CORANGAMITE CMA

Moorabool River Seasonal Watering Proposal 2022-23

FINAL APRIL 2022

healthy and productive lands and waters
cared for by thriving communities

Contents

Figures

Tables

Acknowledgement of Country

The Corangamite Catchment Management Authority (Corangamite CMA) wishes to acknowledge the Wadawurrung, Traditional Owners of the land of the Moorabool River. We pay our respects to their Elders past, present and emerging. We commit to continuing to work with all Traditional Owners to ensure their knowledge and culture is included and valued in Corangamite CMA planning and delivery.

Executive Summary

This Seasonal Watering Proposal (SWP) outlines the Corangamite CMA's proposed priorities for the use of environmental water in the Moorabool River system in 2022-23, as required under section 192A of the *Water Act 1989*. The Victorian Environmental Water Holder (VEWH) will use this SWP to inform the development of the Seasonal Watering Plan 2022-23.

The Moorabool River, which passes near the towns of Ballan, Morrisons, Batesford and Fyansford, is one of the most flow-stressed rivers in Victoria. The Moorabool is very dependent on seasonal rainfall and environmental watering to maintain flows over dry periods.

There are three major water storages at the headwaters of the Moorabool River: the Moorabool, Bostock, and Lal Lal Reservoirs. The Moorabool River Environmental Entitlement (2010) sits within Lal Lal Reservoir and is subject to delivery rules with a maximum use of 7,500ML over three years, which provides the environment with an average of 2,500ML per year, subject to inflows.

This SWP has been developed in consultation with the Wadawurrung Traditional Owners (Wadawurrung Traditional Owners Aboriginal Corporation - WTOAC) and the Moorabool Stakeholder Advisory Committee (MSAC). The Wadawurrung Traditional Owners value maintaining water in the Moorabool River for healthy, thriving, culturally significant species; and for other cultural values such as maintaining water in refuge pools and at confluences. The MSAC is a passionate and dedicated group of individuals, groups and government representatives that have a broad combination of skills, including technical and historical knowledge and an understanding of government policy and community values. The environmental watering objective (below) was developed by MSAC and has guided the watering actions for 2022-23.

"To improve the Moorabool River's flow-dependent ecological values and services through the provision of environmental water. The delivery of environmental water will also provide for social and cultural values for future generations."

A risk assessment has been undertaken by Corangamite CMA for the 2022-23 season, with Barwon Water, the VEWH and Parks Victoria. This assessment identifies the risks associated with delivering water for the priority actions. Mitigation actions to reduce risks have been identified and are undertaken as part of the release plan. Risks are rated minor to extreme. Any risks classed as high or above are listed below. See section 10 for a comprehensive list of risks and their mitigation actions.

- *Unexpected rain events during e-water deliveries can lead to capacity limits at Dolly's Ck Rd crossing being exceeded contributing to flows over the road, with safety risks to road users. Increased environmental entitlements may exacerbate this risk. It should be noted that this site naturally floods frequently, and environmental water contribution is minor. After mitigation actions this risk is downgraded to medium.*

In 2021-22, environmental watering primarily focused on the provision of summer/autumn low flows and targeted short-term releases of higher volumes (freshes). All winter/spring priorities were achieved naturally due to Lal Lal Reservoir spilling and wet climatic conditions, which may not occur in 2022-23. The 2022-23 priorities for watering will be similar to what was proposed in 2021-22, given the allocation of a maximum of 2,500ML for the watering season. The priority watering actions for the 2022-23 season are summarised in Table 1:

Table 1. Summary of priority watering actions for the Moorabool River in 2022-23

Environmental allocation: ~2,500ML/year
Priority 1: Summer/autumn low flow (Dec - May) 5 – 40 ML/day continuously
Priority 2: Winter/spring low flow (Jun - Nov) 5 – 60 ML/day continuously
Priority 3: Summer/autumn fresh event (Apr - May) 60 – 80 ML/day for 5 days
Priority 4: Summer/autumn fresh event (Jan - Feb) 60 – 80 ML/day for 5 days
Priority 5: Little summer/autumn fresh event (Feb - Mar) 30 – 60 ML/day for 3 days
Priority 6: Winter/spring fresh event (Sep - Nov) 80 – 90 ML/day for 5 - 10 days
Priority 7: Winter/spring fresh event (May - Aug) 80 – 90 ML/day for 5 –10 days
Priority 8: Winter/spring fresh event (Sep - Nov) 80 – 90 ML/day for 5 – 10 days

1. Introduction

To support the Moorabool River, Corangamite CMA has developed the Moorabool Flagship project, 'The Living Moorabool', to deliver integrated catchment management to improve the health of the Moorabool River, downstream of the Lal Lal Reservoir, and the West Branch of Sutherland Creek.

This Seasonal Watering Proposal (SWP), part of The Living Moorabool project, outlines Corangamite CMA's proposed priorities for the use of environmental water in the Moorabool River system in 2022-23, as required under section 192A of the *Water Act 1989*. The VEWH will use the SWP to inform the development of the Seasonal Watering Plan 2022-23. The plan will outline the full scope of state-wide priorities for use of the Water Holdings.

As the Moorabool is a water supply catchment with significant environmental values, 17 of the 20 assessed river reaches and wetlands within the Moorabool landscape zone are identified as priorities in the *Corangamite Waterway Strategy 2014-22*. Of these reaches, this SWP is relevant for three as defined in FLOWS Study Update (Jacobs, 2015): reach 3a – Lal Lal Reservoir to the river confluence with the East Branch; reach 3b – confluence with the East Branch to She Oaks Weir; reach 4 – She Oaks Weir to Barwon River. These reaches are shown below in Figure 1.

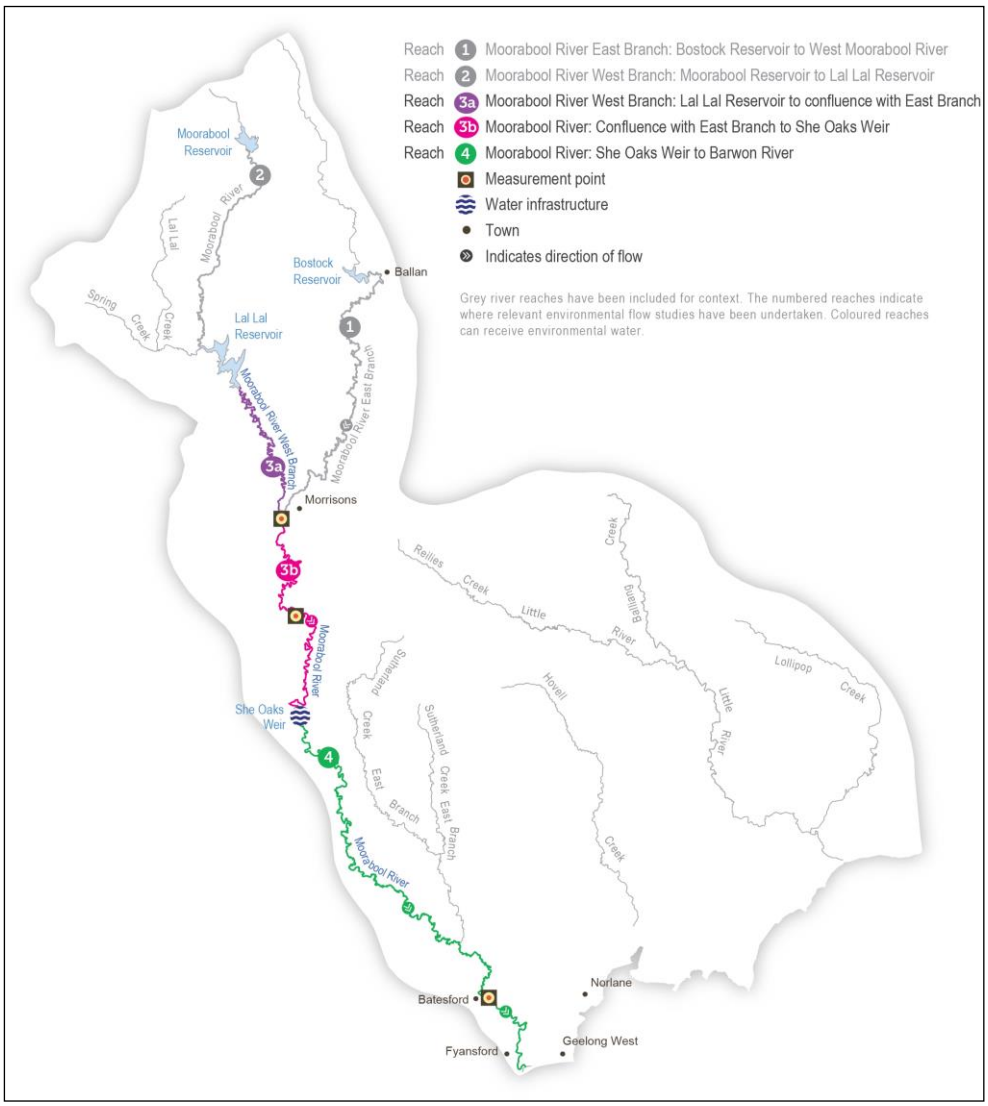


Figure 1. The Moorabool River system, showing reaches 3a, 3b and 4

1.1 System overview

The Moorabool River flows south from the Central Highlands between Ballarat and Ballan and joins the Barwon River at Fyansford. The Moorabool River, *"Moorabull Yaluk"*, flows through Wadawurrung Country and has great cultural significance for Wadawurrung Traditional Owners.

The river's catchment is heavily farmed with about 65 percent of its 1,150km^2 area deemed as being agricultural-related land cover (DELWP, 2021). It is a highly regulated waterway with several large water storages in the upper reaches including the Moorabool, Bostock, and Lal Lal Reservoirs. In the lower reach between She Oaks and Batesford there are nine private diversion weirs that are significant barriers to fish. These barriers have increased the extent of slow flowing habitat and reduced habitat diversity in the lower reach of the Moorabool (Sinclair Knight Merz [SKM], 2004). The amount of water that enters the river is also substantially reduced by the number of farm dams in the catchment, estimated at more than 4,000. Urban growth in the south of the catchment is also placing pressure on values in the lower section of the river. The Moorabool River is also a major tributary of the Barwon River. It flows southward from the Central Highlands between Ballarat and Ballan and joins the Barwon River at Fyansford.

The Moorabool River Environmental Entitlement (2010) is held in Lal Lal Reservoir (see Section 1.2 below). Passing flows from Lal Lal Reservoir (Figure 2) are a significant component of annual stream flow below this structure and are important in maintaining base flows through winter. Passing flow rules stipulate release of 5ML/day (or calculated inflows into the reservoir) when inflow has been less than 43GL over two years, or 20ML/day (or calculated inflows into the reservoir) when inflow has been over 43GL for two years. Passing flows from Lal Lal Reservoir are currently at 20ML/day or calculated inflows into the reservoir (whichever is lesser). Passing flows do not impact the volume of water allocated to the environmental entitlement, nor do they restrict the ability to use the environmental entitlement. Passing flows are an important source of water for the Moorabool River, and where opportunity exists the environmental entitlement will be used to enhance these flows.

Figure 2. Lal Lal Reservoir

Barwon Water releases water from its bulk entitlement at Lal Lal Reservoir during the summer months (usually December to April) for potable water supply purposes. Due to a national chemical shortage, in the 2021-22 water year Barwon Water were unable to utilise their entitlement from Lal Lal Reservoir and subsequently their releases ceased at the end of January for the remainder of the summer. Usually the average flow released by Barwon Water is around 17ML/day (2020-21) (with total yearly average release amount being about 2,600ML) and depending on water quality requirements, these flows may increase to over 30ML/day to freshen the system before domestic water extraction at She Oaks weir. Over the last six years these flows have played a very important

role in maintaining summer low flows between Lal Lal Reservoir and She Oaks Weir, which is the highest priority environmental flow component for the river. Furthermore, these Barwon Water transfers allow the environmental water holdings to be used to provide other benefits such as carrying summer low flows and freshes further down the system to Reach 4. Corangamite CMA and Barwon Water discuss flow release plans annually to determine how the authorities can work together to achieve mutual benefits from the Lal Lal water releases.

No environmental entitlement exists for Bostock or Moorabool Reservoirs, however passing flow rules are in place. For the Moorabool Reservoir the passing flow requirements downstream of the reservoir are the lesser of 3ML/day or gauged inflows into the reservoir. For Bostock Reservoir it is the lesser of flow into the reservoir and 1.2ML/day from December to July and 0.8ML/day from August to November.

1.2 Environmental Entitlement

The Moorabool River Environmental Entitlement (2010) is held within Lal Lal Reservoir (Figure 3) and is subject to delivery rules with a maximum use of 7,500ML over three years, which provides the environment with an average of 2,500ML per year, subject to inflows. The VEWH has 11.9% of the capacity of Lal Lal Reservoir to store the environmental entitlement, and 11.9% of inflows.

The Moorabool River FLOWS Study Update (Jacobs, 2015) divides the Moorabool River system into five river reaches. This delineation is based on geomorphology, hydrology, system operation and natural values. Although this watering proposal is only relevant for reaches 3a, 3b and 4 below Lal Lal Reservoir, a condition summary of each reach of the Moorabool River is provided in Appendix 4 to provide context on the condition of the entire river.

Reach 3a runs from Lal Lal to the river's confluence with the Moorabool River East Branch at Morrisons. Reach 3b runs from the Moorabool River East Branch through to She Oaks Weir. This section of the river passes through extensive tracts of remnant native vegetation, including State and National Park between Morrisons and Meredith. Remnant vegetation includes Stream Bank Shrubland, Riparian Woodland and Grassy Woodland Ecological Vegetation Communities (EVCs). Native fish recorded include non-migratory species such as River blackfish, Australian smelt and Flat-headed gudgeon (Tunbridge, 1988). Other ecological values in the reach include a diverse population of macroinvertebrates, platypus and rakali (Williams & Serena, 2006).

Figure 3. Environmental water (9 ML/day) being released from Lal Lal Reservoir on May 12 2021 (Photo: R.Glover)

Reach 4 contains eight species of native fish including Tupong, Southern pygmy perch, Australian grayling (listed as vulnerable under the *EPBC Act 1999*), Common galaxid and Spotted galaxid (ARI, 2015). Scientific research has identified that high river flows in 2010-11 have contributed significantly to

recolonisation of migratory and estuarine fish species in reach 4, highlighting the importance of high flows in creating habitat linkages between weirs in the Moorabool (Raymond, 2015). The geomorphology of the river flattens out to floodplains in reach 4 and contains fragmented remnant vegetation within the riparian zone. There are eight weirs in reach 4 that are an impediment to fish passage and river connectivity. Many of these weirs can be drowned out by winter/spring freshes and high flow freshes, however this is virtually impossible for the 9-metre high She Oaks Weir, limiting the dispersal of migratory fish to the reaches below.

Flow compliance against recommendations for the Moorabool River is measured for reach 3a at the Morrisons gauging station (WMIS ID: 232204). Reaches 3a and 3b have higher ecological values than the lower reach 4 and the greatest potential to benefit from delivery of environmental water, being directly downstream from Lal Lal Reservoir. Environmental releases have less potential to benefit reach 4, being further downstream and below the significant She Oaks Weir. Flow for reach 4 is monitored via the Batesford gauging station (WMIS ID: 232202). Flow compliance helps determine if flow components have been achieved and assists with determining the likely contribution of water delivery to environmental objectives.

2. Engagement

Corangamite CMA engaged with WTOAC during the development of this proposal. The partnership that Corangamite CMA has with WTOAC has led to the recognition of the cultural values of rivers on Wadawurrung Country within this proposal, cultural flows, and celebration events (see Section 3.1).

Corangamite CMA engaged with the Moorabool Stakeholder Advisory Committee (MSAC) during the development of this proposal. The MSAC was established by Corangamite CMA in 2014 to support the development of SWPs, the Moorabool Environmental Water Management Plan and any scientific studies relating to flows in the river (e.g. 2015 Moorabool River FLOWS Study Update).

Both WTOAC and the MSAC are 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.

This watering proposal is underpinned by technical expertise and advice; however, local and Traditional Owner knowledge and input has added significant value, in particular:

- Feedback and advice on the landscape characteristics of the reaches and any other localised considerations or observations relating to the rivers
- The realities and feasibility of water delivery volumes and timing
- Anecdotal observation and accounts of environmental watering
- New and emerging shared benefits

In line with the Victorian Government best practice for public participation guidelines (VAGO, 2015), Table 2 below defines the level of participation and the timing and method of engagement with stakeholders during the development of the SWP. The International Association for Public Participation (IAP2) spectrum of public participation is designed to assist with the selection of the level of participation that defines the public’s role in any community engagement program and can be found in Appendix 3.

Table 2. Stakeholder engagement for the Moorabool River SWP 2022-23

Who	Stakeholders	IAP2 level	Engagement method	Engagement purpose
Community groups and environment groups	• People for a Living Moorabool (PALM) • Geelong Landcare Network • Moorabool Catchment Landcare Group • Waterwatch	Involve	Membership of MSAC • Meeting to discuss and seek input on draft proposal. • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholder on how their feedback influenced the SWP and why. Attendance at community forums. Direct engagement (1 on 1)	• Seek user input to the development of the proposal. • Review previous environmental watering actions and 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 Moorabool River. • Provide an opportunity for communities and groups to share the benefits of environmental watering. • Increase opportunities to support economic and social values in the region.
Government agencies	• Department of Environment, Land, Water & Planning (Water & Catchments) • Barwon Water • Central Highlands Water • Southern Rural Water • Parks Victoria • Victorian Environmental Water Holder	Involve	Membership of MSAC • Meeting to discuss and seek input on draft proposal. • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholder on how their feedback influenced the SWP and why. Partnership meetings with links or relevance to seasonal water proposal development. Attendance at Community forums. Direct engagement (1 on 1)	

Who	Stakeholders	IAP2 level	Engagement method	Engagement purpose
Landholders / farmers	• Individual landholder / farmer members of MSAC	Involve	Membership of MSAC • Meeting to discuss and seek input on draft proposal • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholder on how their feedback influenced the SWP and why. • Partnership meetings with links or relevance to seasonal water proposal development. Attendance at Community forums. Direct engagement (1 on 1)	
Traditional Owners	• Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC)	Involve	Directly Involved and engaged with regarding the achieved cultural outcomes of 2021-22 and the 2022-23 SWP draft. Membership of MSAC • Meeting to discuss and seek input on draft proposal • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholder on how their feedback influenced the SWP and why. Attendance at Community forums.	
Local Government	• Golden Plains Shire • Moorabool Shire	Consult	Membership of MSAC (Golden Plains) • Meeting to discuss and seek input on draft proposal • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholder on how their feedback influenced the SWP and why. Contacted Moorabool and Golden Plains Shire to enquire if there were any events being held for tourism/sporting/recreational or	

Who	Stakeholders	IAP2 level	Engagement method	Engagement purpose
			social purposes along the Moorabool that could be supplemented by environmental flow.	
Local businesses	• Adelaide Brighton Cement Company	Involve	Membership on MSAC • Meeting to discuss and seek input on draft proposal • Review of draft proposal and opportunity to provide formal feedback. • Response to stakeholder on how their feedback influenced the SWP and why. Attendance at Community forums. Direct engagement (1 on 1)	

2.1 Notable feedback

The Moorabool Seasonal Watering Proposal 2022-23 was presented and distributed to WTOAC, MSAC and other community and agency members in March 2021. Individuals had two weeks to provide feedback to Corangamite CMA. No feedback was received and therefore none was recorded in the feedback register. WTOAC has provided a letter of endorsement (Appendix 6, figure 13).

3. Values and uses of waterways

Corangamite CMA is flexible in its delivery approach and aspires to realise shared benefits from the delivery and use of the water where it does not compromise ecological outcomes.

The primary purpose of environmental water entitlements is to achieve environmental outcomes. However, the delivery of environmental water is likely to provide other benefits that depend on the condition of our waterways, such as supporting social and cultural values. Shared benefits are the many recreational, social, economic and Aboriginal cultural benefits that occur because of environmental watering, such as fishing, boating, bird watching, community events and Traditional Owner events. Opportunities for shared benefits are incorporated into planning and watering decisions.

Through the management of the *Moorabool River Environmental Entitlement 2010* (the Entitlement), Corangamite CMA consults widely with stakeholders to ensure that consideration is given to social, cultural and economic matters relevant to water management for the Moorabool River.

3.1 Aboriginal Cultural Values and uses of waterways

The Wadawurrung Traditional Owners have a strong connection to the river and place a high cultural value on *Moorabull Yuluk.* The Wadawurrung have been a key partner in advocating for additional allocations of water for the Moorabool River and have been consulted in the development of this proposal (see case study on page 20).

The Wadawurrung Traditional Owners released their *Paleert Tjaara Dja* - let's make Country good together 2020-2030 - Wadawurrung Country Plan in 2020. *Yulluk* – waterways, rivers, estuaries and wetlands – is a key value identified in the plan to be looked after. Consultation is ongoing, and meetings have been held with the Wadawurrung to help progress future projects and work together to expand on the opportunities for shared benefits.

The Moorabool River is recognised under the *Aboriginal Heritage Regulations 2007* as an area of cultural heritage sensitivity and many Wadawurrung people live in the region. The following Wadawurrung cultural values and recommendations are applicable across all sites within Wadawurrung Country including the Moorabool:

- Maintaining watering requirements for healthy, thriving, culturally significant species is crucial. Culturally significant species for the Wadawurrung can be found in Table 3 below
- Protection of identified cultural objective species is a priority
- Recognition of confluences as meeting / ceremony / trade places
- Identifying Clan boundaries with confluences
- Maintain deep / permanent waterholes and refuge pools
- Maintain access to culturally important sites – story places, ceremonial places
- Protection of artefact sites
- Use of appropriate Wadawurrung language for places of cultural importance

- Increased opportunities for Wadawurrung Traditional Owners to be involved in monitoring and evaluation activities
- Increased opportunities for Wadawurrung Traditional Owners in all communications around environmental water releases and activities on the Moorabool River

Key cultural objectives and values as identified in Upper Barwon Yarrowee and Leigh River FLOWS study (Alluvium, 2021) are found below in Table 3 and have great synergy with the Moorabool River system.

Corangamite CMA continues to work with Wadawurrung Traditional Owners to support their values and uses of the Moorabool River, and to refine our understanding of how environmental watering can support their desired outcomes and requirements. WTOAC have reviewed, edited and approved relevant section content in this SWP and are also part of the MSAC. They have provided a letter of endorsement to this document which can be found in Appendix 6 (Figure 13).

Table 3. Traditional Owner values and uses

River / wetland	Traditional Owner group	Category	Objectives & opportunities	Values & uses	How will this opportunity be considered environmental watering in 2021-22?
Moorabool River	Wadawurrung Traditional Owner Aboriginal Corporation (WTOAC)	Culturally Significant Species	Maintain or improve abundance, breeding and recruitment of *Wad-dirring/ Perridak* (platypus).	Meat and pelt	Environmental watering will aim to provide pool habitat and connectivity between reaches where possible.
			Maintain or improve abundance of *Buniya* (Eels).	Meat, important food source sometimes smoked. Large gatherings during Eel run at *Benia Wulla* (Buckley's Falls).	Environmental watering aims to provide water where possible for pools, habitat and food sources, as well as providing water over riffles to allow eels to migrate.
			Maintain or improve abundance of *Turrpurt* (Native trout *galaxias spp*.)	Meat	Environmental watering aims to provide water where possible for pools, habitat and food sources; and provide water over riffles to allow fish to move between pools and breed, feed and find new habitats.
			Maintain or improve abundance of *Ware-rap* (Blackfish).	Meat	
			Maintain or improve abundance of *Polango/ Warngare* (Water ribbons *Triglochin procera*).	Plant food. Finger shaped tubers are crisp and sweet. Cooked in ground oven.	Environmental watering aims to maintain adequate depth of water in channels where possible.
			Maintain or improve condition, extent and abundance of *Tark* (common reed *Phragmites australis*), *Toolim* (Pale Rush *Juncus pallidus*), and Bal-yan (Cumbungi *Typha latifolia*)	*Tark*: Weapon-stems used for spear shafts for fishing. Reed cut while still green to make necklaces, weaving-bags and baskets. Also, a food plant. *Toolim*: Weaving baskets.	Environmental watering aims where possible to maintain adequate depth of water to limit terrestrial encroachment into aquatic habitats. This will also support growth on terraces, channel edges and lower banks.

River / wetland	Traditional Owner group	Category	Objectives & opportunities	Values & uses	How will this opportunity be considered environmental watering in 2021-22?
				Bal-yan: Fluff used to pack wounds under paperbark bandage.	
			Maintain or improve abundance of *Biyal* (River red gum *Eucalyptus camaldulensis).*	Bark removed for canoe, shelter and tools. *Tarnuk* (bowl), nectar drink, medicinal – gum or sap was used for burns to shrink or seal them, the sap is high in tannin. Leaves for steam baths.	
			Maintain or improve abundance of *Larrap* (Manna gum *Eucalyptus viminalis*) and *Kokibainang* (swamp wallaby grass *Amphibromus reservatus*).	*Larrap*: Timber used for making club-shields called Malka. Sap sucking lerp bug gathered each season. Young leaves were fed onto fire near patient. Poultice of well chewed leaves applied for back ache. Quail flocks attracted to Manna. *Kokibainang*: Leaves split, dried out & re-constituted in running water. Fibres twisted into rope to make long nets for game hunting.	Environmental watering cannot consider this in 2022-23 due to various constraints such as an insufficient entitlement.
		Physical Features	Deep pools	The presence of deep pools has cultural significance.	Environmental watering will aid in filling and ensuring connectivity to pools where possible.

River / wetland	Traditional Owner group	Category	Objectives & opportunities	Values & uses	How will this opportunity be considered environmental watering in 2021-22?
			Confluences e.g. Moorabool and Barwon	High cultural value due to historical use of site as a meeting place for three different Clans.	Environmental watering will aim where possible to maintain adequate depth of water for connectivity.
		Events	Holding cultural events on the Moorabool	Celebration of culture, family events, fishing days, cultural festivals.	Summer/autumn fresh events and some winter/spring fresh events can be delivered to coincide with cultural events. This can support significant cultural values and species for the lead-up or duration of an event.

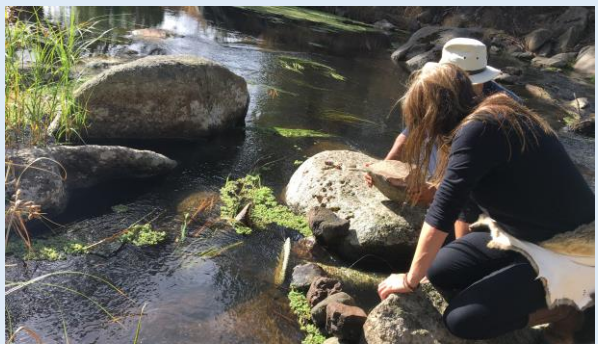
Case study: Celebrating water and culture *Moorabul Yaluk (May 2019)*

On a beautiful autumn day at Dog Rocks, on the *Moorabul Yaluk*, the Wadawurrung joined community and agency to celebrate Water and Culture and the recognition of Wadawurrung values in waterway management. Ceremony was conducted to welcome the extra 500 megalitre fresh sent down the river to protect Cultural values, and the Wadawurrung community placed a *Buniya Binak* – a traditional eel trap – into the river under a Cultural Fishing Permit. Gifts were exchanged, with community gifting water for ceremony. A beautifully designed possum skin, *coolamon* and baby *buniya binak* was given to Corangamite CMA.

Wadawurrung woman Melinda Kennedy explained that the possum skin design "celebrates the projects and symbolises the mountains and confluences of the *Moorabul* and Barwon – and all the meeting places along the river banks".

This moving celebration was the culmination of an 18-month partnership between the Wadawurrung and Corangamite CMA to ensure Traditional Owners have a central voice in the management of Waterways on their Country. Wadawurrung inclusion on the technical panel of the FLOWS study for the Barwon system identified the importance of protecting culturally significant species like the Eel, maintaining deep pools and the recognition of confluences as culturally important places. The spring fresh releases provided pool habitat and longitudinal connectivity, which maintains and improves abundance of *Wad-dirrin*, *Buniya* and *Turrpurt* (Native trout). The rise and fall of the water level maintain and improve abundance of *Tark* (Common reed), *Toolim* (Pale rush) and *Balyan* (Cumbungi) growth on terraces, channel edge and lower banks. These water plants are all used for traditional cultural purposes, including: weapons stems to make spear shafts for fishing; weaving baskets; and for treating open wounds.

A welcome to Country smoking ceremony (left) and placing the eel trap into the Moorabool (right).



3.2. Social, recreational and economic values and uses of waterways

The Moorabool River flows through predominantly private land between Lal Lal Reservoir and the confluence with the Barwon River, although there are some public land such as Meredith Education Centre just outside of Meredith, and other sites, such as Hunts Bridge camping area in Morrisons, just downstream of Lal Lal (see Figure 4). This online review of the camping area was posted in April 2021 when Corangamite CMA was releasing from the Environmental Entitlement: *'What a beautiful place to stay. The river was spectacular. The kids had such an amazing time. Definitely a spot to visit.'* (Goldfields Guide, 2021). There are no regular recreation events held on this section of the river, however Corangamite CMA contacts local government to determine if there are events that can be supported through delivery of environmental water. Opportunities to support social, recreational and economic values are incorporated into planning and watering decisions, if they do not compromise environmental outcomes.

The presence of environmental water in the river does support a range of informal activities, such as fishing, swimming, camping and bird watching. Relevant social, recreational and economic values and uses are listed in Table 4 below.

Figure 4. Hunts Bridge camping area in Morrisons

Table 4. Social, recreational and economic shared benefits for the Moorabool River for 2022-23

Waterway	Beneficiary	Connection to the river	Values / uses / objectives / opportunities	How have these benefits been considered?
Moorabool 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 aids in supporting connectivity throughout the reaches and allows fish to move. Fresh events aid in maintaining and expanding migratory fish populations as they trigger migration and support their life cycle.
Moorabool River	Camping	Camping plays an important social and economic role in the Moorabool system. Those who camp on the Moorabool are more likely to have an interest in maintaining a healthy river system. Camping may also result in economic benefits for communities surrounding the river.	Adequate water quality and flow is essential for maintaining desirable aesthetics for camping.	Environmental watering where possible supports a healthy system with good water quality and flow as well as supporting fringing vegetation.
Moorabool River	Recreation: water-based, eg canoeing, 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 is important for those who are engaging in recreational water activities.	Environmental watering where possible supports a healthy, flowing and connected system with adequate depth to ensure more opportunities for those engaging in recreational water activities.

Waterway	Beneficiary	Connection to the river	Values / uses / objectives / opportunities	How have these benefits been considered?
Moorabool River	Community events	Events on the river are important for social and economic reasons. Use of the river for events supplements economic benefits for the towns and communities around the Moorabool.	Adequate water quality, flow and connectivity is important for supporting community events.	Environmental watering where possible supports a healthy, flowing and connected system to ensure events can be held on the river. Corangamite CMA has contacted the Golden Plains Shire and the Moorabool Shire; they are aware that we can supplement events with e-water and will approach us for future events.
Moorabool River	Economic: stock and domestic use	The section of river from Lal Lal Reservoir to She Oaks (reaches 3a and 3b) is of economic importance as it provides water for stock and domestic use.	Adequate water quality, depth and connectivity is important to improve stock and domestic use from the same system.	Environmental watering where possible supports a healthy, flowing and connected system with adequate depth to ensure economic values are retained.

4. Seasonal review 2021-22

4.1 Climate

The year 2021 was the coolest year since 2012, but still the 19th warmest year on record with the national mean temperature at 0.56°C warmer than the 1961-1990 average. Rainfall was above average for eastern Victoria, however parts of western Victoria were below average. La Niña remained through summer 2020-21, returning to neutral during March, before becoming established again in November 2021. A negative Indian Ocean Dipole in winter and spring fuelled above average winter/spring rainfall in parts of southern Australia (Bureau of Meteorology 2022a).

In the Moorabool catchment, 2021 rainfall was extremely unpredictable with a combination of both above and below average conditions (see Figure 5). Despite July, August and September having below average rainfall, Lal Lal Reservoir spilled for a second consecutive year in early August due to above average rainfall in the months prior to the 2021-22 water year. October rainfall was well above average, with Lal Lal Reservoir spilling until early December. Rainfall in 2022 so far has been very unpredictable, with January rainfall over three times higher than the mean, despite February being well below average.

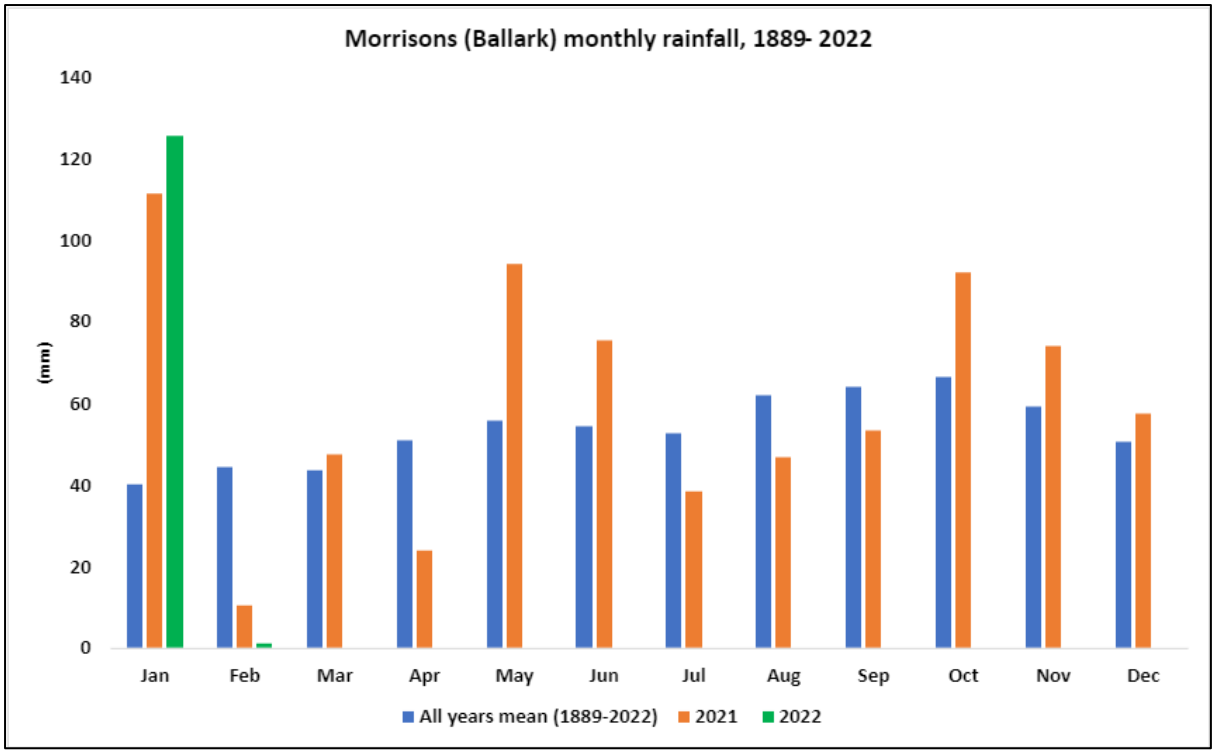


Figure 5. Monthly rainfall comparison of Morrisons: 1889-2022, 2021-22

4.2 Hydrological achievement

The current environmental entitlement can only have a significant effect on the upper reaches (3a, 3b) of the Moorabool River. Compliance is measured at the Morrisons gauging station (WMIS ID: 232204) at the end of reach 3a. While it is understood that environmental releases from Lal Lal have limited ability to influence reach 4, flows are also monitored at the Batesford gauging station (WMIS ID: 232202) to get a sense of the significance of the flow stress in this reach, and to adaptively manage wherever possible to support its values, e.g. through a well-timed fresh delivery. The achievement of flow objectives for reach 4 relies upon the ability of water to pass She Oaks Weir. If the weir pool is low, or Barwon Water is not releasing water down reach 3a/3b to She Oaks Weir, it is difficult to achieve environmental objectives for this reach. Higher and more regular flushes through reach 4 will move organic matter and silt that has accumulated behind weirs, improve water quality and habitat connectivity, and allow greater movement of macroinvertebrates, native fish, *Perridak (*Platypus) and *Rakali* (Water rats). Flows at both Morrisons and Batesford are shown comparatively in Figure 6 and Figure 7 for the 2021-22 year. Data from the end of the 2020-21 water year has also been included, to reflect on outcomes that had not yet been delivered at the time of planning for 2021-22.

Figure 6 compares the actual flow measured at Morrisons to the recommended flow regime for reach 3a. In June 2021 (the previous water year) Corangamite CMA commenced a winter/spring fresh (priority 7), however it had to be cut short by two days due to a rainfall event that would have resulted in environmental water contributing to inundation of Dolly Creek Road. This water was then used to achieve aspirational level winter/spring low flow.

Due to wetter than usual conditions and a spilling reservoir, all 2021-22 winter/spring priority watering actions were achieved naturally (excluding June 2022 which has not occurred yet), allowing the full entitlement to be allocated to summer/autumn priority watering actions. The full entitlement will be used to achieve all of the remaining priority watering actions in 2021-22. All eight priority watering actions will be met in the 2021-22 water year, and full compliance of at least the minimum reach 3a recommendations (where the compliance point is) will be achieved. This includes releasing up to 15ML/day of summer low flow (rather than 5) whilst achieving all other priority watering actions.

All winter/spring priority watering actions (priority 2, 6, 7, 8) were achieved naturally at aspirational volumes which is highly beneficial to the system as it is more likely to generate greater outcomes and build resilience for future drier years (Jacobs, 2015). This includes winter/spring low flow and the recommended three winter/spring freshes. With the reservoir spilling for over four months no environmental water releases were required until late December in the form of summer low flow at 5 ML/day (priority 1). Releases ceased for a few days in January due to a large rainfall event. These releases were increased to 15 ML/day in early February and are scheduled to remain at this volume for the rest of the summer/autumn season. The first summer fresh release (priority 4) was planned for January 2022, however it was achieved naturally after the rainfall event in January. The first fresh release was in March 2022 (little autumn fresh, priority 5). The final autumn fresh is tentatively scheduled for April 2022, (priority 3). Winter/spring low flow (priority 2) will be delivered in June 2022. For a summary of the purpose and benefits of each of these watering actions please see section 5.2. In 2021-22 passing flow continued at 20 ML/day or natural after it was increased to 20 ML/day or natural late in 2020 as per the passing flow rules.

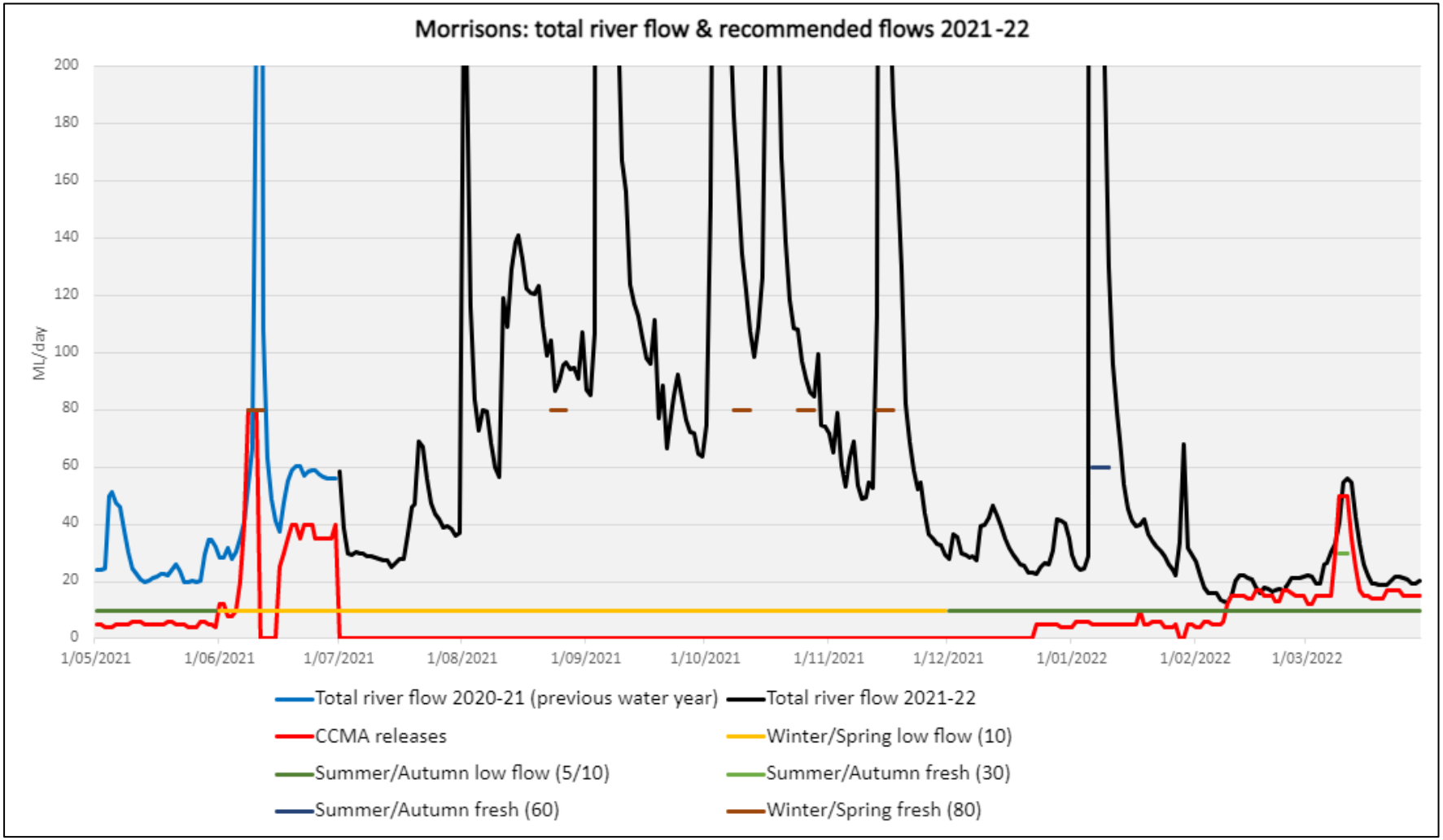


Figure 6. Morrisons flow gauge data 2021-22

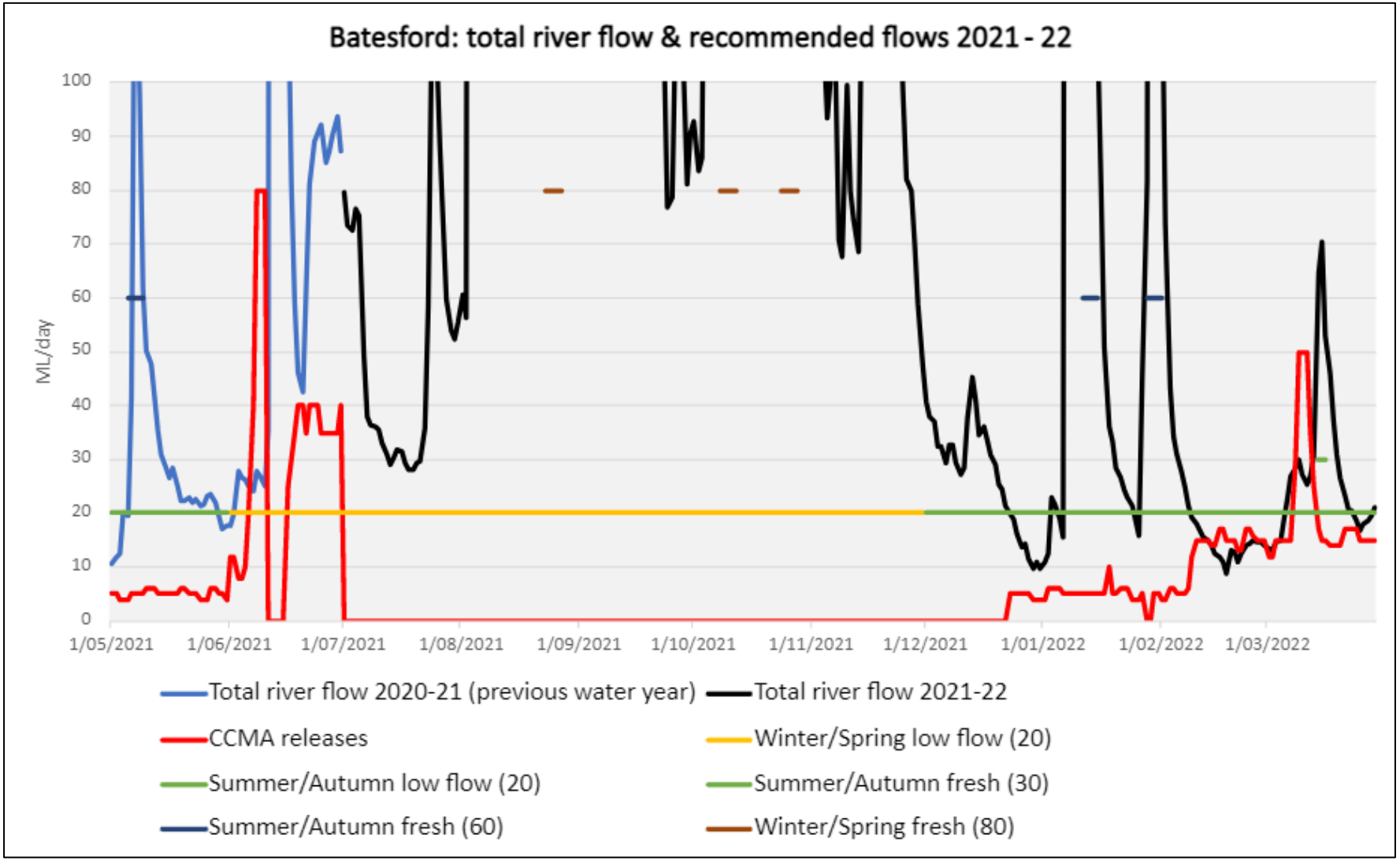


Figure 7. Batesford flow gauge data

Flow compliance helps determine if flow components have been achieved and assists with determining the impact of water delivery. The 2021-22 Environmental Water release program and its compliance at Morrisons is outlined below in Table 5.

Table 5. Environmental water program 2021-22

Flow priorities	Rate	Duration	Total	Achieved?	How?
Priority 1: Summer/Autumn Low Flow (Dec – May)	5 – 15 ML/day	Varies	1667 ML	In process of being achieved	Environmental flows, passing flows and natural flows
Priority 2: Winter/Spring Low Flow (June – Nov)**June 2021 is excluded as it is previous water year*	Up to 10ML/day	Varies	154 ML	Achieved in 2021, planned for 2022	Environmental flows, passing flows and natural flows
Priority 3: Summer/Autumn Fresh event (April/May)	>60ML/day + ramp days	5 days	422 ML	Planned for April 2022	Environmental flows
Priority 4: Summer/Autumn Fresh event (Jan/Feb)	>60ML/day + ramp days	5 days	493 ML	Yes	Achieved naturally
Priority 5: Little Summer/Autumn Fresh event (Feb – Mar)	50ML/day + ramp days	3 days	257 ML	Yes	Environmental flows
Priority 6: Winter/Spring Fresh event (Sep – Nov)	>80ML/day + ramp days	5 days	NA	Yes	Achieved naturally
Priority 7: Winter/Spring Fresh event (May – Aug)	>80ML/day + ramp days	5 days	NA	Yes	Achieved naturally
Priority 8: Winter/Spring Fresh event (Sep – Nov)	>80ML/day + ramp days	5 days	NA	Yes	Achieved naturally

Table 6 highlights that compliance has been significantly better overall since entitlement was created in 2010 and was good for the 2021-22 year due to consistent natural flows.

Table 6. Hydrological flow compliance against flow FLOWS study recommendations for years 2002-3 to 2021-22 at Morrisons

Flow component		Hydrological achievement of flow components over time																				Ecological outcomes/observations relating to the achievement of the flow recommendation/ Priority watering action (PWA) in 2021-22
		2002 – 03	2003 – 04	2004 – 05	2005 – 06	2006 – 07	2007 – 08	2008 – 09	2009 – 10	2010 – 11	2011 – 12	2012 – 13	2013 – 14	2014 – 15	2015– 16	2016 - 17	2017 - 18	2018 – 19	2019 - 20	2020 – 21	2021 – 22	
Summer /Autumn	Low flow															E	E	EO	EO	EO U	EO	Summer low flows of 5 – 15 ML/d for a wet/average year have been or will be met through a combination of Corangamite CMA managed environmental water releases, passing flow, unregulated flow and Barwon Water transfers.
	Freshes															E	E	(E)	E	E	EO U	Two of the 3 recommended freshes for a wet/average year are expected to be met by managed CMA environmental water releases, with the other 1 being met naturally in January 2022. Corangamite CMA released a little autumn fresh in March, with the last autumn fresh planned for April 2022.
Spring/ Winter	Low flow															U	U	OU	OU	EO U	EO U	Winter low flow for a wet/average year (10ML/d) met 100% of the time in 2021. Achieved through natural and passing flow, including a spill. Provision has been made to release winter low flow in June 2022 if not met naturally.
	Freshes															U	E	E	E U	EU	OU	All three freshes and more achieved naturally. Multiple events in May to August at aspirational durations and volumes. Multiple events from September to November also at aspirational durations and volumes.

Flow component		Hydrological achievement of flow components over time																				
		2002 – 03	2003 – 04	2004 – 05	2005 – 06	2006 – 07	2007 – 08	2008 – 09	2009 – 10	2010 – 11	2011 – 12	2012 – 13	2013 – 14	2014 – 15	2015– 16	2016 - 17	2017 - 18	2018 – 19	2019 - 20	2020 – 21	2021 – 22	Ecological outcomes/observations relating to the achievement of the flow recommendation/ Priority watering action (PWA) in 2021-22
	High flow															U	X		U	U	U	High flow freshes recorded in September, October and November (largest peak was 4173 ML/day in January 2022).

	No significant part of the flow component achieved
	Flow component partially achieved
	Flow component has been completely achieved, i.e. complete duration, frequency and volume was achieved
E	Managed environmental water release
O	Consumptive water en route/other managed flow (including passing flows)
U	Unregulated (natural)
X	Unknown at this stage

4.2 Key ecological observations

Platypus monitoring occurred in 2021 in the form of the Great Australian Platypus Search and the Moorabool Catchment Landcare Group (MCLG) Platypus and Short-finned eel eDNA monitoring. Waterways tested by MCLG included the East, West and the confluence. Positive detections of Short-finned eel occurred in the upper reaches of both the East and the West Moorabool Branches. Positive detections of Platypus occurred in the Moorabool West Branch and downstream of the Moorabool River confluence, as well as partial detections in the East Moorabool (Moorabool Catchment Landcare Group, 2021). No other key formal observations were recorded – this is due to a lack of funding available and COVID-19 restrictions. Incidental observations are recorded where possible and associated studies where information can be extrapolated to infer possible outcomes associated with deliveries such as the VEFMAP program are outlined below (4.2.2). Corangamite CMA will continue to seek funding from investment sources for ecological monitoring and observation resources.

VEFMAP

Stage 7 of the Victorian Environmental Flows Monitoring and Evaluation Program (VEFMAP) is now in the development stage. The Arthur Rylah Institute (ARI) has commenced fish monitoring on the Moorabool system, as part of stage 7. The overarching aim of this monitoring is to develop a modelling framework to forecast the responses of fish populations to proposed management interventions, particularly environmental water.

In 2020, Stage 6 (VEFMAP) led by the ARI (Tonkin et al.,2020) identified some of the patterns associated with fish responses to environmental flows across Victoria.

Stage 6 of VEFMAP identified some of the emerging patterns from environmental watering in Victoria (Table 7). The VEFMAP program does not cover all systems comprehensively in the state where environmental water is delivered. Representative systems are chosen for monitoring and assessment and assumptions are then made about similar systems such as the Moorabool. Therefore, this information has been included and its relevance to the Moorabool River is addressed below.

Table 7. Emerging patterns in environmental watering in Victoria

ARI observations	Corangamite CMA Moorabool consideration
Given that high discharge rates in early spring increase the number of galaxiids in rivers, spring environmental flow releases are not expected to provide detectable benefits at the population scale within rivers when a large natural flow pulse has already occurred during spring. These environmental flow releases are best used in years with relatively low spring discharge (e.g. Werribee River in 2017).	Natural rainfall events will be monitored throughout the year. The FLOWS study advises that two spring fresh events are a priority to trigger upstream migration. In the event of a large natural flow pulse, any water reserved for a spring fresh may be better allocated to summer base flows.
To provide conditions for upstream dispersal, instream habitat and survival of *galaxiids* and *Tupong*, maintain recent base flow targets that have been shown to provide enough depth for the	Summer and winter low flows are the highest priority watering actions and will be maintained in 2021-22.

ARI observations	Corangamite CMA Moorabool consideration
upstream migration and sustain suitable water quality for galaxiids and *Tupong*.	
Consider prioritising summer or early autumn freshes to provide connectivity for large-bodied species or, during high recruitment years (e.g. years with high spring flows for galaxiids), to enhance the upstream dispersal of juvenile diadromous fishes. However, sufficient base flows are considered a priority.	Following base (low) flows, summer/ early autumn freshes are already prioritised according to the FLOWS study.
Environmental base flows and fresh releases will not benefit upstream dispersal of diadromous fishes in rivers where barriers (natural or artificial) prevent their movement. Stage 6 2020: Juvenile diadromous fish are influenced by barriers within the Moorabool system.	Corangamite CMA has a program of prioritised fish barrier removal throughout the Barwon-Moorabool system and is working towards barrier removal when funding is available.

Batesford Quarry

The Batesford Quarry is adjacent to the Moorabool River, three kilometres downstream of Batesford Weir (see Figure 8). At this point, a proportion of river flow seeps into groundwater sinks towards a cone of groundwater depression around the Batesford Quarry. Since 2011, water has been pumped from Batesford Quarry back into the Moorabool River, several hundred metres downstream of the sinkholes, under EPA licence. This means this stretch of river can be devoid of water for periods of time. This impacts on aquatic values and acts as a barrier to fish movement. During summer the pools can become disconnected and dry out quickly, resulting in fish and other aquatic fauna becoming stranded. When this occurs, Corangamite CMA and Batesford quarry staff rescue the trapped fish before the pools dry out completely (which can occur in a few short days) and relocate them further downstream.

The current environmental entitlement is insufficient to maintain flows past these sinks in summer unless it is supplemented by natural flow events or purchased water. The quarry discharge that occurs downstream of the sinks is extremely important in providing daily connecting flows in the lower reach of the Moorabool River to the Barwon River.

Two temporary monitoring stations were installed on the Moorabool River in October 2018 at the two sinkholes near the Batesford Quarry (Figure 8). The aim of the monitoring stations was to determine the nature and scale of flow losses to groundwater around Batesford Quarry. The gauges monitored and collected daily average water level (m), temperature (°C), and flow (ML/d).

While direct data for assessing the actual loss of water from the river to the groundwater is lacking, the losses can be estimated from the pool scale or on a reach scale (Lloyd et al. 2020):

- Individual pool scale: loss could reach up to 0.3 ML/d.
- Cone of depression scale (about 7.5 km of river): leakage could be as high as 0.28 ML/d (likely to be underestimated as direct leakage through disturbed river sediments and mining soil was not considered).

- Habitat pools reach scale (about 1km of stream incorporating the pools): a significant proportion (possibly 75%) of lost water could be due to leakage, which represents up to 6 to 7 ML/d which otherwise would be available as baseflow to the Moorabool River.
- Reach scale (about 1km of stream): a loss in daily flow from Batesford to the habitat pools typically varying in volume from 3ML/day to 20ML/day (median of 5.14ML/d; section 6.5) is corroborated by the observed flow data.

  The losses to groundwater in the reach 4 flows mean that the flow recommendations would need to be topped up by the amount of these losses at the habitat pools site in reach 4 in order to maintain connectivity for fish and other fauna to move between habitat pools.

Figure 8. Moorabool River flow gauges: Batesford, upstream pool and downstream pool

4.4 Shared benefit review

This section should be read in conjunction with section 3.1 where it is outlined how stakeholders' values are considered wherever possible through the environmental delivery of water. Table 8 below provides more detail where benefits are general in nature and linked to the overall watering regimes, and of specific outcomes achieved in 2021-22 water year, where they exist.

Although most of the river is bordered by private land, there are scattered allotments of crown frontage along the Moorabool River, which allow opportunities for recreation, including swimming, fishing and camping. There are also several parks, picnic sites and lookouts managed by Parks Victoria and Local Government.

The Moorabool River is predominantly visited informally and used for 'bush' camping, bushwalking and recreational fishing. The river passively supports tourism and visitation to the region, as a series of regionally popular vineyards, such as Clyde Park (Figure 9) are sited along reach 4 (south of She Oaks) and have vistas of the Moorabool River.

Corangamite CMA is flexible in its delivery approach and aspires to achieve shared benefit opportunities that arise from the delivery and use of environmental water.

Figure 9. A view from Clyde Park Vineyard, looking over the Moorabool River

Although few shared benefits were actively reported in 2021-22, observations and feedback from the community highlighted that active and passive recreation have occurred through the provision of water in the river, such as recreational fishing and aesthetic and cultural values linked to a flowing river. Parks Victoria has reported the regular use of the Meredith Education Area for camping and fishing on weekends and school holidays. Corangamite CMA has timed releases to coincide with school holidays, public holidays and long weekends when it has no effect on ecological outcomes. It should be noted that due to COVID-19 restrictions, community events and gatherings were unable to occur; this factor may have reduced the number of shared benefits during 2021-22. Alternatively, recreation such as fishing, kayaking or bushwalking may have become more popular on the river during this time as people attempted to get outdoors in the midst of a pandemic with travel restrictions. Many images can be found on social media when searching 'Moorabool River', of people participating in recreation during the 2021-22 year.

Figure 10. Moorabool River in December 2021 (photo: S. Blum-Caon)

Table 8. Shared benefits review

Beneficiary	Review of benefits / outcomes
Traditional owners	Traditional Owner wellbeing is closely tied to healthy Country. Environmental flows that support and improve the health of the Moorabool River therefore may benefit Traditional Owners. Aboriginal cultural values incorporate Traditional Ecological Knowledge and are applicable to all sites within Wadawurrung Country. Values include maintaining watering requirements for healthy, thriving, culturally significant species. Several of the cultural values and objectives as outlined in Table 3 were maintained and achieved in the 2021-22 watering year as a result of natural rainfall and the release of environmental flow. This included maintaining and improving abundance of culturally significant species such as *Wad-dirring/Perridak* (Platypus), *Bunyia* (Eels), *Turrpurt* (native trout *galaxias spp), Ware-rap* (Blackfish), *Polango Warngare* (water ribbons *Triglochin procera)*, *Tark* (common reed *Phragmites australis*, *Toolim* (Pale Rush *Juncus pallidus*), *Bal-yan* (Cumbungi *Typha latifolia*); and maintaining deep pools and confluences.
Landholders	Low flow and freshes delivered throughout the year can assist in the maintenance of water quality, which may be beneficial for the use of water for stock and domestic purposes. Environmental water may assist with maintaining a level of flow in the Moorabool River that mitigates invasive terrestrial vegetation constricting the channel. Constrictions of the channel may cause flooding of landowners' property.
Recreational users/environment groups/local businesses	The summer/autumn freshes that will be released in March and April 2022 provided a freshening flow which can improve water quality in the Moorabool River and help maintain condition of streamside vegetation near campgrounds. The release can improve amenity and water quality for swimmers, kayakers, bushwalkers, campers, local environment groups, members of the community and others during the public holiday period.
	Environmental flows are delivered to support the spawning and recruitment of native fish and eels, including species as tupong, short finned eel, common galaxias, short headed lamprey and Australian Grayling. This supports and improves fishing opportunities in the river for both locals and tourists.

5. Environmental objectives and scope of environmental watering

The Moorabool River is considered one of the most heavily extracted and flow-stressed rivers in Victoria. The condition of riparian and streamside vegetation ranges from extensively cleared to densely fragmented; there is a lack of streamside vegetation and invasion of exotic species. Furthermore, water quality monitoring shows high nutrient levels.

Corangamite CMA has developed the *Moorabool Flagship* project called 'The Living Moorabool' to improve the health of the Moorabool River through integrated catchment management.

In addition, the *Moorabool Environmental Water Management Plan* (Corangamite CMA, 2016) provides a long-term strategic direction to achieve environmental flow objectives, developed and endorsed by MSAC. The intent of this plan is to ensure the effective use of the current entitlement and highlight the need for additional water to maintain and improve environmental values.

Consistent with this plan, the objective of the Moorabool environmental entitlement is to reduce the adverse impacts caused by the lack of adequate flows downstream of the storage in reaches 3a, 3b and 4, as originally identified in the Moorabool River Water Resource Assessment (SKM, 2004) and Moorabool River FLOWS Study Update (Jacobs, 2015). This can be achieved by increasing variability in flows, reducing the occurrence of cease-to-flow events and increasing median flows where possible.

5.1 Water delivery objectives

The Moorabool FLOWS Study Update (Jacobs, 2015) highlights that the volume of water in the environmental entitlement is insufficient to meet all the recommended flow components identified, and currently only provides for about 10% of the river's flow needs. The report identifies a three-tier water recovery target, developed through the scientific investigation, to maintain and improve flow-dependent ecological values into the future.

Reaches 3a and 3b (Lal Lal Reservoir to She Oaks) contain some of the most valuable in-stream and riparian habitats in the catchment, with remnant populations of threatened EVCs such as Stream Bank Shrub land and Riparian Woodland. An abundance of River blackfish, Australian smelt, Southern pygmy perch and *Buniya* (Short-finned eel) also occurs in these reaches. Other ecological values include a diverse population of macro-invertebrates and widespread *Perridak* (Platypus) and *Rakali* (Water rat) populations (Williams & Serena, 2006).

An aquatic sampling project conducted in 2015 (Raymond, 2015) found that species diversity and abundance has improved dramatically along the entire length of the river since previous surveys were undertaken in 2008, which is thought to be due to environmental flow delivery and changes in climatic conditions Analysis of the flows within reaches 3a and 3b identified prolonged periods of reversal of seasonal flow patterns and lack of flow variability as contributing factors in the decline of the environmental health of the Moorabool River. To address these problems Jacobs (2015) made a range of recommendations for the provision of environmental flows.

The aim of these recommended flows is to achieve the following environmental objectives:

- Maintain self-sustaining populations of fish
- Maintain diverse macro-invertebrate communities
- Maintain in-stream macrophyte communities
- Maintain riparian vegetation communities
- Maintain physical habitat diversity
- Improve water quality
- Restore self-sustaining breeding population of Platypus and support dispersal of juvenile Platypus

Migratory fish species are included in the flow recommendations for reach 3. These are aspirational objectives, such as “restore self-sustaining population of Australian grayling”, which cannot be achieved by flow management alone. Achievement of these objectives for migratory fish will, in the long term, require the provision of fish passage and relevant riparian management outcomes (see Section 8 Confounding Factors).

To date, environmental flows have predominantly been released during the summer period to maintain water quality and habitat connectivity. Declining water quality is a trigger for the release of environmental water to top up base flows during summer/autumn months (December-May) under drying and drought conditions. These trigger levels are designed to maintain water quality in remnant habitat pools for the life dependent on them and will be particularly important in very dry years with low volumes of environmental water in storage. In the event of changing conditions (i.e. drought), the carryover of 1000ML within the entitlement reserve into the following water year is used to support the highest priority watering actions.

Trigger-based freshes (in drought years) and low flows (in other years) are the highest priority flow components, although the limited water available in the entitlement makes it difficult to deliver the magnitude of water required to maintain the recommended low flows all year, even in an average year. Barwon Water’s water transfers between Lal Lal and She Oaks make a substantial contribution to achieving the summer low flow recommendations.

When required under drought conditions, water quality trigger levels are measured through the gauge network at eight sites from Lal Lal downstream to She Oaks. These sites are:

- Egerton Road
- Morrisons
- Slate Quarry Road
- Coopers Bridge
- She Oaks
- Perdrisat Road
- Russells Bridge
- Bakers Bridge

The water quality trigger levels are:

- Dissolved oxygen ≤ 5mg/L
- Electrical conductivity ≥ 10,000µs/cm
- Water temperature ≥ 25°C

When water quality meets a trigger level under a drought scenario, trigger-based freshes of 30ML/d for 3 days will be released to improve water quality and maintain aquatic life to a maximum volume of 250 ML for the drought year.

Achieving all winter / spring (June-November) flow recommendations within the delivery constraints and environmental water availability is not currently possible through environmental water releases, but it can occur naturally. A winter high flow of 3,000ML/day at the compliance point for two days exceeds both the capacity of the outlet pipe and the average annual environmental water entitlement. Hence these flows can only be met when Lal Lal Reservoir is at 100% capacity and spills.

The recommended minimum winter low flow is 10ML/day in reach 3a (compliance point), and in dry or average years it is not practical to use the limited entitlement to meet this recommendation, as a majority of the entitlement would be used on this flow component. Despite this, in the event that winter/spring low flow was not being met naturally, the entitlement would be used to achieve at least partial compliance of this flow recommendation after summer low flow. During a wet winter/spring, winter/spring low flow can usually be met from local rainfall; however local rainfall has only met the minimum baseflow target four times in the last 21 years and with a drying climate trend it is not often that a wet climate scenario will occur. The winter fresh recommendations of two five-day flows of 80ML/day (minimum) are achievable in wet or average rainfall years, when these flows can be built on naturally occurring high inflows from local rainfall where it does not inundate assets.

Improved flows in reaches 3a and 3b are likely to provide some benefits for the lower reaches as flows continue downstream. However, due to the small volume available under the environmental entitlement, attempts to target objectives within the lower reach 4 of the river can potentially compromise outcomes in reaches 3a and 3b. Freshes released from Lal Lal Reservoir have been tracked down to Batesford at the bottom of reach 4, in proportional volumes, which demonstrates the ecological value of planned releases during appropriate seasonal weather conditions.

5.2 Flow recommendations and potential watering actions

The FLOWS Study Update (Jacobs, 2015) recommends a flow regime for the Moorabool River consisting of a number of flow components to be delivered at specific flow rates and frequencies. These are the basis for the potential watering actions in any given year, which is limited by the size of the environmental entitlement itself.

Potential watering actions produce an expected watering effect in the river that will help to achieve an environmental objective. The expected watering effects relate to physical, chemical, biological or behavioural responses to specific components of the watering regime. Environmental objectives, such as *‘maintain the population of resident platypus’*, are measurable outcomes that are not solely linked to environmental watering and are often achieved through a range of complementary management activities, such as instream and riparian improvements (see Section 8 Confounding Factors).

Flow prioritisation is an important part of flow delivery planning for the Moorabool River due to the limited amount of water available within the environmental entitlement and to ensure the water is used for the greatest environmental benefit. Since the environmental entitlement is

insufficient to deliver all recommended potential watering actions for reaches 3a and 3b, actions must be prioritised.

The Moorabool River FLOWS Study Update (Jacobs, 2015) prioritises flows in the following order:

- Provision of low flows (base flows)
- Provision of summer/autumn freshes in priority order
- Provision of winter/spring freshes in priority order

Table 9 provides a list of priorities based on recommendations from the FLOWS Study Update (Jacobs, 2015) for an average year. If climate conditions change as the water year progresses, flow planning may be amended to reflect revised water availability. Table 10 reflects the potential watering actions in order from highest priority (1) to lowest priority (8) for an average/wet climate scenario. Watering actions cannot be met with the entitlement alone and achievement relies on other sources of water such as natural flow. Please note that the flow rates in the priority watering actions are inclusive of all forms of flow, e.g. environmental water, passing flows and consumptive water en route (Barwon Water transfers).

Table 9. Potential watering actions for 2022-23

Potential watering action	**Priority 1: Summer/autumn low flow (*5 – 40 ML/d from Dec-May)**				
Expected watering effects	• Maintain water quality for biota during critical summer period. • Maintain pool and riffle habitats for fish, macroinvertebrates, *Perridak (*Platypus) and submerged aquatic vegetation.				
Environmental objectives	• Rehabilitate migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey, Australian grayling) • Maintain and expand populations of non-migratory fish species (flat-headed gudgeon, Australian smelt, southern pygmy perch, river blackfish) • Maintain the diversity and abundance of macroinvertebrates suited to both slow and fast flowing habitats • Maintain aquatic zone species • Maintain platypus population, particularly in refuge pools during dry years; restore self-sustaining breeding population of platypus • Support dispersal of juvenile platypus to/from the Barwon River • Prevent low dissolved oxygen conditions and elevated EC conditions during low flow periods				
Application of potential watering action in 2022-23		***Magnitude (ML)***	***Duration (days)***	***Frequency (per year)***	***Timing (months)***
	Dry	5 – 40	Daily	Continuous	December-May
	Wet/Average	5 – 40	Daily	Continuous	December-May
Rationale for proposed application in 2021-22	Critical to prevent the river from ceasing to flow, maintaining connectivity, and in providing some water to refuge pools over summer. This watering action should always be delivered. Even though 5ML/d is the dry season recommendation, ***5ML/d will be the target for 2022-23 to allow some water for maintaining other PWAs. The maximum flow rate of 40 ML/day includes Barwon Water's transfer to She Oaks weir and passing flows. Therefore 40 ML/day maximum has been established to allow some environmental water to pass She Oaks weir in the event that Barwon Water were transferring and off taking. Allowing environmental water past She Oaks increases the likelihood of maintaining connectivity through reach 4.				

Potential watering action	**Priority 2: Winter/spring low flow (*5 - 60 ML/d, Jun-Nov)**				
Expected watering effects	• Allow fish movement throughout the reach • Maintain clear flow path and control intrusions by terrestrial vegetation. • Upstream migration of juvenile Turrpurt galaxias, Tupong and Buniya Short-finned eel and Australian grayling.				
Environmental objectives	• Rehabilitate migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey, Australian grayling) • Maintain and expand populations of non-migratory fish species (flat-headed gudgeon, Australian smelt, southern pygmy perch, river blackfish) • Maintain aquatic zone species				
Application of potential watering action in 2022-23		***Magnitude (ML)***	***Duration (days)***	***Frequency (per year)***	***Timing (months)***
	Dry	5-60	Daily	Continuous	Jun-Nov
	Wet/Average	10-60	Daily	Continuous	Jun- Nov
Rationale for proposed application in 2022-23	Critical to prevent the river from ceasing to flow and combined with natural inflow aids connectivity. This watering action should always be delivered when natural flow is not sufficient. Even though 5ML/d is the dry season recommendation, *****5ML/d will be the target for 2022-23 to allow some water for maintaining summer/autumn low flows and other PWAs.				

<table>
<tr><th>Potential watering action</th><th colspan="5">Priority 3: Summer/autumn fresh event (Apr/May, *60 – 80 ML/d for 5 days)</th></tr>
<tr><td>Expected watering effects</td><td colspan="5">Flush silt and scour biofilms and algae from streambed
Water fringing marginal zone vegetation
Allow fish and Perridak Platypus movement through the reach and maintain access to habitat
Trigger downstream spawning migration of Australian Grayling</td></tr>
<tr><td>Environmental objectives</td><td colspan="5">Rehabilitate migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey, Australian grayling)
Maintain and expand populations of non-migratory fish species (flat-headed gudgeon, Australian smelt, southern pygmy perch, river blackfish)
Maintain the diversity and abundance of macroinvertebrates suited to both slow and fast flowing habitats
Maintain marginal zone species
Maintain damp zone species</td></tr>
<tr><td rowspan="3">Application of potential watering action in 2022-23</td><td></td><td>Magnitude (ML)</td><td>Duration (days)</td><td>Frequency (per year)</td><td>Timing (months)</td></tr>
<tr><td>Dry</td><td>60 – 80</td><td>5</td><td>1 event</td><td>December – May</td></tr>
<tr><td>Wet/Average</td><td>60 – 80</td><td>5</td><td>1 event</td><td>December – May</td></tr>
<tr><td>Rationale for proposed application in 2022-23</td><td colspan="5">For a wet/average year, a summer autumn fresh should occur twice. Once in Jan/Feb (priority 4) and once in April/May (priority 3). If climatic conditions were to change to be ‘dry’, this priority 3 fresh in April/May would still be delivered if water was available, and but the priority 4 fresh would not. This fresh event was last delivered in April 2021 and will be delivered in April 2022.

The FLOWS study does not denote a maximum magnitude for summer/autumn freshes, therefore the maximum magnitude of summer/autumn freshes is dependent on the magnitude of winter freshes. The maximum of 80 ML/day in this proposal is based on the minimum magnitude for a winter/spring fresh being 80 ML/day. *60ML/d will be the target for 2022-23 to allow some water for maintaining other PWAs.

The 80 ML/day maximum also allows some environmental water to pass She Oaks weir in the event that Barwon Water were transferring and off taking. Allowing environmental water past She Oaks increases the likelihood of maintaining connectivity through reach 4.</td></tr>
</table>

<table>
<tr><th>Potential watering action</th><th colspan="5">Priority 4: Summer/autumn fresh event (Jan/Feb, *60 – 80 ML/d for 5 days)</th></tr>
<tr><td>Expected watering effects</td><td colspan="5">Flush silt and scour biofilms and algae from streambed
Water fringing marginal zone vegetation
Allow fish and Perridak Platypus movement through the reach and maintain access to habitat
Trigger downstream spawning migration of adult Buniya Short-finned eel.</td></tr>
<tr><td>Environmental objectives</td><td colspan="5">Rehabilitate migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey, Australian grayling)
Maintain and expand populations of non-migratory fish species (flat-headed gudgeon, Australian smelt, southern pygmy perch, river blackfish)
Maintain the diversity and abundance of macroinvertebrates suited to both slow and fast flowing habitats
Maintain marginal zone species
Maintain damp zone species</td></tr>
<tr><td rowspan="3">Application of potential watering action in 2022-23</td><td></td><td>Magnitude (ML)</td><td>Duration (days)</td><td>Frequency (per year)</td><td>Timing (months)</td></tr>
<tr><td>Dry</td><td>60 – 80</td><td>5</td><td>1 event, every 2-3 years</td><td>December – May</td></tr>
<tr><td>Wet/Average</td><td>60 – 80</td><td>5</td><td>1 event</td><td>December – May</td></tr>
<tr><td>Rationale for proposed application in 2022-23</td><td colspan="5">For a wet/average year, a summer autumn fresh should occur twice. Once in Jan/Feb (priority 4) and once in April/May (priority 3). If climatic conditions were to change to be ‘dry’, the priority 3 fresh in April/May would still be delivered if water was available, and but this priority 4 fresh would not. This fresh event was last delivered in Jan 2021 and was achieved naturally in Jan 2022. In dry years eels should survive without this trigger.

The FLOWS study does not denote a maximum magnitude for summer/autumn freshes, therefore the maximum magnitude of summer/autumn freshes is dependent on the magnitude of winter freshes. The maximum of 80 ML/day in this proposal is based on the minimum magnitude for a winter/spring fresh being 80 ML/day. *60ML/d will be the target for 2022-23 to allow some water for maintaining other PWAs.

The 80 ML/day maximum also allows some environmental water to pass She Oaks weir in the event that Barwon Water were transferring and off taking. Allowing environmental water past She Oaks increases the likelihood of maintaining connectivity through reach 4.</td></tr>
</table>

<table>
<tr><th>Potential watering action</th><th colspan="5">Priority 5: Little summer/autumn fresh event (Feb/Mar, *30 – 60 ML/d for 3 days)</th></tr>
<tr><td>Expected watering effects</td><td colspan="5">Allow fish movement throughout the reach
Maintain clear flow path and control intrusions by terrestrial vegetation
Flush silt and scour biofilms and algae from streambed and transport organic matter
Water fringing marginal zone vegetation</td></tr>
<tr><td>Environmental objectives</td><td colspan="5">Rehabilitate migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey, Australian grayling)
Maintain and expand populations of non-migratory fish species (flat-headed gudgeon, Australian smelt, southern pygmy perch, river blackfish)
Maintain marginal zone species
Maintain the diversity and abundance of macroinvertebrates suited to both slow and fast flowing habitats</td></tr>
<tr><td rowspan="3">Application of potential watering action in 2022-23</td><td></td><td>Magnitude (ML)</td><td>Duration (days)</td><td>Frequency (per year)</td><td>Timing (months)</td></tr>
<tr><td>Dry</td><td>30 – 60 ML/d</td><td>3 days</td><td>1 event</td><td>Feb - Mar</td></tr>
<tr><td>Wet/Average</td><td>Same as above</td><td>Same as above</td><td>Same as above</td><td>Same as above</td></tr>
<tr><td>Rationale for proposed application in 2022-23</td><td colspan="5">To be delivered in addition to priority 3 and 4 in wet/average years according to FLOWS study. This fresh is important for watering fringing vegetation. *30ML/d will be the target for 2022-23 to allow some water for maintaining other PWAs.

The FLOWS study does not denote a maximum magnitude for the little summer/autumn fresh, therefore the maximum magnitude is dependent on the magnitude of the larger summer/autumn freshes. The maximum of 60 ML/day in this proposal is based on that the minimum magnitude for the larger summer/autumn freshes is 60 ML/day. *30ML/d will be the target for 2022-23 to allow some water for maintaining other PWAs.

The 60 ML/day maximum also allows some environmental water to pass She Oaks weir in the event that Barwon Water were transferring and off taking. Allowing environmental water past She Oaks increases the likelihood of maintaining connectivity through reach 4.</td></tr>
</table>

<table>
<tr><th>Potential watering action</th><th colspan="5">Priority 6: Winter/spring fresh event (Sep-Nov, *80 – 90 ML/d for 5 – 10 days)</th></tr>
<tr><td>Expected watering effects</td><td colspan="5">Allow fish movement throughout the reach
Maintain clear flow path and control intrusions by terrestrial vegetation
Upstream migration of juvenile Galaxias, Tupong, Short-finned Eel and Grayling
Flush silt and scour biofilms and algae from streambed and transport organic matter
Promote growth and recruitment of native riparian vegetation including woody shrubs and promote strong vegetation zonation on the banks.</td></tr>
<tr><td>Environmental objectives</td><td colspan="5">Rehabilitate migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey, Australian grayling)
Maintain and expand populations of non-migratory fish species (flat-headed gudgeon, Australian smelt, southern pygmy perch, river blackfish)
Maintain aquatic zone species
Maintain the diversity and abundance of macroinvertebrates suited to both slow and fast flowing habitats
Maintain marginal zone species
Maintain damp zone species</td></tr>
<tr><td rowspan="3">Application of potential watering action in 2022-23</td><td></td><td>Magnitude (ML)</td><td>Duration (days)</td><td>Frequency (per year)</td><td>Timing (months)</td></tr>
<tr><td>Dry</td><td>80 - 90</td><td>5 (min)
10 (aspirational)</td><td>1 event</td><td>Sep – Nov</td></tr>
<tr><td>Wet/Average</td><td>80 - 90</td><td>5 (min)
10 (aspirational)</td><td>1 event</td><td>Sep - Nov</td></tr>
<tr><td>Rationale for proposed application in 2022-23</td><td colspan="5">The FLOWS study update specifies that winter/spring fresh events are prioritised after all low flow recommendations, and summer autumn freshes. These events are unlikely to be achieved naturally unless it is a wet year. Considering the winter/spring freshes as a group, a Sep-Nov fresh (priority 6) and the May-Aug fresh (priority 7) should delivered in all years, where water is or becomes available. In an average or wet year an additional Sep-Nov fresh (priority 8) should also be delivered.

*80ML/d will be the target for 2022-23 to allow some water for maintaining other PWAs. In wetter years 90 ML/day will be the target due to the constraint of Dollys Creek Road.</td></tr>
</table>

Potential watering action	**Priority 7: Winter/spring fresh event (May-Aug, *80 – 90ML/d for 5 – 10 days)**				
Expected watering effects	• Allow fish movement throughout the reach • Maintain clear flow path and control intrusions by terrestrial vegetation • Downstream spawning migration of adult Tupong • Flush silt and scour biofilms and algae from streambed and transport organic matter • Promote growth and recruitment of native riparian vegetation including woody shrubs and promote strong vegetation zonation on the banks.				
Environmental objectives	• Rehabilitate migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey, Australian grayling) • Maintain aquatic zone species • Maintain the diversity and abundance of macroinvertebrates suited to both slow and fast flowing habitats • Prevent potential blackwater events that can lead to fish kills • Maintain marginal zone species • Maintain damp zone species				
Application of potential watering action in 2022-23		***Magnitude (ML)***	***Duration (days)***	***Frequency (per year)***	***Timing (months)***
	Dry	80 - 90	5 (min) 10 (aspirational)	1 event	May - Aug
	Wet/Average	80 - 90	5 (min) 10 (aspirational)	1 event	May – Aug
Rationale for proposed application in 2022-23	The FLOWS study update specifies that winter/spring fresh events are prioritised after all low flow recommendations, and summer autumn freshes. These events are unlikely to be achieved naturally unless it is a wet year. Considering the winter/spring freshes as a group, a Sep-Nov fresh (priority 6) and the May-Aug fresh (priority 7) should delivered in all years, where water is or becomes available. In an average or wet year an additional Sep-Nov fresh (priority 8) should also be delivered. *80ML/d will be the target for 2022-23 to allow some water for maintaining other PWAs. In wetter years 90 ML/day will be the target due to the constraint of Dollys Creek Road.				

Potential watering action	**Priority 8: Winter/spring fresh event (Sep-Nov, *80 – 90 ML/d for 5 - 10 days)**				
Expected watering effects	• Allow fish movement throughout the reach • Maintain clear flow path and control intrusions by terrestrial vegetation • Upstream migration of Juvenile Turrpurt galaxias, Tupong, Buniya Short-finned eel and Australian grayling • Flush silt and scour biofilms and algae from streambed and transport organic matter • Promote growth and recruitment of native riparian vegetation including woody shrubs and promote strong vegetation zonation on the banks				
Environmental objectives	• Rehabilitate migratory species (tupong, short-finned eel, common galaxias, spotted galaxias, short-headed lamprey, Australian grayling) • Maintain aquatic zone species • Maintain the diversity and abundance of macroinvertebrates suited to both slow and fast flowing habitats • Maintain marginal zone species • Maintain damp zone species				
Application of potential watering action in 2022-23		***Magnitude (ML)***	***Duration (days)***	***Frequency (per year)***	***Timing (months)***
	Dry	80 - 90	5 (min) 10 (aspirational)	0 event (not required in a dry year)	Sep – Nov
	Wet/Average	80 - 90	5 (min) 10 (aspirational)	1 events	Sep - Nov
Rationale for proposed application in 2022-23	The FLOWS study update specifies that winter/spring fresh events are prioritised after all low flow recommendations, and summer autumn freshes. These events are unlikely to be achieved naturally unless it is a wet year. Considering the winter/spring freshes as a group, a Sep-Nov fresh (priority 6) and the May-Aug fresh (priority 7) should delivered in all years, where water is or becomes available. In an average or wet year an additional Sep-Nov fresh (priority 8) should also be delivered. *80ML/d will be the target for 2022-23 to allow some water for maintaining other PWAs. In wetter years 90 ML/day will be the target due to the constraint of Dollys Creek Road.				

6. Scenario planning

6.1 Outlook for 2022-23

The Barwon South West 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). Regarding long term climate projection (DELWP and CSIRO, 2019) 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.

Australia's temperature and rainfall variability are influenced by global warming caused by human activities, with the nation's climate warming by around 1.44 °C since 1910 (Bureau of Meteorology, 2021). In 2022, the Bureau of Meteorology (2022b) predicts February to April is likely to be wetter than average for much of Australia and eastern Victoria, but makes no prediction for south west Victoria. Whilst the outlook may indicate wetter than average conditions, the southern part of Australia is in its drier season, therefore even if rainfall is above average it is not likely to be enough to relieve long-term rainfall deficits.

Given this year's average/wet conditions and the relative unpredictability of what this means locally, the FLOWS study recommendations for the Moorabool will be in line with an 'average year' and prioritised based on the available entitlement. In a year of potential unknowns regarding rainfall, a priority-based regime would attempt to avoid multiple loss of fauna and flora. Regular monitoring of water levels and discharge through DELWP's WMIS and field observations becomes important to determine the best time to release and in what volume. Even in wetter years, monitoring is important to determine how rainfall is delivering flows to meet our objectives.

In some circumstances, it is possible to release environmental flows during rainfall events. Building on rainfall events can improve environmental flows, particularly freshes, by increasing the variability, magnitude, and duration of planned environmental water releases. There are currently some barriers to Corangamite CMA's ability to take advantage of natural flows (see section 7.2 for more information). In the event of flooding, environmental flows will not be delivered. In the event of average or high flow in the catchment, the flows would be considered against the planned flow regime hydrograph to determine a new priority for flow releases.

6.2 Scenario planning

Planning for this year's environmental watering has been tailored to average rainfall conditions (see section 4.1) but may be adapted if conditions change. The average year scenario has been highlighted below in Table 10, which outlines how achievement of priorities may change under a range of resource availability and climate scenarios. In the driest scenarios the priority is to avoid critical losses or catastrophic events, while in wetter years the priority is to maximise recruitment and maintain geomorphic processes. The ecological objectives of environmental watering under different climates considers impacts from four different seasonal outcomes, ranging through drought, dry, average and wet.

The increased capacity to meet a larger number of priority flow components in wetter years is possible as more elements will be met by naturally occurring flows. However, because the current entitlement only secures 10% of the river's water requirements, the achievement of environmental flow components is largely dependent on the climate during the 2022-23 water year and the assistance of Barwon Water's (BW) potable water transfers during summer (BW's transfers are not included in the scenario planning table volumes).

Table 10. Scenario planning table 2022-23 reach 3a

MOORABOOL RIVER - REACH 3a	Drought	Dry	Average	Wet
Water availability in 2022-23	2500 ML (7086 ML limited by entitlement)	2500 ML (7086 ML limited by entitlement)	2500 ML (7086 ML limited by entitlement)	2500 ML (7086 ML limited by entitlement)
Expected climatic and flow conditions	Little to no rainfall. No inflows to Lal Lal Reservoir No flow. Disconnected pools.	Below average rainfall and inflows to Lal Lal Reservoir Cease to flow events.	Average rainfall and inflows to Lal Lal Reservoir Low flow over summer, high peaks in winter months	Above average rainfall and inflows to Lal Lal Reservoir Bankfull flows persistent throughout winter. Overbank conditions in some parts during spring and autumn months.
Logic for scenario	Scenario is based on going into drought conditions for a first year with full storage Based on dry conditions (FLOWS study). Water is reserved for trigger-based freshes (30ML/d for 3 days) to maintain water quality and aquatic life. These freshes will be triggered by water quality at the Coopers gauge. In drought/dry only one other fresh is required every 2-3 years but in 2022-23 it would be delivered as we have the supply. Summer low flow volume dropped from 10 ML/d to 5ML/d. No freshes achieved naturally.	Scenario is based on dry conditions (FLOWS study) recommendations but assumes a small amount of low flow from either natural or passing flows during part of winter/spring only. Summer low flow volume dropped from 10 ML/d to 5ML/d. No freshes achieved naturally.	Scenario is based on average year recommendations, but summer low flow volume dropped from 10 ML/d to approx. 5ML/d to provide better diversity of PWA's. It assumes six months of natural or passing flows to provide low flow over the winter period. Passing flows during winter are 10 – 20 ML/day. Some freshes may be met naturally dependent on reservoir storage. Dam may spill.	Scenario is based on wet year recommendations and assumes natural or passing flows of >10 ML/d in winter/spring and around >10 ML/day in summer/autumn. All low flow recommendations met naturally. All environmental water deployed on summer/autumn freshes. Dam spill occurs. No tier 1b actions.

MOORABOOL RIVER - REACH 3a	Drought	Dry	Average	Wet
Tier 1a Potential watering actions: Expected to be delivered in 2022-23 (all at minimum recommended flow rates) Tier 1a and 1b* calculations are based on the minimum volumes for (ML) for basic ecological function as per the FLOWS study. Not those volumes (ML) that are aspirational and are required for the long-term survival of the river. ***Priority watering actions and total volumes in the scenario planning table (Tier 1 and Tier 2) do not include Barwon Water operational transfers.***	• **Top Priority – trigger- based freshes** (30 ML/d x 2). • **Priority 1 – summer/autumn low flow** (5 ML/d Dec – May). • **Priority 2 – winter/spring low flow** (5 ML/d Jun – Nov). • **Priority 3 – Apr/May summer/autumn fresh** (60 ML/d x 5).	• **Priority 1 – summer/autumn low flow** (5 ML/d Dec – May). • **Priority 2 – winter/spring low flow (**5 ML/d Jun – Nov, partial only – 2 months achieved naturally). • **Priority 3 – Apr/May summer/autumn fresh** (60 ML/d x 5). • **Priority 4 – Sep-Nov winter/spring fresh** (80 ML/d x 5).	• **Priority 1 – summer/autumn low flow** (5 ML/d Dec – May. • **Priority 2 – winter/spring low flow** (5-10 ML/d Jun – Nov, partial only – 5 months achieved naturally). • **Priority 3 – Apr/May summer/autumn fresh** (60 ML/d x 5). • **Priority 4 – Jan/Feb summer/autumn fresh** (60 ML/d x5) • **Priority 5 – little summer fresh** (30 ML/d x3) • **Priority 6 – Sep – Nov winter/spring fresh** (80 ML/d x 5).	• **Priority 1 – summer/autumn low flow** (>10 ML/d achieved naturally Dec - May). • **Priority 2 – winter/spring low flow** (>10 ML/d achieved naturally June – Nov). • **Priority 3 – Apr/May summer/autumn fresh** (60 ML/d x 5). • **Priority 4 – Jan/Feb summer/autumn fresh** (60 ML/d x 5). • **Priority 5 – Feb/Mar little summer fresh** (30 ML/d x 3). • **Priority 6 – Sep – Nov winter/spring fresh** (achieved naturally). • **Priority 7** – **May – Aug winter/spring fresh** (achieved naturally). • **Priority 8** - **Sep-Nov winter/spring fresh** (achieved naturally).
Tier 1b Potential watering actions: Delivery is reliant on additional water/resources becoming available in 2022-23 *(all at minimum recommended flow rates* refer to above description)*	• **Priority 4 – Sep-Nov winter/spring fresh** (80 ML/d x 5). • **Priority 5 – May - Aug winter/spring fresh** (80 ML/d x 5).	• **Priority 5 – May – Aug winter/spring fresh** (80 ML/d x 5).	• **Priority 7** – **May – Aug winter/spring fresh** (80 ML/d x 5). • **Priority 8 – Sep – Nov winter/spring fresh** (80 ML/d x 5).	In this scenario in 2022-23 there is no tier 1b watering actions.
Tier 1a environmental water demands	**2493 ML** Assumptions: no passing or natural flow for full year.	**2508 ML** Assumptions: passing or natural flow at 5ML/d for 2 months in winter/spring only	**2510 ML** Assumptions: passing or natural flow at 5ML – 10 ML/d for 6 months of the year.	**780 ML** Assumptions: passing flow at >10ML/d in winter/spring and >10 ML/d in summer/autumn.

MOORABOOL RIVER - REACH 3a	Drought	Dry	Average	Wet
Tier 1b environmental water demands	**1130 ML**	**565 ML**	**990 ML**	**0 ML**
High priority carry over requirement	1000 ML, however supply will be close to full (>7 GL) and wont limit full use of entitlement in 2023-23.	1000 ML, however supply will be close to full (>7 GL) and wont limit full use of entitlement in 2023-23.	1000 ML, however supply will be close to full (>7 GL) and wont limit full use of entitlement in 2023-23.	1000 ML, however supply will be close to full (>7 GL) and wont limit full use of entitlement in 2023-23.
Tier 2 Potential watering actions *(closer to aspirational flow rates for optimal long-term health)* Note: Tier 2 watering actions are not in addition to those in tier 1, rather they are modified versions of tier 1 watering actions that are closer to aspirational targets but are still within delivery constraints. Some of the maximum (closer to aspirational) volumes in tier 2 are not as high as what is recommended in the FLOWS study due to constraints such as Dollys Creek Road. Therefore no watering action will have a maximum above 90 ML/day (the volume in which Dollys Creek road is inundated).	• **Priority 1 – summer/autumn low flow** at an aspirational level (up to 20ML/d if not met naturally at this level). • **Priority 2 – winter/spring low flow** at an aspirational level (up to 60ML/d) • **Priority 3 Apr/May summer/autumn fresh** to an aspirational peak of >60 ML/d x 5 (actual volume dependent on volume of winter/spring freshes). • **Priority 4 – Sep – Nov winter/spring fresh** to an aspirational peak and duration of up to 90 ML/d x 10). • **Priority 5 May – Aug winter/spring fresh** to an aspirational peak and duration of up to 90 ML/d x 10). • **Additional Jan/Feb summer/autumn fresh** to an aspirational peak of >60 ML/d x 5 (actual volume dependent on volume of winter/spring freshes). • **Additional Feb/Mar little summer/autumn fresh** to an aspirational peak of >30 ML/d x 3 (actual volume dependent on volume of other freshes and BW transfers). • **Additional Sep – Nov winter/spring fresh** to an aspirational peak and duration of up to 90 ML/d x 10).	• **Priority 1 – summer/autumn low flow** at an aspirational level (up to 20ML/d if not met naturally at this level). • **Priority 2 – winter/spring low flow** at an aspirational level (up to 60ML/d) • **Priority 3 Apr/May summer/autumn fresh** to an aspirational peak of >60 ML/d x 5 (actual volume dependent on volume of winter/spring freshes). • **Priority 4 – Sep – Nov winter/spring fresh** to an aspirational peak and duration of up to 90 ML/d x 10). • **Priority 5 May – Aug winter/spring** to an aspirational peak and duration of up to 90 ML/d x 10). • **Additional Jan/Feb summer/autumn fresh** to an aspirational peak of >60 ML/d x 5 (actual volume dependent on volume of winter/spring freshes) • **Additional Feb/Mar little summer/autumn fresh** to an aspirational peak of >30 ML/d x 3 (actual volume dependent on volume of other freshes and BW transfers). • **Additional Sep – Nov winter/spring fresh** to an aspirational peak and duration of up to 90 ML/d x 10).	• **Priority 1 – summer/autumn low flow** at an aspirational level (up to 20ML/d if not met naturally at this level). • **Priority 2 – winter/spring low flow** at an aspirational level (up to 60ML/d). • **Priority 3 Apr/May summer/autumn fresh** to an aspirational peak of >60 ML/d x 5 (actual volume dependent on volume of winter/spring freshes). • **Priority 4 – Jan/Feb summer/autumn fresh** to an aspirational peak of >60 ML/d x 5 (actual volume dependent on volume of winter/spring freshes). • **Priority 5 – Feb/Mar little summer fresh** to an aspirational peak of >30 ML/d x 3 (actual volume dependent on volume of other freshes). • **Priority 6 – Sep – Nov winter/spring fresh** to an aspirational peak and duration of up to 90 ML/d x 10). • **Priority 7** – **May - Aug winter/spring fresh** to an aspirational peak and duration of up to 90 ML/d x 10). • **Priority 8 – Sep - Nov winter/spring fresh** to an aspirational peak and duration of up to 90 ML/d x 10).	• **Priority 1 – summer/autumn low flow** at an aspirational level (up to 20ML/d if not met naturally at this level). • **Priority 2 – winter/spring low flow** at an aspirational level if not met naturally at this level (up to 60ML/d). • **Priority 3 Apr/May summer/autumn fresh** to an aspirational peak of >60 ML/d x 5 (actual volume dependent on volume of winter/spring freshes). • **Priority 4 – Jan/Feb summer/autumn fresh** to an aspirational peak of >60 ML/d x 5 (actual volume dependent on volume of winter/spring freshes). • **Priority 5 – Feb/Mar little summer fresh** to an aspirational peak of >30 ML/d x 3 (actual volume dependent on volume of other freshes).
Tier 2 water demands (approx)	**15050 ML**	**15050 ML**	**14900 ML**	**9400 ML**

7. Delivery constraints

7.1 Temporary constraints

Although there are few potential temporary constraints that inhibit delivery, risks are identified prior to and reviewed throughout the year. There are potential risks associated with climate events such as fire, flood and heatwaves which may negatively impact the water quality and availability. There is no indication that this year will be dry; however given the climate unpredictability, there may be temporary constraints revealed throughout the 2022-23 year (outlined below in Table 11).

Table 11. Potential temporary constraints to environmental water delivery

Potential temporary constraint	Impact on watering	Action
Blue-green algae bloom in storage reservoir	Interruption to environmental watering, may result in delays.	Water delivery schedule will be revised.
Fire in the catchment or adjacent to the river.	Interruption to environmental watering, depending on scale of fire to 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.

7.2 Systemic constraints

Allocation

Up to 7,086ML can be stored under the Moorabool River Environmental Entitlement 2010. The entitlement is subject to delivery rules (a maximum of 7,500ML over three consecutive years) which provide the authority and the VEWH with an average of 2,500ML per year. This is a quarter of the water recommended by the FLOWS study (Jacobs, 2015) for basic ecological function and only 10% of what is required for all recommended flows. The allocation of water under the entitlement is therefore seen as a systemic constraint to delivering the environmental flows required by the system.

Water delivery

Lal Lal Reservoir has an infrastructure delivery limitation of 140ML/d, which puts a minor constraint on aspirational freshes, and winter high flows outlined in the FLOWS study (Jacobs, 2015).

Carry-over, storage losses and delivery losses

The environmental entitlement has provisions to permit carry-over of unused allocations between years to provide inter-annual security and flexibility in the way that the entitlement is delivered. It

is expected that 2,500ML of water will be available for 2022-23 due to high storage levels in Lal Lal reservoir.

If less than 1,000ML of environmental water is held in storage at the start of the water year, approximately 250ML of water will be delivered in accordance with the drought scenario. This will result in less than 750ML being available for the following three water years, in the event of a continued drought and associated lack of storage inflows to Lal Lal. However, if greater than 1,250ML of water is available at the start of the water year, approximately 1,000ML will be left in storage to ensure there is sufficient water available to maintain water quality over consecutive years.

Water held in storage attracts losses to account for evaporation, seepage and leakage, which are apportioned between entitlement holders. Losses are calculated on a weekly basis and no additional losses are applied to water carried over water years.

Delivery loss allowances of 10 per cent are used when planning urban water deliveries to She Oaks. This provides a basic estimate for use under dry conditions. A management consideration for reducing delivery loss is to time environmental water release with rainfall events. Monitoring of flows during environmental releases revealed that when environmental flows are timed to occur with rainfall events there were no transmission losses between Lal Lal and the reach 3 compliance point; in most cases a net gain is realised owing to the contribution of rainfall runoff.

Operating arrangements and local management rules

Reach 3a and 3b of the river can be used to convey water from Lal Lal Reservoir to Barwon Water operated headworks at She Oaks. Barwon Water operational releases have been successfully integrated with environmental releases to share delivery losses and increase the magnitude, duration and reach of flow events.

Southern Rural Water (SRW) manages water licences for domestic and stock, commercial, and irrigation water users along the Moorabool River. Local management rule (SRW, 2009) extraction restrictions based on flows at Batesford account for and protect environmental releases. Extraction within reach 3a and 3b includes stock and domestic, irrigation as well as urban water extraction. Reach 4 has potential for significant domestic and stock use and irrigation extraction. Local management rules for irrigation are structured in such a way that they shepherd environmental releases down the river. This is achieved through appropriate trigger levels and rolling averages to let ‘freshes’ pass through.

Dollys Creek Road

The Dollys Creek Road crossing that intercepts the Moorabool River at Morrisons is regularly inundated by natural flows at relatively low flow volumes due to the infrastructure being in the channel, with one small circular culvert to allow flow through. Anecdotal evidence suggests inundation occurs at a flow volume of around >90 megalitres a day (ML/day). The crossing can restrict the delivery of environmental water in wet climatic conditions as Corangamite CMA cannot release water that will contribute to the inundation of human assets. Corangamite CMA does take advantage of natural flows to achieve higher volumes where possible but is unable to contribute to inundation of infrastructure thus the crossing is a barrier to reaching higher flow

volumes using environmental water. This occurred earlier in 2021, when Corangamite CMA had to revise a fresh release that was to go on top of significant natural flow, due to the crossing. With the support of WTOAC, Corangamite CMA is currently liaising with Moorabool Shire Council to find a solution to this issue prior to when the entitlement is increased (in ML).

8. Confounding factors

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

As a multiple stakeholder, the integrated catchment management project, *The Living Moorabool* will address many of these issues over the long term.

8.1 Fish Barriers

There are significant barriers to fish movement in the Moorabool River. In the lower reach between She Oaks and Batesford nine private diversion weirs act as a barrier. They have increased the extent of slow flowing habitat, decreased habitat diversity, and barred migratory fish species and other aquatic fauna. These barriers are substantial and can't be totally overcome by the current entitlement or even a natural high flow event (see Figure 11, She Oaks weir as compared to 'high flow').

Two projects were scoped out in 2020 to create a Batesford weir fishway and to improve fish passage through the broken concreted section of the river near Batesford quarry. This included pre-works planning such as biodiversity, cultural heritage and underground service checks, the creation of final design options and operational specifications and stakeholder engagement. However, the projects did not go through to construction for various reasons including access constraints and budget. The reports could be used in future when funding is available.

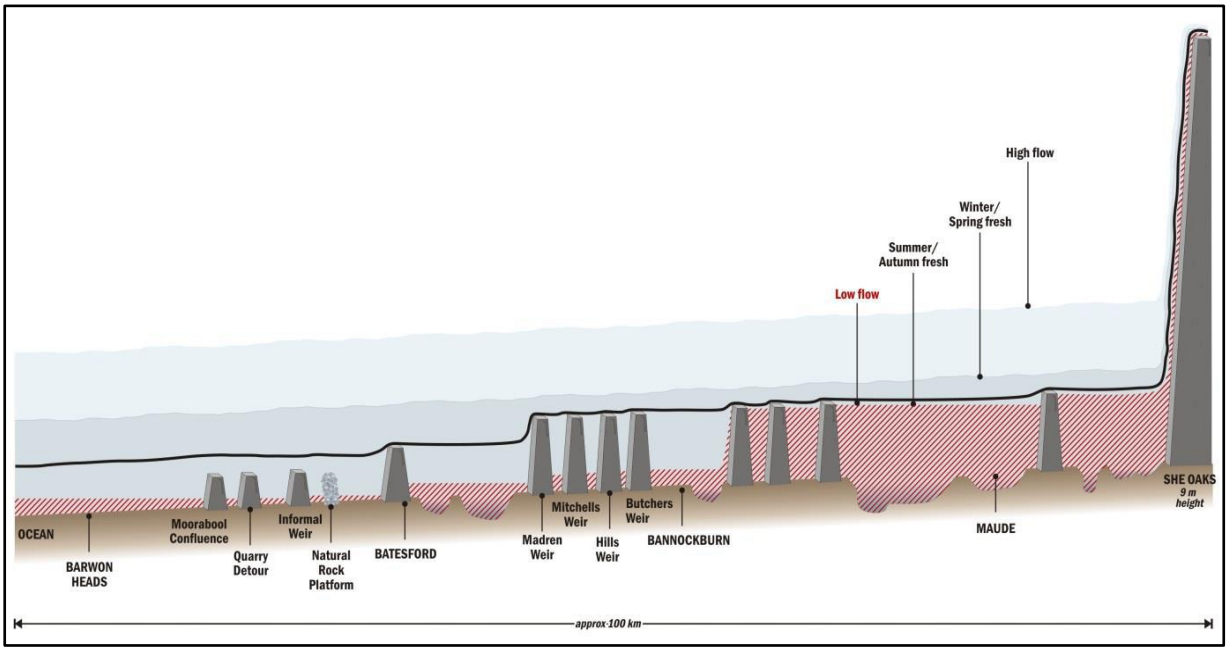


Figure 11. Fish barriers in the Barwon system

8.2 Riparian Rehabilitation

Healthy land supports healthy waterways. Water quality and bank stability can decline due to a lack of adequate riparian vegetation surrounding the river channel and stock access to the river. As many parts of the Moorabool River run through agricultural properties, a severe lack of healthy riparian vegetation in some areas negatively impacts on the river's health in many ways. 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. There were no works undertaken on the Moorabool in the 2021-22 water year due to a lack of funding for on-ground works during that period.

9. Increasing knowledge

9.1 Knowledge gaps

Increasing our knowledge and addressing priority knowledge gaps is an important part of managing risks associated with environmental water delivery. Corangamite CMA regularly reviews the knowledge needs to enable the organisation to plan for and deliver environmental water in an adaptive and effective manner.

Recent studies undertaken for the Moorabool River that have supported environmental water delivery include:

- **Wadawurrung Traditional Owner Aboriginal Corporation (WTOAC) Water quality monitoring report DRAFT (WTOAC, 2022)**
  Corangamite Waterwatch enables community monitors to conduct water tests in priority waterways. In November 2020 a WTOAC water quality monitoring team was trained in Waterwatch methods and the use of water quality monitoring equipment and Agreed Level Taxonomy Macroinvertebrate surveys to undertake an ongoing investigation of water quality at sites of Cultural significance on the Moorabool River "Moorabool Yaluk". The normal suite of tests done by the Waterwatch monitors includes dissolved oxygen, pH, electrical conductivity, temperature, reactive phosphorus and turbidity. WTOAC field staff were trained and provided with the equipment and support to do before and after "fresh" monitoring at four sites on the West Moorabool and monthly monitoring at three sites on the East Moorabool. Aquatic macro-invertebrate assessments were performed by Waterwatch and WTOAC in spring and autumn at the four sites on the West Moorabool to evaluate the condition of these sites over time. A QA/QC program focuses on training in procedures, regular servicing of equipment, appropriate calibration procedures and checking of data entered on the publicly available Waterwatch Data Management System. This report presents the water quality and macroinvertebrate data collected from November 2020 to December 2021 and interpretation of results in relation to SEPP Waters of Victoria values and SIGNAL2 scores.

Figure 12. Wadawurrung man Matthew Chatterton undertaking water testing at Morrisons, 2020

- **Geelong Values: Analysis of the social and economic values dependent on a flowing Barwon River (through Geelong) and lower Moorabool River** (RMCG, 2021)
  This study was commissioned by Corangamite CMA to examine the social and economic benefits that the Barwon and Moorabool Rivers provide to the community of Geelong, and the importance of river flows for supporting and protecting these values. It is intended the results of this study will be used to guide future water recovery decisions for the Barwon and Moorabool Rivers.
- **Strategic analysis of Waterwatch data** (Alluvium, 2020)
  This work has looked back over Waterwatch data sets available on the Moorabool to see how useful they might be to assess the effectiveness of environmental water delivery before and after a flow event, and over many years of delivery. It also assessed which Waterwatch parameters were most responsive to e-flows and how data collection could be adapted in the future to better inform the achievement of e-water objectives.
- **Stage 6 of the Victorian Environmental Flows Monitoring and Evaluation Program (VEFMAP)** (ARI 2020)
  Identified some of the patterns associated with fish responses to environmental flows across Victoria. Stage 6 is now complete, and Stage 7 will also look at how changing spring flow pulses and baseflow recommendations may affect fish retention and survival. See section 4.2 for further information about the findings for stage 6.

- **Final report of the Lower Moorabool River groundwater and FLOWS project** (Lloyd et al., 2020)
  This project analysed the existing (and recently collected) data to define the scale and nature of groundwater losses in the Lower Moorabool River near the Batesford Quarry. The project used the existing FLOWS study (Jacobs, 2015) as a reference and an updated FLOWS (HEC_RAS) analysis to develop recommendations around the scale of environmental water release required to achieve existing FLOWS recommendations for Reach 4 of the Moorabool River, and to maintain connectivity through to the confluence with the Barwon River.
- **DRAFT Moorabool Catchment geomorphology** (Grove, 2018)
  This work sets out the geomorphological condition of the Moorabool.
- **Habitat refuge pools and flow-dependent vegetation of the Moorabool River, Victoria** (Jacobs, 2017)
  To improve Corangamite CMA's ability to manage the Moorabool River Environmental Entitlement, this report documents investigations into the ecological significance and health of habitat refuge pools and flow dependent vegetation in the Moorabool River.
- **Prioritising barriers to upstream fish passage** (Marsden et al., 2016)
  The objective of this project was to assess and identify all potential barriers to fish passage and low flows in the Barwon and Moorabool River basins. Out of the top 34 barriers to fish migration identified in the Barwon Moorabool catchment, the Batesford Quarry Ford and Channel Drop (#11), Batesford Hotel Weir (#17) and the Old Whitford Crossing (#21) were the highest ranked for the Moorabool. Six other sites were identified in the Moorabool River.
- **Assessment of fish populations in the Moorabool River to inform environmental flows** (Raymond, 2015)
- **Moorabool River FLOWS study update** (Jacobs, 2015) A review of the environmental flows assessment for the Moorabool River system.
- **Assessment of fish populations in the Moorabool River to inform environmental flows** (ARI, 2015)
- **Lower Moorabool and Barwon River aquatic plant monitoring** (Water Technology, 2012)
  This report assessed the condition, diversity and distribution of macrophytes in the lower Moorabool and Barwon Rivers following the dewatering of saline water from the Batesford Quarry.
- **Moorabool River fish survey – measuring the impact of dry in-flow conditions** (McGuckin & Ryan, 2009)

In addition to this important information, greater monitoring within the system, analysis of existing data and mapping of significant water users may assist in developing more effective strategies to deliver environmental water and in demonstrating outcomes to the community. Most studies listed above are available online in the Corangamite CMA Knowledge Base.

Greater knowledge of indigenous heritage in the area is a key priority for Corangamite CMA. Creating opportunities to enable Wadawurrung Traditional Owners to create and re-create linkages with the river system will bring about a more precise knowledge base for delivery of environmental water and realise significant shared benefits for Wadawurrung Traditional Owners and the wider community

The installation of the temporary Moorabool water gauges at the Batesford Quarry has given us significant insights into water movement, such as the water loss at the quarry, and a better

understanding of potential scenarios related to that water loss. A summary report from Corangamite CMA is now available.

Table 12 on the following page outlines knowledge gaps in the Moorabool River system that were identified in the Moorabool Environmental Water Management Plan (EWMP) (Corangamite CMA, 2016). It also includes additions of recent investigations being undertaken on the Moorabool River that were not in the EWMP. The projects were prioritised by Corangamite CMA and project status has been provided. Please note these projects have not been committed to by Corangamite CMA or external funding providers. Rather, this list represents potential projects that could improve knowledge for managers and the community.

Table 12. Knowledge gaps and recent investigations in managing the Moorabool River system

Project priority	Knowledge gaps and project recommendation	Responsible authority	Status
NA	The Living Moorabool – evaluating the effect of human driven change This PhD research project commenced in early 2021 and focuses on a longitudinal study of land use change in the Moorabool catchment and the impact on river health. The project is a joint initiative of Barwon Water and Corangamite CMA. Research questions cover • analysing the cumulative impact of farm dams in the catchment to the stream flow • determining if environmental flows released into the river are enough to provide passage across current ecological barriers, such as weirs, to allow migratory fish species to move through barriers at critical development stages • quantification of the impact of environmental flows on water quality.	Corangamite CMA, Barwon Water. Deakin University	In progress
NA	Pathogen Risk Assessment A project considering pathogen risks in the Moorabool River catchment, including: • pathogen risk to drinking water supplied from the Moorabool River special water supply catchment • risk to recreational users in the Moorabool river study area • consideration of ecological health as it relates to the overall project Preliminary findings indicate that the Moorabool Catchment has many sources of pathogen risks. These sources are known to agencies, councils and Barwon Water, with appropriate catchment mitigation actions occurring and with Barwon Water delivering drinking water. The project will recommend additional measures to further reduce the pathogen risk.	Corangamite CMA, Barwon Water	Completed in January, 2022
NA	Platypus eDNA This project aimed to address the current lack of knowledge by investigating the distribution of platypuses throughout the Moorabool using environmental DNA (eDNA).	Moorabool Catchment Landcare Group	Completed Report available on Moorabool Catchment Landcare Group website

Project priority	Knowledge gaps and project recommendation	Responsible authority	Status
1	Aboriginal cultural value mapping (cultural values common to all Wadawurrung Country have been referenced from work on the Barwon system, but this work needs ground truthing on the Moorabool system)	Corangamite CMA, DELWP, VEWH, CHW, Barwon Water, SRW	Partially completed
1	Assessment of fish barriers Further understanding is required on the condition of natural and artificial barriers along the Moorabool River, the extent to which they pose a barrier to fish migration and what additional works are required to improve fish passage. Clearly, She Oaks Weir is the largest barrier impacting on fish movement and major works would be needed to provide fish passage. There are also several smaller barriers downstream.	Corangamite CMA	Completed Report available on Corangamite CMA Knowledge Base.
1	Identification of habitat refuges To assist platypus survival in future severe drought periods, it is recommended that substantial pools that are likely to serve as important refuges for platypus during natural cease-to-flow events should be identified, mapped and managed appropriately (e.g. by fencing out livestock). It is possible that the best (or only) reasonably drought-proof pool in some parts of reach 4 may be associated with an on-stream weir. If so, consideration should be given to installing a mechanism to facilitate fish passage around or over the weir, as opposed to removing the weir entirely.	Corangamite CMA	Identification completed
1	Investigate water movement around Batesford Quarry Seepage and losses of stream flow into Batesford Quarry is an ongoing issue, which has the potential to impact on the connectivity of flows and fish passage. Options to address these seepage losses should be further investigated (discharge at upstream site). Degradation of concrete channel lining works has also led to the creation of potential barriers for fish and Platypus movement. The spurs found on the ankles of male Platypus (used to establish dominance when competing for territories and mates) are likely to be abraded in a very untimely manner if animals have to travel repeatedly along a concrete-lined channel. Further investigations are required to assess the condition of the river in this section, the nature of instability issues and options to improve the stability of the channel and habitat areas for aquatic organisms.	Corangamite CMA, Adelaide Brighton, DELWP	Completed Report available on Corangamite CMA Knowledge Base

Project priority	Knowledge gaps and project recommendation	Responsible authority	Status
3	Investigate sand slugs The number, extent and mobility of sand slugs in the Moorabool Catchment need to be inventoried, and the potential threats that these pose to instream habitat needs to be assessed. Sand slugs dramatically simplify channel morphology, replacing complex structure and substrate with flat sheets of sand and gravel. Pools are filled in, and habitat is lost. Geomorphological changes can also impact other bulk entitlement holders and reservoir managers. Initial work on geomorphological condition has been done, but further work is required.	Corangamite CMA, CHW, Barwon Water	Partially completed
1	Water quality monitoring station It is recommended that additional water quality monitoring stations be installed (in addition to Coopers) in the lower sections of reach 4 before confluence with the Barwon River and reach 1, to confirm that recommended flow rates at the FLOWS assessment site do meet the minimum flow depths and acceptable water quality conditions further downstream.	Corangamite CMA	Proposed
2	Groundwater and Surface Water Interactions. Further investigation and monitoring were needed for groundwater and surface water interactions in reaches 1 to 4 to quantify the contribution of groundwater to low flow and freshes. A summary report is now available. See 4.2.3 Batesford Quarry above for more information.	Corangamite CMA	Completed, report on Corangamite CMA Knowledge Base.
1	1. Aquatic and terrestrial ecological vegetation mapping. Including extent and condition assessments, threats and opportunities. Identification of high priority biodiversity corridors and habitat links in reaches 1, 2,3,4 and also connectivity to the Barwon and Lower Barwon wetlands and ocean. 2. Photo Point Monitoring – Fluker Posts. Defined photo monitoring points to increase community engagement with flows and help determine vegetation and structural change at identified sites over a period of time.	Corangamite CMA, research institutes, DEWLP (EVC Mapping/Nature Print updates etc)	Partially completed (Fluker posts completed)
2	Managing for Climate Change. Changes to biota in response to climate change and understanding how to build resilience in ecological values to cope with a changing climate. Include concise and realistic management actions for waterway and land managers.	Corangamite CMA, research institutes	Proposed

10. Risk management

A risk assessment has been undertaken by Corangamite CMA for the 2022-23 season, with Barwon Water, the VEWH and Parks Victoria.

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 management for the current plan with potential risk mitigation measures and associated residual risk assessment is outlined below in Table 13.

Table 13. Risk assessment for 2022-23

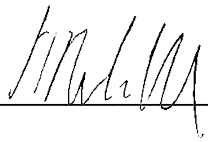
System	Risk ID	Risk category	Risk description	Likelihood	Consequence	Risk Rating	Mitigation actions	Lead for action	Remains med/ high after mitigat[n]	Risk type Static/ Dynamic
Moorabool	CEMO 2020-15	Environment	Inability to maintain summer base flows in reaches 3a and 3b with available environmental water volumes (under dry conditions and noting Barwon Water do not take water from Lal Lal Reservoir over winter), resulting in adverse environmental impacts. *Note: consequence rating is based on experience in recent years*	Possible	Moderate	Medium	• Maintain close communications with Barwon Water to understand expected demands from Lal Lal and design transfer regime to support base flows where possible • Monitor system closely and adjust plans to ensure most effective use of available environmental water volumes. • Consult with storage manager for specific response options in critical/high risk periods *Note: mitigation not fully effective in average to dry years.*	Corangamite CMA		Dynamic
Moorabool	CEMO 2020-16	Environment	Inability to maintain summer base flows in reach 4 (especially under drier conditions) with available environmental water volumes, resulting in adverse environmental impacts.	Likely	Moderate	Medium	• Monitor flows in collaboration with quarry operator and using additional monitoring sites recently installed; communicate situation to community; and where possible make releases to maintain pools and connectivity. • Develop long term engineering solutions to remove physical barriers to fish movement • Consider accessing additional water through trade. • Develop options for greater flexibility to bank water and change flows through the SWS process.	Corangamite CMA Corangamite CMA VEWH		Dynamic
Moorabool	CEMO 2020-17	Environment	Inability to deliver environmental water due to BGA blooms in Lal Lal Reservoir, which may limit releases to the Moorabool River to prevent environmental and human health impacts. *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	CHW		Static
Moorabool	CEMO 2020-18	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 (as per EWMP recommendations).	Corangamite CMA		Static

System	Risk ID	Risk category	Risk description	Likelihood	Consequence	Risk Rating	Mitigation actions	Lead for action	Remains med/ high after mitigat^{n}	Risk type Static/ Dynamic
Moorabool	CEMO 2020-19	Environment	A widespread power failure at Lal Lal may require shutdown of the hydro station releases, resulting in a sudden reduction in environmental flow rates until releases can be restored (which may take up to 3 hours). This may lead to environmental impacts.	Unlikely	Minor	Low	• Monitor site conditions and call out staff to manually restore releases as soon as possible.	CHW		Static
Moorabool	CEMO 2020-20	Safety	Interference or accumulation of debris may result in blockage of the pipe at the Morrison's Junction road crossing, leading to overtopping of the road and safety issues for road users. *Note: likelihood considers environmental water impact on creating a blockage*	Unlikely	Major	Low	• Undertake inspections prior to commencing environmental releases to ensure the pipe is clear.	Corangamite CMA		Static
Moorabool	CEMO 2020-21	Legal	Heavy rainfall following environmental deliveries may lead to unintended inundation of private land 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.	Corangamite CMA		Static
Moorabool	CEMO 2021-22	Environment	Capacity limits at Dolly's Ck Rd crossing limit max flows to 90 ML/d, leading to an inability to supplement some event due to safety concerns, resulting in failure to meet higher environmental flow requirements. *Note that access to increased e-water volumes may exacerbate this risk*	Possible	Minor	Low	• Consult with LGA to seek upgrade of road crossing • Monitor flows closely and adapt plans as necessary	Corangamite CMA		Dynamic
Moorabool	CEMO 2021-22	Safety	Unexpected rain events during e-water deliveries can lead to capacity limits at Dolly's Ck Rd crossing being exceeded contributing to flows over the road, with safety risks to road users *Note: that increased e-water volumes may exacerbate this risk. This site naturally floods frequently, and e-water contribution is minor*	Unlikely	Extreme	Medium	• Consult with LGA to seek upgrade of road crossing • Monitor flows closely and adapt plans as necessary • Include provision in water order for cessation of releases under sudden rain events This risk remains medium after mitigations, due to the potential for contribution to loss of human life.	Corangamite CMA	Medium	Dynamic
Moorabool	CEMO 2021-22	Environmental	Failure to place an order for summer base flows may lead to cease to flow events, resulting in environmental impacts	Unlikely	Minor	Low	• Closely monitor water actions and orders • Check and confirm with CMA prior to stopping baseflow events	Corangamite CMA, Storage managers		Static

10. Approval and endorsement

I, John Riddiford, the authorised representative of the agency shown below, approve the Moorabool River Seasonal Watering Proposal 2022-23.

SIGNED FOR AND ON BEHALF OF Corangamite Catchment Management Authority



Signature of authorised representative

John Riddiford

Name of authorised representative

Date:

Appendix 1. Abbreviations

BGA	Blue green algae
BW	Barwon Water
Corangamite CMA	Corangamite Catchment Management Authority
CHW	Central Highlands Water
CMA	Catchment Management Authority
CRWS	Corangamite Regional Waterway Strategy
DELWP	Department of Environment Land Water and Planning
EPA	Environment Protection Agency
EPBC Act	Environmental Protection and Biodiversity Conservation Act
EVC	Ecological Vegetation Class
EWMP	Environmental Watering Management Plan
MCLG	Moorabool Catchment Landcare Group
MSAC	Moorabool Stakeholder Advisory Committee
PALM	People for a Living Moorabool
PWA	Priority Watering Action
SEPP	State Environment Protection Policy
SRW	Southern Rural Water
SWP	Seasonal Watering Proposal
SWS	Sustainable Water Strategy
VEWH	Victorian Environmental Water Holder
WTOAC	Wadawurrung Traditional Owners Aboriginal Corporation

Appendix 2. References

Alluvium. (2020). *Strategic analysis of Waterwatch monitoring data for Corangamite CMA: project report*. [report prepared by Alluvium Australia for Corangamite CMA]. https://www.ccmaknowledgebase.vic.gov.au/soilhealth/soils_resource_details.php?resource_id=4846

Alluvium. (2021). *Updated Final Recommendations Report: Upper Barwron, Yarrowee and Leigh Rivers FLOWS study update.* [report prepared by Alluvium Australia for Corangamite CMA].

ARI. (2020). *Stage 6 of the Victorian Flows Monitoring and Evaluation Program (VEFMAP).* https://www.ari.vic.gov.au/__data/assets/pdf_file/0036/489654/VEFMAP-Stage-6-brochure-results-2016-2020.pdf

ARI. (2015). *Assessment of fish populations in the Moorabool River to inform environmental flows.* [Unpublished report for Corangamite CMA].

Bureau of Meteorology. (2021). Climate change and variability: Tracker: Australian timeseries graphs (bom.gov.au)

Bureau of Meteorology (2022a) Climate Driver Update Archive. *http://www.bom.gov.au/climate/enso/wrap-up/archive/20210316.archive.shtml*

Bureau of Meteorology. (2022b,January 21). *Wetter February to April likely for parts of eastern and south-west Australia, drier in parts of interior WA.* http://www.bom.gov.au/climate/outlooks/#/rainfall/summary

Corangamite Catchment Management Authority (Corangamite CMA). (2016). *Moorabool River environmental water management plan*. [Final. Version 2.6]. https://www.ccmaknowledgebase.vic.gov.au/kb_resource_details.php?resource_id=4856

Corangamite Catchment Management Authority (Corangamite CMA). (2014). *Corangamite Waterway* Strategy 2014 – 2022. https://issuu.com/gsdm/docs/waterway_strategy_2014-22

Department of Environment Land Water and Planning (DELWP). (n.d.). *Water monitoring.* http://data.water.vic.gov.au

DELWP. (2015). *Climate-ready Victoria – Barwon South West.* [Factsheet]. https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/60743/Barwon-South-West.pdf

DELWP. (2021) *Victoria's Land Cover Time Series*. Victoria's Land Cover Time series (environment.vic.gov.au)

DELWP and CSIRO. (2019). *Barwon Climate Projections 2019* https://www.climatechange.vic.gov.au/adapting-to-climate-change-impacts/victorian-climate-projections-2019.

Goldfields Guide. (2021). Hunts Bridge Camping Area. https://www.goldfieldsguide.com.au/explore-location/562/hunts-bridge-camping-area/

IAP2 International Federation. (2018). *IAP2 spectrum of public participation*. https://www.iap2.org.au/resources/spectrum/

Marsden, T., Stuart, I. & O'Connor, J. (2016). *Prioritising barriers to upstream fish passage: Barwon and Moorabool catchments*. [Report prepared by The Fisheries Collective for the Corangamite CMA].

McGuckin J. & Ryan, T. (2009). *Moorabool River fish survey – measuring the impact of dry inflow conditions*. [Report prepared by Streamline Research & environous for Corangamite CMA]

Moorabool Catchment Landcare Group (2021). Platypus eDNA testing. https://mooraboolcatchment.com.au/platypus-edna-testing/

Jacobs (2017). *Habitat Refuge Pools and Flow-dependent Vegetation of the Moorabool River, Victoria*. [Report prepared by Jacobs Australia for the Corangamite CMA].

Jacobs. (2015, October 1). *Moorabool River FLOWS Study update.* [Report prepared by Jacobs Australia for the Corangamite CMA]. https://www.ccmaknowledgebase.vic.gov.au/soilhealth/soils_resource_details.php?resource_id=4732

Lloyd, L.N., Clarke, S. and Dahlhaus, P. (2020). *Final report of the Lower Moorabool River groundwater and FLOWS project* (Corangamite CMA Project No. 1731). [Lloyd Environmental report to Corangamite CMA]. https://ccma.vic.gov.au/wp-content/uploads/2020/08/Moorabool-Groundwater-and-FLOWS-Project-Final-Report-3-July-2020.pdf

Raymond, S. (2015). *Assessment of fish populations in the Moorabool River to inform environmental flows*. [Unpublished client report prepared by Arthur Rylah Institute for Environmental Research for Corangamite CMA]. https://www.ccmaknowledgebase.vic.gov.au/kb_resource_details.php?resource_id=4740.

RMCG (2021). *Analysis of the social and economic values dependent on a flowing Barwon River (through Geelong) and Lower Moorabool River).* [Report prepared by RMCG for Corangamite CMA]. https://www.ccmaknowledgebase.vic.gov.au/soilhealth/soils_resource_details.php?resource_id=4897

Sinclair Knight Merz (2004). *Moorabool River water resource assessment* [Report prepared for the Corangamite CMA]. https://www.ccmaknowledgebase.vic.gov.au/soilhealth/soils_resource_details.php?resource_id=1850

Southern Rural Water (2009) Local Management Rules. http://www.srw.com.au/Files/Local_management_rules/moorabool_local_Management_Rules_Sept09.pdf

Tonkin, Z., Jones, C., Clunie, P., Vivian, L., Amtstaetter, F., Jones, M., Koster, W., Mole, B., O'Connor, J., Brooks, J., Caffrey, L., & Lyon, J. (2020). *Victorian Environmental Flows Monitoring and Assessment Program. Stage 6 Synthesis Report 2016-2020*. (Technical Report Series No. 316). Arthur Rylah Institute for Environmental Research /Department of Environment, Land, Water and Planning. https://www.ari.vic.gov.au/__data/assets/pdf_file/0040/488839/ARI-Technical-Report-316-Victorian-environmental-flows-assessment-program-stage-6-synthesis-report-2016-2020.pdf

Tunbridge, B.R. (1988) Environmental Flows and Fish Populations of waters in the South Western Region of Victoria. ARI Technical Report Series No.65. Arthur Rylah Institute for Environmental Research Heidelberg.

Victorian Auditor-General's Office (VAGO). (2015) *Public participation in government decision-making: a better practice guide*. https://www.audit.vic.gov.au/sites/default/files/20150130-Public-Participation-BPG.pdf

Victorian Legislation (2022). *Aboriginal Heritage Regulations 2007.* https://www.legislation.vic.gov.au/as-made/statutory-rules/aboriginal-heritage-regulations-2007

Water Technology (2012) Lower Moorabool and Barwon River Aquatic Plant Monitoring: Report prepared for the Corangamite CMA by Water Technology. Water Technology, Notting Hill, Vic.

Williams G.A. and Serena M. (2006). *Ecology and conservation of platypus in the Moorabool River: III. Results of population surveys, November 2005 – January 2006.* [Unpublished report for Corangamite CMA].

Appendix 3. IAP2 spectrum of public participation

Table 14. IAP2 spectrum of public participation

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Appendix 4. Condition summary of the Moorabool River reaches

Reach 1	**East Moorabool River Bostock Reservoir to the confluence with the West Moorabool River**
Description	The East Branch of the Moorabool River begins with the Korweinguboora Reservoir south of Spargo Creek and is soon impounded by Bostock Reservoir (approximately 500m AHD) near Ballan. Reach 1 flows south for most of its length before tending south west to join with the West Branch of the Moorabool near Morrisons.
Environmental condition	Highly regulated hydrology with associated alteration of geomorphology. Water quality parameters often outside of State Environment Protection Policy (SEPP) objectives. A knowledge gap exists for the current biological condition of the East Moorabool. The only native fish recorded was the Buniya Short-finned eel in 1988. Exotic species include Brown trout and Redfin.
Water supply	Korweinguboora Reservoir, Bostock Reservoir, Bolwarra Weir.

Reach 2	**Moorabool Reservoir to Lal Lal Reservoir**
Description	The West Branch forms near Mollongghip before flowing south into the Moorabool Reservoir (approximately 600m AHD) at Bolwarrah before flowing on to the larger Lal Lal Reservoir formed by Bungal Dam (approximately 400m AHD) located south of Mt Egerton.
Environmental condition	Highly regulated hydrology along with farm dam impacts and irrigation diversions. Water quality parameters often outside of SEPP objectives. The only native fish recorded is the *Turrpurt* Mountain galaxias. Exotic species include Brown trout and Redfin.
Water supply	Moorabool Reservoir, Lal Lal Reservoir.

Reach 3a	**Lal Lal Reservoir to confluence with East Branch, Morrisons Sharps Road, She Oaks. Priority reach under the Corangamite Waterway Strategy (CWS), this reach will benefit the most from environmental flows.**
Description	Flowing from Lal Lal Reservoir, this reach flows in a south, south-east direction and is joined by the East Branch at Morrisons. The reach continues south to She Oaks Weir which serves as an offtake point for BW.
Environmental condition	Flows typically less than half of natural flow in most years, with some reversal of flow seasonality and greatly reduced variability. The geomorphology includes both confined and floodplain forms. Generally improved water quality, however there are ongoing issues with salinity and nitrogen. Areas of intact remnant riparian vegetation, diverse macroinvertebrate communities and several non-migratory native fish species recorded in addition to migratory *Buniya* Short-finned eels.
Water supply	Lal Lal Reservoir.

Reach 3b	**Lal Lal Reservoir to confluence with East Branch, Morrisons Sharps Road, She Oaks Priority reach under the CWS, this reach will benefit the most from environmental flows.**
Description	The river flows from the East Branch at Morrisons heading in a southerly direction to She Oaks Weir, which serves as an offtake point for BW.
Environmental condition	Flows typically less than half of natural flow in most years, with some reversal of flow seasonality and greatly reduced variability. The geomorphology includes both confined and floodplain forms. Generally improved water quality, however there are ongoing issues with salinity and nitrogen. Areas of intact remnant riparian vegetation, diverse macro-invertebrate communities and several non-migratory native fish species recorded in addition to *Buniya* Short-finned eels (migratory).
Water supply	Lal Lal Reservoir and She Oaks Weir.

Reach 4	**Sharps Road, She Oaks downstream to the confluence with the Barwon River. Will benefit from flow on effect of environmental water releases in reach 3.**
Description	Reach 4 is a highly modified reach including numerous small private diversion weirs (associated with irrigation developments) and a realignment and concrete lining.
Environmental condition	Significantly altered flow and form due to diversion weirs, water extractions and channel realignment. Diversion weirs act as barriers to fish migration with a significant native fish population (including Australian grayling) occurring below most downstream barriers.
Water supply	Eight private diversion weirs.

Appendix 5. VEWH risk matrix

Table 15. VEWH risk rating matrix

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Extreme
Almost certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	Extreme	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Low	Medium	High	Extreme
Rare	Low	Low	Low	Medium	High

Rating		Description	Probability
Rare	1	Event may occur only in exceptional circumstances	0-5%
Unlikely	2	The event could occur at some time	5-20%
Possible	3	The event might occur	20-50%
Likely	4	The event will probably occur in most circumstances	50-80%
Almost certain	5	The event is expected to occur in most circumstances	80-100%

Table 16. VEWH risk consequence table

Rating		Environment	Business Costs	People		Political/ Reputational	Legal	Service Delivery
				Safety and Well-being	People and Culture			
Negligible Harm	1	No material effect on the environment, contained locally within a single site/ area. Environment affected for days	Cost impact of up to 2.5% of allocated operational budgets (including capital budget); OR a cost impact of up to $2.5m	On-site first aid treatment only	Staff disgruntlement	Minimal adverse local attention (1 day only)	Non-compliance with legislation, identified internally and resulting in internal acknowledgement and process review.	Insignificant impact to the partnership's capability in providing its services – no inconvenience to customers/ stakeholders
Minor Harm	2	Limited effect on the environment, restricted to a single township or locality. Environment affected for weeks.	Cost impact between 5%-10% of allocated operational budgets (including capital budget); OR a cost impact of up to $5m	Minor injuries/illness requiring medical attention	Complaints, passively upset, and uncooperative	Adverse localised public attention on a single issue over a short period (up to 1 week)	Non-compliance with legislation or breach of duty of care, identified externally and either (1) resolved without prosecution of or civil action, or (2) resulting in prosecution or civil action involving low level of resourcing required to defend, exposure to low level remedies or damages, and low-level risk of negative precedent	Minimal short-term temporary impact to the partnership's capability in providing its services – customers/ stakeholders slightly inconvenienced
Moderate Harm	3	Moderate effect on the environment, impacting on a municipality or multiple localities. Environment affected for months.	Cost impact >10% of allocated operational budgets (including capital budget); OR a cost impact of up to $10m	Significant injury/illness requiring inpatient hospitalisation	Low morale, disengagement, increased absenteeism and workplace conflict	Adverse localised negative public attention on a single issue over a sustained period (up to 2 months)	Non-compliance with legislation or breach of duty of care resulting in prosecution of, or civil action, with one of high level of resourcing required to defend; exposure to high level remedies or damages or high-	Significant impact to the partnership's capability in providing its services – customers/ stakeholders inconvenienced

							level risk of negative precedent.	
Major Harm	4	Major effect on the environment, impacting on a region or multiple municipalities. Environment affected for 1-3 years.	Cost impact between $10m-$50m	Extensive and/or permanent injury/ illness	Major morale issues, high absenteeism and resignations of key staff	Serious adverse public attention on more than one issue over a prolonged period (up to 2 years)	Non-compliance with legislation or breach of duty of care resulting in prosecution of or civil action (with *all* high level of resourcing required to defend, exposure to high level remedies or damages, and high-level risk of negative precedent); or public enquiry	Continuing difficulties in the partnership's capability in servicing customers/stakeholders over a protracted period
Extreme Harm	**5**	**Very serious effect on the environment, impacting on the state or multiple regions. Environment affected for >3 years**	**Cost impact of over $50m**	**Death or permanent disability/ illness**	**Partnership wide morale issues, mass resignations and absenteeism**	**Very serious public outcry over a prolonged period (greater than 2 years), or leading to a formal inquiry, serious investigation of other major political event**	**Non-compliance with legislation or breach of duty of care resulting in prosecution of or civil action (leading to imprisonment of an officer and/or uninsured compensation payments)**	**Long term detrimental effect on the partnership's capability in providing services to customers/ stakeholders**

Appendix 6. Wadawurrung Traditional Owners – letter of endorsement

Wadawurrung
Traditional Owners
Aboriginal Corporation

ABN 11 312 302 330
ICN 3330
99 Mair St East, Ballarat VIC 3350
p +61 3 4308 0420
86 Mercer St, Geelong VIC 3320
p +61 3 5222 5889
e reception@wadawurrung.org.au
w wadawurrung.org.au

17th February 2022

Attn: Rhiannon Glover (via email)

RE: Moorabool River Seasonal Watering Proposal

Dear Rhiannon,

Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) is a Registered Aboriginal Party (RAP) under the Aboriginal Heritage Act 2006 (Vic) and was established in 1998. WTOAC is governed by a Board of Directors of Wadawurrung Traditional Owners. Each director represents a family group of the Wadawurrung People.

The role of the Corporation is to protect and advance the aspirations of Wadawurrung People by managing their cultural heritage rights and interests while providing a representative voice for Traditional Owners in relation to the management of Wadawurrung Country.

I am pleased to advise that Wadawurrung Traditional Owners Aboriginal Corporation support the Catchment Management Authority's Seasonal Watering Proposal and the potential watering actions 2022-23.

Yours sincerely,

Paul Davis
CEO
Ph: 0417 593 000
E: paul@wadawurrung.org.au

Figure 13. Wadawurrung Traditional Owners letter of endorsement