CORANGAMITE CMA

Upper Barwon River Seasonal Watering Proposal 2024-25

April 2024 FINAL

healthy and productive lands and waters cared for by thriving communities

Table of Contents

TABLES

FIGURES

Acknowledgement of Country

We acknowledge the Gulidjan and Gadubanud people of the Maar Nation as Traditional Owners of the land and waters of the Barwon River from its headwaters to Winchelsea. We pay respect to their elders past, present and emerging and extend this recognition and respect to the Wadawurrung People of the Kulin Nation who are the Traditional Owners where water in the Barwon River flows, downstream of Winchelsea.

1 CONTEXT

Corangamite Catchment Management Authority (CMA) is pleased to provide a draft of the 2024-25 Upper Barwon River Seasonal Watering Proposal for review by and feedback from Traditional Owners and the Upper Barwon Surface Water Advisory Group.

This Seasonal Watering Proposal (SWP) outlines Corangamite CMA's proposed priorities for the use of environmental water from the West Barwon Reservoir within the Upper Barwon River system in 2024-25, as required under section 192A of the Water Act 1989. The Victorian Environmental Water Holder (VEWH) will use the SWP to inform the development of the Seasonal Watering Plan 2024-25. This is a state-wide plan outlining where, when and why water for the environment can be delivered throughout Victorian waterways.

The format of the 2024-2025 SWP is shorter than previous years. The Victorian Environmental Water Holder (VEWH) has amended the SWP guidelines for 2024-25 to reduce the length of the document, whilst still retaining key information relevant to watering. The current water year (2023-24) seasonal review section will not be included in this document as it has been in previous years. Instead, it will be created separately in mid-2024 and will be provided to the VEWH, Traditional Owners and the Upper Barwon Surface Water Advisory Group (UBSWAG) when completed. Undertaking the seasonal review at the end of the water year will allow for all environmental watering to be reported on after it has occurred, rather than doing a review that misses several months and/or speculates on watering. The separate seasonal review document will include content on climate, hydrological achievement, ecological observations, and community observations.

Key sections of the SWP that outline planning for the Upper Barwon River Environmental Entitlement include:

- **Scope of environmental watering** – which describes the range of potential watering actions which may be delivered during 2024-25 (see outline below in Table 1).
- **Scenario planning** – which describes how the combination of actions may change

depending on the climate scenario (dry, average and wet).

- **Risk management –** This chapter provides a summary of the risks associated with releasing environmental water and how the program partners plan to manage the risk. This is an important chapter of the proposal and will be based on the outcomes from the 2024 Shared Operational Risk Workshop – in particular the risk management table.

Table 1 Summary of priority watering actions for the Upper Barwon River 2024-25

Environmental allocation: ~1,750 ML if 2024-25 is an average climate scenario.
East Branch
Priority 1: Upper Barwon east branch low flows of 0.5-5 ML/day between December-May
Priority 2: 2 x 6-9 ML/day freshes in the Upper Barwon east branch over two days between December-May
Priority 3: Upper Barwon east branch low flows of 1-9 ML/day between June-November
West Branch
Priority 1: Upper Barwon west branch low flows of 3-15 ML/day between December-May
Priority 2: Upper Barwon west branch low flows of 3-15 ML/day between June-November

2 SYSTEM OVERVIEW

Waterway Manager: Corangamite Catchment Management Authority

Storage Manager: Barwon Water

Environmental Water Holder: Victorian Environmental Water Holder.

Proportions of water entitlements in the Barwon basin held by private users, water corporations and environmental water holders on 30 June 2020

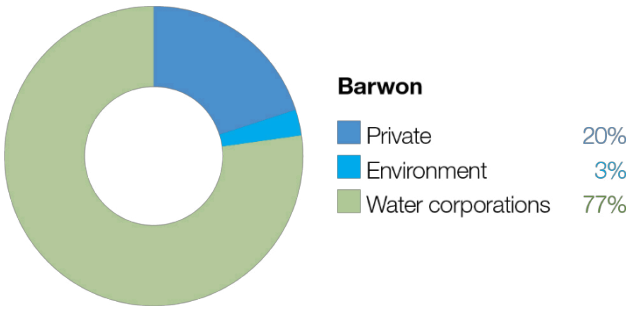

Figure 1: Water entitlements in the Barwon Basin.

The Barwon River flows east from the Otway Ranges, passing the towns of Forrest, Birregurra, Winchelsea, Inverleigh and the City of Geelong before discharging into Bass Strait at Barwon Heads. The Leigh and Moorabool rivers are major tributaries, joining the Barwon River at Inverleigh and Fyansford, respectively. Other tributaries, including Birregurra, Boundary, Callahan, Dewing, Matthews, Pennyroyal, Deans Marsh, and Gosling creeks flow into the Barwon River above Winchelsea. The main storages in the Barwon River catchments are the West Barwon and Wurdee Boluc reservoirs.

The operation of the West Barwon Reservoir regulates flows in the upper Barwon River. Water can be released directly from the reservoir into the west branch or into the east branch via a diversion tunnel. The junction of the two branches is near Boundary Creek. Downstream of the reservoir, operational water can be diverted into the Wurdee Boluc inlet channel, a 57 km concrete-lined channel that transfers water to Wurdee Boluc Reservoir.

Barwon Water releases passing flow in the order of 1-5 ML per day in both the upper east and west branch from the West Barwon Reservoir. These releases may increase to 15 ML per day in September in a wet year. When the West Barwon and Wurdee Boluc reservoirs collectively holds more than 40,000 ML, all the natural flow is passed down the east branch between January and March. Flood spills from the reservoir and natural inflows from unregulated and regulated tributaries add to the passing flow in the west branch. Regulated and unregulated tributaries add to the flow in the east branch.

The Upper Barwon River Environmental Entitlement 2018 enables water for the environment to be made available from the West Barwon Reservoir. The entitlement provides an average of 1,000 ML per year and up to 2,000 ML of the total storage capacity at full supply. Water for the environment was first delivered to the upper Barwon River in 2018-19. The current entitlement provides only enough water to meet the highest-priority environmental watering actions in the upper Barwon east branch (reach 4) and the upper Barwon west branch (reach 3) under particular climatic conditions.

The volume and timing of environmental water releases is informed by the *Upper Barwon, Yarrowee and Leigh rivers Environmental FLOWS Study (Alluvium, 2021)*. Flow studies tell us about the timing, watering duration and amount of water needed to sustain environmental values.

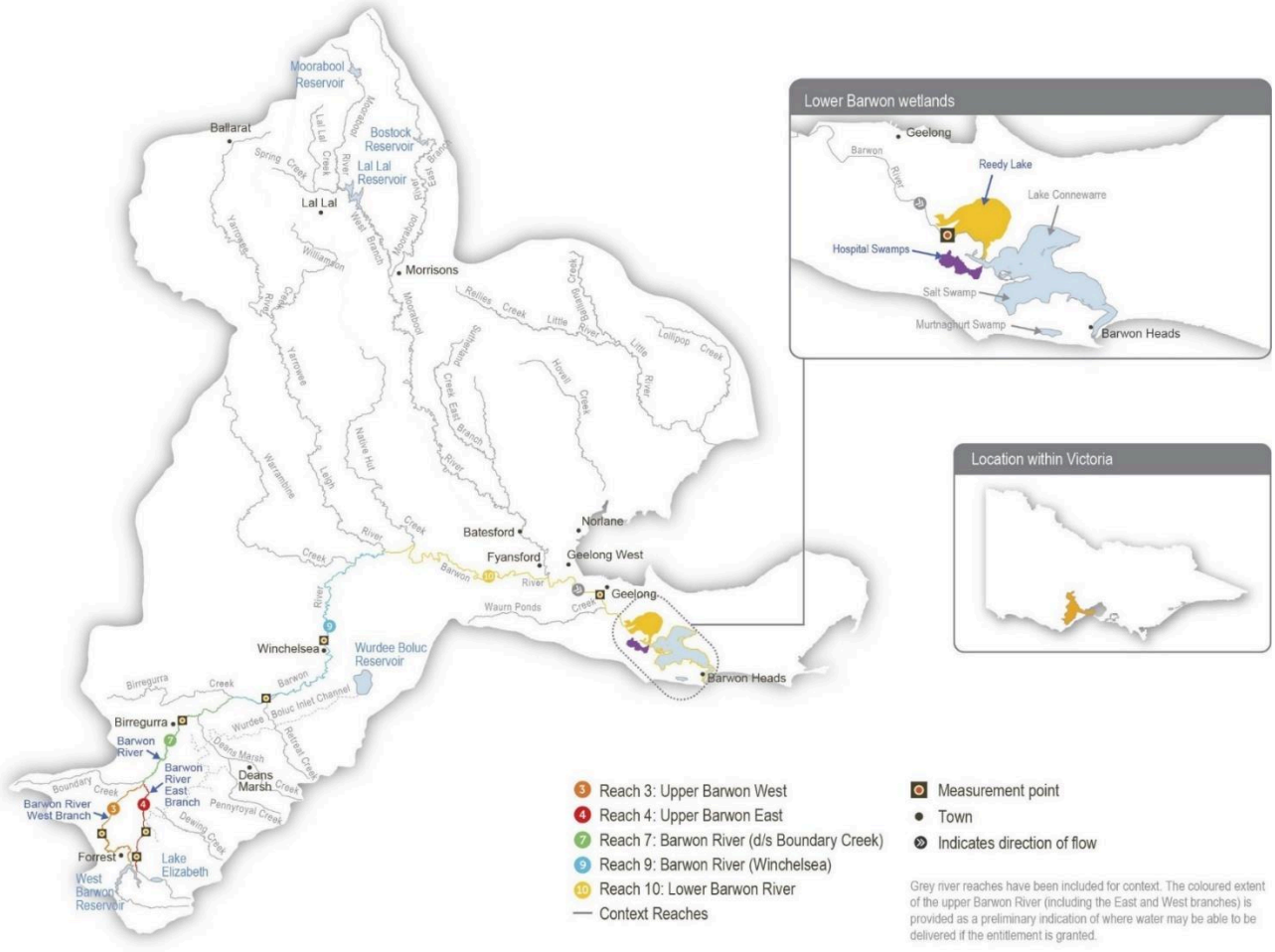

Figure 2: The Barwon System

3 TRADITIONAL OWNER CULTURAL VALUES AND USES

The reaches of the Barwon River that can be most influenced by water delivered from the West Barwon Reservoir sit on Eastern Maar Country.

In February 2020, the Eastern Maar Aboriginal Corporation (EMAC) received Registered Aboriginal Party (RAP) status under the Victorian *Aboriginal Heritage Act 2006* over a large portion of land in south-west Victoria, including the Barwon River upstream of Winchelsea. In 2023 Eastern Maar gained formal recognition of their rights under the Commonwealth *Native Title Act 1993* for over half of the RAP area and on the 21st of March 2024, the Federal Court of Australia handed down a third native title determination, marking a significant milestone since their initial recognition in 2011 under the Native Title Act. Further areas remain in negotiation. Native Title determination acknowledges Eastern Maar's ongoing connection and intrinsic relationship to Country across south-west Victoria, including parts of the Barwon River catchment.

Eastern Maar obligations to Country and objectives for Country are described in the Eastern Maar Country Plan *Meerreengeeye Ngakeepoorryeeyt* (EMAC, 2015). Eastern Maar assertions for *parreeyt* (water) are further documented in Eastern Maar's Nation Statement in Water is Life: Traditional Owner Access to Water Roadmap (DEECA, 2022).

In January 2024, staff from Corangamite CMA met with the newly appointed CMA Partnerships Officer at EMAC. The meeting took place on Country, including visits to the West Barwon Reservoir and sites on the west branch of the upper Barwon River. The meeting was an opportunity for Corangamite CMA staff to get to know the CMA Partnerships Officer, provide a summary of the Upper Barwon River Environmental Entitlement and introduce the Seasonal Watering Proposal. In February 2024 EMAC was invited to review and provided feedback on the Corangamite CMA's Upper Barwon River seasonal watering proposal, which outlined proposed environmental flows for the year ahead.

The current environmental entitlement can have most effect on the river reaches between the West Barwon Reservoir and Winchelsea, with diminishing benefit to the reaches downstream. The reaches of the river downstream of Winchelsea sit on Wadawurrung Country. Corangamite CMA is also working with Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) to understand opportunities to provide for cultural values and uses and other aspirations for the management of water for the environment in the Barwon River downstream of Winchelsea, on Country where WTOAC holds Registered Aboriginal Party status. In January 2024, Corangamite CMA met with WTOAC online to discuss seasonal watering proposals in the Corangamite Region.

EMAC and WTOAC have formal plans for how to heal Country in the region, and the Corangamite CMA continues to work with each Traditional Owner group to identify their cultural objectives and associated values and uses that align with environmental flows.

4 SOCIAL RECREATIONAL AND ECONOMIC VALUES AND USES

The adjacent land use of the upper Barwon River is dominated by grazing for livestock (beef, sheep, and dairy) and forestry, and is of significant economic value. Limited public access to river frontage limits social and recreational values and uses of the upper Barwon.

In planning the potential environmental watering actions, Corangamite CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as swimming and fishing, particularly for river blackfish)
- riverside recreation and amenity (such as birdwatching, camping, trail running, mountain bike riding and walking)
- socioeconomic benefits (such as for diverters for stock needs and domestic use; water levels and water quality can rely on the delivery of water for the environment, particularly in summer).

Although the watering actions listed in this proposal may support social, recreational, and economic values and uses, watering actions in the upper Barwon are not actively modified to accommodate a social, recreational, or economic value(s). The shared benefits of environmental watering are listed in Table 2.

Table 2 Social, recreational and economic shared benefits for the Upper Barwon River 2024-25

Waterway	Beneficiary	Connection to the river	Values / uses / objectives / opportunities	How have these benefits been considered?
Upper Barwon River	Recreation: fishing	Recreational fishing is important for social and recreational purposes. Recreational fishers have an interest in maintaining a healthy system.	A healthy fish population is important as it provides opportunities for recreational fishing.	Environmental watering supports a healthy system. Low flow watering supports connectivity throughout the reaches and allows fish to move. Fresh events aid in maintaining and expanding migratory

Waterway	Beneficiary	Connection to the river	Values / uses / objectives / opportunities	How have these benefits been considered?
				fish populations as they trigger migration and support their life cycle.
Upper Barwon River	Recreation: riverside e.g. running, bike riding and walking	Riverside recreational activities are important for social and recreational purposes. Those who engage with the natural environment are likely to support the idea of maintaining a healthy system.	Adequate water quality and flow is essential for maintaining desirable aesthetics for riverside recreational activities.	Environmental watering supports a healthy system with good water quality and flow as well as supporting fringing vegetation.
Upper Barwon River	Recreation: water based e.g. swimming	Water based recreational activities are important for social and recreational purposes. Those who engage with the natural environment are likely to support the idea of maintaining a healthy system.	Adequate water quality, depth and connectivity are important for those who engage in recreational water activities.	Environmental watering supports a healthy, flowing, and connected system with increased depth to create more opportunities for people engaging in recreational water activities.

Waterway	Beneficiary	Connection to the river	Values / uses / objectives / opportunities	How have these benefits been considered?
Upper Barwon River	Economic: stock and domestic use	The upper Barwon River predominantly flows through private property which is mostly used for farming purposes. Landholders have an interest in maintaining a healthy system.	Adequate water quality, depth and connectivity are important to ensure use as a water supply catchment. Indirect watering and fencing stock out of the waterway has the potential to greatly improve water quality, reducing erosion and nutrient load.	Environmental watering supports a healthy, flowing and connected system with increased depth and water quality to ensure economic values are retained.

5 ENVIRONMENTAL VALUES AND OBJECTIVES

The upper Barwon River is home to native fish species, including the river blackfish, short-finned eel, southern pygmy perch, Australian smelt, and various galaxias. The upper Barwon River is also home to the iconic platypus. The system retains some submerged aquatic vegetation, undercut banks, overhanging vegetation, and riffle-pool sequences, which provide important habitat for fish and other aquatic animals.

Long-term environmental objectives for the upper Barwon system are based on delivering watering actions recommended in the *Upper Barwon, Yarrowee and Leigh rivers Environmental FLOWS Study (Alluvium 2021)*. These include improving the breeding and recruitment of various fish, platypus, and macroinvertebrate species, as well as improving the condition, extent and diversity of in-stream, emergent, streamside and floodplain vegetation. However, due to the limited entitlement to water for the environment and channel constrictions, the recommended flow magnitudes have been modified to less than the known channel constraints. It is unlikely that there will be significant improvements in the river's ecological condition by delivering the watering actions in this plan. Until works are carried out to address channel constraints and other factors (such as unrestricted livestock access and weed infestation), this plan's potential environmental watering actions aim to maintain the current ecological condition and prevent cease-to-flow events.

Table 3. Environmental objectives in the upper Barwon River

Environmental objectives in the upper Barwon River
F1 – Maintain the abundance of migratory fish species, including short-finned eels and tupong. F2 – Maintain the abundance of resident freshwater fish, including several species of galaxias, Australian smelt, big-headed gudgeon, Yarra pygmy perch, southern pygmy perch and river blackfish.
PR1 – Maintain the abundance of platypus populations.
V1 – Maintain the condition and extent of in-stream vegetation to provide structural habitat for waterbugs and various fish species V2 – Maintain the condition, extent and diversity of emergent macrophyte vegetation and streamside vegetation to provide structural habitat and stabilise the channel and lower banks.
MI1 – Maintain the abundance of waterbugs as a food source for fish, frog, and platypus populations.
WQ1 – Maintain water quality for native fish, waterbugs, aquatic vegetation and other water-dependent animals.

6 ENGAGEMENT

Corangamite CMA has engaged with the Upper Barwon Surface Water Advisory Group (UBSWAG) during the development of this proposal. The UBSWAG was established by Corangamite CMA in 2017 to support the development of SWPs. Membership was initially based on groups/individuals who submitted an EOI during the advertising period in 2017. Into the future, group members can submit an application via the Corangamite CMA website. To be considered as a member, applicants must have:

- an active interest in the health and management of the upper Barwon River and/or represent a major user or user group;
- The ability to represent an established community user group,
- Commitment to work within the Terms of Reference.

The group also supports other important scientific studies relating to flows in the river. The UBSWAG is a passionate and dedicated group of individuals, community groups and government representatives with a broad combination of skills including technical knowledge, historical information and an understanding of government policy and community values. The UBSWAG is notified of all environmental flow releases throughout the year, and Corangamite CMA also works

with stakeholders individually on specific issues related to the management of environmental water as they arise.

Two key issues have been raised by the Upper Barwon Surface Water Advisory Group (UBSWAG) for acknowledgement in preparing previous proposals.

1. Potential impacts of historical Barwon Downs ground water extraction.
2. The river appears to have been disappearing to ground in the mid-Barwon between Winchelsea and Inverleigh gauges; the cause is unknown, but it is likely the water is going underground.

Usually, Corangamite CMA would host an UBSWAG meeting in the middle of the water year to provide a summary of the contents of the SWP but this year, Corangamite CMA has chosen to wait until the end of the water year so that we can use the meeting to reflect on what watering actions were achieved, share observations, and provide an update on the scenario planning based on the long-range forecast.
Corangamite CMA provided the UBSWAG with a draft of the proposal to review in early 2024, and offered to catch up with individual members to discuss elements of the SWP in person. Feedback provided by email or phone in the two-week comment period was recorded on an identified feedback register.

After reviewing the draft proposal, a member of the UBSWAG felt that there was little explanation as to why the watering actions from the previous year had been reduced. In response, Corangamite CMA has expanded on this in the "scope of environmental watering" section of this document. They also questioned if the expected watering effects and environmental objectives would be achieved if the watering actions were lower in magnitude than what is recommended in the *Upper Barwon, Yarrowee and Leigh rivers FLOWS Study* (Alluvium, 2019). In response, Corangamite CMA have edited the expected watering effects and environmental objectives to be more conservative in what can be achieved given the watering actions are lower in magnitude. A comment was also made about the new format of the Seasonal Watering Proposal in response to the revised Seasonal Watering Proposal Guidelines prepared by the Victorian Environmental Water Holder (VEWH). The UBSWAG member suggested that the confounding factors and knowledge gaps pointed out in the previous Seasonal Watering Proposal should be addressed and considered to be essential to the watering actions. Corangamite CMA have revisited these and have included them in the appendix of this proposal.

Detail of the comments received, and Corangamite CMA responses can be found in the Upper Barwon River SWP 2023-24 Comments Register. Detail of the comments received (other than letters of support) and Corangamite CMA responses are provided to the UBSWAG. Other individuals or organisations can contact the Corangamite CMA at info@ccma.vic.gov.au to request a copy of the Upper Barwon SWP 2023-24 Comments Register.

Together with the UBSWAG, Corangamite CMA engages with Traditional Owners through Eastern Maar Aboriginal Corporation (EMAC) and Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) on activities relating to the management of environmental water in the Barwon River on Eastern Maar and Wadawurrung Country, including this SWP.

This year there has been ongoing engagement with the local community about the Upper Barwon River Environmental Entitlement. This engagement has focused on promoting the environmental benefits of environmental water in the upper Barwon and keeping people updated as to when releases are happening. This ongoing engagement has included-

- Articles in the Barwon Flagship e-newsletter
- Early Bird Platypus Spotting on the Barwon River (community event hosted by Corangamite CMA)
- Upper Barwon River Electro-fishing demonstration (community event hosted by Corangamite CMA, Barwon Water and Arthur Rylah Institute)
- *What's going on with our river?* Launch of the Barwon Flagship Waterway Management Plan (community event hosted by Corangamite CMA, Barwon Water and Upper Barwon Landcare)
- Social media posts on citizen science activities helping monitor some of the benefits of environmental watering, how environmental watering works, what is the VEWH and a summary of Barwon Flagship projects that are helping us work towards being able achieve flow recommendations.

Table 4. Summary of stakeholder engagement that informed this Seasonal Watering Proposal

Who	Stakeholders	Engagement method	Engagement purpose
Community groups and environment groups	• Friends of the Barwon • Land and Water Resources Otway Catchment (LAWROC) • Geelong Field Naturalists Club • Otway Agroforestry Network • Birregurra Landcare Group • Winchelsea Landcare Group • Upper Barwon Landcare Network • Environment Victoria	Representation on UBSWAG • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholders on how their feedback influenced the SWP and why (April, 2024). • Meeting to reflect on the 2023/24 water year and review the scenario planning (July, 2024). Direct engagement (one-on-one). Attendance at community forums and events.	• Seek user input to the development of the proposal. • Review previous environmental watering actions, seek feedback on any outcomes and capture observations. • Provide an opportunity for individuals, agencies and groups to contribute to the proposed watering actions and intended outcomes. • Identify opportunities to achieve shared benefits. • Assist in increasing awareness and understanding of the purpose and objectives of the environmental watering program for the upper Barwon River.
Government agencies	• Department of Energy, Environment and Climate Action (Water & Catchments) • Barwon Water • Southern Rural Water	Representation on UBSWAG • Review of draft proposal and opportunity to provide formal feedback.	

	• VEWH	• Response to stakeholder on how their feedback influenced the SWP and why (April, 2024). • Partnership meetings with links or relevance to seasonal water proposal development. • Meeting to reflect on the 2023/24 water year and review the scenario planning (July, 2024). Direct engagement (one-on-one) (UBSWAG). Attendance at community forums and events.	
Landholders / farmers & recreational users	• Individual owners and users	Membership of UBSWAG • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholder on how their feedback influenced the SWP and why (April, 2024).	

		• Meeting to reflect on the 2023/24 water year and review the scenario planning (July, 2024). Direct engagement (one-on-one). Attendance at community forums events.	
Traditional Owners	Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC)	Directly engaged on the applicable cultural aspects within the 2024-25 SWP draft. Online meeting to discuss and seek input to draft proposal. Invited to review relevant sections of draft proposal and opportunity to provide formal feedback.	
	Eastern Maar Aboriginal Corporation (EMAC)	Invited to attend community forums and events. Meeting on country to get familiar with the upper Barwon River and Corangamite CMA activities. Invited to review relevant sections of draft proposal and opportunity to provide formal feedback.	

Local Government	Colac Otway Shire Council	Representation on UBSWAG • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholder on how their feedback influenced the SWP and why (April, 2024). • Meeting to reflect on the 2023/24 water year and review the scenario planning (July, 2024). Attendance at community forums and events.	

7 SCOPE OF ENVIRONMENTAL WATERING

In this chapter, Corangamite CMA proposes how the water in the Upper Barwon River Environmental Entitlement will be used and prioritised, based on recommendations in the *Upper Barwon, Yarrowee and Leigh rivers Environmental FLOWS Study* (Alluvium, 2021); known waterway constrictions; and the expected water available to the environment in the 2024-25 water year.

Flow prioritisation is an important part of flow delivery planning for the upper Barwon River, due to the limited amount of water available within the entitlement and to ensure the water is used for the greatest environmental benefit. The FLOWS study (Alluvium, 2021) was developed to determine the volume, priority, and ecological objectives for flow components in the Barwon River under different climatic scenarios. It prioritises flows in the following order, with flows in the east branch prioritised over the west:

1. provision of dry season low flows
2. provision of dry season freshes (a pulse of water)
3. provision of wet season freshes (a pulse of water)
4. provision of wet season low flow

Whilst the FLOWS study (Alluvium, 2021) recommends delivering all the upper Barwon east branch flow recommendations before putting water down the west, these priorities are a trade-off, particularly considering the flow volume limitations of the upper Barwon east branch preventing delivery of wet period freshes, bankfull and overbank recommendations; the exception being the ability to supplement wet period low flow. On balance, provision of water down both upper branches in the dry period is prioritised as the only practicable option.

The 2024-25 proposed watering actions have changed from those that appear in the 2023-24 Seasonal Watering Plan. The Upper Barwon Environmental River Entitlement was established in 2018. Every year since the entitlement was established, we capture new information about the east and west branch of the upper Barwon. Since the last seasonal watering proposal was written we've learnt more about where the water flows once it leaves the West Barwon Reservoir, and the impact that constrictions and break outs from the main river channel are having on our ability to deliver environmental water. In the short term, we adjust the watering actions accordingly to reduce the risk of inundating private land. This is one of the reasons why we submit a new proposal every year, because it gives us the ability to be adaptive in how we manage the entitlement. In response to what we have learnt in the last 12 months, the magnitude of the priority watering actions for the west branch have been reduced since last year's seasonal watering proposal and are lower than what is recommended in the FLOWS study (Alluvium, 2021).

In the long term we are working towards addressing constrictions and break outs through activities happening as part of the Barwon Flagship Project. These activities include working with landholders to remove weed constrictions, erosion mitigation and bank stabilization, fencing and revegetation. Corangamite CMA is also in the process of gathering more data on the channel capacity in different sections of the river so we can identify what parcels of land are most vulnerable when the low flow

recommendations are delivered (30 ML/day in the west). This data will help us to generate flood maps at different flow rates and identify constrictions that should be prioritized to enable the provision of environmental water to the east and west and downstream reaches. These maps will be an important engagement tool when working with landholders to deliver higher flows to the east and west branch of the upper Barwon.

Table 5 describes the potential environmental watering actions in 2024-25, their expected watering effect (that is, the intended physical or biological effects of the watering action) and the environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

The planned watering actions presented in Table 5 are deliberately less than the known channel capacity constraints and would provide a lower environmental benefit. Given the limitations described above, the primary aim of watering actions is to deliver enough flow through the system to maintain pool habitat and food for aquatic animals. A low flow will aim to prevent or limit cease-to-flow events, and small freshes will be delivered as needed in the east branch to manage potential water quality issues.

Table 5. Potential Watering Actions 2024-25

Potential environmental watering action	Expected watering effects	Environmental objectives	
Upper Barwon River – targeting reach 3-west branch (233255 WEST BARWON RIVER @ BOUNDARY ROAD FORREST)			
PWA 1 – west branch Summer/autumn low flow 3-15 ML/day December to May **PWA 2 – west branch** Winter/spring low flow 3-15 ML/day June to November	• Maintain permanent water in the channel/pools to provide habitat to support resident and migratory fish and platypus. • Maintain an adequate depth of permanent water in the channel to promote the recruitment of aquatic and streamside plants and to limit the encroachment of terrestrial species.	  	**F1 –** Maintain the abundance of migratory fish species, including short-finned eels and tupong. **F2 –** Maintain the abundance of resident freshwater fish, including several species of galaxias, Australian smelt, big-headed gudgeon, Yarra pygmy perch, southern pygmy perch and river blackfish. **PR1** – Maintain the abundance of platypus populations. **V1** – Maintain the condition and extent of in-stream vegetation to provide structural habitat for waterbugs and various fish species. **V2** – Maintain the condition, extent and diversity of emergent macrophyte vegetation and streamside vegetation to provide structural habitat and stabilise the channel and lower banks.

Potential environmental watering action	Expected watering effects	Environmental objectives	
Upper Barwon River – targeting reach 4-east branch (233268 EAST BARWON RIVER @ FLUME)			
PWA 1 – east branch Summer/autumn low flow 0.5-5 ML/day December to May	• Maintain an adequate depth of permanent water in the channel/pools to provide habitat to support resident and migratory fish and platypus. • Maintain an adequate depth of permanent water in the channel to promote the recruitment of aquatic and streamside plants and to limit the encroachment of terrestrial species. • Provide minimum velocity to mix pools.	   	**F1 –** Maintain the abundance of migratory fish species, including short-finned eels and tupong. **F2 –** Maintain the abundance of resident freshwater fish, including several species of galaxias, Australian smelt, big-headed gudgeon, Yarra pygmy perch, southern pygmy perch and river blackfish. **PR1** – Maintain the abundance of platypus populations. **V1** – Maintain the condition and extent of in-stream vegetation to provide structural habitat for waterbugs and various fish species. **V2 –** Maintain the condition, extent, and diversity of emergent macrophyte vegetation and streamside vegetation to provide structural habitat and stabilise the channel and lower banks. **WQ1 –** Maintain water quality for native fish, waterbugs, aquatic vegetation and other water-dependent animals.

Potential environmental watering action	Expected watering effects	Environmental objectives	
PWA 2– east branch Summer/autumn freshes 2-3 freshes of 6-9 ML/day x 2 days December to May	• Maintain an adequate depth of water in the channel and pools to provide habitat to support resident and migratory fish, platypus and waterbugs. • Provide a mosaic of wetted areas to maintain instream, emergent and streamside vegetation. • Provide minimum velocity to mix pools.		**F1 –** Maintain the abundance of migratory fish species, including short-finned eels and tupong. **F2 –** Maintain the abundance of resident freshwater fish, including several species of galaxias, Australian smelt, big-headed gudgeon, Yarra pygmy perch, southern pygmy perch and river blackfish.
			**PR1 –** Maintain the abundance of platypus populations.
			**V1 –** Maintain the condition and extent of in-stream vegetation to provide structural habitat for waterbugs and various fish species. **V2 –** Maintain the condition, extent, and diversity of emergent macrophyte vegetation and streamside vegetation to provide structural habitat and stabilise the channel and lower banks.
			**MI1** – Maintain the abundance of waterbugs as a food source for fish, frog and platypus populations.
			**WQ1 –** Maintain water quality for native fish, waterbugs, aquatic vegetation and other water-dependent animals.

Potential environmental watering action	Expected watering effects	Environmental objectives	
PWA 3 – east branch Winter/spring low flow 1-9 ML/day June to November	• Maintain an adequate depth of permanent water in the channel and pools to provide habitat to support resident and migratory fish and platypus. • Maintain an adequate depth of permanent water in the channel to promote the recruitment of aquatic and streamside plants and to limit the encroachment of terrestrial species. • Provide minimum velocity to mix pools.	   	**F1 –** Maintain the abundance of migratory fish species, including short-finned eels and tupong. **F2 –** Maintain the abundance of resident freshwater fish, including several species of galaxias, Australian smelt, big-headed gudgeon, Yarra pygmy perch, southern pygmy perch and river blackfish. **PR1 –** Maintain the abundance of platypus populations. **V1 –** Maintain the condition and extent of in-stream vegetation to provide structural habitat for waterbugs and various fish species. **V2 –** Maintain the condition, extent and diversity of emergent macrophyte vegetation and streamside vegetation to provide structural habitat and stabilise the channel and lower banks. **WQ1 –** Maintain water quality for native fish, waterbugs, aquatic vegetation and other water-dependent animals.

8 SCENARIO PLANNING

Table 6 outlines potential environmental watering and expected water use in a range of planning scenarios (dry year, average year, and wet year). Planned watering actions for the upper Barwon River are derived from recommendations in the *Upper Barwon, Yarrowee and Leigh rivers Environmental FLOWS Study (Alluvium 2021).* Many of the flow recommendations in the study cannot be delivered due to the size of the environmental entitlement and the risk of inundating private land.

Table 6. Scenario Planning in 2024-25

Planning scenario	Dry year	Average year	Wet year
Expected conditions	• Disconnected pools during summer and autumn • Cease-to-flow events	• Low flow in summer and autumn • Peak flow in winter and spring	• Continuous flow throughout the year • Reservoir spills are likely, especially during winter and spring
Expected availability of water for the environment	• 2180 ML	• 2250 ML	• 2350 ML
Upper Barwon River (targeting reach 3 – west branch)			
Potential environmental watering – tier 1 (high priorities)	Tier 1a (can be achieved with predicted supply)		
	• Summer/autumn low flow (delivered at a lower magnitude in the range)	• Summer/autumn low flow (delivered at a lower magnitude in the range)	• Summer/autumn low flow
	Tier 1b (supply deficit)		
	• Winter/spring low flow (delivered at a lower magnitude in the range)	• Winter/spring low flow (delivered at a lower magnitude in the range)	• Winter/spring low flow

Planning scenario	Dry year	Average year	Wet year
Potential environmental watering – tier 2 (additional priorities)	• N/A	• N/A	• N/A
Upper Barwon River (targeting reach 4 – east branch)			
Potential environmental watering – tier 1 (high priorities)	Tier 1a (can be achieved with predicted supply)		
	• Summer/autumn low flow (delivered at a lower magnitude in the range) • Summer/autumn freshes (two freshes)	• Summer/autumn low flow (delivered at a lower magnitude in the range) • Summer/autumn freshes (two freshes	• Summer/autumn low flow • Summer/autumn freshes (three freshes) • Winter/spring low flow
	Tier 1b (supply deficit)		
	• Winter/spring low flow	• Winter/spring low flow	
Potential environmental watering – tier 2 (additional priorities)	• N/A	• N/A	• N/A
Possible volume of water for the environment required to achieve objectives	• 1264 ML (tier 1a) • 2340 ML (tier 1b)	• 1085.5 ML (tier 1a) • 1170 ML (tier 1b)	• 540 ML (tier 1a) • 360ML (tier 1b)
Priority carryover requirements for 2025-26	• **500 ML**	• **500 ML**	• **500 ML**

In this proposal, the expected availability of water for the environment is less than previous years. This is due to a review of the methodology used to calculate this value and a review of the data that has been collected since the entitlement started in 2018. Each year the expected availability of water for the environment will change depending on how much water is carried over from the previous year and the climate scenario for the upcoming water year. Table 6 shows the amount of environmental water used will be less in a wet year than in a dry year. During a wet year, natural flows will achieve many of the watering actions without a contribution from environmental water. The minimum carryover reserve for 2024-25 for the upper Barwon River is 500 ML, the drought reserve amount agreed upon with the Upper Barwon Surface Water Advisory Group.

The Barwon Southwest region has a temperate climate, with mild to warm summers and cold winters. Summer average maximum temperatures are around 22-24°C near the coast and in elevated areas, and 25-27°C inland. Winter average maximum temperatures are around 12-14°C. Rainfall occurs mostly in winter and spring and is generally the result of rain-bearing weather systems coming from the west (DELWP, 2015). Climate change continues to influence Australian and global climates. Australia's climate has warmed by around 1.47 °C over the period 1910–2021. There has also been a trend towards a greater proportion of rainfall from high intensity short duration rainfall events, especially across northern Australia (Climate Driver Update Archive BOM (2023b, February)). Regarding long term climate projection based on a medium (RCP4.5) emissions scenario, annual rainfall totals are likely to decline by 25% by the end of the decade, with the greatest drying to occur in spring. As warming continues, more heat extremes will occur.

The Bureau of Meteorology (BOM) states that at the time of writing (April 2024) El Niño is near its end with the expectation that conditions will return to neutral before the start of the 2024-25 water year. The BOM also states that four out of seven climate models are predicting a La Nina by late winter 2024. However, the BOM also states that current forecasts beyond May should be used with caution (BOM, 2024). Considering this it is thought that on balance, average rainfall is likely for the upcoming water year and Corangamite CMA will plan watering in line with an average climatic scenario, noting adaptive management may be required to respond to ambient conditions if La Nina returns and influences the Corangamite Region.

9 RISK MANAGEMENT

A risk assessment has been undertaken for the 2024-25 season, with representatives from Barwon Water, the VEWH, and the Corangamite CMA present. This assessment identifies the risks associated with delivering water for the priority actions. Mitigation actions to reduce risks have been identified and should be undertaken as part of the release plan. An overview of the risk assessment and potential risk mitigation measures and associated residual risk assessment is outlined below in Table 7.

Table 7. Risk assessment for the upper Barwon River environmental watering 2024-25

			Pre-Mitigation Risk					Residual Risk		
Risk ID	**Risk category**	**Risk description**	**Likelihood**	**Consequence**	**Risk Rating**	**Mitigation actions**	**Lead organisn. for action**	**Likelihood**	**Consequence**	**Risk Rating**
CEBA2020-22	Legal	Heavy rainfall following environmental deliveries may lead to unintended inundation of private land in the upper Barwon River, resulting in impacts on landowner activities and assets.	Possible	Minor	Low	• Undertake detailed monitoring of water levels and adjust delivery plans based on seasonal conditions and forecasts. • Ongoing communication of delivery plans to landholders. • Limiting maximum delivery rates to reduce risk of flooding - Undertake regular communications between CMA and Barwon Water to identify local risks (using operator knowledge) and manage releases accordingly - Reassess acceptable flow limits following willow/constraints removal program	CCMA CCMA CCMA/BW CCMA/BW CCMA	Unlikely	Minor	Low
CEBA2021-23	Cultural Heritage	Inadequate engagement with Eastern Maar during planning may lead to a failure to address T.O. values or damage to heritage/artifacts and may impact on values or heritage *Note: There may also be some reputational risks if Eastern Maar can't be engaged in environmental water processes*	Possible	Minor	Low	• Continue efforts to seek to establish meaningful partnership arrangements with Eastern Maar people, leading to ongoing inclusion of T.O. values into watering proposals • Continue to partner and share knowledge with T.O.s to build capacity to actively engage in water related issues	CCMA	Unlikely	Minor	Low
CEBA2024-32	Reputational	Implementing watering actions for sites supplied from West Barwon Reservoir may not be successful due to lack of information on flow behaviour and constraints resulting in inundation of private land	Likely	Minor	Low	• Review and assess potential risk issues for water delivery actions and develop specific mitigation actions. • Continue to support community and stakeholder information and engagement processes. - Continue to implement upper Barwon restoration project to restore channel capacity for environmental water delivery - Expand flow monitoring capability where possible to assess outcomes of restriction removal programs, and adjust watering actions accordingly - undertake detailed assessment of channel capacity in hot spots on both branches and identify and implement remediation measures (Landholder agreements, constraints removals)	CCMA	Unlikely	Minor	Low

			Pre-Mitigation Risk					Residual Risk		
Risk ID	**Risk category**	**Risk description**	**Likelihood**	**Consequence**	**Risk Rating**	**Mitigation actions**	**Lead organisn. for action**	**Likelihood**	**Consequence**	**Risk Rating**
CEBA2020-25	Reputational	Community concerns related to establishment and implementation of Barwon Water groundwater remediation plan may be extended (incorrectly) to Barwon River environmental release plans, leading to a loss of public/political support for activities	Unlikely	Moderate	Low	• Engage with key objectors to address information gaps and concerns.	CCMA	Unlikely	Minor	Low
CEBA2020-26	Reputational	The availability of environmental entitlements creates a community expectation (which can't be met) that regular "natural" cease to flow events in the mid-Barwon and low flows/BGA issues in the lower Barwon will no longer occur.	Unlikely	Moderate	Low	• Continue to engage with the local community to build understanding of the limitations on the available environmental water entitlements and the processes for identifying and prioritising environmental watering actions. • Engagement in the redevelopment of the SWS to address environmental water needs. • Consider accessing additional water through trade	CCMA CCMA VEWH	Unlikely	Minor	Low
CEBA2020-27	Environment	Environmental releases do not achieve planned/specified flow targets due to releases being diverted by other users before reaching delivery site.	Likely	Minor	Low	• Ensure licensing authority is aware of planned events and alert it to the need to manage compliance by all users. • Work with SRW to improve diversions compliance management options and shepherding of environmental flows through the system.	CCMA	Possible	Minor	Low
CEBA2024-33	Reputational	Inability to accurately control and manage low volume releases into east branch results in risk of flooding private land *(Note: this risk could be considered as legal or financial)*	Likely	Minor	Low	• A number of actions are being undertaken to develop more accurate delivery arrangements. - monitor progress in 2025 - Modify order specification to provide more realistic/achievable flow range for operators - Maintaining ordered flows to low magnitudes to minimise impacts	CCMA+Storage manager CCMA CCMA	Possible	Minor	Low
CEBA2024-34	Environment	Inability to deliver environmental water due to BGA blooms in West Barwon Reservoir in order to prevent environmental and human health impacts may lead to a failure to achieve environmental objectives. *Note: releases for consumptive purposes will still probably be required, so environmental releases don't increase human safety risks significantly*	Unlikely	Minor	Low	- Monitor algal levels and review release options and risks throughout the season. - inform SRW of algal risks where relevant to allow notification to D&S users	Barwon Water Storage operator (Barwon Water)	Unlikely	Minor	Low

10 APPROVAL, ENDORSEMENT AND CONSENT

WATERWAY MANAGER APPROVAL OF THE SEASONAL WATERING PROPOSAL
I, the authorised representative of the agency shown below, approve the Seasonal Watering Proposal for the Barwon system in 2024-25. SIGNED FOR AND ON BEHALF OF CATCHMENT MANAGEMENT AUTHORITY Signature of authorised representative:  Name of authorised representative: Amber Clarke Position of authorised representative: Chief Executive Officer Date: 19 April 2024

ENDORSEMENT OF THE SEASONAL WATERING PROPOSAL				
I, the authorised representative of the agency shown below, approve the Seasonal Watering Proposal for the Barwon system in 2024-25.				
Role	**Endorsing partner**	**Representative Role**	**Status Date**	**Notes/Comments**
Water Corporation	Barwon Water	Jared Scott, Coordinator Systems, Waterways and Catchments	☒ Endorsed. Date:09/04/2024	*Endorsement received by email.*

CONSENT TO USE OF CONTENT						
Role	**Endorsing partner**	**Delegate Role**	**Content**	**For use in the**		**Notes**
				Seasonal Watering Proposal	**Seasonal Watering Plan**	
Traditional Owner	Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC)	Claire Mennen *Project Officer, Caring for Country Team*	All chapters	☒ Consent provided. Date:23/02/2024	☐ Consent provided. Date:	Support and consent received by email. At the request of WTOAC, Wadawurrung language has been excluded from the SWP.
Traditional Owner	Eastern Maar Aboriginal Corporation (EMAC)	Mundara Clark, CMA Partnerships Officer	All chapters	☒ Consent provided. Date: 18/04/2024	☐ Consent provided. Date:	Consent provided over the phone and via email.

11 REFERENCES

Alluvium, 2020. Final Report: Upper Barwon Restoration. [Report prepared by Alluvium Consulting Australis for CCMA].

Alluvium , 2021. Upper Barwon, Yarrowee and Leigh rivers FLOWS study update. [Report prepared by Alluvium Consulting Australia for CCMA].

BOM. 2024. *Climate Driver Update*. http://www.bom.gov.au/climate/enso/

DELWP, 2022. Water is life: Traditional Owner access to water road map. https://www.water.vic.gov.au/aboriginal-values/the-aboriginal-water-program

Eastern Maar Aboriginal Corporation, 2015. Meerreengeeye ngakeepoorryeeyt – Our Country. EMAC Country Plan accessed from https://easternmaar.com.au/

VEWH, 2023. Seasonal Watering Plan 2023-24

VEWH, 2023. Seasonal watering proposal 2024-25 guidelines

Wadawurrung Traditional Owners Aboriginal Corporation, 2020. *Paleert Tjaara Dja – Wadawurrung Country Plan*. https://wadawurrung.org.au/resources

12 APPENDICES

1. Delivery constraints

1.1 Temporary constraints

Although there are few potential temporary constraints that inhibit delivery, risks are identified prior to and reviewed throughout the year. Potential risks associated with climate events, such as fire, flood and heatwaves may negatively impact the water quality and availability. There is no indication of what the 24/25 climate scenario (dry, average, and wet) will be, however given the climate unpredictability, temporary constraints may be revealed throughout the 2024-25 year (outlined below in Table 1).

Table 1. Potential temporary constraints to environmental water delivery

Potential temporary constraint	Impact on watering	Action
Weed removal works	Potential impact on low flow and fresh delivery	Corangamite CMA conducts an integrated catchment management program that incorporates willow, glyceria, and riparian management with the delivery of environmental water. Barwon Water are a delivery partner so we will work collaboratively to determine if any works are likely to impact environmental water delivery options.
Systematic landscape-scale in-channel weed infestations	Interrupt environmental water passing further downstream and spot works associated	Corangamite CMA conducting works on site to deal with specific weed infestation, potentially results in reduced volumes of environmental water to facilitate works. Water delivery is discontinued if it is considered that there will be detrimental effects, such as private land inundation.
Blue-green algal bloom in storage reservoir	Interruption to environmental watering, may result in delays.	Water delivery process and schedule will be assessed and revised if necessary.
Fire in the catchment or adjacent to the river.	Interruption to environmental watering, depending on scale of fire will determine significance.	Water delivery discontinued if it is considered that there will be detrimental effects, such as water quality issues to the river or further downstream.

Flood warnings	Interruption to environmental watering.	In the event of a flood watch or flood warning issued by the Bureau of Meteorology, all environmental releases will be stopped.

1.2 Systemic constraints

1.2.1 Flow constriction and diversion points

The FLOWS study update (Alluvium, 2021) highlights that many complementary actions will be required to realise the full effectiveness of the environmental entitlement, in particular 'fresh' events. For example, the dry period fresh flow peak for the east branch has been reduced from 35ML/day to 9ML/day. The need for modification of planned flow releases has been demonstrated in previous watering years in both branches where despite the flow rate being significantly reduced each season, some flooding was still experienced. The flooding appeared to be caused by in-channel flow constrictions such as choking Willows and Glyceria, and to a lesser extent, old channel diversions to restricting infrastructure points.

The Central and Gippsland Sustainable Water Strategy (DELWP, 2022), is a significant strategy for the Upper Barwon as sustainable water strategies enable long term water resource planning for Victoria's water resources and can be a vehicle for recovering more water for the environment. The strategy addresses the issue of flow constriction in Action 8.4.

Action 8-4: Improving waterway health in the Barwon River (Short term: by 2027)

The Victorian Government will improve waterway health in the Barwon River, increase the effectiveness of environmental water releases and address constraints to their delivery by:

- *investigating options to improve native fish migration at Buckley Falls*
- *restoring channel form and removing willows and reed sweet-grass from the upper Barwon River*
- *investigating risks of releasing higher volumes of water and prioritising works to mitigate them.*

1.2.2 Allocation

The FLOWS study update (Alluvium, 2021) recommends a water recovery target of 28.6GL for the Barwon River to get back to 70% of natural flow and meet ecological requirements. Therefore, the current allocation is significantly insufficient to meet the river's health requirements. The Central Gippsland Region Sustainable Water Strategy (DELWP, 2022) acknowledges that the allocation of 1GL/year delivers only a small portion of the recommended summer flows for the east and west branches of the upper Barwon River and in Policy 8-3 states that by 2032, the Victorian Government will return up to 5GL of water for the environment in the Barwon River to improve waterway health.

The Upper Barwon River Environmental Entitlement 2018 allows for a 2,000ML share of the total storage capacity of the West Barwon Reservoir and allows for storage of 3.8% of the flow into the reservoir, up to the 2,000ML. Modelling has shown that this will typically be about 1,000ML of water each year, but theoretically up to 2,000ML or more could be available if a portion of the stored allocation was used and the 2,000ML storage allocation refilled. Corangamite CMA will however aim to always keep approximately 500ML in storage in case of drought.

1.2.3 Barwon Water delivery infrastructure limitations

Although the West Barwon Reservoir is situated on the upper Barwon west branch, water can be released down the upper Barwon east branch (through a diversion tunnel) as well as to the upper Barwon west branch. Due to the manual operation of gates on the inlet to the tunnel and the diversion weir on the west branch there is limited control of flow through the gate system into the tunnel at low flows. For this reason, it is very difficult to accurately deliver low flow environmental transfers to the east branch when the minimum passing flow for the Bulk Entitlement (Upper Barwon System) is "Pass natural flow". This reduces Barwon Water and the Corangamite CMA's ability to deliver environmental water efficiently and manage the risk associated with delivering low flow environmental water releases on top of fluctuating natural flows in the East Barwon River and the potential for minor inundation of private property.

As operators of the West Barwon Reservoir, Barwon Water reports that the maximum release capacity from the reservoir is 320ML/day, with 140ML/day down the Upper Barwon east branch. This is not a systematic constraint now, due to channel capacity limitations further downstream. Barwon Water and Corangamite CMA are liaising to ensure any modification of the environmental weir takes into consideration opportunities to simplify/improve the management and delivery of environmental releases. A return of up to 5GL of water for the environment in the Barwon River by 2032 (DELWP, 2022) will need to be considered when planning upgrades to Barwon Water delivery infrastructure.

2. Confounding factors

Flow alteration is one of many factors that affect the environmental condition of the upper Barwon and many environmental watering objectives will not be fully achieved unless other impacts are adequately addressed. In the upper Barwon system, there are multiple confounding factors that impact negatively on the river's health that cannot be mitigated by the entitlement alone. Confounding factors can be resolved between agencies and other stakeholders.

The Upper Barwon project is a newly established integrated catchment management project under the Barwon Flagship that will work with many stakeholders to address flow restrictions and break outs through riparian management as part of a long-term program.

2.1 Flow Constrictions

Following review of the environmental flow requirements for the Upper Barwon, Yarrowee and Leigh Rivers (Alluvium, 2021), release of the first environmental flows caused some inundation of private properties. This flooding was caused by in-channel flow constrictions from invasive species such as Willow and Glyceria and historic channel diversions and infrastructure. These flow constrictions prevent optimal delivery of the entitlement through the east and west branches of the river and have forced Corangamite CMA to reduce the volumes of many flow components in these branches to avoid flooding.

In response to flooding and the temporary closure of Birregurra-Forrest Road in 2021, a modelling exercise was completed to determine what impact targeted removal of instream Glyceria and Willows would have on flow in the west branch of the Upper Barwon River (Alluvium, 2021a). The final report by Alluvium recommended that to help alleviate backwatering, Corangamite CMA remove an infestation of Glyceria upstream and downstream of Birregurra-Forrest Road and two willow blockages in the reach downstream of the road. In Autumn 2022, Corangamite CMA removed Glyceria from a 2.6km stretch of river and removed six willows downstream of the road. In the summer months of 2022-23, Corangamite CMA has completed spray treatment of the site and revegetated in winter/spring 2023. Removal of Willows has now taken place across 5 properties situated on the upper Barwon River and revegetation works are to follow.

2.2 Riparian Rehabilitation

Healthy land supports healthy waterways. Water quality, bank stability and habitat can decline due to a lack of adequate riparian vegetation surrounding the river channel. As many parts of the Barwon River run through agricultural properties, there are degraded riparian zones that negatively impact on the river's health. In order to mitigate these impacts, Corangamite CMA works directly with landholders to fence off the riparian zone to keep stock away from the waterway and replant and revitalise native vegetation.

The Corangamite CMA funds waterway protection and restoration works with incentives available for fencing, weed control and revegetation. Riparian restoration is a significant component of the Barwon Flagship project.

2.3 Fish Barriers

In the upper Barwon system, there are several barriers to fish passage. This includes weirs, dams and obsolete structures that limit fish migration. To mitigate these impacts, removal or modification will be required. Along with other agencies, Corangamite CMA will seek to remediate these barriers where funding and resources are available.

3.0 Knowledge gaps

Table 2 below outlines some of the knowledge gaps in the upper Barwon River. The initial projects were prioritised by Corangamite CMA and project status has been provided. Please note the proposed projects have not been committed to by the Corangamite CMA or external funding providers. This list represents potential projects that could improve knowledge for managers and the community. The

Corangamite CMA will continue to seek opportunities for investment in these priority projects to enhance the management for waterway health outcomes.

Table 2. Knowledge Gaps, Responsible Authority and Status

Knowledge gaps and project recommendation	***Responsible authority***	***Status***
Identifying Traditional Owner values Increasing understanding of tangible and intangible indigenous heritage values in the area is a key priority for the Corangamite CMA. Empowering Traditional Owners to re-establish linkages with the river system will bring about a more precise knowledge base for delivery of environmental water and realise significant shared benefits for Traditional Owners and the wider community. Corangamite CMA will continue to work with Traditional Owners and VEWH to incorporate Water is Life information and outcomes into the planning and delivery of environmental water.	CCMA	*Proposed*
Fish monitoring in the Upper Barwon system There is currently no monitoring on the upper Barwon River to assess progress towards environmental objectives being targeted by the Upper Barwon Environmental River Entitlement deliveries. Proposed Barwon River Flagship monitoring includes fish monitoring as it is a major knowledge gap in the system, despite the Barwon River having 44 species of fish (including native protected species) and the local community being highly interested. Monitoring could be undertaken to track presence and abundance in the context of	CCMA Barwon Water	*In progress:* Corangamite CMA have partnered with Barwon Water to conduct fish surveys in the dry season of 2024 and 2025. Arthur Rylah Institute have been engaged to conduct the monitoring at sites on the east and west branch and downstream as far as Winchelsea.

current environmental releases, following an expected increase in the annual volume of the environmental entitlement and post remediation of choke points throughout the system over the life of the Flagship. This would progress towards the fish objectives outlined in the FLOWS study. Engagement with the Eastern Maar Traditional Owners would be beneficial to ascertain culturally significant species.		
eDNA monitoring for growling grass frog and platypus The aim of this citizen science program conducted in Autumn 2024 is to identify the eDNA in the upper and mid Barwon from not only platypus but also the growling frass frog. The Upper Barwon, Yarrowee and Leigh Rivers FLOWS Study (Alluvium, 2021) suggests that there are no Growling grass frog present in the east and west branch of the upper Barwon River but anecdotal evidence suggests otherwise. When available the report findings will build on eDNA data evidence gathered by the Upper Barwon Landcare Network in association with Friends of the Barwon and Geelong Landcare Network in 2018, 2019, 2020 and 2021.	Corangamite CMA	*In progress:* Corangamite CMA's citizen science program has partnered with the Upper Barwon Landcare Network and Waterwatch volunteers to collect water samples in April 2024. These water samples will be analysed for the presence of DNA by EnviroDNA who will also be preparing a report.
Waterwatch The aim of this citizen science program is to help evaluate the benefit of e-water regimes on water quality and waterbug communities in the Upper Barwon.	Corangamite CMA	*In progress*: The Water Quality Report Upper Barwon 2023-Corangamite CMA Citizen Science can be found here https://www.ccmaknowledgebase.vic.gov.au/kb_resource_details.php?resource_id=5523
Deakin University Riparian Buffer Study – Riparian Restoration	Barwon Water, Deakin University and WaterRA	*In progress*

A PhD project focusing on the effects of willow removal and the physical characteristics of riparian restoration on water quality, microclimate and morphology.		
Upper Barwon River Ground Survey Project The Corangamite CMA wants to avoid contributing to flooding while releases of water for the environment are taking place from the West Barwon Reservoir. To do this, we need to collect additional data to understand how the size and shape of the river channel changes along the length of the river.	Corangamite CMA	*In progress:* Over the first half of 2024, Corangamite CMA has engaged contractors to survey the river channel in sections of both the east and west branch of the upper Barwon River. The surveyor will measure the change in the width and depth of the river channel at regular intervals and will take measurements of other features such as bridges and culverts.
Upper Barwon River Flood Study The Upper Barwon River Ground Survey Project is just the first step. Once the measurements have been taken by the surveyor, the data will be used to create a model of the upper Barwon River. This model can be used to determine what volumes of water can travel through the river before it starts to inundate private property.	Corangamite CMA	*Proposed*
Additional gauging To better understand how the water moves through the east branch and how the flow rate changes from the East Barwon River@Flume gauge to the downstream end of the east branch, additional gauging is required.	Corangamite CMA	*Proposed*
Review of expected watering effects and environmental objectives	Corangamite CMA	*Proposed*

A review of these would help to understand and communicate what impact environmental watering at a magnitude lower than what is recommended in the FLOWs Study (Alluvium, 2021) can have on river health.		