OFFICER SOUTH EMPLOYMENT PRECINCT

Integrated Water Management Strategy

Prepared For Victorian Planning Authority

April 2023

spiire

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Document Information

File Name:	Officer South IWMS
Version:	06
Date:	1 April 2023
Project ID:	308981

1. EXECUTIVE SUMMARY

Spiire Australia Pty Ltd have been engaged by the Victorian Planning Authority (VPA) to undertake an Integrated Water Management Strategy (IWMS) for the future Officer South Employment Precinct Structure Plan (OSE PSP), which is currently in the planning phase.

This report has been prepared to summarise the integrated water management (IWM) analysis for the Precinct. The report describes the proposed IWM interventions with consideration of stakeholder values and objectives and site specific needs of the area. This report has also been developed to align with the principles in the Department of Energy, Environment and Climate Action (DEECA - formerly DELWP) IWM Framework for Victoria, the Central and Gippsland Sustainable Water Strategy (SWS, 2022), the Western Port Strategic Directions Statement (SDS)(2018), and the principles of PSP 2.0.

The objective of this project is to understand how the water cycle will be managed under an integrated approach and identify a pathway to realising the benefits.

IWM Vision and Objectives

To develop options for improved water cycle management within the PSP, a vision and objectives for IWM were developed with the stakeholders through workshops and interviews. The following Stakeholders were engaged: Department of Energy, Environment and Climate Action (DEECA); South East Water (SEW); Melbourne Water (MWC); Cardinia Shire Council (Council); and the Victorian Planning Authority (VPA)

A Vision statement was developed with the Stakeholders during the first Workshop, building on the Western Port SDS (2018). The Stakeholders decided on the following statement:

Collaborating to deliver an innovative, affordable and sustainable, carbon neutral water cycle, that supports industry; provides protection of waterway, biodiversity and Western Port values; and facilitates a more resilient, engaged, and prosperous community that connects to the broader region.

The Objectives were similarly developed with the Stakeholders and align with the Western Port SDS as shown in the adjacent text and imagery. These were customised for the specifics of the local context of the Officer South Employment PSP with consideration to regional influences.

Options Development

A long list of IWM initiatives were developed, presented and tested with the Stakeholders. Due to the need to cater for current and future conditions the options fell into two main scenarios as follows:

- Good Practice IWM - covers embedding good practice IWM under the current frameworks and policy that govern water cycle management in Victoria.
- Leading Edge IWM (Future Framework) - intends to cover a longer-term outlook on the IWM options that would be viable under a potential future framework but may seem aspirational now (e.g. encompassing aspects like climate change and future policy changes.

Results

The selected options and performance based on water balance modelling against cost is shown below.

Safe, secure & affordable supplies in uncertain future	Increased use of non-potable water (fit for purpose & valued by community). Secure and resilient supply under all climatic conditions. Water is available to maintain valued green community assets. Water supporting economic growth.
Effective & affordable wastewater systems	Maximises waste-to-resource opportunities. Exceed public health and environmental outcomes
Opportunities are sought to manage flood risks and impacts	Mitigated / reduced flood risk to downstream users for nuisance flooding. Community, business and water systems are resilient to local flood risk and climate change. Stormwater drainage and WSUD assets are resilient and effective in mitigating a range of flood issues.
Healthy and valued waterways and marine environments	Vegetation, habitat and biodiversity values for waterways and the marine environment are protected and improve over time. Continuous riparian zones and high vegetation quality are maintained within natural waterways. HWS volume reduction targets are addressed. Stormwater and WSUD assets are resilient and effective, reducing pollutant loads to the bay and mitigating flood issues. Traditional Owner practices are integrated and protected
Healthy and valued green landscapes	Reduced urban heat island effect, landscapes retain moisture for cooler greener spaces. Recreation supported by water. Improved connectivity for active transport links & access to water assets. Community and local values are reflected and aboriginal cultural values are protected
Community values are reflected in place-based planning	Stakeholders and the broader community are knowledgeable, engaged, empowered and working together. Connections between the community, waterways and open space are maximised. Local emerging and legacy issues, are understood and managed. Diverse urban landscapes that reflect local values
Jobs, economic growth and innovation	Economic growth supported by water, innovative planning, strong governance and collaboration (support water quality trading). Common understanding at the catchment scale offset options. Traditional Owner actions under Water for Victoria on economic development have been implemented.

Scenario	Proposed IWM Opportunities	Volume Reduction Benefit (% of Healthy Waterways Target)	Cost $ / ML	Comments
Good Practice IWM	Passive irrigation Rainwater tanks Stormwater Harvesting – local scale	207 ML/yr harvested (6 %) 18 ML/yr infiltrated (4 %)	$7,162 / ML	High cost against the volume benefit. However, the options address other criteria such as supporting canopy cover targets and diverse landscapes for urban cooling.
Leading Edge IWM (Future Framework)	Regional Rainwater Tanks Stormwater to Potable / Environmental / Cultural systems - via Cardinia Reservoir Closed Loop System	4,249 ML/yr harvested (100 %) 18 ML/yr infiltrated (4 %)	$3,597 / ML	Achieves a better cost against volume benefit & addresses all other objectives including flood risk reduction. Levelised cost is competitive against other large scale sources (e.g. desal).

2. INTRODUCTION

Integrated Water Management (IWM) is a collaborative approach to water cycle planning, intended to provide improved outcomes for the environment and the community through integration of water management assets and approaches.

The Victorian Planning Authority (VPA) has engaged Spiire to explore IWM in the Officer South Employment PSP area. This report documents the requirements and assessments conducted to provide for a holistic approach to water cycle management, specific to the site and with consideration to the broader region.

This report has been developed to align with the principles in the Department of Energy, Environment and Climate Action (DEECA - formerly DELWP) IWM Framework for Victoria, the Central and Gippsland Sustainable Water Strategy (SWS, 2022), the Westernport Strategic Directions Statement and the principles of PSP 2.0.

The main phases governing the project is as follows:

- Phase 1: Inception
- Phase 2: IWM Policy Context & Site Situational Analysis
- Phase 3: Workshop 1 – Future IWM Scenario
- Phase 4: Water Balances and Workshop 2
- Phase 5: IWM Analysis Report

This report summarises the inputs, engagement with stakeholders, modelling and analysis that has occurred up to and including Phase 5.

Project Objectives

The overall objective of this project is to understand the various IWM initiatives and inputs feasible to the area to provide for a holistic approach to water cycle management, specific to the site and with consideration to the broader region.

Specifically, the objectives of this study are as follows:

- Understand the existing conditions at the site and the broader context of the region,
- Identify and consult with Stakeholders in the region to understand the local needs of the community and environment.
- Identify a shared vision and objectives for IWM in the Precinct,
- Identify meaningful IWM initiatives that meet this vision for inclusion into the PSP in collaboration with Stakeholders
- Undertake modelling and analysis to validate the feasibility of identified IWM initiatives such that the range of options can be narrowed down by the Stakeholders to two main options.
- To prepare an estimate of cost on which each of the IWM options can be compared
- Develop an Integrated Water Management Strategy based on the selected options.

In recognising that water plays a significant role in contributing to the development and liveability of new communities, the options contained in this report have been developed by local stakeholders.

3. WHY IWM?

What is IWM?

Integrated water management is a holistic approach to managing water and addresses all components of the water cycle in order to provide benefits to the community and environment. The adjacent diagram illustrates how IWM can be broken-down into its key components parts starting from the inside and moving outward. This wheel has been customised to the Officer South Employment Precinct's particular drivers (discussed later subsequent to the Stakeholder Engagement section).

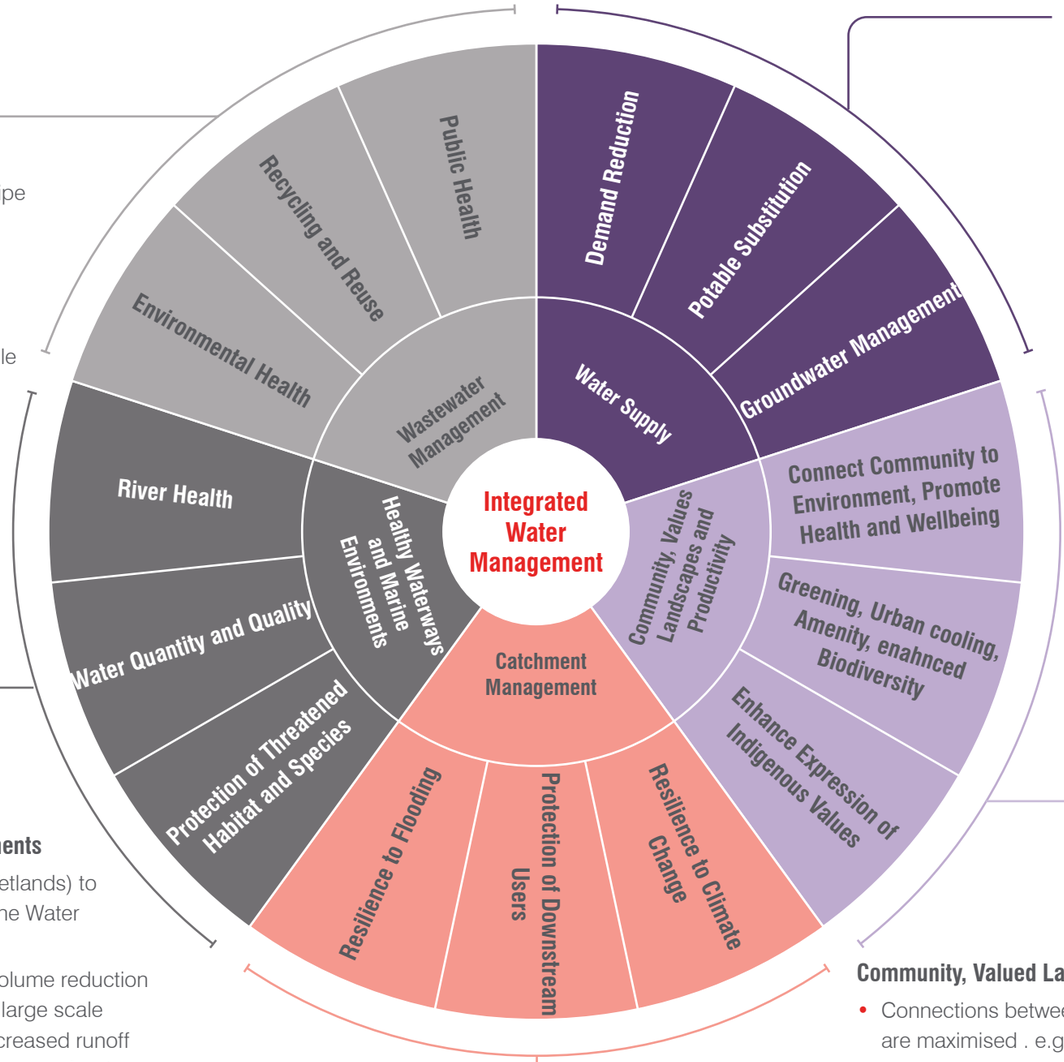
Why IWM?

Urban spaces are subject to increasing pressures due to climate change, population growth and increasing development density. Water services are expected to do more and more to service community and environment needs. A holistic approach and integrated options that satisfy raise the bar and satisfy long term requirements is increasingly necessary. For example, due to uncertainty around water supply caused by climate change, IWM seeks to diversify and decentralise water systems so that more resilient systems can be created. Climate change is a significant threat to water resources due to its impact on rainfall, which in general will cause a lack of rainfall or, conversely, too much of it at once. Both of these scenarios pose risk to water resources since a lack of rain reduces and threatens our water supply whilst flooding can devastative property, crops, and also contaminate water supplies, which also results in a threat to, the community, water supply and the environment.

IWM can mitigate these risks by reducing reliance on a single water source and utilising water more effectively through the implementation of innovative technologies. such as rainwater tanks, stormwater harvesting, and tree pits.

How can IWM be applied in Officer South?

There are multiple ways that IWM can be applied to Officer South. The text surrounding the adjacent diagram provides examples of how the key components of IWM can be approached when developing Officer South.



Wastewater Management

- Identifying alternative uses for treated wastewater, e.g. potential for a third pipe system.
- Standard sewerage systems will be provided to new premises.
- Potential "Closed Loop" system to be investigated, i.e. waste water to potable water.

Water Supply

- Identifying and developing alternative water solutions to reduce the potable water usage, i.e. rainwater harvesting for lots and stormwater harvesting for schools and ovals.
- Demand management including 5 star water and energy appliances to reduce water and energy use in households
- Investigation of an 'adaptive pathway' for 'stormwater to potable' water. The main example fo this in the area would involve pumping water to a newly created storage near Cardinia Reservoir and discharging the stormwater flows from the OSE PSP as environmental flows to Cardinia Creek until such time that legislation allows for stormwater to be pumped directly into Cardinia Reservoir.
- Explore the possibility of including Regional Rainwater Tanks in the PSP, within open space or drainage reserves.

Healthy Waterways and Marine Environments

- Large Scale WSUD assets (primarily Wetlands) to be incorporated as part of the Melbourne Water Development Service Scheme.
- Implementation of assets that enable volume reduction such as rainwater tanks, and local and large scale stormwater harvesting to reduce the increased runoff from development, whilst providing a source of water, e.g. stormwater harvesting for oval irrigation. Removing volume from downstream waterways is beneficial as it can protect species habitat in Cardinia Creek and provide flood mitigation in Gum Scrub Creek.
- Promoting Healthy Streetscapes through urban greening, trees and WSUD. Provides multiple benefits (reducing heat island effect, increased pollutant and volume removal)
- Passive Irrigation to provide the dual benefit of volume reduction and promoting increased trees.
- Provide enhanced habitat for Growling Grass Frog and fish species along creek lines.

Flood Management

- Flood mitigation and WSUD assets to be incorporated as part of the Melbourne Water Development Service Scheme that target a range of flood events (not just the standard)
- Large scale volume removal to reduce nuisance flooding in farmland
- Adherence to the requirements for discharge to the Koo Wee Rup Flood Protection District (KWRFPD)

Community, Valued Landscapes and Economic Productivity

- Connections between the community, waterways and open space are maximised . e.g. Melbourne Water DSS WSUD assets.
- Greener community spaces that reduce heat urban heat effect, increase amenity, and enhances shade, active water play and connections for biodiversity.
- Diverse urban landscapes that reflect local values
- Stakeholders and the broader community are knowledgeable, engaged, empowered and working together,
- Local emerging and legacy issues, are understood and managed
- Economic growth supported by water, innovative planning, strong governance and collaboration (support water quality trading)
- Traditional Owner actions under Water for Victoria on economic development have been implemented

4. SITE DESCRIPTION

The future Officer South Employment Precinct (OSE PSP) site is located in the in Melbourne's southeast growth corridor, approximately 65km southeast of Melbourne's Central Business District (CBD). At present, the site is largely used for agricultural purposes.

The site location is presented in Figure 1, shown in relation to the CBD. The OSE PSP is approximately 1,069 ha, bounded by the Princes Freeway to the north, Gum Scrub Creek to the East, the urban growth boundary and Patterson's Road to the south and Cardinia Creek to the west (as shown on Figure 2).

The area is characterised by three main watercourses; Cardinia Creek, Gum Scrub Creek and Officer South Drain (as shown on Figure 2). Another key feature of the area is that the site borders the Koo Wee Rup Flood Protection District (KWRFPD) to the south. Each of the watercourses have large upstream catchments of the order of 1,000+ ha and as result large flows traverse the site in the north to south direction. Flows from the site outfalls are conveyed in a southerly direction for several kilometres through the KWRFPD and ultimately to Western Port Bay which is a RAMSAR protected area.

In addition to the PSP area, the upstream catchments are undergoing development, which is increasing the volume of water to the PSP outlets. This is of concern for the receiving watercourses. In particular, Cardinia Creek is a high priority catchment in Melbourne Water's Healthy Waterway's Strategy (HWS)(2018) and is habitat to the Growling Grass Frog (GGF), Australian Grayling, and Dwarf Galaxia as identified in Conservation Area 36 in the Biodiversity Conservation Strategy. Gum Scrub Creek develops into a complex levee system downstream of the PSP and a high volume of stormwater can present flood risks to the existing landowners. This Creek also retains habitat for GGF.

Overall, the Officer South area has a number of challenges due the site location, topography of the land, waterways, and ecological considerations. A summary of the site challenges are as follows with visual representations and more details in the following sections:

- Flat terrain and
- Flooding downstream
- Large upstream catchments
- Major existing services (gas, Telstra, electrical);
- Shallow groundwater
- Sodic soils
- Heritage sites
- Extensive biodiversity values
- High value vegetation
- RAMSAR area downstream
- Priority waterway under the HWS (2018).

Figure 1: *Future OSE PSP site location*

5. EXISTING SITE SITUATIONAL ANALYSIS SUMMARY

An IWM Policy Context and Existing Site Situational Analysis Report was undertaken by Spiire in 2021 for the OSE PSP. The purpose of the document was to:

- Identify and understand existing constraints within and around the PSP area.
- Identify and understand opportunities within and around PSP area, from an IWM perspective.

The key areas that the document focused on were:

- Topography and catchments
- Stormwater and Drainage
- Water, sewer, recycled water
- Biodiversity, ecology and vegetation
- Heritage
- Ground conditions

These are described in more detail in Spiire (2021) and summarised below.

The following pages present further details around key areas of contributing catchments, downstream flooding, regional context, and constraints, however, for an in-depth understanding of the existing site conditions and constraints refer to the ESA report (Spiire 2021).

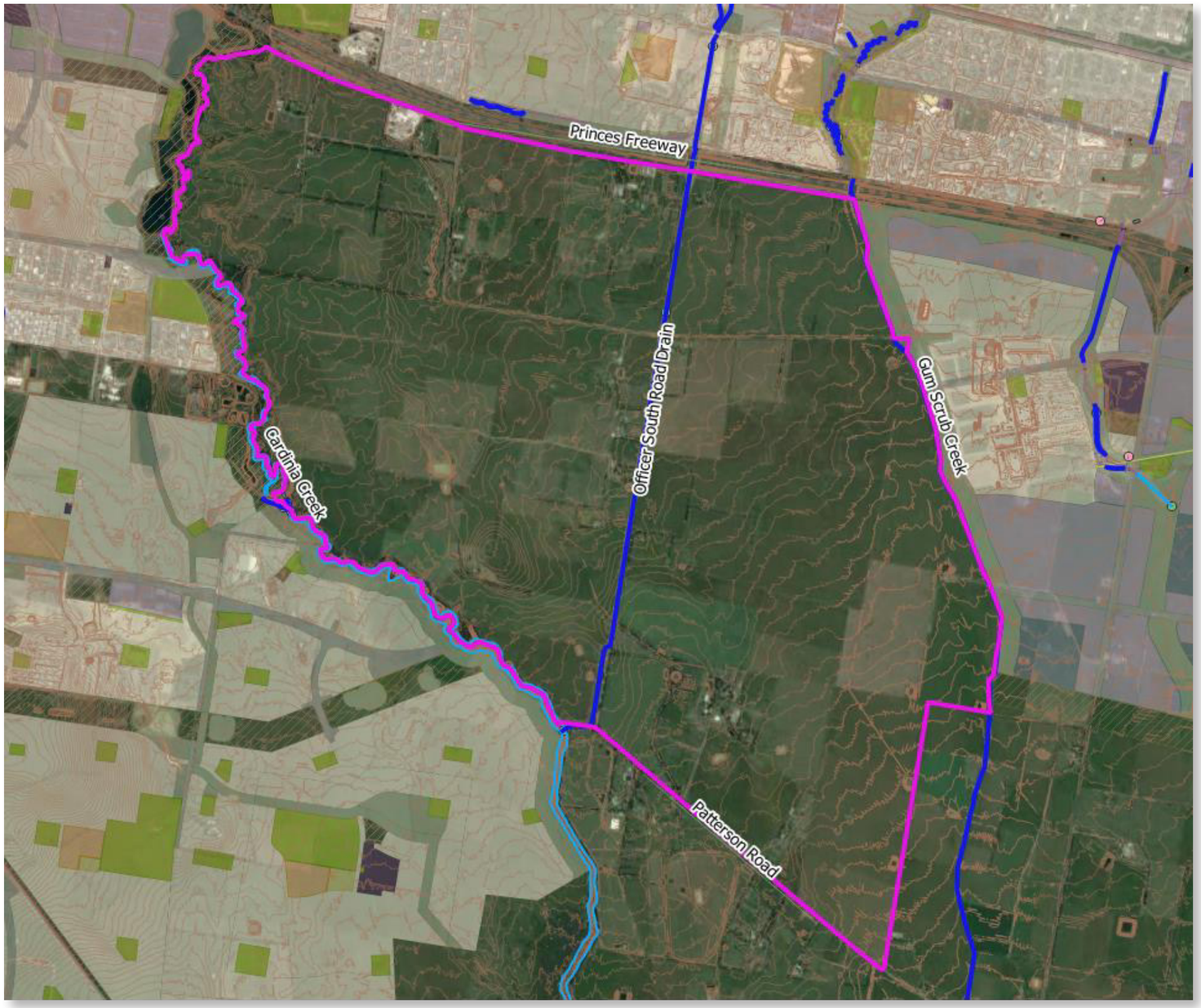


Figure 2: *Officer South Employment PSP site*

6. CATCHMENTS

The three drainage lines that define the OSE PSP all have large upstream catchments and signficant constraints. A summary of the catchment characteristics are presented in Table 1 and visual representation is provided in Figure 3.

The terrain is relatively flat, generally sloping northwest-southeast. Each of these drainage lines have large upstream catchments as stated in the table below. The table also summarises some key features and high level constraints of each catchment.

As mentioned in Section 4, and described in Table 1, Cardinia Creek is a priority reach under MWC's Healthy Waterways Strategy (2018). This means the reach is subject to certain catchment and stormwater treatment criteria (beyond the simple stormwater quality measures). This includes:

- The catchment is to remain < 3% Directly Connected Impervious:
- Volume reduction is to be 5.5 ML/ha/yr harvested and 1.9 ML/ha/yr / infiltrated.

Gum Scrub Creek is not a priority reach but also has volume reduction criteria, described in further detail later.

Table 1: *Contributing Catchment Summary*

Catchments	Total Catchment	Upstream Catchment Area	Key Features	Key Constraints
Cardinia Creek (CC)	9,188 ha	7,935 ha	• High priority reach within MW's HWS likely due to ecological values e.g. Dwarf Galaxias, Australian Grayling and Growling Grass Frog.	• High environmental values with recordings of several EPBC listed fish species.
Officer Catchment (OC)	1,529 ha	1,010 ha	• Rapidly developing upstream catchment. • Small roadside drain along Officer South Rd with low capacity.	• Highly constrained roadside drain to cater for low flows and a rural catchment. • Remnant vegetation along the channel. • Shallow groundwater table
Gum Scrub Creek (GSC)	3,397 ha	1,830 ha	• Rapidly developing upstream catchment. • Histroically a creek that has been cut drain into a small farmers cut drain that frequently spills	• Areas of Strategic Importance mapped across and in adjacent land. • Shallow cut drain

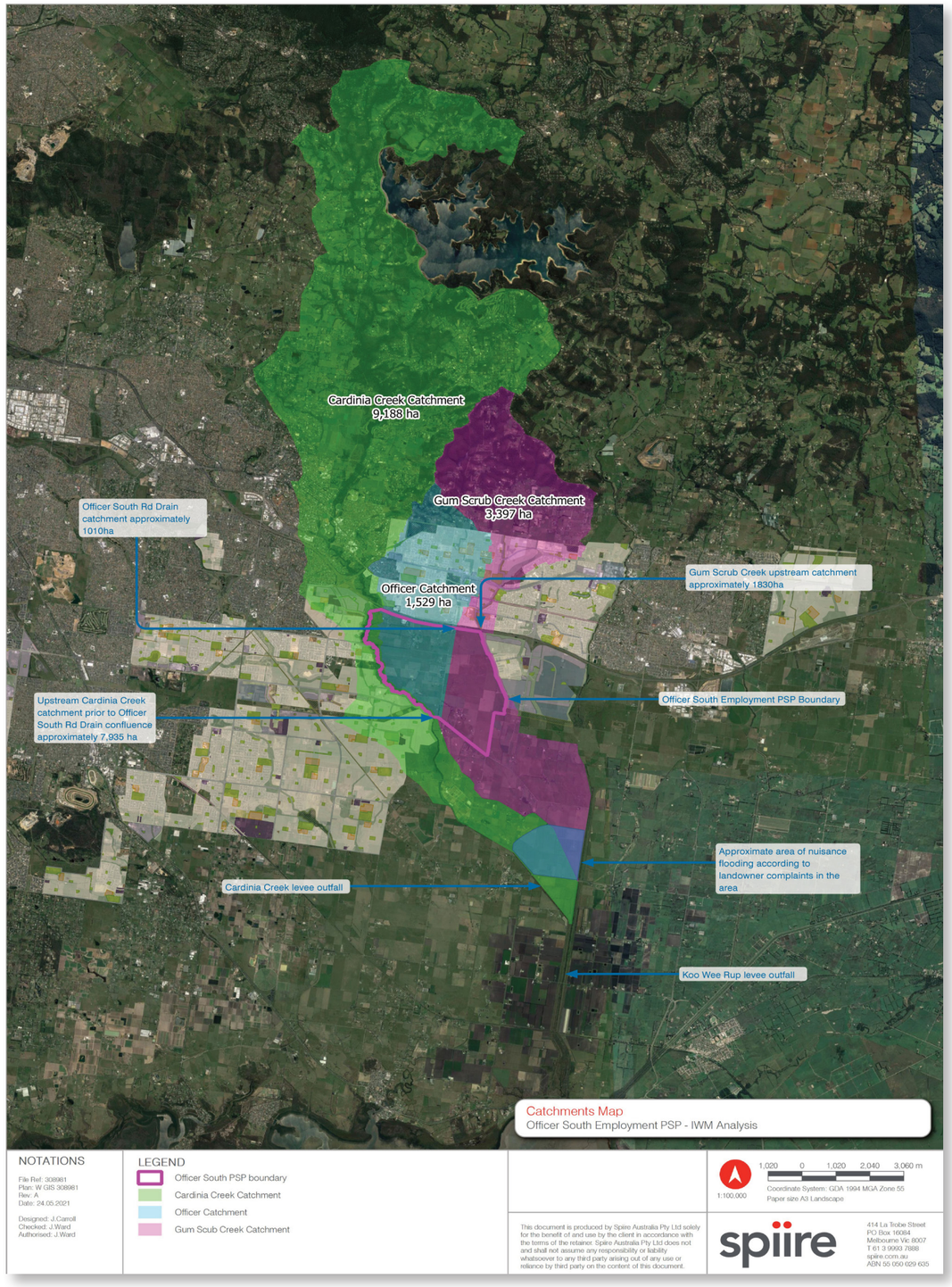


Figure 3: *Officer South Contributing Catchments*

7. OUTFALLS AND FLOODING

There is currently a Flood Overlay along Cardinia Creek and Gum Scrub Creek, the two creeks which border the site, covering the east and west boundaries of the PSP area.

A Land Subject to Inundation Overlay (LSIO) is also present in the PSP and covers the Officer South Road Drain and small breakaway flow at the southern portion of the drain. In addition, although not directly located in the precinct, the area to the south of the PSP is covered by a large LSIO indicating the the KWRFPD. The extents of these overlays can be seen below and in more detail in the Existing Conditions Map (Spiire, 2021). It should be noted that as part of the PSP process, the flood overlay along Lower Gum Scrub Creek is proposed to be amended.

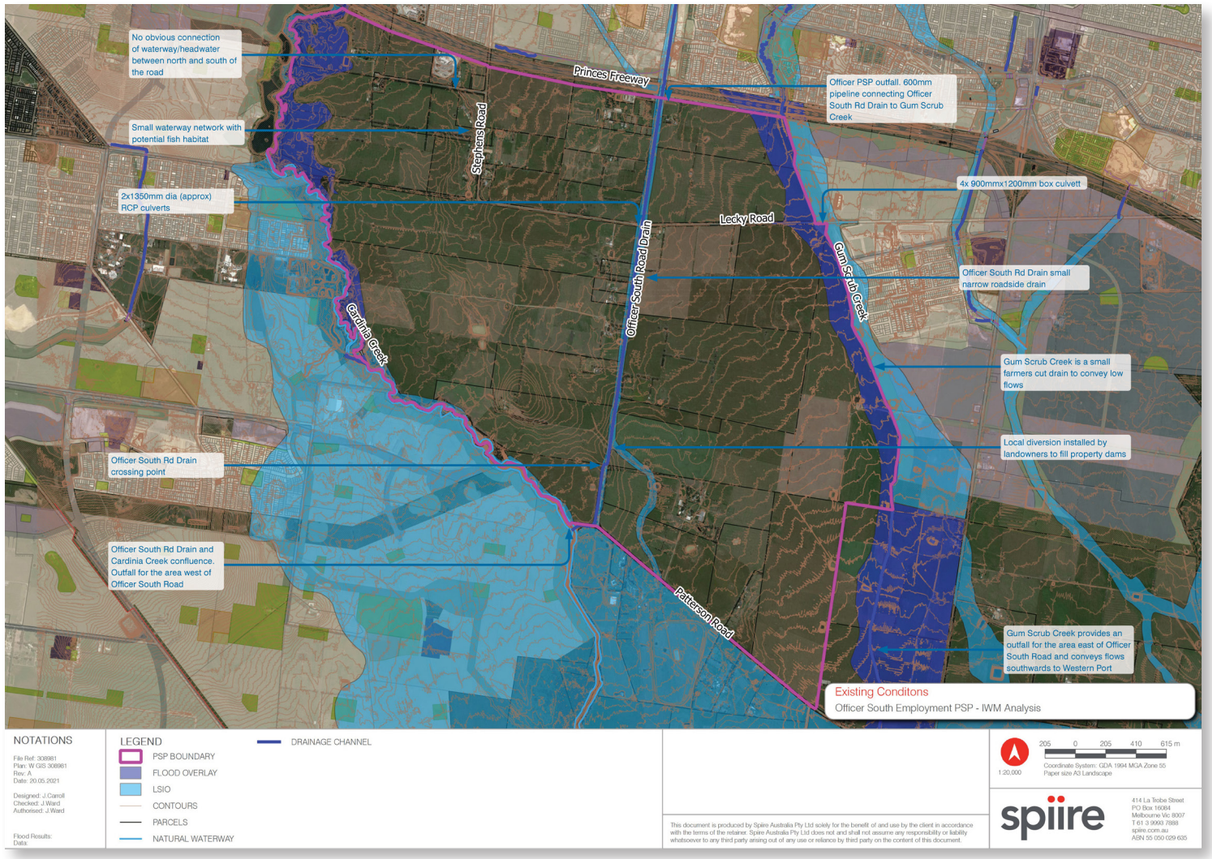


Figure 4: *Flood overlays and LSIO around PSP area*

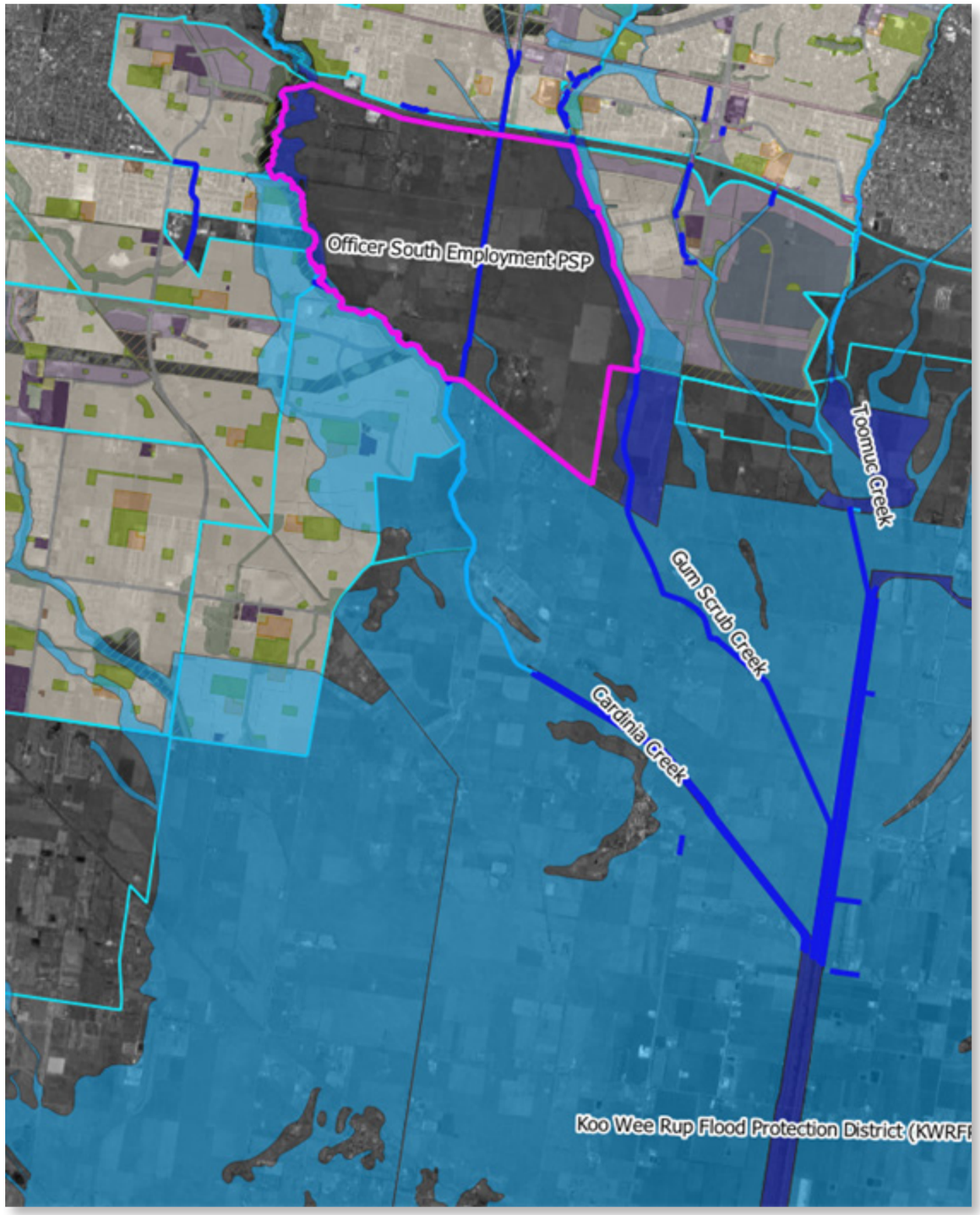


Figure 5: *Koo Wee Rup Flood Protection District*

8. REGIONAL CONTEXT

IWM can be realised at multiple spatial scales, and the regional context is important to understand in order to explore interfaces between the subject area and the region and also to understand significant water management features and infrastructure that may play a role in the optimal IWM Strategy.

The significant key water features in the region are:

- Cardinia Reservoir
- Eastern Treatment Plant
- Pakenham Water Recycling plant
- Bunyip Food Bowl
- Desalination pipeline
- Marine outfall via the Eastern Treatment Plant

These are shown conceptually on Figure 6.

Cardinia Reservoir is located ~12 km north of the Precinct. This reservoir receives water from Silvan Reservoir and the Victorian Desalination Plant, and has a 5 ML/day passing flow requirement to maintain downstream flows to support environmental values. In addition to supplying customers, Cardinia Reservoir also has the capacity to transfer water to areas serviced by Westernport Water and South Gippsland Water, and can transfer water back to Silvan Reservoir (Silvan) to the wider Melbourne network. Water is supplied to customers directly from Cardinia Reservoir through the Cardinia Treatment Plant. All water in Cardinia Reservoir is held as potable water entitlement, there are no environmental or Traditional Owners entitlements currently in place.

The Pakenham Recycled Water Plant (RWP) is located to the east of Cardinia catchment. This RWP currently supplies Class A recycled water to agriculture in the Koo Wee Rup region. The capacity of the RWP is being upgraded to 12 ML/day in the near future, with plans to increase this to 40 ML/day by approximately 2030. Up to 25 ML/day of this water is being planned to supply Class A water to developments in the Cardinia catchment.

With the upgrade to the Pakenham RWP, South East Water are also investigating a marine outfall via the South East Outfall (SEO) at the Eastern Treatment Plant (ETP). A study is currently underway to investigate a new pipeline route to the SEO from ETP. The OSE PSP may be able to leverage this marine outfall for excess stormwater, however, a pipe duplication may be required to accommodate the different water supplies (stormwater versus recycled water).

Lastly, the desalination plant can provide up to a third of Melbourne's needs. As mentioned, the Cardinia Reservoir receives desalination plant water via a 2m pipeline that runs to the west of the OSE PSP.

These locations provide opportunities for excess stormwater to be delivered or disposed of or utilised.

Figure 6: *Regional Context Map*

9. INITIAL OPPORTUNITIES AND CONSTRAINTS SUMMARY

A summary of the opportunities and constraints that were established in the IWM Policy Context and Existing Site Situational Analysis Report (Spiire, 2021) is provided in Table 2. The constraints are shown visually on Figure 7.

Table 2: *Initial Opportunities and Constraints Summary*

Aspect	Description	Constraints	Opportunities
Topography and catchments	The significant water features are CC, GSC and OSRD, with the KWRFPD bordering the site to the south. In addition to the major waterways, there are a number of smaller headwater streams that traverse the site The terrain is relatively flat, generally sloping northwest-southeast. Each of these drainage lines have large upstream catchments.	• Large upstream catchments • A number of headwater streams within the Precinct boundary • Only one crossing exists from the Officer catchment north of the Freeway; • Outfall levee system is complex with 300 flood gates within the KWR area • Development to occur from upstream end of the catchment making construction of a “free draining outfall” more difficult.	• Existing drainage lines can be expanded for multiple uses, e.g. flood conveyance, stormwater treatment and amenity; • Connected habitat links to encourage biodiversity and access for community; • Connecting habitats for protected species e.g. GGF’s along GSC • Headwater streams could be set aside and utilised for community and habitat benefit
Stormwater and Drainage	Large flood overlays are associated with each of the drainage lines and the KWRFPD (refer to Section 6). The outfalls occur through the KWRFPD via a system of levees, and ultimately to Western Port Bay. Two drainage schemes exist via MWC, governing drainage for the Precinct (Officer South DS - 1304 and Lower GSC DS - 1402), featuring wetland and retarding assets along each of the creeks.	• Flat topography; • Under-treated stormwater from Officer (due to lack of SWQ treatment); • MWC has advised nuisance flooding occurring downstream of the PSP, • MWC Drainage Schemes are generally space constrained and implementing innovative precinct scale approaches will require expansion	• Large drainage reserves for locating IWM infrastructure; • Lecky Rd wetland is a large asset that could be co-located with IWM features (subject to agreement with Melbourne Water) • Conventional stormwater drainage, utilising pipes and roads
Water, sewer recycled water	There is currently minimal infrastructure within the precinct. These assets are planned to be upgraded once the precinct develops. No recycled water is proposed, however, SEW have indicated that there may be a recycled water main traversing the precinct to connect the Pakenham Water Recycling Plant.	• Currently recycled water is not proposed in the precinct; • Sufficient demand for recycled water; • Competing objective with respect to stormwater volume reduction as required by the HWS (2018).	• Existing infrastructure; • Recycled water; • Waste to resource / closed loop systems; • Co-location of assets within stormwater assets;
Biodiversity, ecology and vegetation	A large Area of Strategic Importance is mapped across the Creek corridors and adjacent land; and Cardinia Creek provides habitat for nationally listed threatened fish species	• Vegetation along proposed drainage lines to be protected. • Protected fish and frog species within GSC and CC.	• Passive irrigation for high value tree corridors; • Integration of water assets, such as wetlands with existing vegetation for increased amenity.
Heritage	High potential for artefacts along watercourses. A number of sites have compulsory CHMPs that may produce further findings in the future	• Certain areas will need to be protected.	• To educate the public about traditional owners’ relationship with water; • Leverage aboriginal values to inform design.
Existing services	A major gas main - the Dandenong to Morwell main – traverses the area and will affect the constructibility of drainage / IWM infrastructure; A major Telstra optical fibre cable is located along Lecky Rd	• Major APA gas main traversing through the middle of the site; • Major optical fibre cable running from Cardinia Creek to western boundary of Lecky Rd; • Restrictions around electricity towers.	• Electricity easements can be used for WSUD and IWM assets reducing the burden on land take.
Ground conditions	Shallow groundwater, and sodic soils in the area will need to be considered with respect to constructibility issues	• Construction issues due to the sodic soils; • Groundwater can impact on clay liners for wetlands.	• Improved construction practices to manage sodic soils resulting in lower than normal sediment loads to Western Port; • Opportunity to test ‘Leaky’ wetlands.

10. CONSTRAINTS MAP

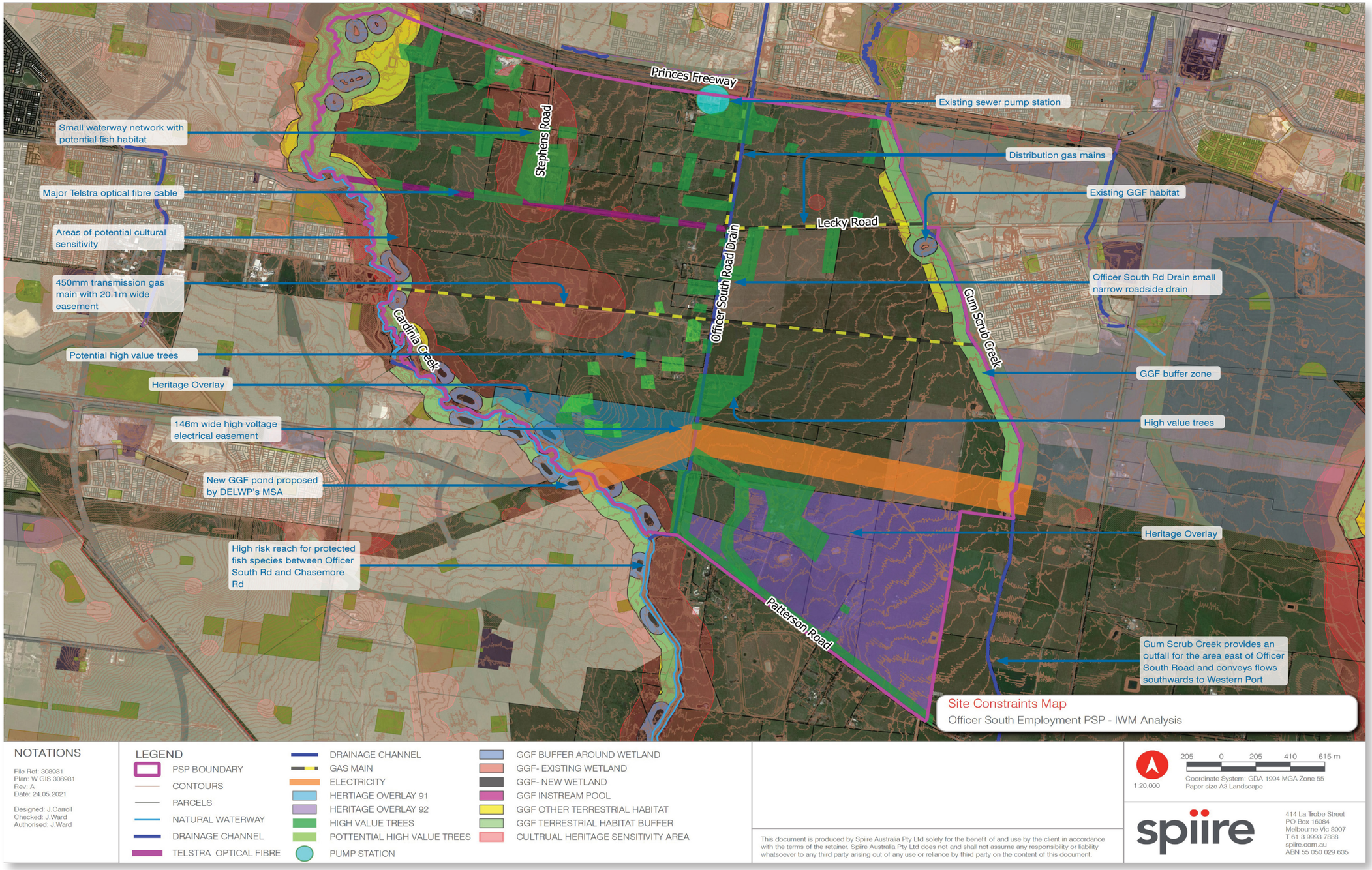


Figure 7: *OSE PSP Constraints Map*

Note: Heritage Overlay is subject to amendment through the PSP process.

11. OFFICER SOUTH EMPLOYMENT PRECINCT FUTURE URBAN STRUCTURE

The OSE Future Urban Structure has been prepared by VPA and is presented in Figure 8. Note that at the time of writing, the concept is preliminary and subject to change.

Notable features:

- The PSP area is predominantly zoned industrial, with the exception of the northeast corner which is zoned commercial and residential.
- There are distributed stormwater assets throughout the precinct for retardation and stormwater quality treatment.
- There are 3 main watercourses which split the PSP into approximately thirds.
- There are 2 major arterial roads which traverse the site from east-west.
- Conservation areas cover the land adjacent to Gum Scrub Creek and Cardinia Creek.

From a water management perspective, land has been identified for drainage, flood management and stormwater quality improvement assets. The majority of water demand will come from industrial development. It is understood from the Stakeholder Workshop (discussed in the next section) that Council and the VPA will be attempting to draw water intensive industries to the OSE PSP, particularly in the southern portion of the precinct. There is a notable absence of other high water demand facilities such as large sporting precincts.

This Future Urban Structure has been used as a basis for the Integrated Water Management Strategy.

Note for Figure 8: this is an earlier superseded version of the Place-based Plan. The IWM assessment is considered appropriate for application to the slightly modified land use configuration of the draft Place-based Plan

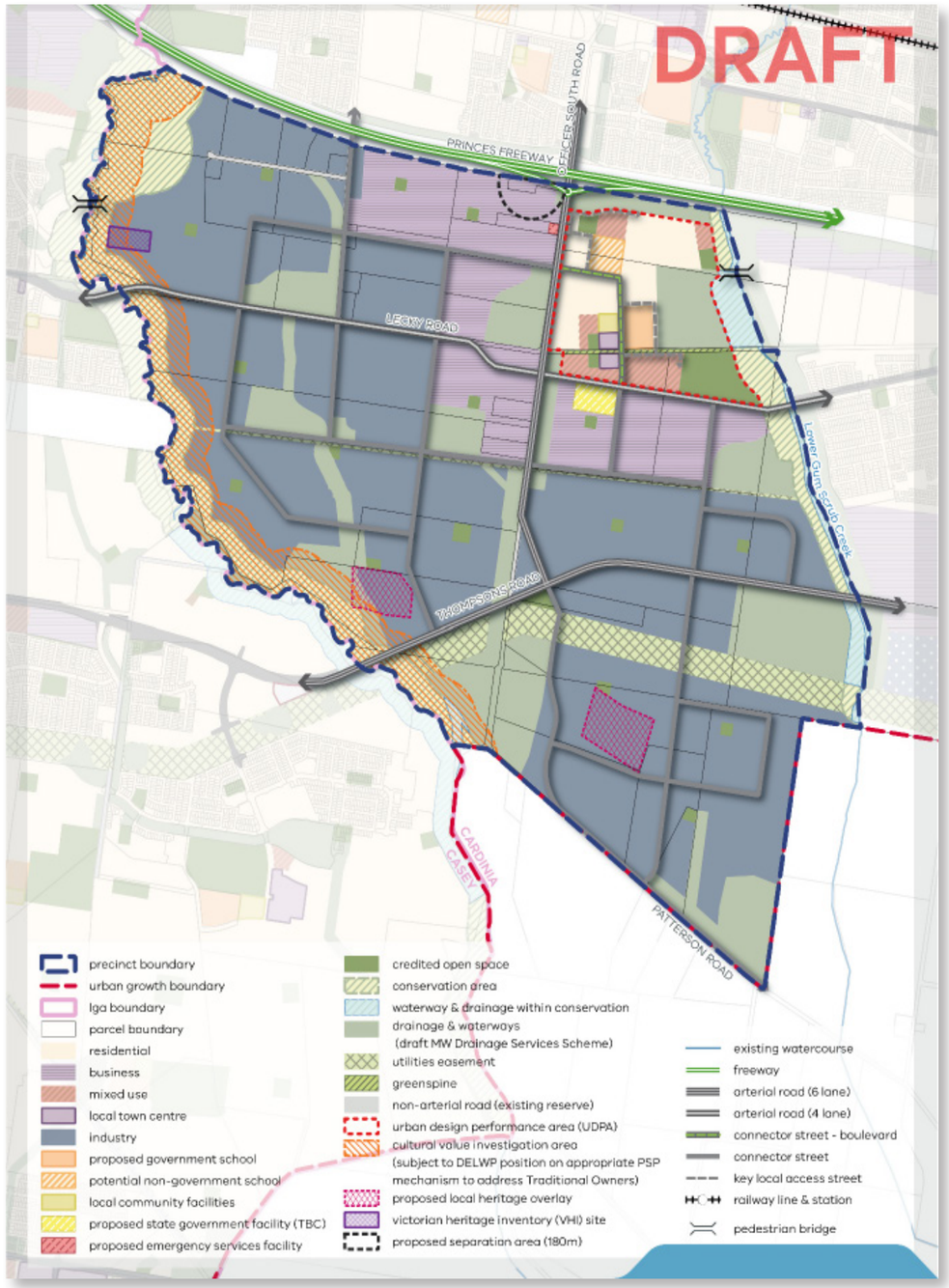


Figure 8: *Proposed OSE PSP concept plan (VPA, 2022)*

12. IWM IN OFFICER SOUTH EMPLOYMENT PSP

The aim of IWM in this area is to facilitate collaborative exploration of a holistic approach to water cycle management. This must be specific to the site, with consideration to the broader region, and is understood through detailed review of background information and Stakeholder Engagement.

Methodology

The methodology in developing this IWM strategy is as follows:

- Detailed review of all data relevant to IWM in the region including all stakeholder documents/ policies and previous stakeholder engagement (understood through the Spiire, 2021) to understand specific drivers.
- Stakeholder engagement through Workshop 1 to input into the three key areas of the IWM strategy, those being: the vision, objectives/drivers and opportunities (IWM assets/mechanisms)
- Follow up Stakeholder interviews to understand drivers and opportunities in more detail.
- Undertake water balance modelling and analysis on preferred IWM options
- Workshop 2 to present results and incorporate further feedback.

Stakeholder Engagement

Due to the numerous Stakeholders who are involved in the development of the PSP and wish to see positive water related outcomes within the precinct, a stakeholder workshop was organised by Spiire on the 13 of July 2021.

The workshop included representatives from the VPA, Cardinia Shire Council, Melbourne Water, DEECA (formerly DELWP) and South East Water. The intent of the workshop was to gain Stakeholder input into the three key areas of the IWM strategy, those being: the vision, objectives/drivers and opportunities (IWM assets/mechanisms). For the full list of Stakeholders considered refer to Spiire (2021). The workshop was conducted as follows:

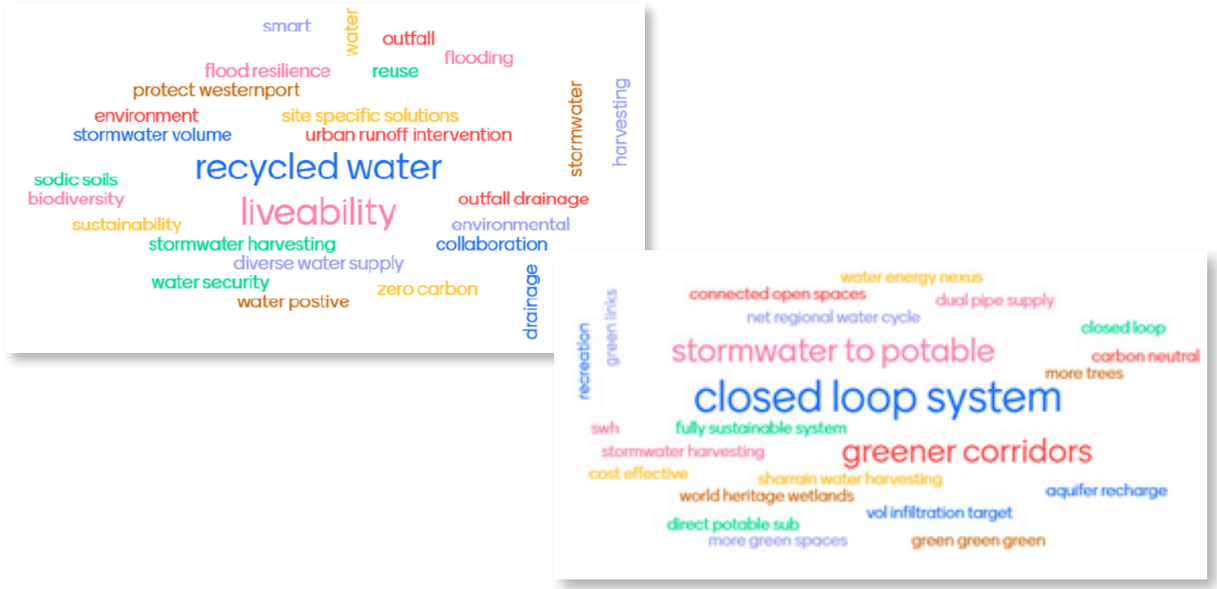
- Associated with each of the Stakeholders the documents / policies and plans relating to IWM were presented and informed the Workshop.
- Break out groups were created and a draft vision was presented. Wordclouds were then developed to identify the key themes which were important to the stakeholders such that they could be incorporated into the vision.
- Similar to the development of the IWM Vision, Spiire presented a draft set of objectives which were aligned with Westernport Strategic Directions Statement (SDS) and the agreed 'Values' or drivers of IWM specific to OSE PSP. The stakeholders were invited to comment on and added to the objectives and drivers. The four draft drivers were kept and an additional two drivers were added to the list as shown in Figure 9.

Options Development

Finally, the workshops also discussed the opportunities for the OSE Precinct. A long list of IWM initiatives were presented and tested with the Stakeholders. Due to the need to cater for a range of current and future conditions it became evident that the options fell into two main scenarios as follows:

- Good Practice IWM - covers embedding good practice IWM under the current frameworks and policy that govern water cycle management in Victoria.
- Leading Edge IWM (Future Framework) - intends to cover a longer-term outlook on the IWM options that would be viable under a potential future framework but may seem aspirational now (eg encompassing aspects like climate change and future policy changes.)

The long list of opportunities are presented in Spiire (2021a), *Workshop 1 Outcomes Report*, with the shorlist falling into the above two scenarios presented herein (from Section 14).



Site IWM Values	Further Description	Specific Objective
Waterway Values	• Biodiversity values: Nationally protected species: GGF, Dwarf Galaxia, Australian Grayling • Healthy Waterways Strategy	Priority reach targets: to remain < 3% DCI: harvesting 5.5 ML/yr & infiltrating 1.9 ML/yr / ha.
Western Port Values	• RAMSAR Wetlands • SEPP (WOV) 2018 – setting distinct pollutant loads for TSS for Western Port	Avg annual load of TTS must not exceed 28,000 t DEECA and MW must work together to achieve.
Flood Protection	• Koo Wee Rup Flood Protection District • Farmers increasingly experiencing nuisance flooding	Site specific flood protection requirements are being developed
Water Supply	• Recycled water supply not being supplied to the area	A diverse range of water supplies for fit for purpose human, industrial and agricultural consumption
Added by Stakeholders: Productivity	• The PSP is estimated to cater for 22,000 jobs and 5,000 new residents • Industrial, residential, commercial and agricultural reach • Liveability	Thriving residential estate, industry, agriculture and economic hub supported by water
Added by Stakeholders: Landscape Values	• Riparian and remnant vegetation along corridors and existing constructed channel • Sensitive vegetation and habitat values • Greening and canopy cover enhancement	Preserved biodiversity and habitat Reduced heat island effect Moisture retained in the landscape

Figure 9: *Summary of Values relevant to Officer South Employment PSP area*

13. VISION AND OBJECTIVES

The Vision and Objectives were developed through Workshop 1 and confirmed through stakeholder interviews and feedback received from the ‘Workshop 1 Outcomes’ document.

Vision

The Vision statement was first drafted with the Stakeholders during the first Workshop, based on on the Western Port Strategic Directions Statement (SDS)(2018). The Stakeholders decided on the following statement:

Collaborating to deliver an innovative, affordable and sustainable, carbon neutral water cycle, that supports industry; provides protection of waterway, biodiversity and Western Port values; and facilitates a more resilient, engaged, and prosperous community that connects to the broader region.

Objectives

The Objectives were similarly developed with the Stakeholders and align with the Western Port SDS outcomes (2018) as shown in the adjacent text and imagery. These were customised for the specifics of the local context of the Officer South Employment PSP with consideration to regional influences.

Safe, secure & affordable supplies in uncertain future	• Increased use of non-potable water (fit for purpose & valued by community) • Secure and resilient supply under all climatic conditions • Water is available to maintain valued green community assets • Water supporting economic growth.
Effective & affordable wastewater systems	• Maximises waste-to-resource opportunities • Exceed public health and environmental outcomes
Opportunities are sought to manage flood risks and impacts	• Mitigated / reduced flood risk to downstream users for nuisance flooding • Community, business and water systems are resilient to local flood risk and climate change • Stormwater drainage and WSUD assets are resilient and effective in mitigating a range of flood issues.
Healthy and valued waterways and marine environments	• Vegetation, habitat and biodiversity values for waterways and the marine environment are protected and improve over time • Continuous riparian zones and high vegetation quality are maintained within natural waterways • Healthy Waterways Strategy volume reduction targets are addressed • Stormwater drainage and WSUD assets are resilient and effective, reducing pollutant loads to the bay and mitigating flood issues. • Traditional Owner practices are integrated and protected in waterway planning
Healthy and valued green landscapes	• Reduced urban heat island effect, landscapes retain moisture for cooler greener spaces • Recreation supported by water • Improved connectivity for active transport links & access to water assets • Community and local values are reflected and aboriginal cultural values are protected
Community values are reflected in place-based planning	• Stakeholders and the broader community are knowledgeable, engaged, empowered and working together, connections between the community, waterways and open space are maximised • Local emerging and legacy issues, are understood and managed • Diverse urban landscapes that reflect local values
Jobs, economic growth and innovation	• Economic growth supported by water, innovative planning, strong governance and collaboration (support water quality trading) • Common understanding at the catchment scale offset options • Traditional Owner actions under Water for Victoria on economic development have been implemented

14. SUMMARY OF IWM VALUES - OBJECTIVES AND METRICS

After receiving all the Stakeholder feedback, the following summary of the values, objectives and associated metrics will be used to assess the 'performance' or 'success' of the proposed IWM opportunities.

Table 3: *Summary of site IWM value and objectives*

Site IWM Values	SDS Outcomes	Related Objective	Description of Values	Summary Targets / Metrics
Waterway and Western Port Values		Healthy and valued waterways and marine environments	• Biodiversity values: Nationally protected species: GGF, Dwarf Galaxia, Australian Grayling • Cardinia Creek is a priority reach (Healthy Waterways Strategy) • RAMSAR Wetlands downstream of the Precinct • SEPP (WOV) 2018 – setting distinct pollutant loads for TSS for Western Port	• Priority reach targets (Cardinia Creek): to remain < 3% DCI: harvesting 4.1 ML/ha/yr & infiltrating 0.8 ML/ha/yr • General waterways target: harvesting 1.6 ML/ha/yr and infiltration 0.7 ML/ha/yr • IWM Forum Volume Targets (2021) apply • Avg annual load of TSS must not exceed 28,000 t • DEECA and MW must work together to achieve.
Flood Protection		Opportunities are sought to manage flood risks and impacts	• Koo Wee Rup Flood Protection District • Farmers increasingly experiencing nuisance flooding	• 50 % AEP to 1 % AEP predevelopment targets have been locked in by Melbourne Water for flood mitigation (retarding assets). Climate Change sensitivity is being checked. • IWM assets to incorporate cross-benefit of flood mitigation.
Water Supply and Wastewater		Safe, secure & affordable supplies in uncertain future Effective & affordable wastewater systems	• A diverse range of water supplies for fit for purpose • Recycled water supply not being supplied to the area. Connection may be available subject to high water use / feasibility.	• Stormwater to be considered for reuse. Achieves the co-benefit of volume reduction to waterways and reducing potable demand. Closed loop system to be investigated (includes co-generation and biosolids reuse benefits).
Community and Landscape Values		Community values are reflected in place-based planning Healthy and valued landscapes	• Riparian and remnant vegetation exists along corridors and existing constructed channels • Sensitive vegetation and habitat values	• Place making opportunities are identified through the IWMS • Landscape values are protected. • Percent of canopy cover supported by alternative water supply • Traditional owner partnership for IWM initiatives
Productivity and Liveability		Jobs, economic growth and innovation	• The PSP is estimated to cater for approx 22,000 jobs and 5,000 new residents • Industrial, commercial and agricultural reach	• Thriving industry, residential and agriculture and economic hub supported by alternative water






15. IWM OPPORTUNITIES

To achieve the identified objectives and assist with the IWM strategy at Officer South Employment PSP, a comprehensive list of IWM options were prepared as presented in Table 4.

These were developed with the Stakeholders. For each IWM objective, options range from good practice to more aspirational. The options fall into two main scenarios (discussed in more detail in Section 17): 'Good Practice IWM' and 'Leading Edge IWM'. Good Practice covers industry best practices or standard IWM based on current regulatory conditions. Whereas the 'Leading Edge' options, consider what the regulatory frameworks might be in 10 years' time and what the future climate conditions could be.

Based on the stakeholder engagement the IWM options highlighted blue in Figure 13 were selected to be adopted as part of the IWMS.

Underpinning all the options (but not explicitly stated in the below table) is consultation and integration of Traditional owner values.

Implementation ready

Supported, with further work required to ready for implementation

SWH = Stormwater Harvesting,

RWT = Rainwater Tank

GGF = Growling Grass Frog

*Attracting businesses with higher demand, and /or encouraging practices such as car washing in winter

Table 4: *IWM Opportunities Summary*

Objective	Outcomes	Good Practice IWM Options			Leading Edge IWM Option
Waterway and Western Port Values	Satisfy conventional stormater quality targets Protect biodiversity values Protect RAMSAR Values Adhere to HWS and DEECA Forum targets	Conventional drainage scheme assets to meet stormwater quality targets	Drainage scheme assets that meet additional Western Port stormwater quality targets	Effective WSUD ,passive irrigation, RWT's & local SWH to provide stormwater quality treatment & reduce volume from development.	Significant volume reduction through a Stormwater to Potable system Leaky or seasonal wetlands
Managing Flood Risk	Safely convey stormwater throughout development. Protect downstream properties from flood impacts. Discharge stormwater at pre developed rates, resilient to climate change	Conventional drainage scheme assets and stormwater drainage, utilising pipes and roads	Drainage scheme assets that are also resilient to climate change and address nuisance flooding downsteam	Linear streetscape swales for conveyance of stormwater and infiltration of stormwater flows for use by local vegetation. (Note Council does not support swales)	Smart lot tanks with storage provisions for detention purposes
Water Supply and Wastewater	Sustainable and diverse drinking water supply to Precinct,	Connection to conventional potable network	Connection to roof water harvesting and local SWH to offset potable water supplied	Recycled Water	Closed Loop System -Stormwater to Potable and wastewater reuse
Community and Landscape Values	Attractive diverse streetscapes, linear open space, liveable neighbourhoods with enhanced biodiversity	Developer led vegetation and neighbourhood character	Shared paths linking waterway and open spaces.	Urban cooling via maximised canopy cover, supported by passive irrigation	Linear parks and creation of biolinks via Melbourne Water Scheme Assets and GGF habitat
Productivity	To produce a thriving industry, agriculture and economic hub supported by water	Lot based rainwater tanks	Encourage businesses or provide incentives for demand management*	Wastewater reuse to supply recycled water to industry.	Large Stormwater to Potable system and Regional RWT's

16. IWM SCENARIOS

The IWM scenarios have been developed due to the rapidly changing nature of the industry and objectives. The intent is to cover currently regulatory conditions, but also cater to the long term outlook.

Scenarios

As described above, a long list of IWM initiatives were presented and tested with the Stakeholders. Due to the need to cater for a range of current and future conditions it became evident that the options fell into two main scenarios as follows:

- Good Practice IWM - This scenario covers embedding good practice IWM (ie not just the implementation of typical / regular drainage schemes) under the current frameworks that govern water cycle management in Victoria. 'Good Practice IWM' includes integrated assets that are generally accepted and utilised broadly in Victoria with plenty of case studies / examples.
- Leading Edge IWM (Future Framework) - This intends to cover a longer-term outlook on the IWM options that would be viable under a potential future framework and includes options that may seem aspirational now. This would be based on current predictions for what the future drivers might be (eg encompassing aspects like climate change and future policy changes) – that the PSP should be responding to in order to achieve future outcomes.

Selected Options

The selected options were grouped into these scenarios to work in taandem together. The selected options are shown in the Table 5 and described in more detail in the next section.

Long List

The additional options that could be intertwined with these key assets introduced by the Stakeholders are:

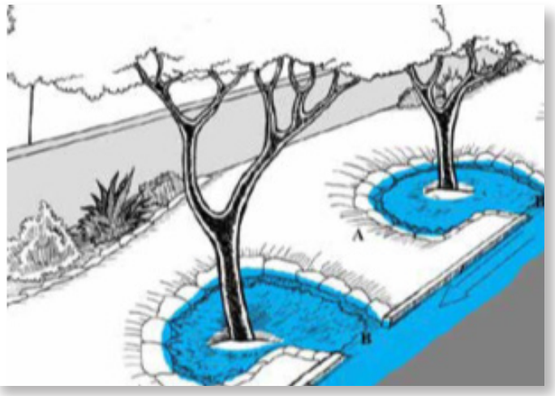
- Water features as setting for active centres (for example next to the residential town centre to the north)
- Retention of existing trees
- Shared paths to and along waterways and open spaces, connecting to the southern Western Port Bay area and surrounding PSP's
- Linear parks (particularly around the transmission line to utilise surplus land), and enhance bio-links
- Encourage businesses or provide incentives to incorporate sustainable practices
- Incentives for demand management (eg car washing in winter)
- Special use zones (via appropriate planning controls) such as large community gardens or agricultural zones.
- Attract high water users
- Rainwater harvesting with hot water systems
- Seeking demand outside the Precinct - such as the Eastern Irrigation scheme, or asparagus and other farmers
- Some stormwater treatment via the Pakenham Treatment Plant
- Disposal of stormwater through the Marine Outfall (via the Eastern Treatment Plant.
- Encourage use of solar energy
- Use of non-potable water on green infrastructure
- Mini hydro polishing systems in riparian zones
- Consultation and integration of Traditional Owner Values with every asset and opportunity
- Aquifer storage and recharge

Table 5: *IWM Scenarios*

Scenario	Description and Criteria	Proposed IWM Opportunities
Good Practice IWM	• Incorporates integrated assets that are generally accepted (with case studies available). • Criteria under current policy and framework conditions (eg current State Policy, BPEM, MW and Council Standards, current Stakeholder Objectives – Identified in Table 1) • Comparison against below 'Future IWM Framework' Criteria (ie how does 'Business as Usual' scenario stack up under future conditions?')	Passive irrigation – on Boulevards or large landscaped road only. Rainwater tanks – assume a minimum on lot rainwater tank uptake. Stormwater Harvesting – small scale servicing open space irrigation only facilities.

Leading Edge IWM (Future Framework)	• Incorporating climate change aspects
	• Incorporating predicted future policy changes and Stakeholder objectives, eg:
	  • future flow reduction and stormwater quality targets (such as EPA BPEM changes and HWS objectives, CMA's more aspirational targets, Council and SEW's long term IWM plan objectives).
	  • State Policy on 'stormwater to potable' change
		Regional Rainwater Tanks - that can be owned and maintained under a shared Stakeholder agreement
		Stormwater to Potable / Environmental / Cultural systems – with a local storage and treatment system that delivers water to Cardinia Reservoir
		Closed Loop System – incorporating a wastewater to dual pipe system and waste to energy recovery

17. GOOD PRACTICE IWM OPPORTUNITIES



Passive Irrigation and Infiltration

Passive irrigation is a feasible option to enhance urban forestry at OSE PSP. This option would contribute to achieving the VPA's canopy cover target of 30% for public land.

The guiding principle of passive irrigation is to allow runoff to flow to vegetated areas in a controlled manner to facilitate infiltration into the entire soil profile. Increased infiltration encourages deep root growth that improves the establishment and growth of street trees. From a drainage perspective, the purpose of passive irrigation is to capture frequent small flows and use all available runoff for irrigation of street trees.

The increased infiltration into the root zone helps to maintain moisture in the soil and can significantly improve long-term tree health. Tree health is the main objective for passive irrigation in the OSE PSP as improved health of trees has a cascading effect in the urban environment, including:

- Increasing urban cooling
- Increasing active and passive recreation and amenity
- Sense of place
- Biodiversity
- Increasing real estate value
- Reducing tree replacement costs

Soil and subsurface conditions can limit passive irrigation and infiltration. This requires further investigation in the area.

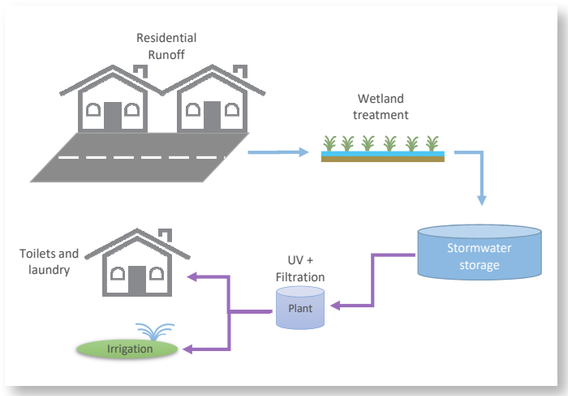
Rainwater Tanks

Rainwater tanks can be fitted in the new residential, commercial and industrial areas. The harvested rainwater can be used for non-potable water usage on site such as toilets and irrigation. Rainwater tanks can also contribute to reducing the volume of stormwater discharged to waterways.

Rainwater harvesting provides the following benefits:

- Provide an alternative water source
- Reduce demand on potable water supply
- Help control and manage peak stormwater flows
- Rainwater tanks can be retrofitted on existing buildings and have a relatively low capital cost
- A highly visible technology, which can be used for education

Although rainwater tanks will primarily meet the demands of toilet flushing and other typical non-potable uses, since the OSE PSP will predominantly zoned industrial other non-potable demands will also be present such as washdown areas, cooling tower and process water that may be met with rainwater.,



Stormwater Harvesting

Stormwater Harvesting is a potential option within the OSE precinct. Whilst the precinct is predominantly industrial there is the possibility there is a sports reserve proposed in the northeast corner of the PSP. The intent of the harvesting would be capture runoff from the residential area within the precinct, after it has been treated at the Lecky Rd Wetland, and utilise it to water the sports reserve.

Stormwater reuse has the benefit of:

- Reduce demand on potable water supply
- Mitigates downstream minor flooding by reducing volume to the watercourses
- Contributes to the Healthy Waterways Strategy and the EPA's Urban Stormwater Management Guidance target.
- After the stormwater has been used for irrigation, the water renters the water cycle via a infiltration or evapotranspiration.

There is also the opportunity to harvest stormwater within this precinct and deliver it to neighbouring precincts such as the Officer and Cardinia Road PSPs. This would further mitigate the negative effects of urban stormwater on waterways by reducing runoff volumes closer to predeveloped levels.

18. LEADING EDGE IWM OPPORTUNITIES

Regional Rainwater Tanks

An alternative to local rainwater tanks, are regional rainwater tanks. Regional rainwater tanks could be shared between multiple properties and provide greater storage than traditional local rainwater tanks. Harvested rainwater can be used for non-potable uses, such as site and truck wash downs, non-potable industrial use, and irrigation.

Regional Rainwater tanks provides the following benefits:

- Reduce demand on potable water supply
- Help control and manage peak stormwater flows
- Large tanks can be located underground so as not to take up space above ground.
- Costs could be split amongst several landowners to take advantage of economies of scale.
- Large tanks could be advantageous for water intensive industries as alternative water could be supplied at a lower price than through traditional mains.
- The biggest benefit compared to regular tanks is that they are not on lot, allowing for SEW or other authority to properly maintain and operate the system.

One of the complexities with regional rainwater tanks is the ownership and maintenance of the tanks. It is envisioned SEW would be best placed to ensure the ongoing maintenance and operation. However, as it benefits multiple Stakeholders, Melbourne Water and Council could also play a role and costs could be evenly distributed. Another potential complexity is the location of the tank and obtaining agreement amongst all landowners.

Stormwater to Potable

The stakeholders identified “Stormwater to Potable” as a preferred IWM option at the OSE PSP due to the multiple benefits it provides.

Stormwater to potable, as the name suggest is treating stormwater to a potable standard so that it can be distributed through the existing potable mains system. The way that this would be implemented in OSE PSP is through providing a storage along Gum Scrub Creek, in order to capture runoff from east of Officer South Road as well from the upstream catchment. Due to space requirements, the storage would be required to be outside the PSP. The captured stormwater in the storage around OSE PSP, would be pumped up to Cardinia Reservoir where it would be mixed with potable water and distributed through South East Water’s mains.

As legislation does not currently allow for stormwater to be treated and provided as potable water, an adaptive pathway is proposed. In the adaptive pathway, another storage would be created just downstream of Cardinia Reservoir where flows from OSE PSP would be pumped to. The water from this second storage would then be released into Cardinia Creek as environmental flows. These flows will still need to be of the right quality and frequency to be feasible. Once potable substitution becomes viable, environmental flows will still need to form a demand and consideration. Stormwater to Potable has the following benefits:

- Potable water from the reservoir is saved and the associated costs with that water.
- Flood impacts downstream of the OSE PSP are reduced.
- Cardinia Creek receives adequate environmental flows.

In the ultimate scenario the above benefits are provided with the addition of an alternative water source being supplied, which will reduce reliance on the desalination pipeline.

Closed Loop System

A Closed Loop Water System was proposed in the stakeholder workshop and was the preferred option by Council. Closed Loop system refers to supplying all water demand for the local PSP area, via wastewater reuse.

A Closed Loop within the PSP does not necessarily address all the objectives of the Stakeholders such as waterway protection by reducing stormwater volumes, however, Council has indicated that a ‘Stormwater to Potable’ system could work in tandem. The two systems could work well togther, with the stormwater system providing waterway health benefits, and wastewater reuse providing additional security to water supply rather than relying on stormwater. Nonetheless, the Closed Loop system at PSP scale is impractical and costly in terms of capital cost and minimising risk. If considering the broader water cycle, drinking water is supplied from Cardinia Reservoir, and sewage goes to Pakenham TP. Stormwater goes to waterways and Western Port Bay. To create a closed loop system, we seek to collect and reuse back in the precinct as many resources as possible. Recycled water is used in agriculture which grows produce for our consumption, and during the treatment process biogas, electricity and biosolids can also be produced and used by the treatment plant and agriculture. Stormwater may be harvested and provided back to waterways as passing, environmental or cultural flows, improving waterway health. When policy allows stormwater and recycled water may be treated to a potable quality and again reused back into the precinct.

19. WATER BALANCE - CATCHMENTS, TARGETS AND DEMANDS

The water balance has been split by the PSP catchments. This is broadly split in three catchments based on the proposed layout of Melbourne Water's Development Services Schemes assets. The Schemes propose three main waterways that traverse the precinct. The Stephens Rd Waterway Catchment, Officer South Rd Drain and Gum Scrub Creek. A summary of the catchments is described below, with catchment area details provided in Table 6 (overpage).

Stephens Rd Waterway and Officer South Road Drain (Cardinia Creek Catchment)

- A mix of commercial and industrial zoning (90 % fraction impervious).
- Stephens Road is an area of 131 ha and Officer South Rd Drain is 206 ha.
- Harvesting Target:
  - Stephensons Road - 131 ha x 90 % x 4.1 ML/ha/yr = 482 ML/yr harvesting
  - Officer South Rd Drain - 206 ha x 90 % x 4.1 ML/ha/yr = 759 ML/yr
- Infiltration Target:
  - Stephensons Road - 131 ha x 90 % x 0.8 ML/ha/yr = 94 ML/yr harvesting
  - Gum Scruib Creek - 206 ha x 90 % x 0.8 ML/ha/yr = 148 ML/yr

Gum Scrub Creek

- Most diverse catchment in terms of zoning, with residential, mixed used, commercial, Industrial and open space. Fraction impervious value ~ 85 %.
- Harvesting target: 351 ha x 85 % 1.6 ML/ha/yr = 477 ML/ yr
- Infiltration target - 351 ha x 85 % x 0.7 ML/ha/yr = 209 ML/yr.

Water Demand

The water supply demand of the PSP is difficult to quantify as it is very dependent on the types of Industrial use. The average lot area for the industrial zone was assumed to be 5,000 m^2, and a demand based on similar values to the Dandenong South Industrial Area (supplied by SEW) was used. Total demands are shown in Table 6 and 7.

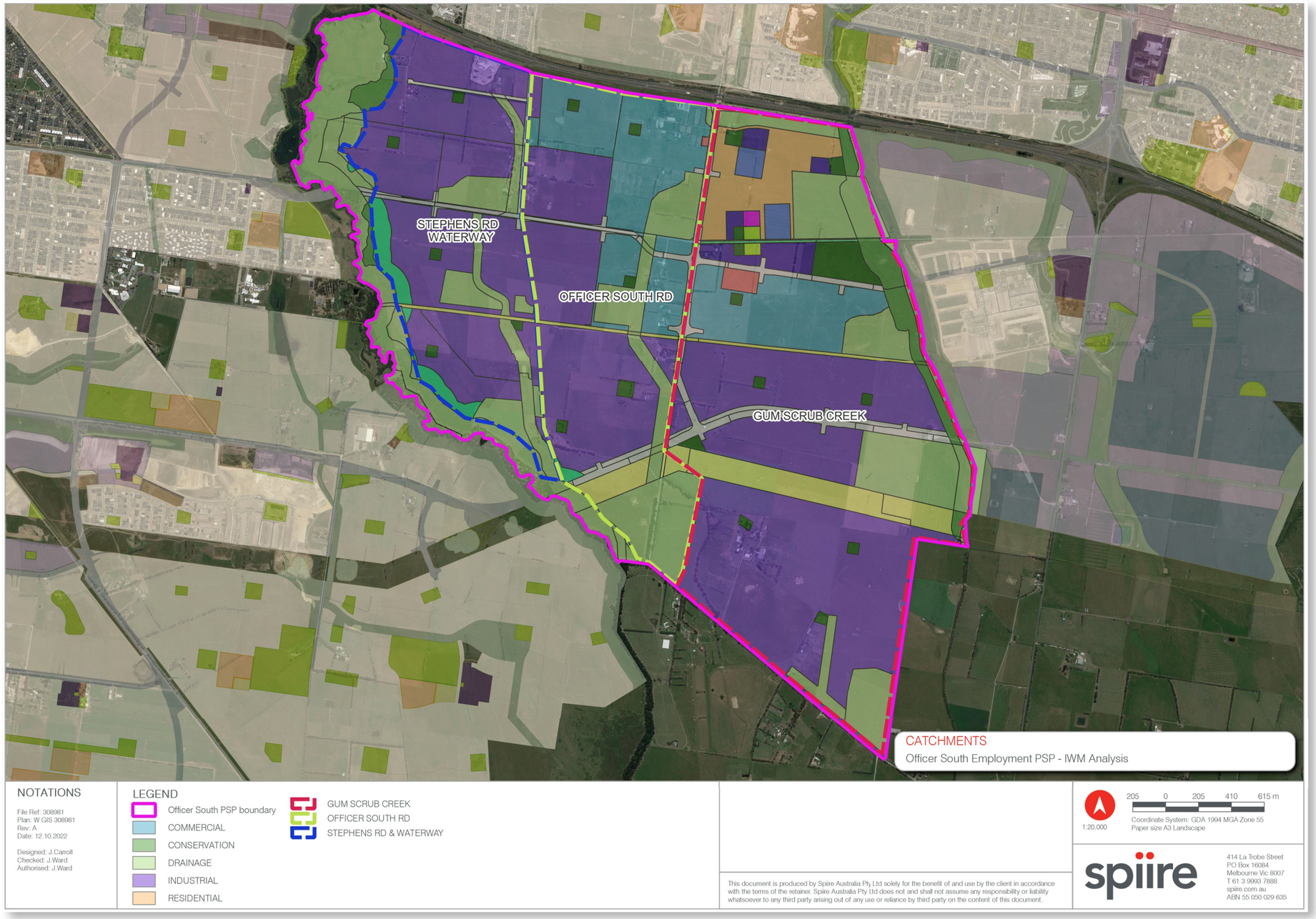


Figure 10. *Water Balance Local Catchments*

20. WATER BALANCE - GOOD PRACTICE IWM

As discussed in Section 17, Good Practice IWM refers to water management that goes above and beyond standard convention by utilising established technologies. Within the Officer South Employment PSP the technologies examined in the water balance were: on lot rainwater tanks, passive irrigation and local stormwater harvesting.

The results of the water balance indicate that rainwater tanks are the most effective option. This is an easy option to implement that benefits the end user by providing a free alternative water source as well the receiving waterways by reducing volume impacts of development.

The local stormwater harvesting option proposes a 1ML storage for the future sports reserve within the precinct, which would be able to service approximately three quarters of the sports reserve demand and reduce reliance on potable water for irrigation purposes.

Passive irrigation provides the least benefit in terms of water quantity with minimal reductions in volume. Although, it provides other benefits such as reducing the urban heat island effect through supporting increased canopy cover. It is noted that Council indicated in Workshop 1 that they may not be supportive of this option and therefore this option may not be implemented broadly throughout the precinct.

The water balance results are shown in Table 6 and Figure 11, and the assets are shown conceptually on Figure 13.

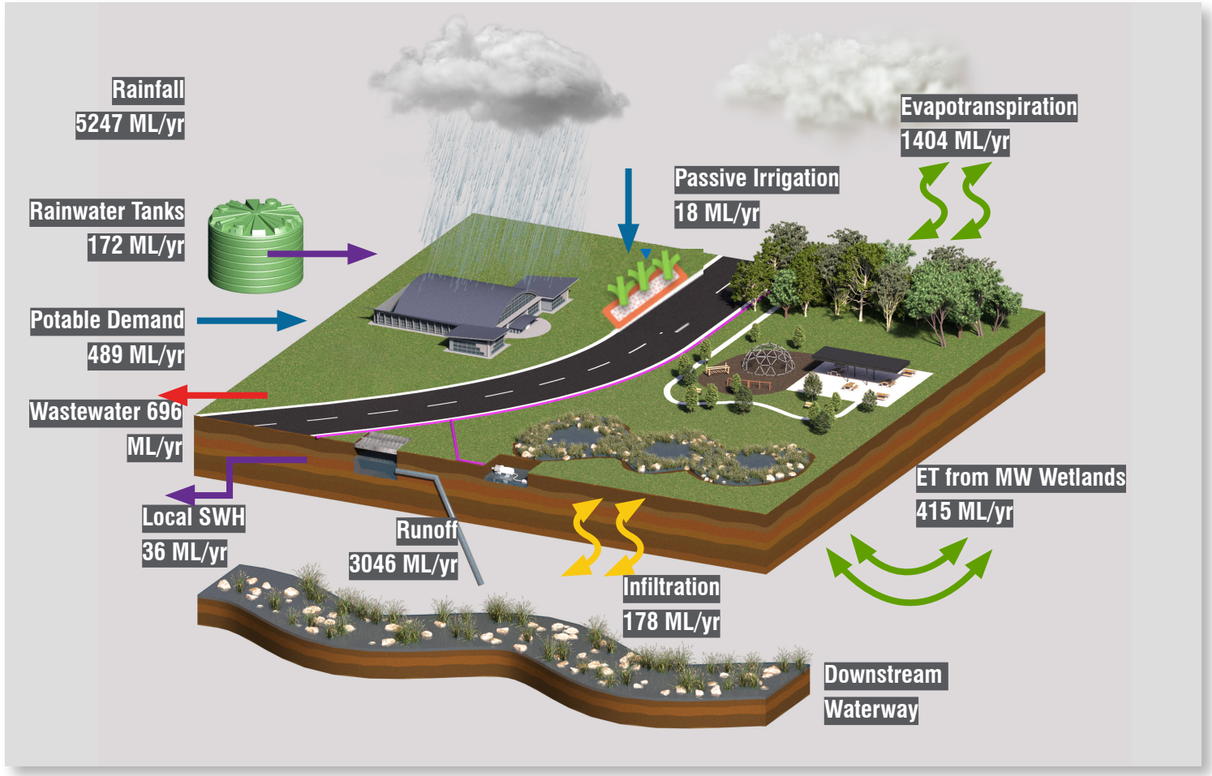


Figure 11: *Good Practice IWM Water Balance*

Table 6: *Good Practice IWM Water Balance*

Catchment	Stephens Rd Waterway	Officer South Rd	Gum Scrub Creek	Total
Catchment Area (ha)	131	206	351	687
Rainfall (ML/yr)	998	1572	2677	5247
Evapotranspiration (ML/yr)	254	400	749	1404
Infiltration (ML/yr)	26	41	92	160
Runoff (ML/yr)	718	1131	1837	3686
Demand (ML/yr)	75	126	487	688
ET Loss from MW Drainage Reserves	75	90	250	415
Opportunities				
Rainwater Tanks (Reuse)	21	35	116	172
Passive Irrigation (Infiltration)	2	5	11	18
Stormwater Harvesting (Reuse)	0	0	36	36
Total Harvesting +ET from MW Reserves (ML/yr)	96	125	401	622
HWS Reuse Target (ML/yr)	482	759	477	1719
% HWS Target Achieved	20%	16%	84%	36%
Total Infiltration (ML/yr)	2	5	11	18
HWS Infiltration Target (ML/yr)	94	148	209	451
% HWS Target Achieved	3%	3%	5%	4%
Runoff with Opportunities (ML/yr)	619	1001	1426	3046
Difference in Runoff with Opportunities (ML/yr)	99	130	412	640

21. WATER BALANCE - LEADING EDGE IWM

The Leading Edge IWM option builds on the Good Practice IWM with the main difference being the inclusion of the regional stormwater harvesting system ("Stormwater to potable"). To model this system accurately and quantify its effectiveness, the catchments upstream of the Princes Freeway were included. The implementation of this system would result in approximately 4GL (out of 10.5GL) ultimately being reused via being mixed with the potable water at Cardinia Reservoir. The reservoir would then be able to supply this precinct and its potable demand of 687ML/yr as well as other precincts.

It should be noted, that the closed loop system has not been specifically modelled in the water balance. As there a minimal losses through this type of system, it can be assumed that the wastewater will be treated to a non-potable standard and meet most of the non-potable demands.

The water balance results are shown in Table 6 and Figure 12, and the assets are shown conceptually on Figure 14.

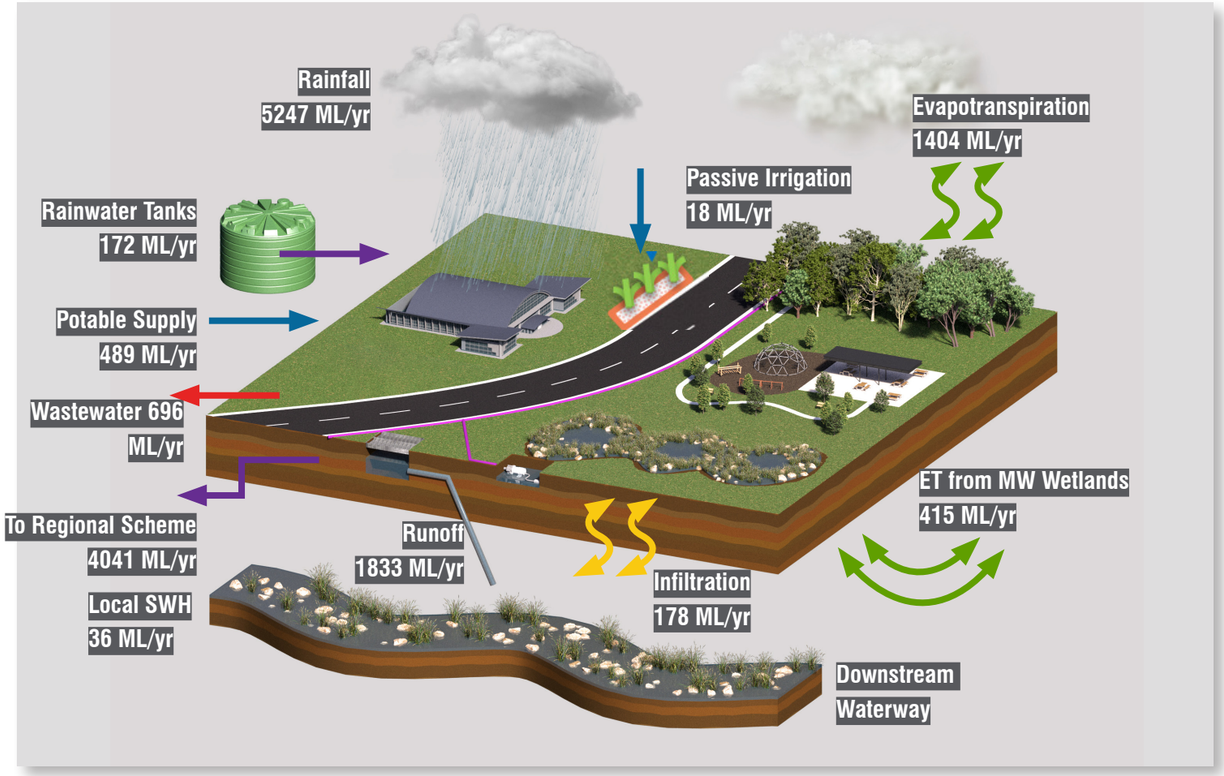


Figure 12: *Leading Edge Water Balance*

Table 7: *Future Framework Water Balance*

Catchment	Stephens Rd Waterway	Officer South Rd	Gum Scrub Creek	Total
Catchment Area (ha)	131	206	351	687
Rainfall	998	1572	2677	5247
Evapotranspiration (ML/yr)	254	400	749	1404
Infiltration (ML/yr)	26	41	92	160
Runoff (ML/yr)	718	1131	1837	3686
Demand (ML/yr)	75	126	487	688
ET Loss from MW Drainage Reserves	75	90	250	415
Opportunities				
Rainwater Tanks (Reuse)	21	35	116	172
Passive Irrigation (Infiltration)	2	5	11	18
Stormwater Harvesting (Reuse)	0	0	36	36
Stormwater to Potable* (Reuse)	0	0	1212	1212
Total Harvesting +ET from MW Reserves (ML/yr)	21	35	1212	1420
HWS Harvesting +ET Target (ML/yr)	96	125	1613	1835
% HWS Target Achieved		N/A combined asset		100%
Total Infiltration (ML/yr)	2	5	11	18
HWS Infiltration Target (ML/yr)	94	148	209	451
% HWS Target Achieved	3%	3%	5%	4%
Runoff with Opportunities (ML/yr)	619	1001	213	1833
Difference in Runoff with Opportunities (ML/yr)	99	130	1624	1852

***** *Stormwater to Potable value is the scaled constribution of the total catchment (as there are large upstream catchments). The total reuse for the asset is 4,041 ML (ie Officer South Employment Precinct makes up ~30 % of this catchment and value)*

22. CONCEPT GOOD PRACTICE IWM – OPPORTUNITIES AND LOCATION

The OSE PSP Good Practice IWM concept is presented in Figure 12.

A summary of the key opportunities in concept are as follows:

- Lot scale rainwater tanks on all industrial, commercial and residential lots (industrial and commercial lots assume 5 kL tanks and for the residentail area 2 kL tanks per lot have been assumed).
- Passive irrigation to be implemented throughout the precinct. One tree per lot to achieve canopy cover requirement.
- 1ML stormwater harvesting system of the future sports reserve. This is expected to be an underground tank (to minimise space impact).
- Melbourne Water DSS assets provide green corridors for residents amenity.
- Conservation area for growling grass frog to provide opportunity for increased amenity along the western side of the precinct.

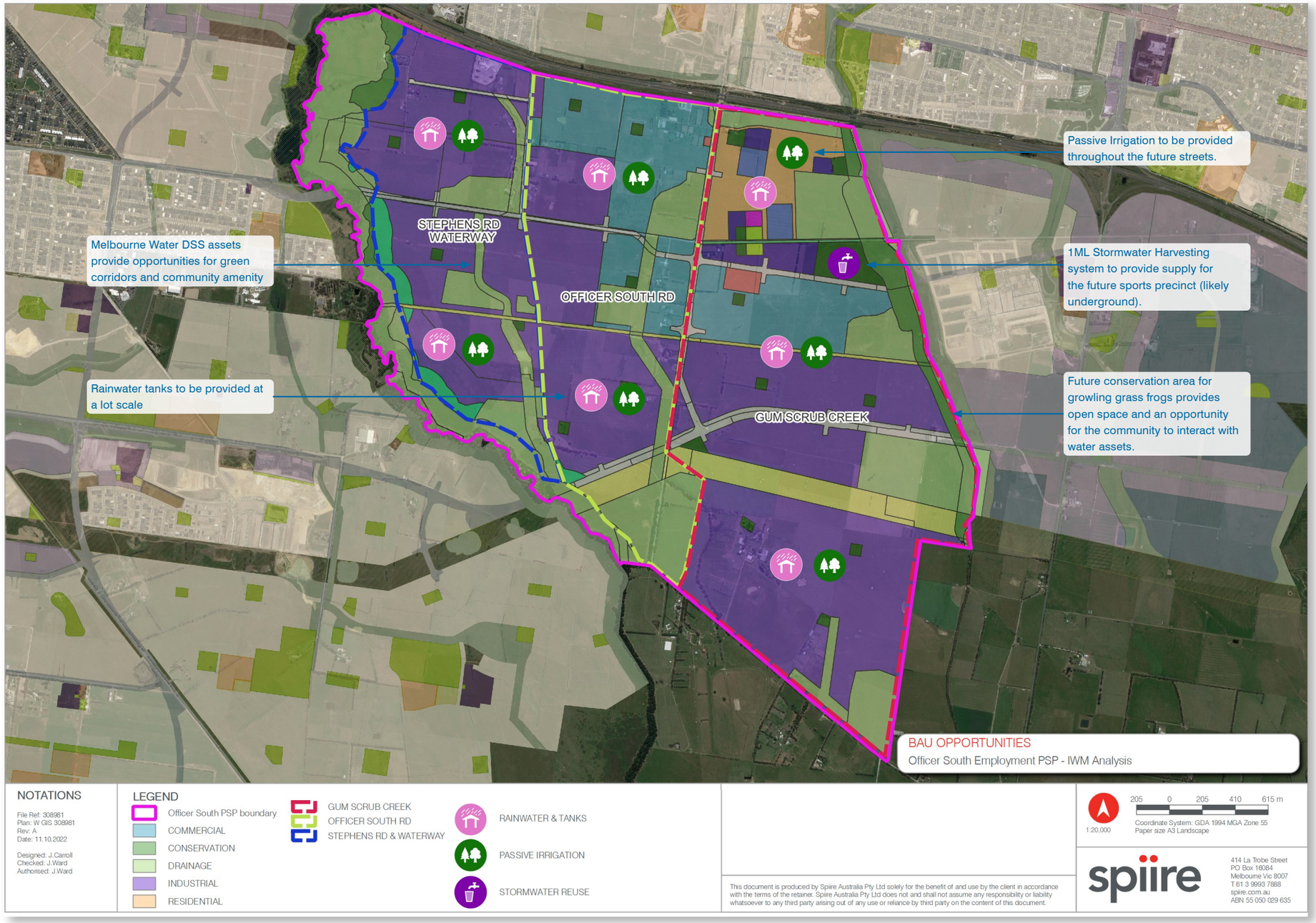


Figure 13: *Good Practice IWM Opportunities*

23. CONCEPT LEADING EDGE IWM– OPPORTUNITIES AND LOCATION

The OSE PSP Leading Edge IWM concept is presented in Figure 14.

A summary of the key opportunities in the concept are as follows:

- Regional scale rainwater tanks collecting roof water from all industrial, commercial and residential lots. Reticulated back within the precinct. Refer concept on Figure 15.
- Passive irrigation to be implemented throughout the precinct. One tree per lot to achieve canopy cover requirement. Melton City Council Passive Street Tree Irrigation example could be adopted. However, a site specific kerb and trench detail needs to be developed and approved by Council.
- 1ML stormwater harvesting system of the future sports reserve.
- Melbourne Water DSS assets provide green corridors for residents amenity
- 200ML Storage for Stormwater to Potable, ~10 ha.
- Diversion pipe linking Officer South Road Drain to the 200 ML main storage.
- Transfer pipe to deliver water to Cardinia Reservoir.
- Conservation area for GGF to provide opportunity for increased amenity along the edges of the precinct.

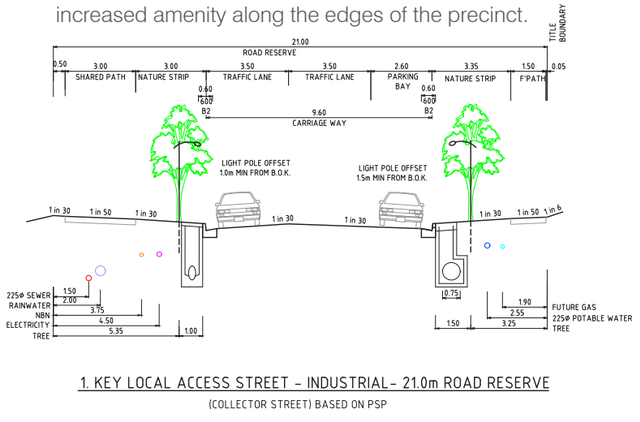


Figure 15: *Typical Road Cross Section including conduit for Regional Rainwater Tanks*

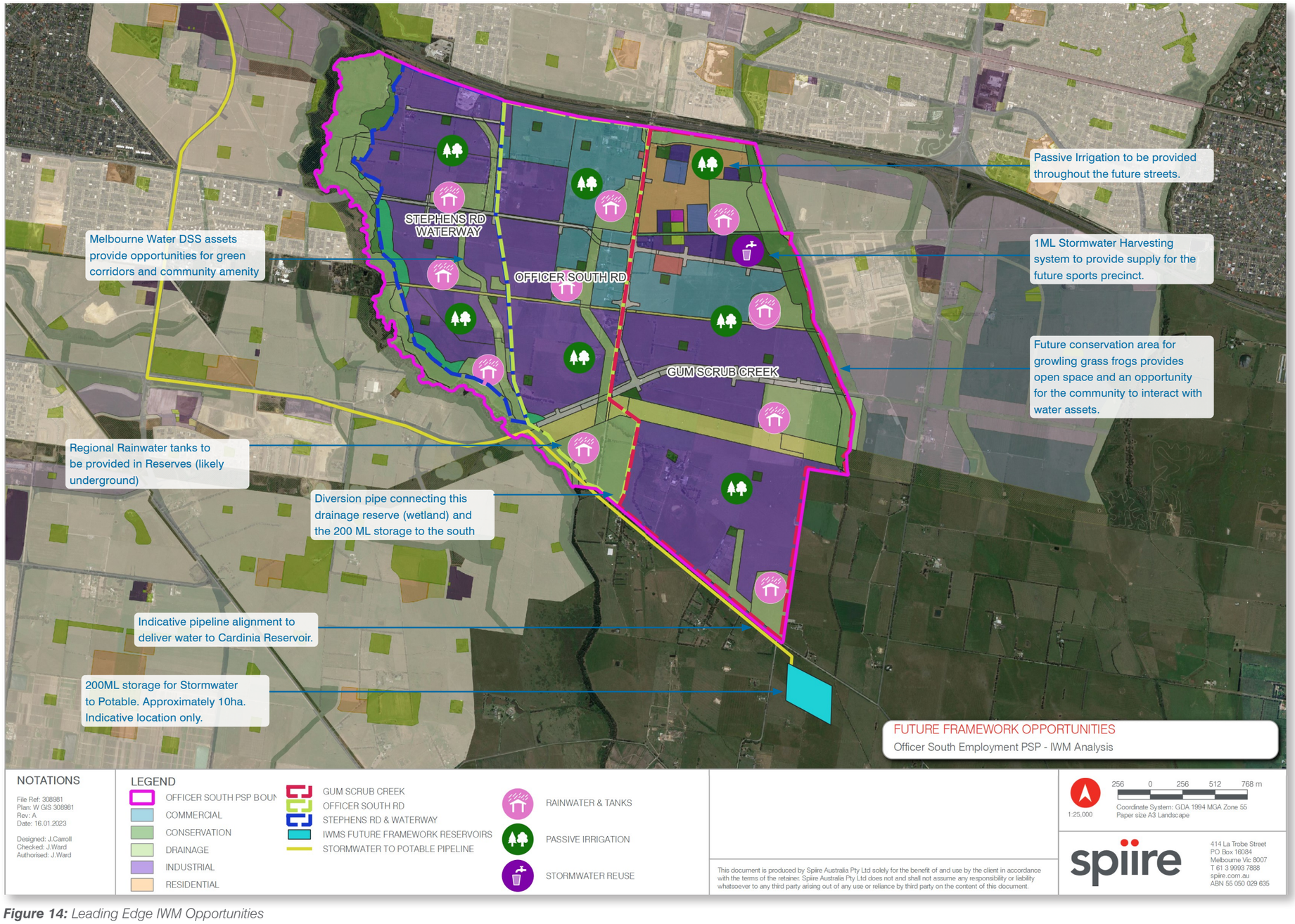


Figure 14: *Leading Edge IWM Opportunities*

24. IWM OPPORTUNITIES - PERFORMANCE SUMMARY

A performance summary including volume benefits and cost estimates for each of the options is shown in Table 8. The total indicates the sum for all opportunities (including best practice and leading edge).

As Cardinia Creek is a priority reach under MWC's Healthy Waterways Strategy (2018), the performance of the system in terms of benefit is assessed against the HWS (2018) volume targets. These are similar and align with the Western Port IWM forum targets (2021).Refer to Section 20 for a detailed breakdown of the targets.

As shown in the Table, the Good Practice option does not effectively meet HWS targets, and is quite expensive. However, combined with the Leading Edge scenario, the cost against benefit illustrates the options are feasible. For comparison against other manufactured water such as desalination, the marginalised cost is of the order of $3,500 / ML.

As 'stormwater to potable', is not currently feasible under current policy, an 'adaptive pathway' such as 'stormwater to environmental flow' would be required in the interim. This would require an additional storage at Cardinia Reservoir allowing for the slow and strategic release of environmental flow. This would need further investigation. A further adpative pathway (or disposal option alternative) is the Marne Outfall via the Eastern Treatment Plant (ETP). It is undestood that the sewer adjacent the precinct connecting to the Eastern ETP has capacity to accomodate additional flow. The ETP would require an upgrade.

A further demand option that has not been considered in this report is supply of water to the GGF ponds that are adjacent the major waterways (Gum Scrub Creek and Cardinia Creek). This demand option was not considered as it was raised by Melbourne Water after the water balance assessment had been conducted, but should be considered in further investigations.

Table 8: *IWM Opportunities Performance Summary*

Scenario	Opportunity	Volume Benefit (% of Healthy Waterways Target)	Cost ($M)	Levelised Cost ($ / ML)
Good Practice	Passive Irrigation	18 ML (1 - 2 %)	12.6	$53,958 / ML
	Rainwater Tanks on Lot	172 ML (5 %)	5.1	$2,582 / ML
	Local Stormwater Harvesting	36 (1 %)	2.0	$5,334 / ML
	Sub-Total (cost incl 30 % Contingency and 10 % design cost)	607 ML harvested + ET* (36 %) 18 ML infiltrated (4 %)	28.2	$7,162 / ML
Leading Edge				
	Regional Rainwater Tanks	172 (5 %)	3.0	$2,392 / ML
	Stormwater to Potable	4041*** (100 %)	150**	$3,503 / ML
	Closed Loop System	0	-	-
	Total (cost incl 30 % Contingency and 10 % design cost)	4,249*** ML harvested + ET* (100 %) 18 ML infiltrated (4 %)	190	$3,597 / ML

*ET = evapotranspiration (includes DSS Assets)

**This includes 2 x treatment plants, 1 x plant that treats the stormwater to a sufficient level for environmental flow (for the adaptive pathway period) and 1 x advanced system to treat the stormwater before entry to Cardinia Reservoir

***This number is the total harvested including upstream catchments (not the scaled value shown in Table 7).

25. IWM OPPORTUNITIES PERFORMANCE

The table below builds on the previous pages to demonstrate how the selected IWM measures relate to the objectives of IWM.

The table illustrate which values the IWM opportunities are trying to contribute to or achieve. (Note this does not necessarily mean it is meeting the associated target or metric - the performance against these metrics is assessed in previous sections).

It is acknowledged, that further IWM opportunities are available for the Officer South Employment Precinct, however, the opportunities analysed in this report were selected in consultation with the Stakeholders and as best aligning with the IWM vision and stakeholder priorities.

Table 9: *IWM options assessment for Officer South Employment Precinct*

	IWM Opportunities	Waterway and Western Port Values	Flood Protection	Water Supply and Wastewater	Productivity	Community and Landscape Values
	Good Practice Options					
1	Passive Irrigation	✓				✓✓
2	Rainwater Tanks	✓	✓	✓✓	✓	✓
3	Stormwater Harvesting	✓	✓	✓	✓	✓
	Leading Edge Options					
1	Regional Rainwater Tanks	✓✓	✓	✓	✓	✓
2	Stormwater to Potable	✓✓✓	✓✓	✓✓✓	✓✓✓	✓
3	Closed Loop System			✓✓✓	✓✓✓	✓

Contribution to IWM Objectives

✓✓✓ High ✓✓ Medium ✓ Low

26. IMPLEMENTATION AND RESPONSIBILITIES

A summary of the implementation and responsibility opportunities is provided as follows.

Table 10: *IWM Implementation and responsibilities*

Framework	Opportunity	Actions / Next Steps	Implementation	Responsibility and Ownership
Good Practice	Passive Irrigation	• A guideline document to accompany the PSP documentation may be required to assist landowners and developers in implementation and ensuring it is mandated • Identify feasibility of passive irrigation to support infiltration and urban cooling by Council • Identify design to maximise opportunities for infiltration, while still providing for tree growth. Design must be submitted to Council for approval. The Melton City Council Passive Street Tree Irrigation example could be adopted. A site specific design approved by Council needs to be developed.	Immediate	Cardinia Shire Council
	Rainwater Tanks	• A guideline document to accompany the PSP documentation may be required to assist landowners and developers in implementation and ensuring it is mandated • Ensure implementation via building codes` • Consultation with builders to ensure proper installation • Provide maintenance guidance for landowners	Immediate	Landowner
	Local Stormwater Harvesting	• Identify ownership arrangement, likely through collaboration with SEW and Council • Identify further opportunities for local stormwater harvesting (sports precinct north of Princes Freeway, surrounding farmland)	Immediate	Cardinia Shire Council/South East Water
Leading Edge				
	Regional Rainwater Tanks	• Identify ownership and maintenance arrangement. The regional tanks have the benefit of not being on lot, allowing for the SEW authority to properly maintain and operate the system	Immediate to 3 +Years	Consortium/Body Corporate or South East Water Owned and operated
	Stormwater to Potable	• Identify feasibility of adaptive pathway - prior to 'stormwater to potable' policy change, the stored water could be used for environmental/passing flow to Cardinia Creek. Melbourne Water and SEW to consult. • Make provision for the large 10 ha footprint required (currently proposed outside of the PSP in flood land)	10 + Years	Melbourne Water/South East Water
	Closed Loop System	• Identify feasibility of a closed loop system at the small scale of OSE PSP • Consider the viability of expanding the 'closed loop concept to be more regional.	10 + Years - Subject to regional influence	Council/South East Water

27. RECOMMENDATIONS

The IWM concept for the Officer South Employment Precinct has been developed to allow flexibility across different scales and time periods. Two scenarios have been presented that can be adopted subject to further, more detailed analysis, Stakeholder commitment and further consultation. As such a range of recommendations have been considered.

The IWM concepts are presented in Figure 13 and Figure 14, and assume two scenarios: Good Practice IWM and Leading Edge IWM. Under each of these scenarios, the following recommendations apply:

Good Practice IWM

- Implement Passive Irrigation - the feasibility of this option to support urban cooling and passive irrigation needs to be further investigated. A site specific detail is required (Melton City Council's detail is an example as a starting point shown in Figure 16).
- Implement the on lot Rainwater Tanks to provide an alternative non-potable water source as well as reduce volumes to receiving watercourses. To enable implementation, the requirement for these tanks needs to be incorporated in building codes and maintenance guidance to landowners should be provided.
- Implement the Local Stormwater Harvesting system to irrigate the local sports precinct and reduce volume to receiving waterways. This is expected to be an underground system and operated by Council.

Leading Edge IWM

- Under this option, implementation of the Passive Irrigation network and the Local Stormwater Harvesting System still applies.
- Implement the Regional Rainwater Tanks in place of lot scale rainwater tanks. These have the benefits of economy of scale, reduced land take and operation via skilled staff such as at SEW (rather than on lot landowners). The location of the underground tanks is required to be confirmed and is tentatively expected to be at the large drainage reserves. A cost sharing and ownership model is required to be developed.
- Implement the Stormwater to Potable system, capturing runoff from the Officer area and delivering flows to the Cardinia Reservoir to be mixed with the potable supply. As legislation does not currently allow for this, an adaptive pathway of using the treated stormwater for environmental flows would be implemented until such time that stormwater can be treated for potable purposes. The land outside the Precinct needs to be acquired.
- The closed loop system suggested by Council needs to be further assessed against more regional influences (at this Precinct scale it may be impractical). To assist this investigation Council has provide the adjacent in Figure 17.

Further Analysis and Other Options

Further analysis and stakeholder engagement is required to:

- Further investigate the feasibility of the options and understand in better detail the full range of benefits and costs,
- Confirm cost sharing and governance arrangements, and
- Consider the viability of other major opportunities such as:
  - The Marine Outfall disposal option via the Eastern Treatment Plant.
  - Servicing the residential area and other high use demands with Recycled Water. SEW has indicated during Stakeholder Engagement they were not going to provide recycled water in this precinct, however, could still consider high water users such as the open space fields adjacent the residential area. A cost-benefit analysis against stormwater harvesting is required.
  - Infiltration options to better achieve the infiltration target (e.g. Leaky Wetlands, Riparian Sponges)
  - Supply of stormwater to the GGF ponds.
  - Further investigation into potential demands outside the Precinct, such as irrigation of crop land.

The full range of options suggested by the Stakeholders that could be further investigated is provided in Section 17.

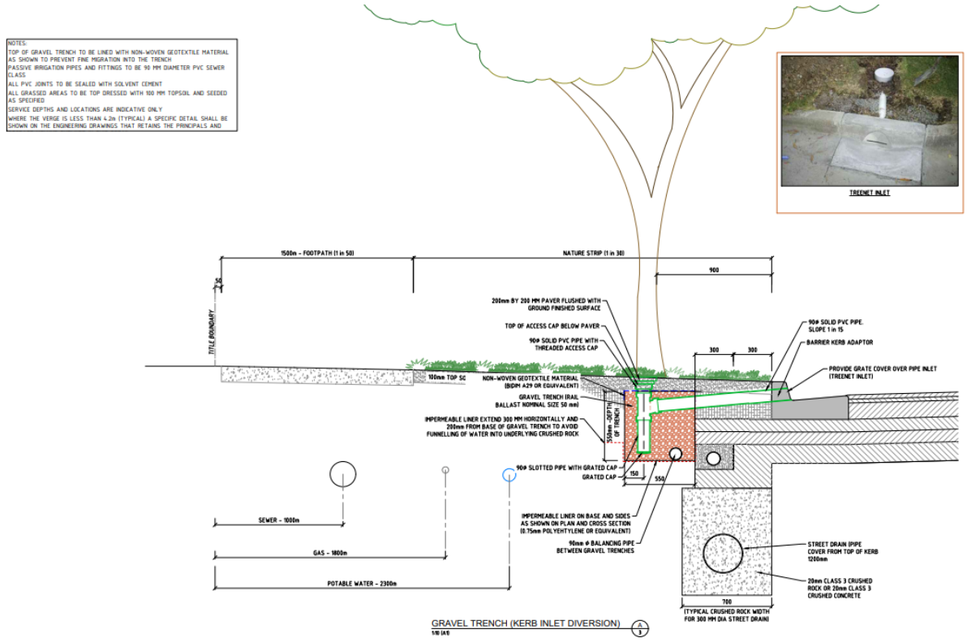


Figure 16: *Example Passive Irrigation Section (source: Melton City Council)*

IWM Element	1 Conventional	2 Current Practice IWM	3 Leading Practice IWM	4 Beyond Best Practice Stormwater	5 Closed Loop PSP Water Cycle	6 Net Positive Regional Water Cycle	7 Closed Loop PSP Water-Energy Nexus	8 Net Positive Regional Water-Energy-Food Nexus
	Meets regulatory requirements	Typically adopted 'best practice' being delivered in Greenfield PSPs	Emerging 'best practice' being planned in Greenfield PSPs	Focus on achieving Healthy Waterway Strategy targets	Aiming to supply all water demand from local sources	Net positive water cycle (incl. importing/ exporting of water)	"Closed loop PSP Water Cycle" & energy recovery	"Net Positive Regional Water Cycle" & energy recovery (incl. importing green waste)
Greening & WSUD	**Yes** Elements/Design will vary across options							
Rain tanks	**~50% uptake** Toilet + Outdoor	**~50% uptake** Toilet + Outdoor	**100% uptake** Hot Water	NA [1]				
Stormwater to POS	**Yes** Harvesting from Wetlands			NA [2]				
Stormwater to Potable	NA			**Yes** Capture of all stormwater runoff, treatment to potable standard & reuse				
Wastewater to Dual Pipe	NA	**Regional RWP** Toilet + Outdoor	**Regional RWP** Toilet + Outdoor + Laundry	NA	**Local Sewer Mine** Toilet + Outdoor + Laundry	**Regional RWP** Toilet + Outdoor + Laundry	**Local Sewer Mine** Toilet + Outdoor + Laundry	**Regional RWP** Toilet + Outdoor + Laundry
Waste-to-Energy Plant	NA						**Local W2E** PSP waste only	**Local or Regional W2E** PSP + external waste

1. Rainwater tanks not required, because all stormwater runoff is captured in PSP and reused. Also, removing roofwater runoff impacts the stormwater quality entering the treatment plant. Tanks could still be used however as detention storages.
2. Stormwater harvesting for irrigation to open space not required because all stormwater runoff is captured in PSP and reused (avoid duplicate infrastructure). However, if it made sense (e.g. sports field adjacent to wetland) this can be considered.

Figure 17: *Cardinia Council's Ambitions for the Closed Loop System (provided by Council, January 2023)*

28. SUMMARY

An IWM concept has been developed for the Officer South Employment Precinct allowing for flexibility into the future to cater for potential Policy Changes and the impacts of Climate Change. This was based on engineering analysis and stakeholder engagement to establish concepts that take advantage of the opportunities that exist for the site and within the region.

The IWM concepts are presented in Figure 13 and Figure 14, and assume two scenarios: Good Practice IWM and Leading Edge IWM. The concepts are comprised of the following:

Good Practice IWM

- Passive Irrigation, to help achieve canopy cover targets and reduce the urban heat island effect.
- Rainwater tanks to provide an alternative non-potable water source as well as reduce volumes to receiving watercourses.
- Stormwater Harvesting to irrigate local sports precinct and reduce volume to receiving waterways.

Leading Edge IWM

- Rainwater tanks which provide the same benefits as lot scale rainwater tanks however have the benefits of economy of scale, reduced land take and operation via skilled staff such as at SEW (rather than on lot landowners).
- Stormwater to potable, a regional stormwater harvesting approach which would capture runoff from the Officer area and deliver flows to the Cardinia Reservoir to be mixed with the potable supply. As legislation does not currently allow for this, an adaptive pathway of using the treated stormwater for environmental flows would be implemented until such time that stormwater can be treated for potable purposes.
- The closed loop system suggested by Council needs to be further assessed against more regional influences as at the Precinct scale it may be impractical.

The results and costs associated with these two scenarios are shown in the below table.

Further analysis and stakeholder engagement is required to:

- Further investigate the feasibility of the options and understand in better detail the full range of benefits,
- Establish cost sharing and governance arrangements, and
- Consider the viability of other major opportunities such as the Marine Outfall disposal option via the Eastern Treatment Plant and providing Recycled Water to high water users.

Scenario	Proposed IWM Opportunities	Volume Reduction Benefit (% of HWS Target)	Cost $ / ML	Comments
Good Practice IWM	Passive irrigation Rainwater tanks SWH – local scale	607 ML/yr harvested + ET (36 %) 18 ML/yr infiltrated (4 %)	$7,162 / ML	High cost against the volume benefit. However, the options address other criteria such as supporting canopy cover targets and diverse landscapes for urban cooling.
Leading Edge IWM (Future Framework)	Regional Rainwater Tanks SW to Potable / Environmental / Cultural - via Cardinia Reservoir Closed Loop System	4,249 ML/yr harvested + ET (100 %) 18 ML/yr infiltrated (4 %)	$3,597 / ML	Achieves a better cost against volume benefit & addresses all other objectives including flood risk reduction. Levelised cost is competitive against other large scale sources (e.g. desal).

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