Torres Strait Islander tribes were the first sovereign Nations of the Australian continent and its adjacent islands, and possessed it under their own laws and customs.



Artwork: 'Shift to shape an even better world' by Gilimbaa artist, Tarni O'Shea

Our team

ARUP

Priyani Madan

Celeste Morgan

Ayisha Paw

Melissa Truong

Hayden Yu

Agenda

Welcome and acknowledgement (10mins)

Project overview (5mins)

Review of IWM constraints and opportunities (20mins)

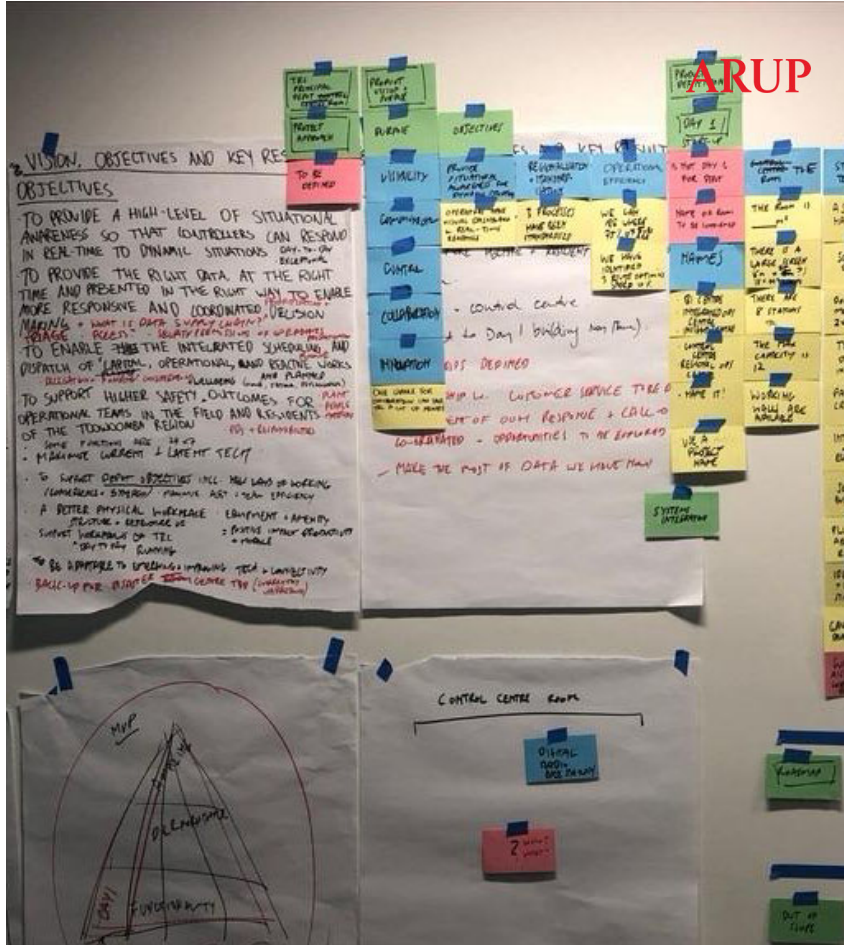
Previous options (10mins)

Current state of play (20mins)

Coffee break (15mins)

IWM Options and shortlisting (60mins)

Next steps (10mins)



Tech we'll be using today

- **Miro** for sharing content and capturing your ideas
- **Microsoft Teams** for video, audio, and chat

hello

Our link for today

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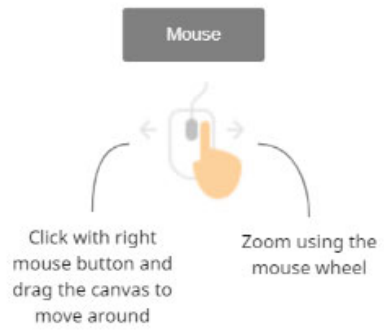
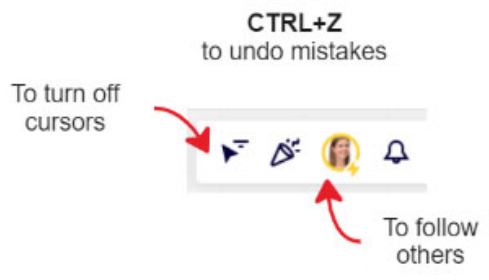
Navigating the board



Contribute with stickies

Double-click to edit!

Top tips



Introductions

Name
Organisation
Talk to me about

Monique So
VPA
Reviewing Water Report

Andrew Marshall, Principal Planner, Greenfield Strategic Development Melbourne Water.

Ayisha Paw
Arup
Talk to me about drainage, civils and soccer

Felicity Brown
VPA, Project Manager
Merrimu PSP

Steph Brown, DEECA
IWM team
(Werribee & Maribyrnong PM)

Jonathan Ho - GWW IWM team

Ian Pham
Melbourne Water - Drainage infr

Priyani Madan
Arup
IWM

Mel Truong
Arup
IWM

Sam Innes-GWW IWM Team

Stephen Miller
Melbourne Water
Stormwater engineer

Hayden Yu
Arup
Water

Katy Marriott - Melbourne Water
drainage planning- environment

Wira Yan - Melbourne Water - IWM

Ron Zhang
Moorabool Shire Council - Infrastructural Team

Paul Bezemer
Moorabool Shire Council

Talk to me about the general layout and land use of the area

Who's on the call

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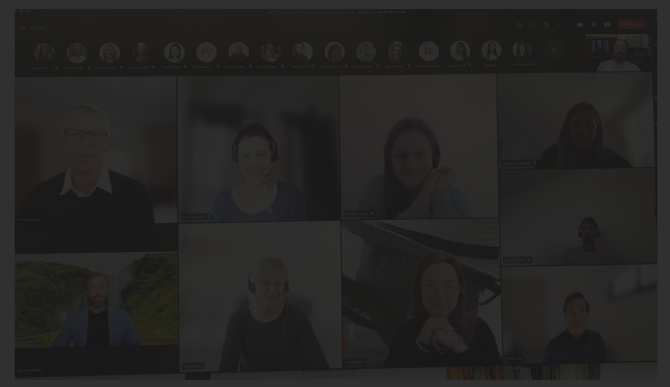

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Overview of the Project

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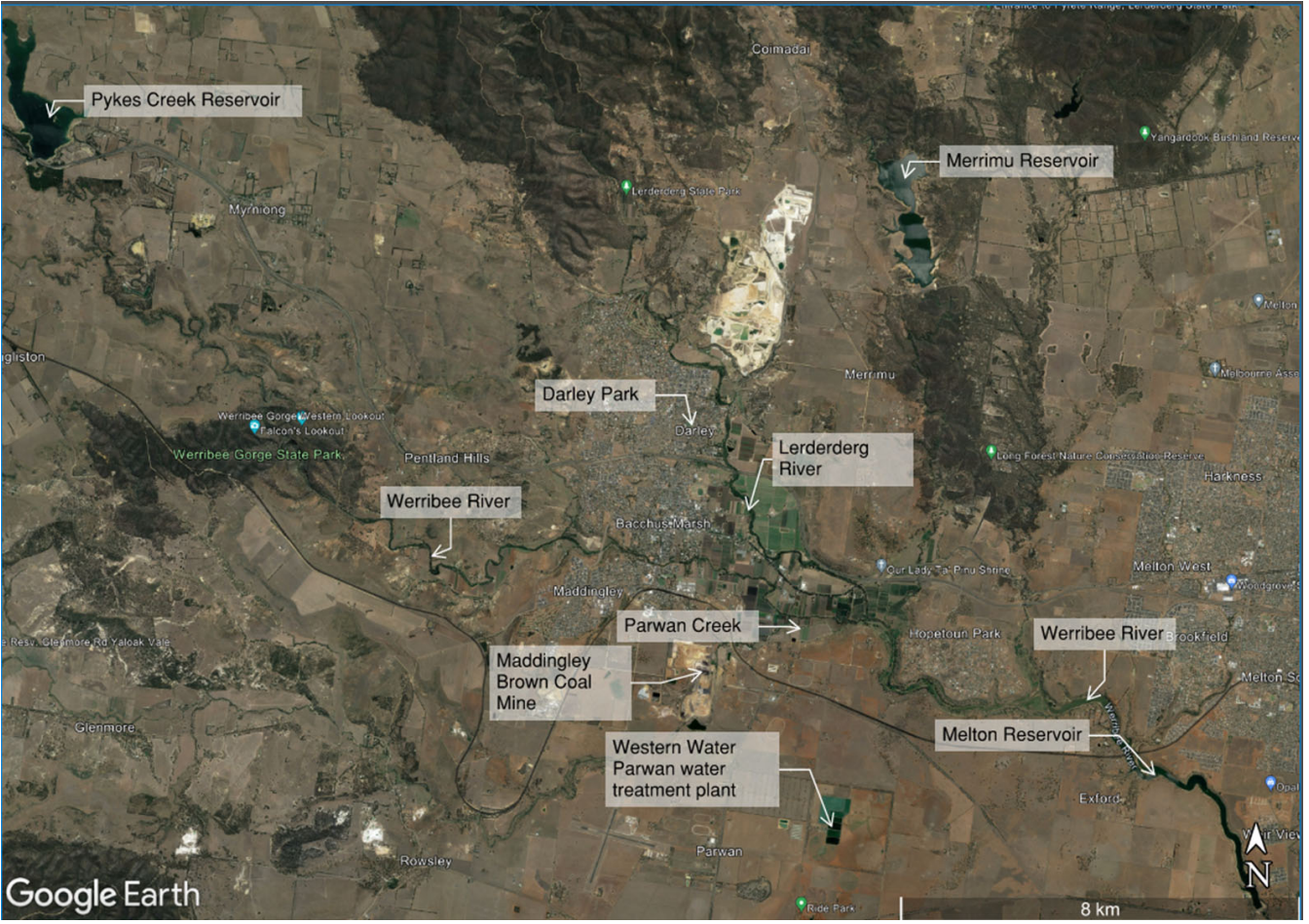
Regional Context: Key Features



Precinct Structure Plan areas

Merrimu
- 1,800 jobs
- 20,000 new residents
- Residential led
- 870ha

Parwan Station
- Mixed –use
- 10,000 new residents
- 900 new jobs
- Potential train station
- 472ha

Parwan Employment
- 1,500 new jobs
- 2,840ha

Minor comment: it's 2,480 ha instead of 2,840 ha

Comment - seems low - potentially older numbers - likely to be bigger than the numbers indicate. Numbers unknown at this stage.

Timing for Parwan Employment - VPA still working on staging/seq plan - first stage of development will be along BM road - predominately east west will be staging

Melbourne Water have been adopting a more conservative fraction impervious I.Pham

Prev was 60% - now using 70-80% for drainage infrastructure (for Merrimu)

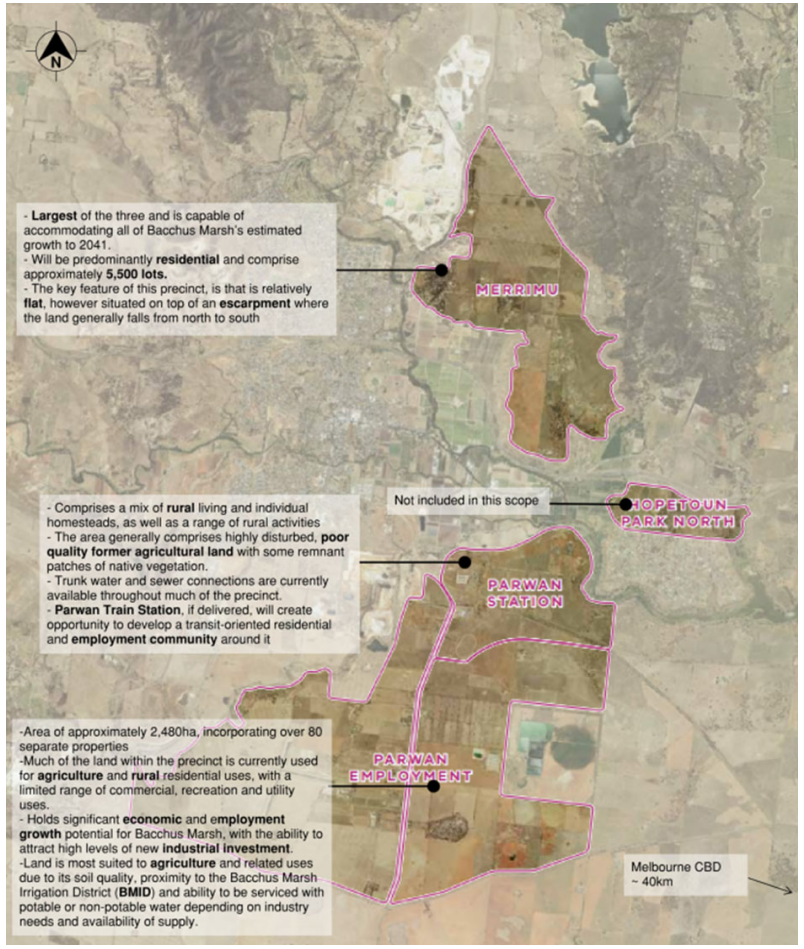
Parwans - also taking conservative approach - using combinations for different zones. Range from 70-90%. Industrial will be 90%. Uncertainy for agribuisness and aerodrome.

Exclusion zones, new open space?
For Merrimu - % is for areas that are only going to be developed. Offset from escarpments for example will be 5% only. The rest will all be the higher band.
For Parwans - similar. Coarse comparison between 70 & 90% and then eventually refine.

For Merrimu may have lower density than standard - would this change the conservative fraction?

Sizing large end of point infra so looking at safety for escarpment, so can ultimately use lower fraction but for the design will use the guidance.

Concious that this could overestimate the stormwater



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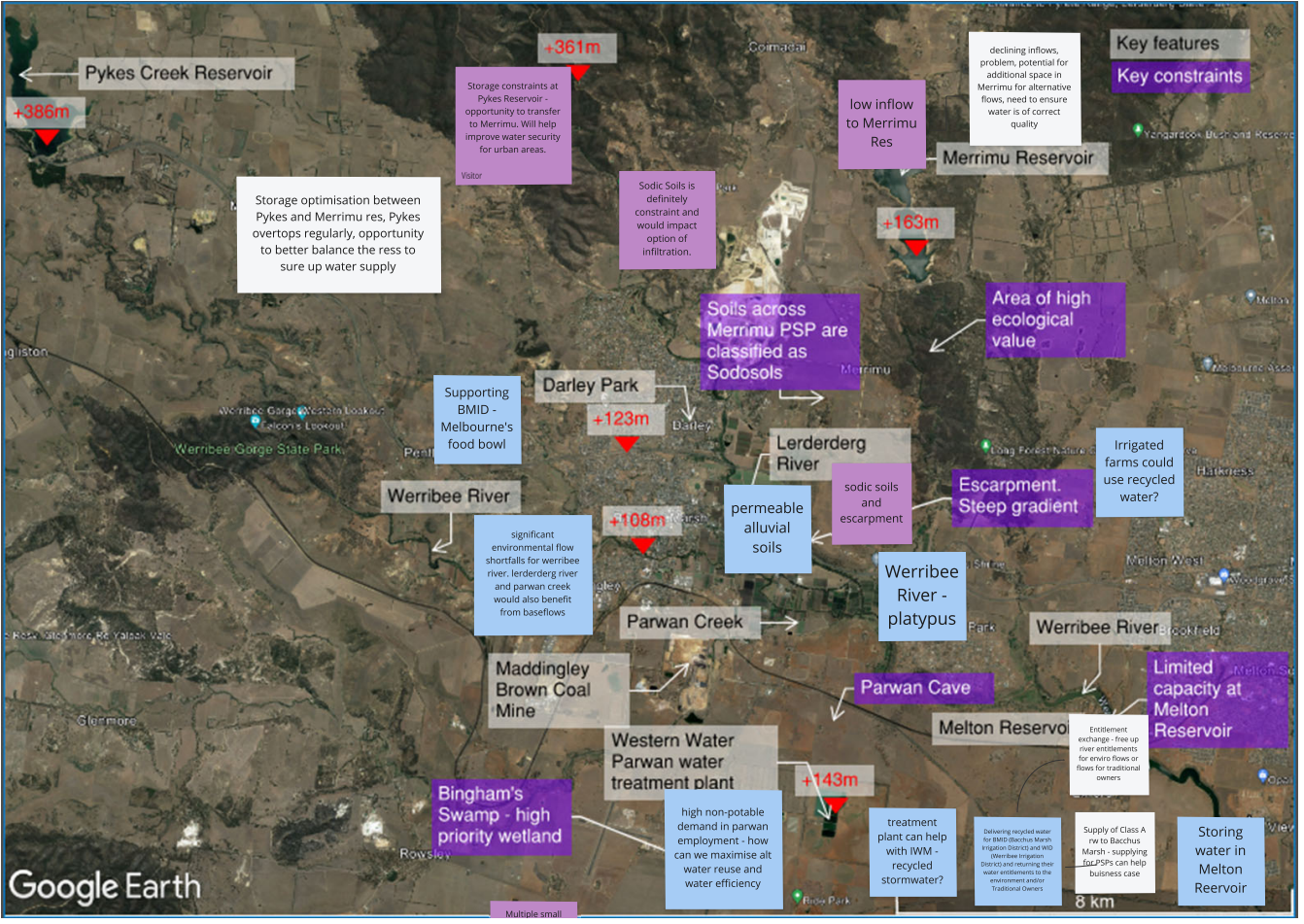
Review of IWM constraints and opportunities



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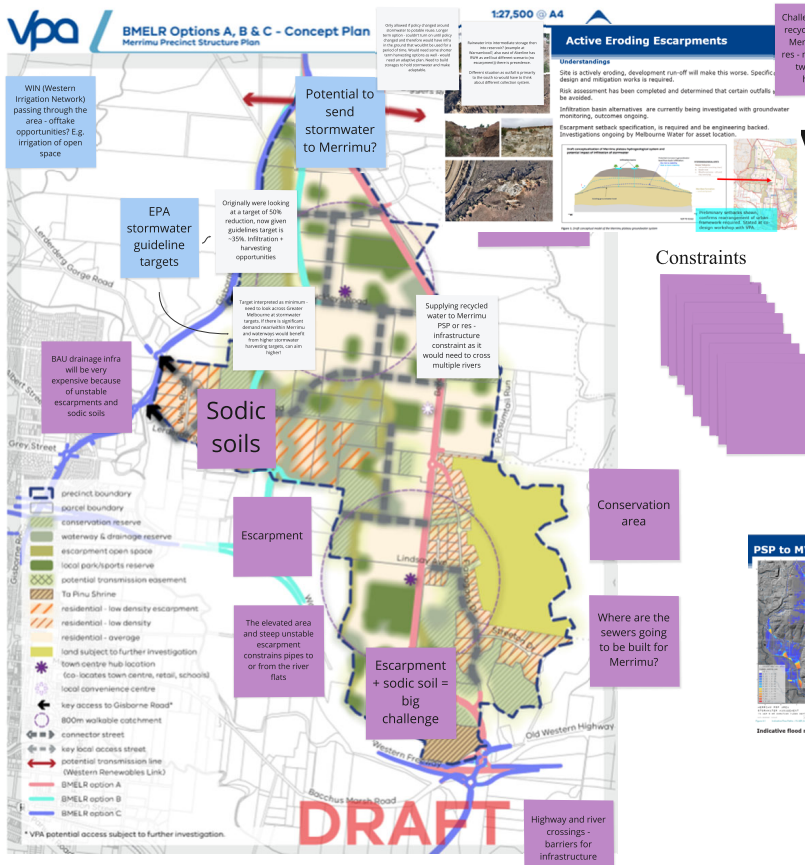
Regional Constraints and Drivers

Escarpments and challenges to retain water on top of plateaus (Merrimu currently very dry compared to lower lands)

Constraints

Drivers

WM Constraints and Drivers



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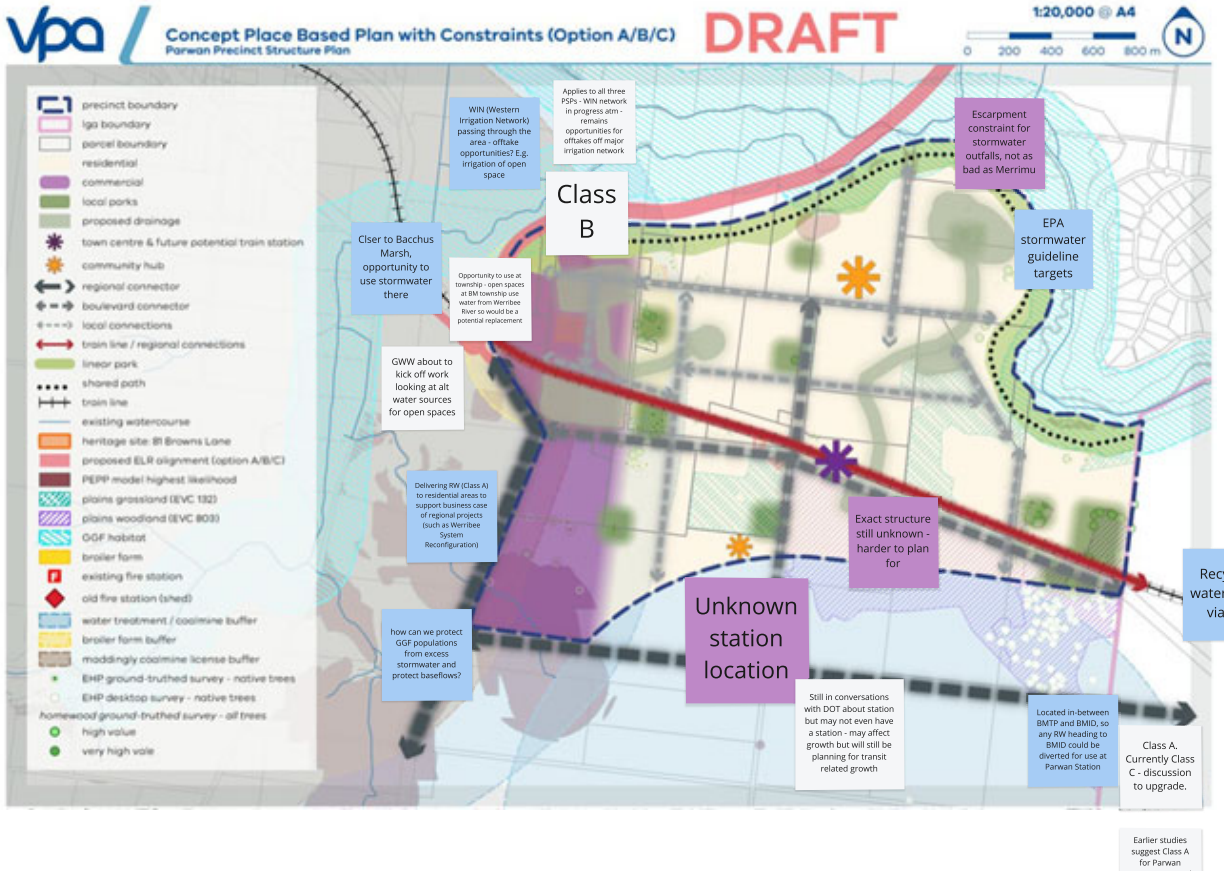

Risks

Drivers for IWM

Parwan Station

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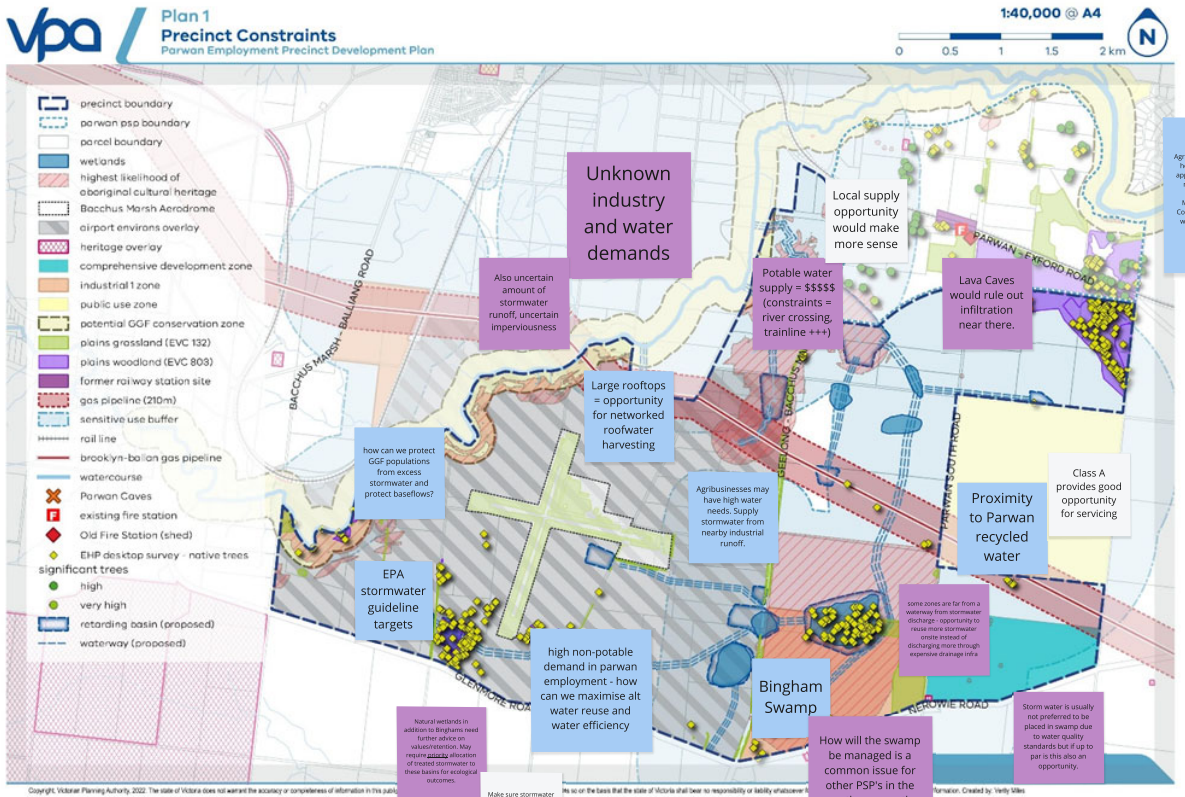
Plan 1
Precinct Constraints
Parwan Employment Precinct Development Plan
1:40,000 @ A4
0 0.5 1 1.5 2 km
N
precinct boundary
parwan psp boundary
parcel boundary
wetlands
highest likelihood of aboriginal cultural heritage
Bacchus Marsh Aerodrome
airport environs overlay
heritage overlay
comprehensive development zone
industrial 1 zone
public use zone
potential GGF conservation zone
plains grassland (EVC 132)
plains woodland (EVC 803)
former railway station site
gas pipeline (210m)
sensitive use buffer
rail line
brooklyn-ballan gas pipeline
watercourse
Parwan Caves
existing fire station
Old Fire Station (shed)
EHP desktop survey - native trees
significant trees
high
very high
retarding basin (proposed)
waterway (proposed)
BACCHUS MARSH - BALLIANG ROAD
PARWAN SCHOOL ROAD
BALLIANG - EXPRESS
PARWAN SOUTH ROAD
BACCHUS ROAD
PARWAN ROAD
Unknown industry and water demands
Also uncertain amount of stormwater runoff, uncertain imperviousness
Potable water supply = $$$$$ (constraints = river crossing, trainline +++)
Local supply opportunity would make more sense
Lava Caves would rule out infiltration near there.
Large rooftops = opportunity for networked roofwater harvesting
how can we protect GGF populations from excess stormwater and protect baseflows?
Agribusinesses may have high water needs. Supply stormwater from nearby industrial runoff.
Proximity to Parwan recycled water
Class A provides good opportunity for servicing
EPA stormwater guideline targets
high non-potable demand in parwan employment - how can we maximise alt water reuse and water efficiency
some zones are far from a waterway from stormwater discharge - opportunity to reuse more stormwater onsite instead of discharging more through expensive drainage infra
Bingham Swamp
How will the swamp be managed is a common issue for other PSPs in the northern growth corridor.
Storm water is usually not preferred to be placed in swamp due to water quality standards but if up to par is this also an opportunity.
Natural wetlands in addition to Binghams need further advice on value/retention. May require priority allocation of treated stormwater to these basins for ecological outcomes.
Make sure stormwater allocations for enviro is priority - retaining and maintaining enviro values on site is priority
Agri-business potential high water users - however unknown until you deal with applicant about detailed plans - tricky to make broad / general assumptions.
Might need further work building on Councils work from 2018 to understand what it means to have 500ha of these businesses for water
Constraints
Drivers
Parwan Employment

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Previous work

Back at
10.35

Outcomes of the 2021 IWM Strategy

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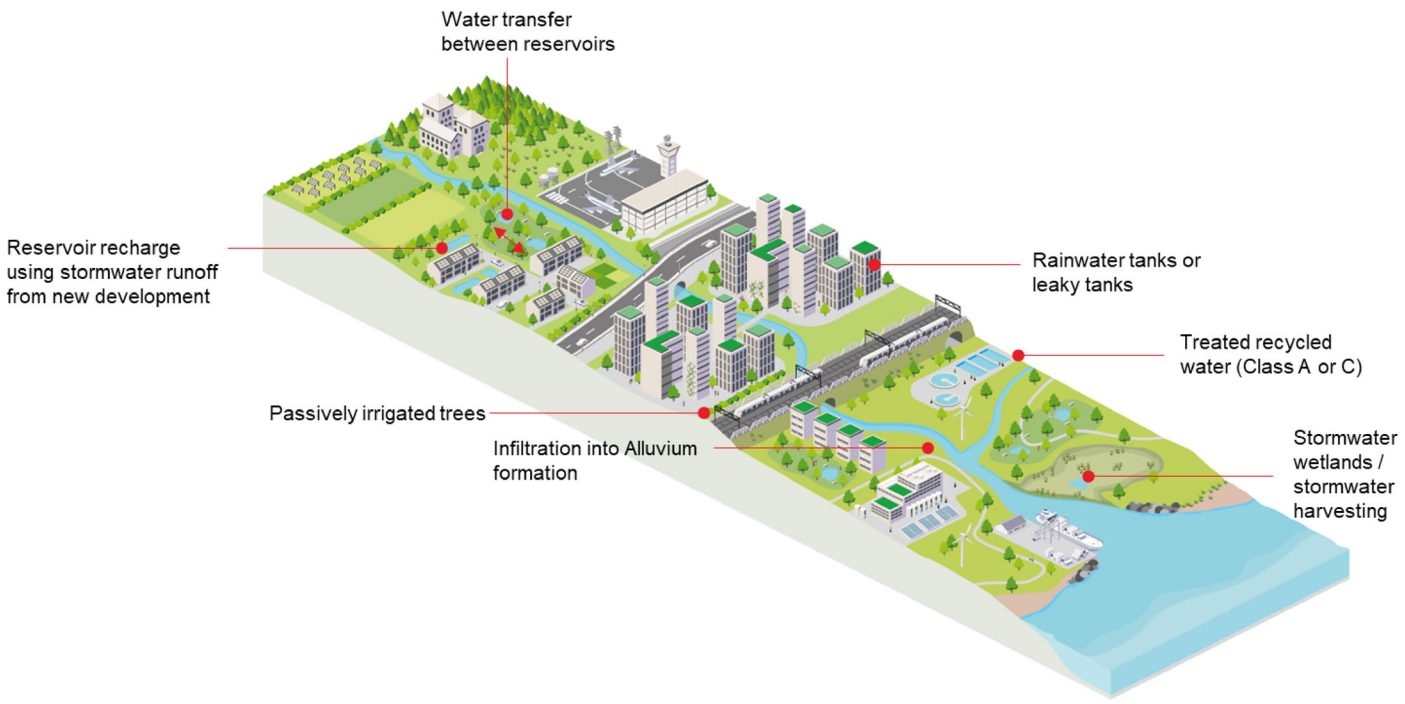
Variety of Options



Shortlisted Options 2021 Strategy

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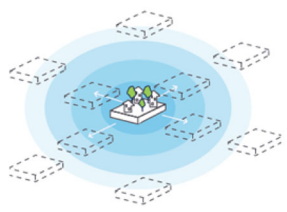
Local

1. **Rainwater tanks** to service non-potable demands in new developments
2. **Infiltration** through swales, leaky tanks, wetlands, and stormwater harvesting
3. **Stormwater** harvesting for Darley Park, using a wetland (in the existing town of Bacchus Marsh – not in the three PSPs)

Regional

4. End of Line **infiltration** into the highly **permeable alluvium** formation
5. Creation of a **Class A recycled water** treatment facility at **Parwan** Wastewater Treatment Plant to service Bacchus Marsh Irrigation District (BMID), residential areas or future industrial demands in Parwan
6. Collect and **harvest stormwater from the new development** and either pipe it to Melton Reservoir, or let the flows runoff to the Melton Reservoir via the Werribee River



Catchment

7. Collect and harvest stormwater from the new development and transfer it to Melton Reservoir (as per solution 6). From there, **create a pipe between Melton and Merrimu Reservoirs**
8. Top up **Merrimu Reservoir using recycled treated water** from Parwan WWTP

1. Rainwater tanks on lot

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The installation of rainwater tanks for new homes would collect roof water to supplement non-potable household water demands such as water for toilets, gardens, and laundry while also contributing to stormwater management goals.

2. Rainwater tanks + Increased on-site flow reduction

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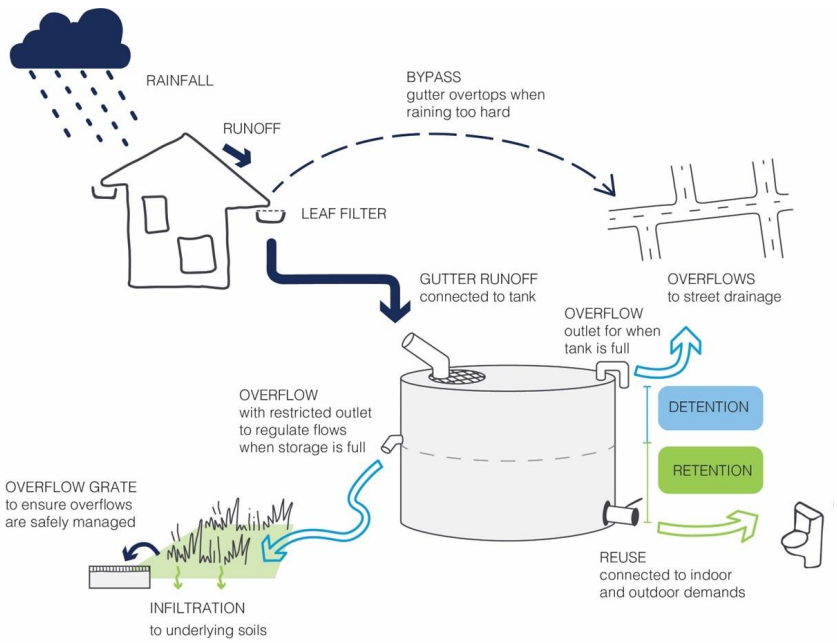

By increasing permeability in developed areas, runoff into the waterways can be reduced.

A. 25% flow reduction can be achieved using ‘leaky tanks’ that releases water to an infiltration area in a garden

B. With option A, 50% flow reduction can be achieved using passively irrigated trees, increased on-lot permeability, stormwater harvesting for local open spaces, and stormwater treatment wetlands.

3. Stormwater harvesting for Darley Park

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This option is within the existing town of Bacchus Marsh, and is not relevant to the IWM opportunities for the PSP areas.

4. ‘End of line’ infiltration of stormwater runoff

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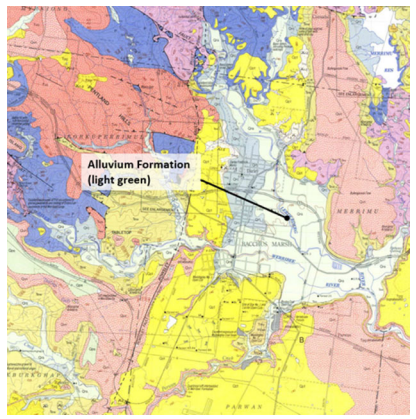

Making full use of the high permeability of the alluvium formation, swales can be used to capture treated stormwater and then used to recharge river baseflow. This option presents both passive and simple designs which can be readily deliverable.

5. Bacchus Marsh Class A recycled water scheme

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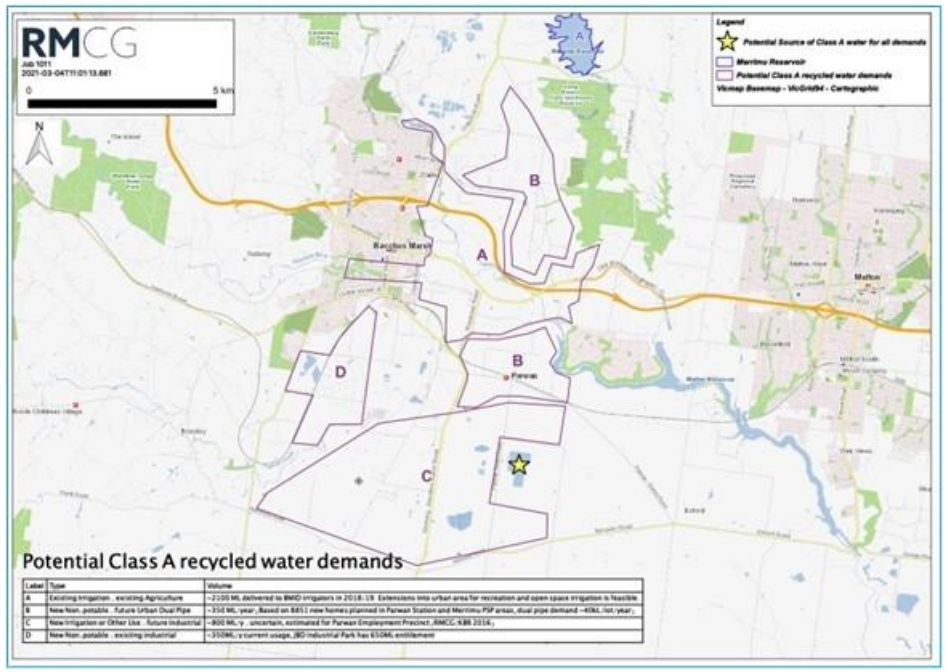

The creation of a Class A recycled water treatment facility at the Parwan wastewater treatment plant and a distribution network would allow for supplementing water used in irrigation for the Bacchus Marsh Irrigation District (BMID), residential and potential industrial demands.
Sub-options tested to consider viability of servicing PSPs, industrial area and BMID.

6. Stormwater for BMID irrigation supply

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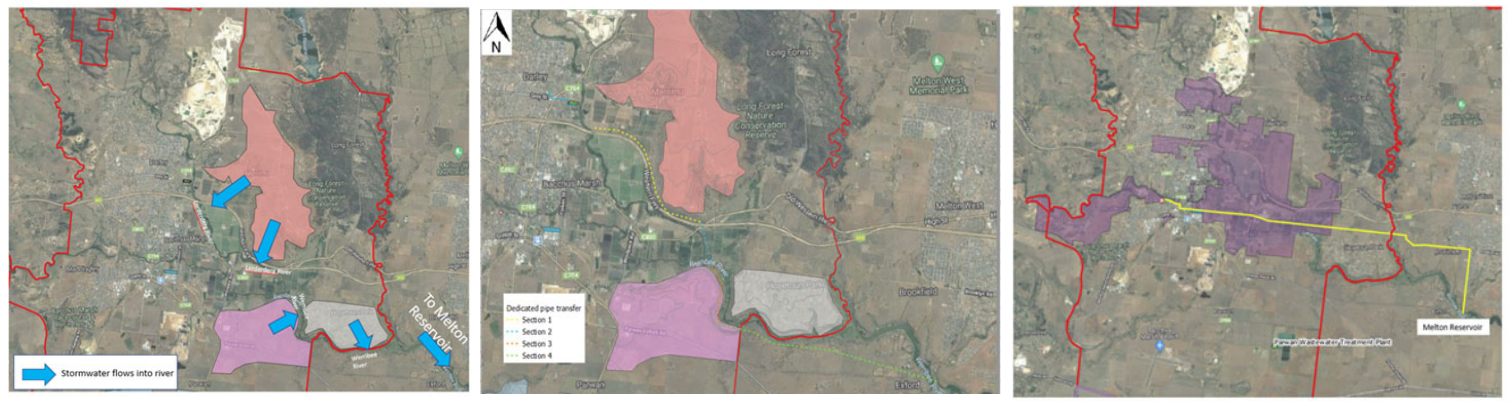

In this option, stormwater would be harvested around new development areas which would then be used for irrigation in the BMID. The two variations of this option examine how the stormwater is harvested.

A. Treated stormwater from the development areas would be released to the Lerderderg and the Werribee River and then flow into the Melton Reservoir

B. Treated stormwater would be transferred via pipe to the Melton Reservoir, thereby bypassing and protecting the downstream waterway.

7. Stormwater to supplement regional water resources

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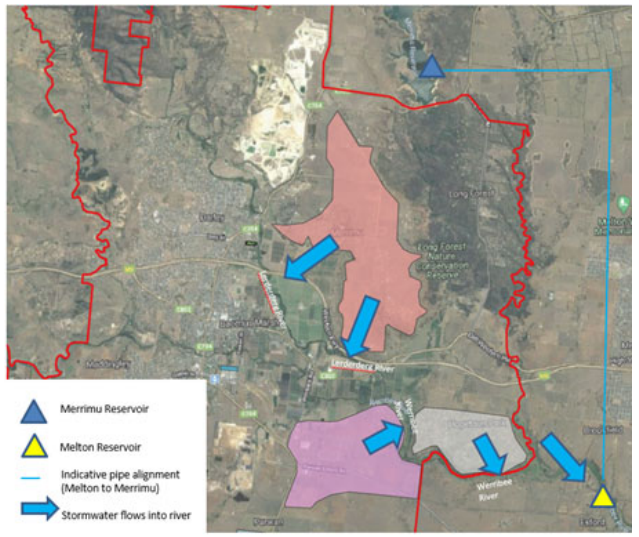

This option examines the opportunity to transfer treated stormwater from new development areas in Bacchus Marsh to Melton Reservoir and then transfer the stormwater to Merrimu Reservoir to supplement regional potable water supplies. The two variations describe how water would be transferred to Melton reservoir.

A. Stormwater that flows into the Lerderderg and Werribee River, would then flow to the Melton.

B. Stormwater would be piped towards the Melton Reservoir.

8. Recycled water to supplement regional water resources

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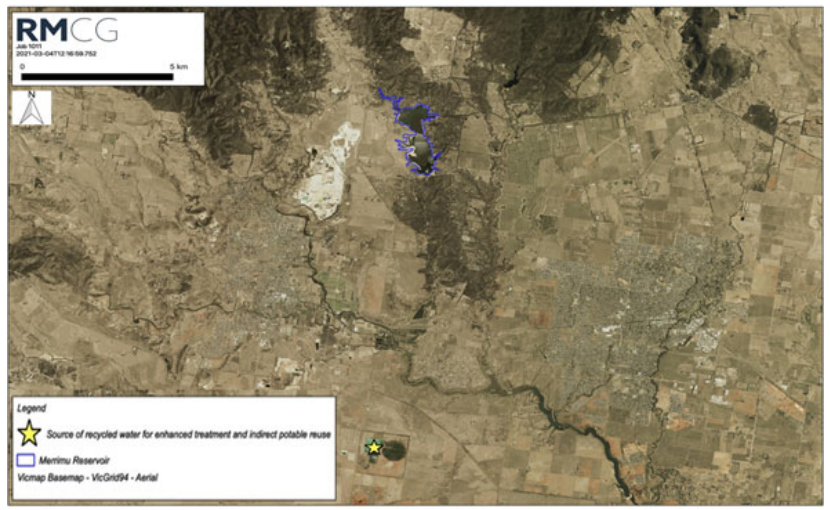

By treating Class C recycled water at Parwan RWP to a potable standard, the water may be pumped back into the Merrimu reservoir to supplement regional potable water use.

Evaluation scores from IWM strategy

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Option	Total Outcome Score	Benefit-Cost Ratio
1 Rainwater tank on lot	13	1.06
2a Rainwater tank + increased permeability	17	1.01
2b Multi-scale enhanced reuse and permeability	42	0.69
3 Darley park stormwater harvesting	8	0.64
4 End of line infiltration of stormwater runoff	17	14.82
5 Bacchus Marsh Class A recycled water scheme	40	1.10
5a Bacchus Marsh Class A recycled water scheme (BMID)	17	0.84
5b Bacchus Marsh Class A recycled water scheme (Dual pipe)	15	0.97
5c Bacchus Marsh Class A recycled water scheme (Industrial)	8	2.68
6a Stormwater for BMID irrigation supply (transfer in river)	20	1.60
6b Stormwater for BMID irrigation supply (dedicated separate transfer)	28	2.53
7a Stormwater harvesting to supplement regional water resources (transfer in river)	13	5.25
7b Stormwater harvesting to supplement regional water resources (dedicated transfer)	21	5.40
8 Recycled water to supplement regional water resources	10	1.66

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Current state of play

What's happened since the IWM Strategy?

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1. Updated studies in the area (land use, geomorphology, soil assessment)
2. Updated guidelines (PSP, EPA and IWM Plans)
3. Interview with stakeholders
4. Site Visit by Arup team

GMUWSS

CGRSWS

Water Is Life: Traditional Owner Access to Water Roadmap

Updated Studies

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- Sodic soils report (Merrimu), Coffey
- Merrimu Stormwater management strategy, Rain Consulting
- Merrimu IWM opportunities and stormwater report, Rain Consulting
- Merrimu MW VPA meeting, Melbourne Water
- Parwan, Merrimu and Parwan Employment Precinct Key Issues and Opportunities, VPA
- Parwan PSP Co-Design Workshop, Ricardo
- Parwan Lava Cave Assessment, Golder

- Drainage Schemes for Merrimu, Melbourne Water (*in progress*)
- Werribee Recycled Water Network Modelling, GWW (i*n progress)*

Updated Guidelines

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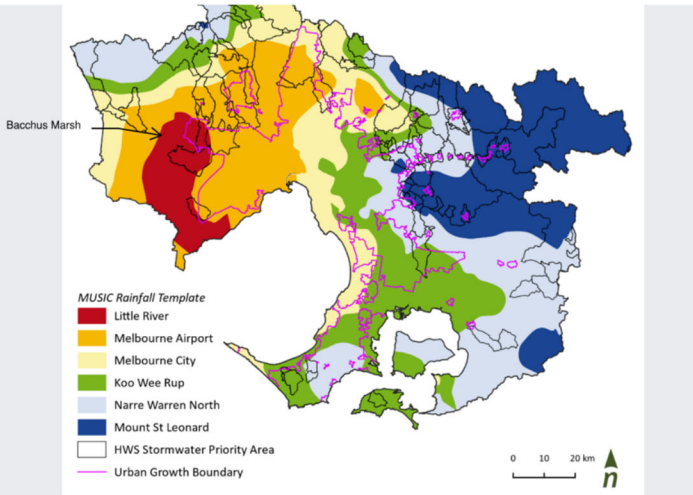
Updated Studies | Updated guidelines | Interviews | Site visit



Template Name	Annual rainfall range	Model annual rainfall	Runoff	Priority areas				Other Areas			
				Harvesting target		Infiltration target		Harvesting target		Infiltration target	
	(mm)	(mm)	ML/year from 1 impervious ha	ML/year from 1 impervious ha (and %)							
Little River	400 - 500	472	3.7	2.9	(79 %)	0.1	(4 %)	1.2	(32 %)	0.1	(3 %)
Melbourne Airport	500 - 650	575	4.6	3.4	(74 %)	0.4	(8 %)	1.4	(29 %)	0.3	(6 %)
Melbourne City	650 - 750	708	5.8	3.9	(67 %)	0.7	(12 %)	1.6	(27 %)	0.5	(9 %)
Koo Wee Rup	750 - 850	769	6.3	4.1	(65 %)	0.8	(13 %)	1.6	(26 %)	0.7	(10 %)
Narre Warren North	850 - 1100	932	7.8	4.6	(59 %)	1.3	(16 %)	1.8	(23 %)	1.0	(13 %)
Mount St Leonard	1100 - 2100	1221	10.6	5.3	(50 %)	2.2	(21 %)	2.1	(20 %)	1.8	(17 %)

To review: GMUWSS & CGRSWS - regional drivers

To review: Water is Life - Traditional Owner Access To Water Roadmap

To review: Draft IWM Action Plan (Steph/DEECA can give you a list of the draft actions)

Stakeholder Interviews

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Updated Studies | Updated guidelines | Interviews | Site visit

Key points

Site Visit

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Updated Studies → Updated guidelines → Interviews → Site visit

Escarpment, Merrimu

Parwan Station PSP escarpment

Bacchus Marsh Irrigation District

Merrimu Reservoir

Site Visit

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Updated Studies → Updated guidelines → Interviews → Site visit

Merrimu PSP

Parwan Station PSP

Parwan Employment PSP

Feedback and Discussion

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Have we missed any documents, guidelines or reports that would impact IWM solutions?

Guidelines

new asset guidance being developed by MW to help achieve sw targets

Studies and reports

Anything else?

GMUWSS

CGRSWS

Water Is Life

IWM Action Plan: Draft Action List

Arup Workshop

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Coffee break

Barrack Place

What did we find?

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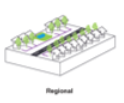
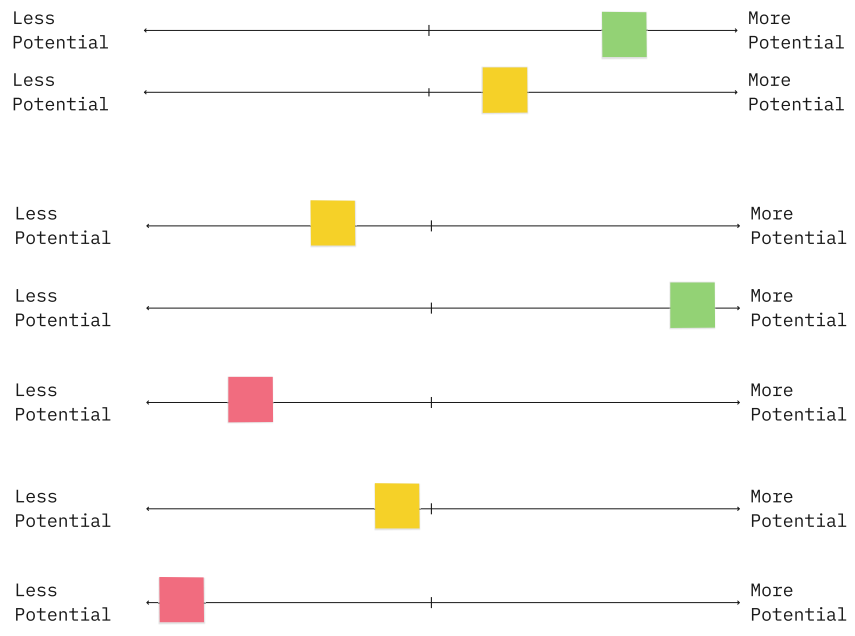
Evaluation of the original 8 options

1. **Rainwater tanks** in new developments
2. **Infiltration** through leaky rainwater tanks combined with on lot permeability, stormwater harvesting and street tree irrigation.
3. **Stormwater** harvesting for Darley Park, using a wetland



4. **Infiltration** into the **permeable alluvium** formation
5. Creation of a **Class A recycled water** at **Parwan** WTP to service BMID, residential areas or future industrial demands in Parwan
6. Collect and **harvest stormwater from the new development** and either pipe it to Melton Reservoir, or let the flows runoff to the Melton Reservoir via the Werribee River

7. Collect and harvest stormwater from the new development and transfer it to Melton Reservoir. From there, **create a pipe between Melton and Merrimu Reservoirs**
8. Top up **Merrimu Reservoir using recycled treated water** from Parwan WWTP



What did we find?

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Additional Options

1.	Stormwater harvesting for street tree irrigation	1. Raised as potential new option given local targets. Analysis of new option required or an “add on” to an existing option.	1
2.	Class B/C open space irrigation	2. Raised as alternative to Class A recycled water and residential reuse. Analysis of new option required.	2
3.	Local infiltration at Merrimu PSP	3. Raised as alternative to constructing transfers down the escarpments given challenges. Pending results of Melbourne Water investigation. Consider of Sodic Soils report.	3
4.	Local stormwater harvesting to Merrimu Reservoir	4. Raised as a potential previous option to review. Analysis of new option required. Consider infrastructure requirements including outfalls, pump sizing and installation, as well as ongoing operating and maintenance costs and energy requirements.	4
5.	Stormwater storages at previous mine site	5. The Maddingley Brown Coal Mine is an old mine site that now is an EPA landfill site, within the Parwan employment PSP. There is work undertaken at the site to rehabilitate the disused Star Dam into a habitat for endangered species. A potential option could be tying in stormwater harvesting with the existing site and utilising it for stormwater storage. Potential option raised from interviews. Likely to be major constraints to viability.	5

Comments and next steps

Potential

what about shandying stormwater and recycled water at parwan TP for non-potable demands

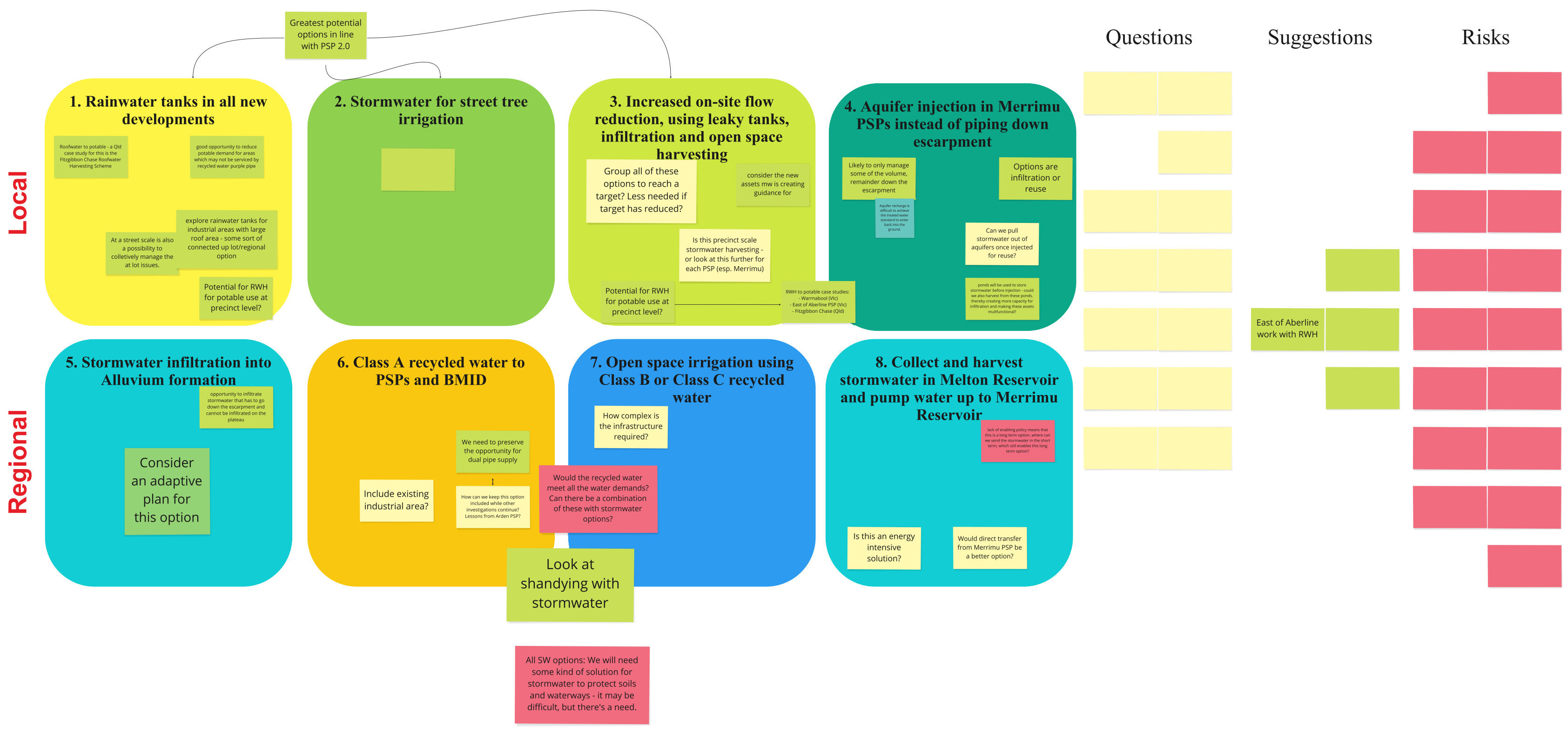
storage! with stormwater need larger storages. some connection of bypass flow may be a possibility. could potentially assist in the short term. long term could be an issue with competing water sources.

once water balance is done look at how these volumes could make a difference.

benefit - reduce salt content - good for irrigators

Discussion

Variety of Options



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Reflections and next steps

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Next steps of this project;

- Finalise Situational Analysis Report
- Develop a water balance for each PSP
- Options assessment
- Measure against Werribee IWM targets
- Opportunity recommendations and report

Considerations:

- Funding mechanisms and investment, O&M
- How IWM will be measured – links to Werribee IWM plan and targets

Option assessment framework

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Werribee IWM Plan Measures (project scale selection)

Other considerations:

- Land take and layout implications
- Implementation and delivery
- Policy support
- Alignment with other urban design, biodiversity and climate objectives

Program

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Part 1 –Assessment

UNDERSTAND → Hold

November - December

- 1.1 Inception meeting
- 1.2 Draft situational Analysis Report
  - Background review
  - Stakeholder Interview
  - Site visit and analysis
  - Situational analysis report

Draft Situational Analysis Report

Part 2 – Engagement and implementation

IDEATE AND PRIORITISE → Hold

January - February

- 2.1 Stakeholder Workshop
- 2.2 Final Situational Analysis Report

Final Situational Analysis Report

Stakeholder workshop

Part 3 – Draft Issues and Opportunities Report

TEST & DEVELOP → Hold

February - April

- 3.1 Draft Issues and Opportunities Report
  - Review initial IWM options
  - Updating Water Balance for each PSP
  - Indicators, targets and measures
  - IWM Opportunity Assessment
  - Opportunity Analysis- recommendations for the PSPs
  - Draft IWM Opportunities Report
- 3.2 Optional task- Cost-benefit analysis

Draft Issues and Opportunities Report

Optional cost benefit analysis

Part 4 –Final Issues and Opportunities Report

FINALISE

April

- 4.1 Presentation Meeting
- 4.2 Final Issues and Opportunities Report

Final Issues and Opportunities Report

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Close

Contact
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Priyani.Madan@arup.com