Fish survey at Myaring Bridge Glenelg River, by Arthur Rylah Institute for Environmental Research

Section 4

Western region

4.1 Western region overview

The systems in the western region that can receive water from the VEWH's environmental entitlements are *Bochara-Bogara-Pawur* (Glenelg River), the Wimmera River system and the Wimmera-Mallee wetlands. The Wimmera River system and Wimmera-Mallee wetlands are part of the Murray-Darling Basin, although *Barringgi Gadyin* (Wimmera River) ends in terminal lakes without directly flowing into the Murray River.

Water for the environment in the western region is supplied from the Wimmera-Mallee System Headworks, which is a series of on-stream reservoirs, off-stream storages and connecting channels that harvest water (mainly near the Grampians) and distribute it to entitlement holders throughout the Wimmera catchment and parts of the Avoca, Loddon, Glenelg and Mallee catchments.

The Wimmera and Glenelg systems share water available under the environmental entitlement and the VEWH works with the Wimmera and Glenelg Hopkins CMAs to determine how the available allocation will be used in each river in a given year. There is an additional volume of water available to the Glenelg River, as a compensation flow account. The Commonwealth Environmental Water Holder (CEWH) also holds entitlement in the Wimmera system that can be used to supply the Wimmera River and lower Mount William Creek systems. Water for the environment available to the Wimmera-Mallee wetlands is provided under the same entitlement but not shared with the Glenelg system. Instead, the water is available for use in small wetlands supplied by the Wimmera-Mallee pipeline across the Wimmera, Mallee and North Central CMA areas.

Environmental values, recent conditions, environmental watering objectives and planned actions for each system in the western region are presented in the system sections that follow.

Traditional Owners in the western region

Traditional Owners and their Nations in the western region continue to have a deep connection to the region's rivers, wetlands and floodplains.

The Barengi Gadjin Land Council Aboriginal Corporation, Dja Dja Wurrung Clans Aboriginal Corporation and Gunditj Mirring Traditional Owners Aboriginal Corporation are the Registered Aboriginal Parties for the areas incorporating waterways covered by this section of the seasonal watering plan.

The Burrandies Aboriginal Corporation (based in South Australia) represents the Boandik Traditional Owners, who share cultural connections to the western parts of the Glenelg River catchment including the small part in South Australia.

In 2005, the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagalk peoples, who are often referred to collectively as the Wotjobaluk Peoples and who are represented by the Barengi Gadjin Land Council, were recognised in a Native Title Consent Determination. The Barengi Gadjin Land Council also entered into an Indigenous Land Use Agreement with the Victorian and Australian governments in 2005.

In 2007, the Gunditjmara people were granted nonexclusive native title rights and interests over almost 140,000 ha of Crown land, national parks, reserves, rivers, creeks and sea in Victoria's western district, and the State of Victoria reached an Indigenous Land Use Agreement with the Gunditjmara People that establishes how they will exercise their rights and interests in the determination area, including the Glenelg River.

In 2013, the Dja Dja Wurrung Clans Aboriginal Corporation entered into a recognition and settlement agreement under the *Traditional Owner Settlement Act 2010* in Victoria. Under the agreement, Dja Dja Wurrung people have rights to access and use water for traditional purposes, providing the take of water does not affect other parties.

The Eastern Maar Aboriginal Corporation is also a Registered Aboriginal Party within the geographic area, but its boundaries do not incorporate waterways managed with water for the environment in this section of the seasonal watering plan.

Engagement

Seasonal watering proposals are informed by community, stakeholder and program partner engagement, as well as longer-term regional catchment strategies, regional waterway strategies, relevant technical studies (such as environmental flows studies and environmental water management plans). Program partners and other stakeholders help to identify environmental watering priorities and opportunities for the coming year. The strategies and technical reports collectively describe a range of environmental, cultural, economic, social and Traditional Owner perspectives and longer-term integrated catchment and waterway management objectives that influence environmental watering actions and priorities.

The VEWH and its program partners also consider Aboriginal cultural, social and recreational values and uses of waterways when planning for environmental watering activities. Through engagement with community representatives, waterway managers aim to determine how community benefits from environmental flows can be provided while optimising environmental priorities for the year ahead. Aboriginal cultural, social and recreational values and uses are considered for each system in the following system sections.

The International Association for Public Participation's Public Participation Spectrum (IAP2 Spectrum) has been used to categorise the levels of participation of stakeholders involved in the environmental watering planning process. Table 4.1.1 shows the IAP2 Spectrum categories and participation goals.

Table 4.1.1 International Association for Public Participation's Public Participation Spectrum categories and participation goals[1]

IAP2 level	Engagement goal
Inform	Provide balanced and objective information to assist understanding, alternatives, opportunities and/or solutions
Consult	Obtain feedback on analysis, alternatives and/or decisions
Involve	Work directly throughout a process to ensure that concerns and aspirations are consistently understood and considered
Collaborate	Partner in each aspect of the decision including the development of alternatives and the identification of the preferred solution
Empower	Place final decision-making in the hands of the stakeholder

1 The VEWH has the permission of the International Association for Public Participation to reproduce the IAP2 Spectrum.

Tables 4.1.2, 4.1.3 and 4.1.4 show the partners, stakeholder organisations and individuals with which Glenelg Hopkins CMA, Mallee CMA, North Central CMA and Wimmera CMA engaged when preparing the Glenelg, Wimmera and Wimmera-Mallee wetlands systems' seasonal watering proposals. This includes engagement conducted as part of developing the seasonal watering proposals as well as engagement during the preparation of key foundational documents that directly informed the proposals. VEWH staff were also consulted for operational information as part of the development of all annual seasonal watering proposals by CMAs.

The tables also show the level of engagement between Glenelg Hopkins CMA, Mallee CMA, North Central CMA and Wimmera CMA and stakeholders of the environmental watering program in the western region, based on the CMAs' interpretation of the IAP2 Spectrum.

The level of engagement differs between organisations and between systems, depending on the availability, capacity or interest of stakeholders to participate, the roles and responsibilities of organisations in managing a site or system, and the potential interaction of proposed watering with other activities on the waterway. For example, in the Wimmera region, councils have a strong involvement in environmental flows planning and delivery because they manage town weir pools in Horsham, Dimboola and Jeparit through which environmental flows must pass. Councils in the Wimmera region have also expressed a strong interest in water for the environment, because of the benefits watering provides the region's economy, tourism and environment. The Wimmera CMA works with these councils in the planning process and during the year to incorporate any aspirations or concerns. In other parts of the western region, local governments are less involved in management and may only need to be informed of the seasonal watering proposals.

Table 4.1.2 Partners and stakeholders engaged by Glenelg Hopkins Catchment Management Authority in developing seasonal watering proposals for the Glenelg system and other key foundation documents that have directly informed the proposal (grouped in alphabetical order)

Partner/stakeholder	Glenelg system
Community groups and environment groups	**IAP2 level: Inform** • Friends of the Glenelg River Inc. • Glenelg River User Group
Government agencies	**IAP2 level: Collaborate** • GWMWater
	IAP2 level: Consult • Parks Victoria
	IAP2 level: Inform • Department of Environment, Land, Water and Planning • Limestone Coast Landscape Board • Victorian Fisheries Authority • Wimmera CMA
Landholders/ farmers	**IAP2 level: Collaborate** • Individual landholders
Local businesses	**IAP2 level: Inform** • Balmoral Bush Nursing Centre • Balmoral Local Post Office • Nelson Boat and Canoe Hire • Nelson River Cruises • Paestan Canoe Hire • Vickery Bros
Recreational users	**IAP2 level: Consult** • Balmoral District Angling Club • Casterton Angling Society Inc. • Dartmoor Angling Club • Southwest Victoria fishing reports • VRFish
	IAP2 level: Inform • Individual anglers
Traditional Owners	**IAP2 level: Collaborate** • Barengi Gadjin Land Council • Burrandies Aboriginal Corporation • Gunditj Mirring Traditional Owners Aboriginal Corporation

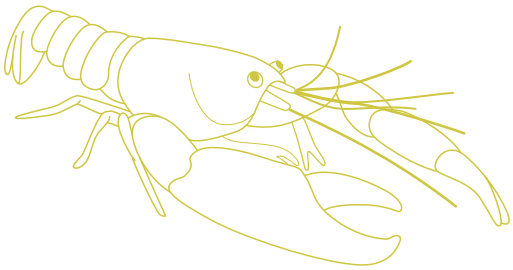


Table 4.1.3 Partners and stakeholders engaged by Wimmera Catchment Management Authority in developing the seasonal watering proposal for the Wimmera system and other key foundation documents that have directly informed the proposal (grouped in alphabetical order)

Partner/stakeholder	Wimmera system
Community groups and environment groups	**IAP2 level: Consult** • Friends of Bungalally and Burnt Creek Group • Lake Lonsdale Action Group • Yarriambiack Creek Advisory Committee
Government agencies	**IAP2 level: Collaborate** • Commonwealth Environmental Water Office • Department of Environment, Land, Water and Planning • Glenelg Hopkins CMA • GWMWater
	IAP2 level: Involve • Hindmarsh Shire Council • Horsham Rural City Council
	IAP2 level: Consult • Murray-Darling Basin Authority • Northern Grampians Shire Council • Parks Victoria • Victorian Fisheries Authority • Yarriambiack Shire Council
Landholders/ farmers	**IAP2 level: Inform** • Wimmera community members, especially landholders and stock and domestic water users
Recreational users	**IAP2 level: Consult** • Dimboola Boat and Water Ski Club • Dimboola Fishing Classic • Dimboola Rowing Club • Hindmarsh Ski Club • Horsham Fishing Competition Inc. • Horsham Triathlon Committee • Jeparit Anglers Club • Murtoa Angling Club • Natimuk Lake water ski club • Paddle Victoria • Stawell and District Angling Club • Warracknabeal Angling Club • Wimmera Anglers Association • VRFish
Traditional Owners	**IAP2 level: Collaborate** • Barengi Gadjin Land Council

Table 4.1.4 Partners and stakeholders engaged by Mallee Catchment Management Authority, North Central Catchment Management Authority and Wimmera Catchment Management Authority seasonal watering proposals for the Wimmera-Mallee wetlands and other key foundation documents that have directly informed the proposals (grouped in alphabetical order)

Partner/stakeholder	Wimmera-Mallee wetlands
Community groups and environment groups	**IAP2 level: Inform** • Berriwillock Landcare • Birchip Landcare Group • Birchip Cropping Group • Cokum community group • Community members on the Mallee CMA Land and Water Advisory Committee • Culgoa Landcare • Donald and District Landcare Group • Green Lake Regional Park • Hopetoun Landcare • Lake Tuhum Committee • Lalbert Landcare • Millewa-Carwarp Landcare • Nullawil Landcare • Ouyen Lake Project • OzFish Unlimited • Sea Lake Landcare • Ultima Landcare • Waitche Landcare • Wimmera Bushwalking Club • Woomelang-Lascelles Landcare
Government agencies	**IAP2 level: Collaborate** • Commonwealth Environmental Water Office • GWMWater • Mallee CMA • North Central CMA • Parks Victoria • Victorian Environmental Water Holder
	IAP2 level: Inform • Buloke Shire Council • Department of Environment, Land, Water and Planning • Mildura Rural City Council • Yarriambiack Shire Council
Landholders/ farmers	**IAP2 level: Collaborate** • Private landholders
Local businesses	**IAP2 level: Inform** • Ouyen Lake Project • Wimmera Mallee Tourism
Recreational users	**IAP2 level: Consult** • Natimuk & District Field & Game Inc.
	IAP2 level: Inform • Recreational users in the local community
Traditional Owners	**IAP2 level: Collaborate** • Barengi Gadjin Land Council • Dja Dja Wurrung Clans Aboriginal Corporation

Integrated catchment management

Altered water regimes are one of many threats to the health of Victoria's waterways. To be effective, environmental flows need to be part of an integrated approach to catchment management. Many of the environmental objectives from water for the environment in the western region will not be fully met without simultaneously addressing issues such as barriers to fish movement, high nutrient loads, loss of stream bank vegetation and invasive species.

Victorian and Australian government agencies, Traditional Owner groups, community groups and private landholders collectively implement a wide range of programs that aim to protect and improve the environmental condition and function of land, soils and waterways throughout Victoria's catchments.

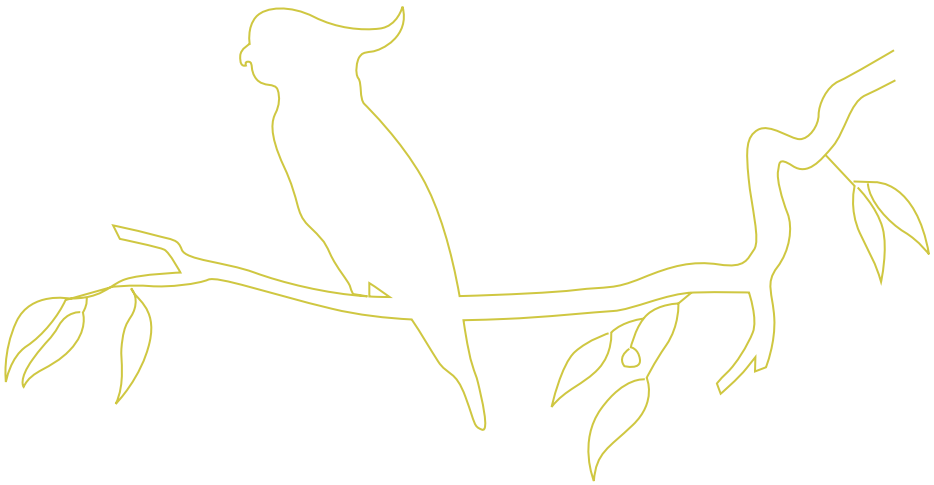
Examples of catchment management authority (CMA) on-ground works programs likely to support environmental watering outcomes in the western region include:

- major works to improve fish passage for over 1,000 km including fish passage works at Sandford Weir, Dergholm Gauge and Warrock are used in combination with the delivery of water for the environment to facilitate the movement of migratory fish from the estuary to the upstream reaches of the Glenelg and Wannon rivers
- installation of artificial wetland pontoons in the Dimboola weir pool and a regulating structure to reconnect Langlands Anabranch in the Horsham weir pool, as well as walking tracks to manage recreational access along the Wimmera River to reduce bank erosion
- weed and rabbit control to prevent bank erosion in the upper Wimmera catchment to improve water quality, stream form and increase native biodiversity
- stock-exclusion fencing along priority waterways throughout the Wimmera and Glenelg catchments, to support the re-establishment of streamside and in-stream vegetation, with over 2,000 km of fencing erected, 500,000 trees planted and 796 ha directly seeded along the Glenelg River alone
- sand management, including the removal of around 30,000 m^3 of excess bedload sand a year to improve the availability and quality of habitat for native fish, platypus and crayfish
- carp management activities in the Wimmera and Glenelg systems, to reduce the number of carp and to better understand their behaviour in both rivers to help improve environmental watering outcomes
- installation of 870 pieces of large wood in Glenelg River reach 2 using red gum trunks and root balls, to restore complex habitat for native fish
- control of invasive species and stock-exclusion fencing in the Wimmera-Mallee wetlands.

For more information about integrated catchment management programs in the western region, refer to the Glenelg Hopkins, Mallee, North Central and Wimmera CMA's regional catchment strategies and regional waterway strategies.

Risk management

During the development of the seasonal watering proposals for the Glenelg, Wimmera and Wimmera-Mallee wetland systems, environmental watering program partners assessed risks associated with potential environmental watering actions for 2021-22 and identified appropriate mitigating strategies. Risks and mitigating actions are continually assessed by program partners throughout the year (see subsection 1.3.6).



Seasonal outlook 2021-22

Rainfall across the western region in 2020-21 varied seasonally and geographically. In the Glenelg system, rainfall was above the long-term average for much of winter and spring, with natural inflows delivering most of the planned watering actions from July to December 2020. Water for the environment was needed to help maintain continuous flows from Rocklands Reservoir to the estuary from December 2020 through to May 2021. Rainfall in the Wimmera system remained below average for the fourth consecutive year. A high-rainfall event in February 2021 delivered the largest flow in the Wimmera River since 2016, but other parts of the Wimmera system had few natural events, and inflows to the catchment's storages were low. Water for the environment was used to maintain drought refuges in the MacKenzie River and Burnt Creek from mid-October 2020 and to maintain flow in the Wimmera River downstream of Dimboola from January 2020. Water for the environment was also used to freshen water quality and prevent a hypoxic blackwater event in the Wimmera River after the February flood. No flows were delivered in the Mount William Creek, due to natural top-ups in the upper section and accumulated passing flows that refilled pools in December 2020.

Water storages across the Wimmera-Mallee System Headworks were collectively at 31 percent capacity at the start of 2020-21. They rose to 40 percent in November 2020 and were below 30 percent of capacity at the end of April 2021, which is slightly less than at the same time in 2020. The VEWH received 57 percent allocation against its environmental entitlement for the Wimmera and Glenelg rivers in 2020-21. The wetlands environmental entitlement and CEWH did not receive any allocation in 2020-21.

Below-average rainfall and well-above-average temperatures are predicted for the western region in winter 2021. The Wimmera-Mallee storages will need significant inflows before any allocations are made to the environmental entitlement. The storage manager has indicated that entitlement holders will receive low allocations in 2021-22 under drought, very dry, dry and average climate scenarios, and they are unlikely to receive full allocations even under a wet scenario.

If environmental allocations do not significantly increase in winter/spring 2021, water for the environment for the rest of 2021-22 will be managed in line with drought, very dry and/or dry climate scenarios in the Wimmera and Glenelg systems. This will be the fifth consecutive year that environmental watering actions in the Wimmera and Glenelg systems have been managed according to drier-than-average climate scenarios. The focus in 2021-22 will likely be on delivering minimum low-flow and small freshes as needed to maintain continuous river flow where possible, to maintain refuge pools where continuous flow cannot be achieved and to protect water quality.

Carryover from 2020-21 will be critical in supporting these watering actions. If inflows into the storages support higher environmental allocations, water for the environment may be used to deliver winter/spring freshes and low flow in the Glenelg River through to reach 3, deliver additional winter/spring freshes in the Wimmera River and extend the summer/autumn low flow and freshes through to reach 3 of the MacKenzie River. Winter/spring inflows to the Wimmera-Mallee storages will need to be well above average, to allow wet-scenario watering actions to be delivered in 2021-22.

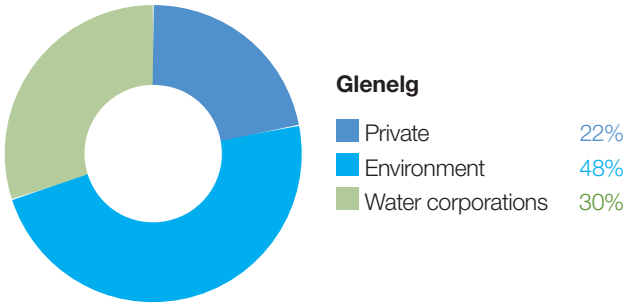
The Wimmera-Mallee wetlands entitlement is not likely to receive any allocation in 2021-22 under drought, very dry or dry climate scenarios and only small volumes under average and wet climate scenarios, so managed environmental deliveries to those sites will rely on carryover from 2020-21. The continuing focus of environmental watering in the Wimmera-Mallee wetlands will be to provide refuge and maintain habitat in the dry landscape to support local plants and animals. Carryover will also be prioritised to allow critical wetland deliveries in future years until new allocations are made.

4.2 Glenelg system

Waterway manager – Glenelg Hopkins Catchment Management Authority

Storage manager – GWMWater

Environmental water holder – Victorian Environmental Water Holder



Proportion of water entitlements in the Wimmera and Glenelg basins held by private users, water corporations and holders of water for the environment on 30 June 2020.

The Wimmera-Mallee System Headworks captures runoff from both the Wimmera and Glenelg catchments. Entitlements to water held in this system cannot be accounted for separately in the two river basins, so this figure shows the proportion of entitlements across both systems.

Did you know...?

The Glenelg River, known as *Bochara* in Dhauwurd Wurrung, *Pawur* in Bunganditj and *Bogara* in Wergaia- Jadawadjali, features in creation stories from south-western Victoria and is a traditional boundary between the lands of the Gunditjmara, Boandik and Jadawadjali people.

Top: Swans and ducks on the Glenelg River at Moree Bridge, by the VEWH
Above: Spiny crayfish, by Glenelg Hopkins CMA

System overview

Bochara-Bogara-Pawur (Glenelg River) rises in the Grampians and flows west through Harrow and then south to Casterton and Dartmoor (Figure 4.2.1). The Glenelg River estuary flows west from Dartmoor and passes through South Australia for a short distance before returning to Victoria and flowing into the sea at Nelson. At over 500 km, the Glenelg River is one of the longest rivers in Victoria.

Moora Moora Reservoir and Rocklands Reservoir are Wimmera-Mallee System Headworks water storages in the Glenelg River system that contribute to the supply of water to towns and properties across the Wimmera, Mallee, Glenelg, Loddon and Avoca river catchments. Water for the environment is actively managed in the Glenelg River below Rocklands Reservoir. Passing-flow rules are in place for the Glenelg River and upper Wannon River.

The priority reaches of the Glenelg River that can be targeted by environmental flow releases are Rocklands Reservoir to 5-Mile Outlet (reach 1a), 5-Mile Outlet to the confluence with the Chetwynd River (reach 1b), Chetwynd River to the Wannon River (reach 2) and Wannon River to the tidal extent just below the confluence with Crawford River (reach 3). Water for the environment in the Glenelg system is released from Rocklands Reservoir for reach 1a via the reservoir wall outlet and for reaches 1b, 2 and 3 via the 5-Mile and 12-Mile outlets.

The Glenelg River estuary benefits from releases of water for the environment to upstream reaches, but releases do not currently target the estuary. The Glenelg Hopkins CMA is investigating the influence of water for the environment managed on the Glenelg River estuary, which is listed as a heritage river reach and a site of international significance under the Ramsar Convention.

Trial releases were delivered from Moora Moora Reservoir above Rocklands Reservoir (reach 0) in 2017-18, 2018-19 and 2019-20. The results of that trial will be analysed to inform future decisions about the potential use of water for the environment in reach 0.

Environmental values

The Glenelg River starts in the Grampians (Gariwerd) National Park and flows to the sea through the Lower Glenelg National Park. The lower reaches of the Glenelg River are part of a landscape recognised as one of Australia's 15 national biodiversity hotspots, and the Glenelg Estuary and Discovery Bay site is Australia's most recent listing under the Ramsar Convention.

The Glenelg River supports a range of rare and unique aquatic life including the endangered Glenelg freshwater mussel, Glenelg spiny crayfish and a newly described species of river blackfish. It is also home to platypus and populations of native fish including estuary perch, kooyang (short-finned eel), tupong and three species of pygmy perch including the threatened variegated pygmy perch and Yarra pygmy perch. Some of these fish species migrate long distances to and from the Glenelg River estuary to complete their life cycles.

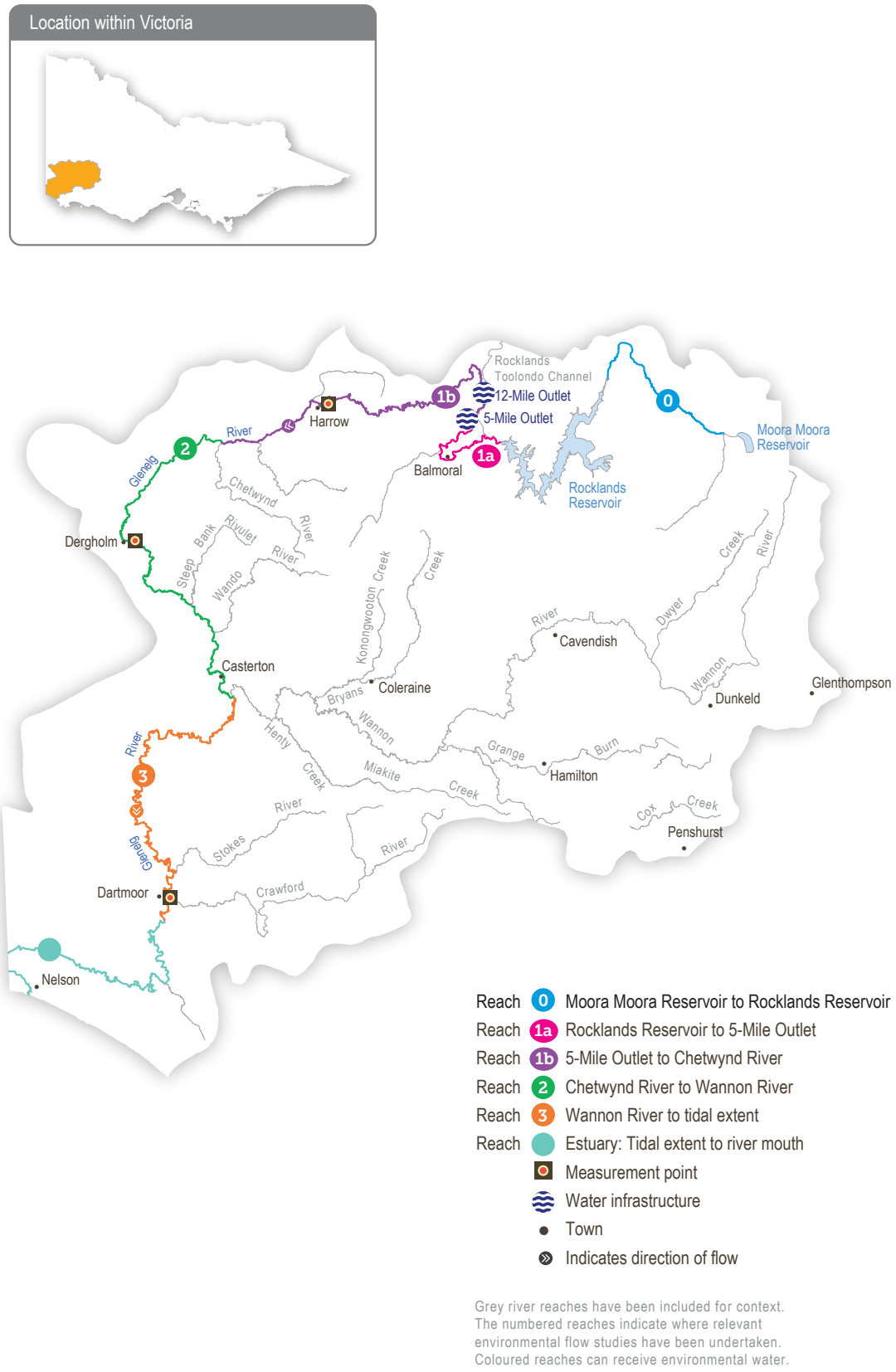
Frasers Swamp is another important feature of the upper Glenelg system and is home to a healthy growling grass frog population.

The Glenelg River supports a variety of streamside vegetation communities and species including the endangered Wimmera bottlebrush. Streamside and floodplain vegetation is comprised of river red gum woodlands with paperbark, bottlebrush and tea tree understorey.

Environmental watering objectives in the Glenelg River

- Protect, maintain and where possible enhance populations of endemic fish, including threatened and diadromous species
- Maintain deep pool habitats and connectivity along the river
- Maintain the platypus population
- Maintain healthy and diverse mosaics of water-dependent vegetation (such as river red gums and Wimmera River bottlebrush)
- Maintain a wide range and large number of waterbugs to break down organic matter and support the river's food chain
- Maintain water quality for native fish, waterbugs, aquatic vegetation and other water-dependent animals

Figure 4.2.1 The Glenelg system



Grey river reaches have been included for context. The numbered reaches indicate where relevant environmental flow studies have been undertaken. Coloured reaches can receive environmental water.

Traditional Owner cultural values and uses

The Glenelg River, known as *Bochara* in Dhauwurd Wurrung, *Pawur* in Bunganditj and *Bogara* in Wergaia-Jadawadjali languages, is a significant feature in the cultural landscape of south-western Victoria. The river features in the region's creation stories. *Bochara-Bogara-Pawur* continues to be an important place for Traditional Owners, who have inhabited the area for thousands of years, using the rich resources available along the river and associated habitats.

In planning for environmental flows in the Glenelg River, the Gunditj Mirring Traditional Owners Aboriginal Corporation, Barengi Gadjin Land Council, Burrandies Aboriginal Corporation and Glenelg Hopkins CMA have considered:

- supporting the health of cultural heritage sites (such as scar trees) and the health of native plants, which are sources of traditional foods and medicines
- that improving the health and abundance of totem species and their habitat by environmental watering also benefits Traditional Owners' spiritual wellbeing
- supporting contemporary cultural events (such as the Johnny Mullagh Cup).

Aboriginal Peoples across the Glenelg catchment have retained a strong identity and connection to the traditional lands for which they have custodial rights and responsibilities. Traditional Owners' values in the *Bochara-Bogara-Pawur* system align strongly with environmental values. Traditional Owners' values are holistic and interrelated: they are bound up with the health of the river system overall, and the Country of which the river is part. Traditional Owners' wellbeing is connected to the health of the river and of Country.

Gunditjmara Traditional Owners have identified that it is a priority to spend time on the river and increase cultural practices and connection to Country. They have highlighted the importance of increasing ceremony and on-Country gatherings along the river, including at Casterton and Nelson.

During the current phase of the Glenelg River Cultural Flows project, on-Country gatherings were planned at important sites along the river, to identify and discuss cultural values with Traditional Owners who are connected to the river. Due to COVID-19, these physical gatherings could not take place, so the project partners undertook 'virtual visits', where Traditional Owners visit important places on the river to take photos and footage of the site, which are then uploaded to an online 'virtual tour' platform. The initial sites to be featured on the platform are Piccaninnie Ponds in South Australia, Jananginj Njaui (Victoria Gap, Gariwerd), and Red Cap Creek Streamside Reserve near Casterton.

Senior Traditional Owners have recorded stories and information at several important sites: about the history and culture of the river and how it needs to be looked after for future generations. The stories and other information will inform the cultural flows plan and will become part of the 'virtual tour'.

Figure 4.2.2 *Glenelg River Environmental Flow Seasonal Calendar* arises from the six seasons of Gunditjmara Country, and it was produced by Gunditj Mirring Traditional Owners Aboriginal Corporation. The northern part of the river upstream of the Harrow area is in Jadawadjali Country and the south-western part of the system is in Boandik Country. The calendar illuminates flow regimes along one reach of the Glenelg River — reach 1b, from 5-Mile Outlet to Chetwynd River — and aligns them with corresponding environmental events and observations. The calendar reflects the seasonal flow conditions that all Traditional Owner groups recognise.

The value of the calendar is in its clear visual depiction of Traditional Owner knowledge, developed over many generations, of how varying flows correspond to seasonal conditions and broader environmental patterns. In recognition of this knowledge, the Gunditjmara seasons have been incorporated into Table 4.2.1, as a complementary description of the timing of potential watering actions. The six seasons will eventually be embedded in the flow recommendations and scenario planning in future years.

Increasing the involvement of Traditional Owners in environmental water planning and management, and ultimately providing opportunities to progress towards self-determination within and beyond the environmental watering program, is a core commitment of the VEWH and its agency partners. This is reinforced by a range of legislation and policy commitments (for example the *Water Act 1989*, the Victorian Aboriginal Affairs Framework, *Water for Victoria* (2016)) and, in some cases, agreements under the *Traditional Owner Settlement Act 2010*. Where Traditional Owners are more deeply involved in the planning and/or delivery of environmental flows for a particular site, their contribution is acknowledged in Table 4.2.1 with an icon. The use of this icon is not intended to indicate that these activities are meeting all the needs of Traditional Owners but is incorporated in the spirit of valuing that contribution, and indicating progress towards this objective.

Watering planned and/or delivered in partnership with Traditional Owners to support cultural values and uses

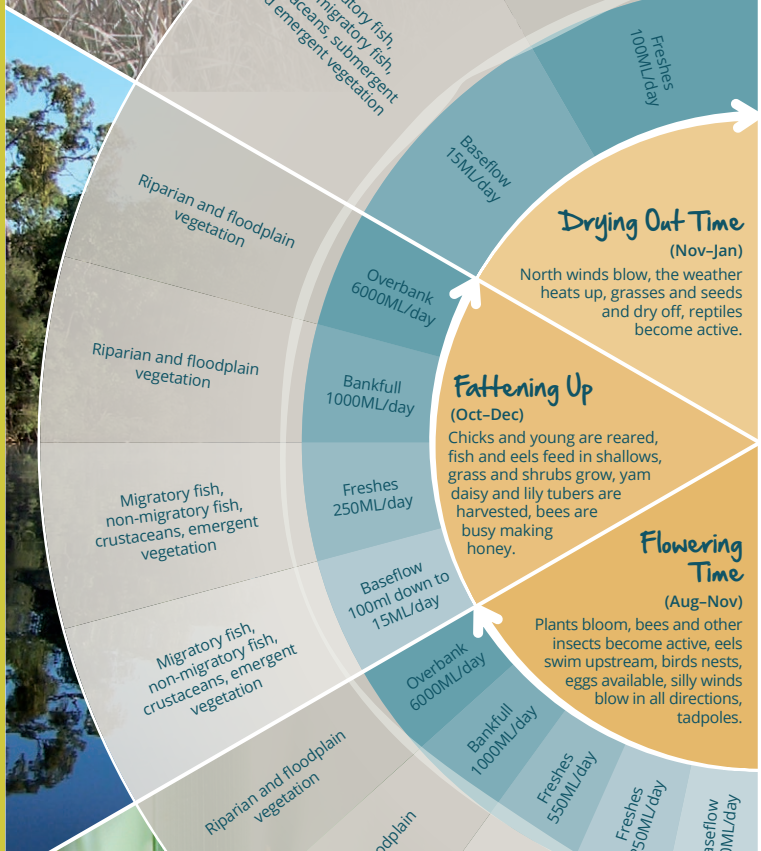
The timing of the summer/autumn fresh is planned to support the annual Johnny Mullagh Cup cricket match between the Gunditj Mirring and Barengi Gadjin Traditional Owners. The fresh will improve water quality in swimming holes and improve amenity for Traditional Owners attending the cricket event, which is an important cultural event on the river.

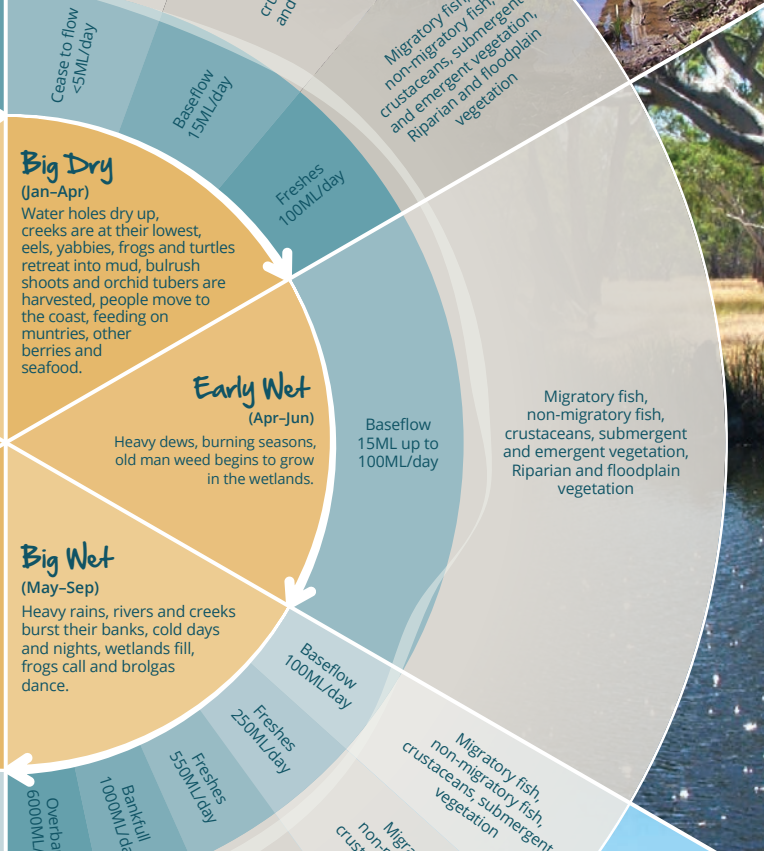
Following page: Figure 4.2.2 Glenelg River Environmental Flow Seasonal Calendar

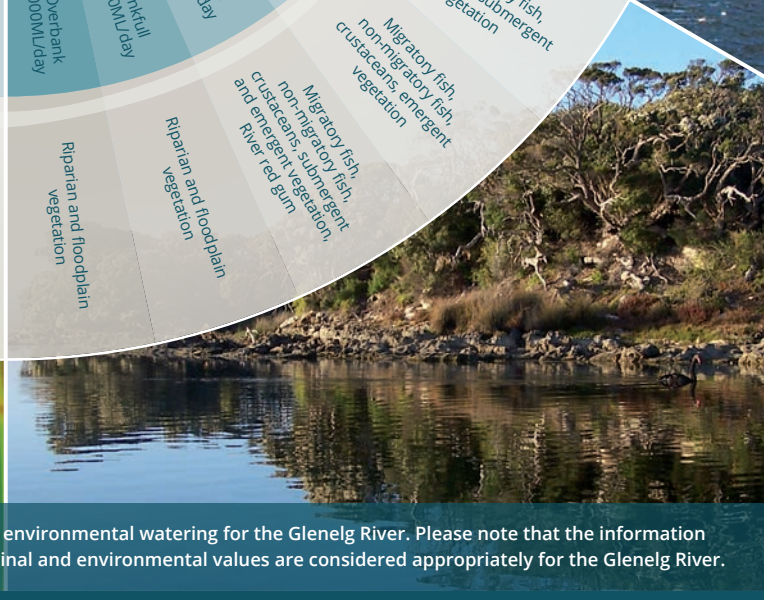
Glenelg River Environmental Flow Seasonal Calendar

Reach 1b Harrow

- *6 seasons of Gunditjmara Country*
- *Flow component and rate*
- *Flow asset and objective*







Drying Out Time
(Nov–Jan)

North winds blow, the weather heats up, grasses and seeds and dry off, reptiles become active.

Big Dry
(Jan–Apr)

Water holes dry up, creeks are at their lowest, eels, yabbies, frogs and turtles retreat into mud, bulrush shoots and orchid tubers are harvested, people move to the coast, feeding on muntries, other berries and seafood.

Fattening Up
(Oct–Dec)

Chicks and young are reared, fish and eels feed in shallows, grass and shrubs grow, yam daisy and lily tubers are harvested, bees are busy making honey.

Early Wet
(Apr–Jun)

Heavy dews, burning seasons, old man weed begins to grow in the wetlands.

Flowering Time
(Aug–Nov)

Plants bloom, bees and other insects become active, eels swim upstream, birds nests, eggs available, silly winds blow in all directions, tadpoles.

Big Wet
(May–Sep)

Heavy rains, rivers and creeks burst their banks, cold days and nights, wetlands fill, frogs call and brolgas dance.

Migratory fish, non-migratory fish, crustaceans, emergent vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation, Riparian and floodplain vegetation

Cease to flow <5ML/day

Baseflow 15ML/day

Freshes 100ML/day

Baseflow 15ML up to 100ML/day

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation, Riparian and floodplain vegetation

Baseflow 100ML/day

Freshes 250ML/day

Freshes 550ML/day

Bankfull 1000ML/day

Overbank 6000ML/day

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation

Migratory fish, non-migratory fish, crustaceans, emergent vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation, River red gum

Riparian and floodplain vegetation

Riparian and floodplain vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation, River red gum

Riparian and floodplain vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation

Riparian and floodplain vegetation

Riparian and floodplain vegetation

Migratory fish, non-migratory fish, crustaceans, emergent vegetation

Migratory fish, non-migratory fish, crustaceans, emergent vegetation

Baseflow 100ml down to 15ML/day

Freshes 250ML/day

Bankfull 1000ML/day

Overbank 6000ML/day

Riparian and floodplain vegetation

Riparian and floodplain vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation

Baseflow 15ML/day

Freshes 100ML/day

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation

Migratory fish, non-migratory fish, crustaceans, submergent and emergent vegetation, Riparian and floodplain vegetation

This is the first attempt at incorporating Aboriginal values and knowledge into environmental watering for the Glenelg River. Please note that the information provided is not exhaustive, further work is still required to ensure that all Aboriginal and environmental values are considered appropriately for the Glenelg River.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 4.2.1, Glenelg Hopkins CMA considered how environmental flows could support values and uses including:

- water-based recreation (such as canoeing and fishing)
- community events and tourism (such as the Johnny Mullagh Cup and visitation)
- socio-economic benefits (such as diversions for domestic and stock uses, greater wellbeing and economic benefits for regional communities).

If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in Table 4.2.1 with the following icons.

Watering planned to support angling activities

Watering planned to support water sports activities (e.g. canoeing)

Watering planned to support peaks in visitation (e.g. camping or other public activities on long weekends or school holidays)

Environmental flow releases support the spawning and recruitment of popular angling species like estuary perch and bream. Local anglers continue to report increased fish activity associated with the delivery of freshes, improving fishing opportunities in the river. Releases support numerous fishing competitions including those of the Balmoral, Casterton and Dartmoor angling clubs.

The planning of the summer fresh improves accessibility, water quality and amenity for canoeists planning trips on the Glenelg River over the summer holiday period.

Summer and spring freshes provide a freshening flow that improves conditions at popular riverside campgrounds in the upper reaches of the Glenelg River including Fulham Reserve near Balmoral and the Johnny Mullagh Reserve at Harrow.

Recent conditions

Rainfall and temperatures in the Glenelg system in 2020-21 were close to the long-term average, and large rain events over spring and summer contributed to significant tributary inflows below Rocklands Reservoir. However, rainfall in the catchments of the Wimmera-Mallee System Headworks storages was well below the long-term average, which limited allocations of environmental water. Allocations to the Wimmera-Glenelg environmental entitlement only reached 57 percent by April 2021, and many environmental watering actions in 2020-21 were provided by water that had been carried over from 2019-20 and passing flows that were accumulated during winter/spring 2020.

Catchment runoff, tributary inflows and managed passing flows maintained minimum low-flow requirements and provided several freshes in the Glenelg River during winter and spring 2020. Large natural flows during September and October peaked at 1,837 ML per day in reach 1b, 5,269 ML per day in reach 2 and 16,916 ML per day in reach 3, providing natural connections between the river and some low-lying floodplain areas. These flows improved the health of vegetation on the banks and floodplain areas, and they allowed native fish and platypus to access feeding and breeding habitat along the length of the river. Water for the environment was used to maintain a continuous connection between Rocklands Reservoir and the estuary between December 2020 and May 2021 and to deliver one summer/autumn fresh to reach 1b to support native fish, platypus and vegetation objectives.

The limited supply of water for the environment in the Wimmera-Glenelg environmental entitlement meant that the Glenelg system was managed under a drought climate scenario, even though local climatic conditions were closer to average. All high-priority watering actions that were planned for the drought climate scenario were delivered in 2020-21, including summer/autumn low flows to reaches 1b and 2. Two additional watering actions were also delivered: summer/autumn low flow to reach 1a and summer/autumn fresh to reach 1b. Natural flows and passing flows during winter and spring met additional priorities under the drought climate scenario including winter/spring low flows in reaches 1a, 1b and 2 as well as two winter/spring freshes in reaches 1b and 2.

If dry conditions persist, environmental watering actions in the Glenelg River during 2021-22 will likely focus on maintaining connectivity and water quality in reaches 1a, 1b and 2 to support recently recruited native fish including galaxiids, river blackfish, pygmy perch and estuary perch and to provide foraging opportunities for platypus.

Scope of environmental watering

Table 4.2.1 describes the potential environmental watering actions in 2021-22, their expected watering effects (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objective(s) they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

Table 4.2.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Glenelg River

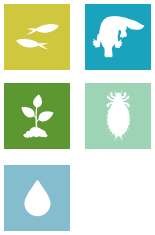
Potential environmental watering action	Expected watering effects	Environmental objectives
Winter/spring low flow in reach 1a (60 ML/day or natural during June to November)	• Maintain water quality for fish and waterbugs • Wet aquatic vegetation to maintain its condition and prevent encroachment by terrestrial species • Maintain shallow-water habitat for fish, waterbugs and platypus	
Winter/spring low flow in reach 1b (100 ML/day or natural during June to November/Big Wet to Fattening Up*)		
Winter/spring low flow in reach 2 (160 ML/day or natural during June to November)		
Winter/spring low flow in reach 3 (400 ML/day or natural during June to November)	• Wet benches to increase habitat and allow widespread fish passage	
Winter/spring fresh(es) in reach 1b (one to five freshes of 250 ML/day for one to five days during June to November/Big Wet to Fattening Up*)	• Wet benches to improve the condition of emergent vegetation and vegetation on the riverbanks to support recruitment and growth and maintain habitat diversity • Provide adequate depth for fish passage and cue fish movement • Encourage female platypus to select a nesting burrow higher up the bank to reduce the risk of higher flow later in the year flooding the burrow when juveniles are present • Scour sand from pools to improve the quality of fish habitat	
Winter/spring fresh(es) in reach 2 (one to five freshes of 300 ML/day for one to five days during June to November)		
Summer/autumn low flow in reach 1a (10 ML/day or natural during December to May) 	• Protect against rapid water-quality decline over the low-flow period • Maintain edge habitats, pools and shallow-water habitat for fish, waterbugs and platypus • Maintain a near-permanent wetted stream channel to promote the growth of in-stream vegetation and prevent encroachment by terrestrial plants	
Summer/autumn low flow in reach 1b (15 ML/day or natural during December to May/Big Dry to Early Wet*) 		
Summer/autumn low flow in reach 2 (25 ML/day or natural during December to May) 		
Summer/autumn low flow in reach 3 (80 ML/day or natural during December to May) 		

Table 4.2.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Glenelg River *(continued)*

Potential environmental watering action	Expected watering effects	Environmental objectives
Summer/autumn freshes in reach 1a (one to two freshes of 60 ML/day for two to three days during December to May)	• Flush fine silt from the stream bed and hard substrate to improve the quality of fish and waterbug habitat • Wet emergent vegetation on the lower banks to improve its condition and prevent the encroachment of terrestrial species • Flush pools to improve water quality and to lower temperatures • Provide sufficient flow to allow native fish and platypus to access habitat	
Summer/autumn fresh(es) in reach 1b (one to two freshes of 100 ML/day for two to three days during December to May/Big Dry to Early Wet*)		
Summer/autumn fresh(es) in reach 2 (one to two freshes of 150 ML/day for two to three days during December to May)		
Summer/autumn fresh(es) in reach 3 (one to two freshes of 150 ML/day for three days each or natural during December to May)		

* See Figure 4.2.2: Glenelg River Environmental Flow Seasonal Calendar

Scenario planning

Table 4.2.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

In the Glenelg system, water for the environment is delivered to support varying ecological objectives. In reach 1a, deliveries under dry and drought climate scenarios focus on protecting water quality and preventing the swampy reach from drying out, to support frogs and aquatic vegetation. Under wetter conditions, the priority is to increase flows to improve flowing habitat for native fish and improve the extent of emergent vegetation. In reach 1b, environmental flows aim to maintain the connection to the lower reaches for native fish and platypus and ensure that water quality does not decline in critical drought refuge pools. Under wetter conditions, larger environmental flows are needed to improve the condition of emergent vegetation on the banks and to scour sand from pools, to improve native fish habitat. Reaches 2 and 3 have greater contributions from tributaries, and environmental flows in these reaches are used to stimulate native fish to move and breed, as well as to support in-stream vegetation, which provides additional habitat for native fish, platypus and crayfish.

The highest priority under all scenarios is to maintain connectivity and water quality between pool and swamp habitats upstream of Casterton, as these are the reaches that are most affected by Rocklands Reservoir.

Increased water availability under dry, average and wet climate scenarios will be used to deliver summer/autumn freshes to as many reaches as possible, to allow fish and platypus to move throughout the system to access food and alternative habitats and to wet streamside vegetation. Under a drought climate scenario, there is unlikely to be enough water for the environment to influence flow downstream of Casterton.

If more water is available, the next priorities under all scenarios will be to deliver winter/spring low flow and winter/spring freshes in all reaches, to facilitate the migration and spawning of native fish from the upper reaches down to the estuary. Providing periods of additional or increased flow during winter/spring is likely to also support the re-establishment of small-bodied native fish populations in the upper Glenelg River and Frasers Swamp, located in reach 1.

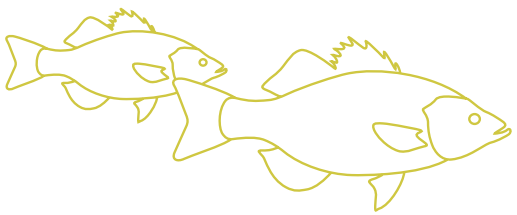
Reserving water for carryover into the 2021-22 water year will be a priority under all scenarios, to ensure sufficient water is available to deliver the highest-priority flows during summer and autumn 2022-23. The volume carried over against the Wimmera-Glenelg environmental entitlement will be decided in consultation with the Wimmera and the Glenelg Hopkins CMAs during the year, and it will be based on use during 2021-22, seasonal conditions and seasonal outlooks for 2022-23.

Table 4.2.2 Potential environmental watering for the Glenelg River under a range of planning scenarios

Planning scenario	Drought	Very dry	Dry	Average	Wet
Expected river conditions	• No volumes of passing flow and low volumes of compensation and natural flow	• Low volumes of passing, compensation and natural flow	• Some passing, compensation and natural flow	• Some passing, compensation and significant natural flow, particularly in winter/spring	• Passing, compensation and natural flow meet some watering requirements in winter/spring
Predicted supply of water for the environment	• 21,742 ML	• 25,392 ML	• 35,532 ML	• 46,078 ML	• 55,812 ML
Glenelg River (targeting reach 1a)					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• Summer/ autumn low flow	• Summer/ autumn low flow • Summer/ autumn fresh (one fresh)	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)	• Winter/spring low flow • Summer/ autumn low flow • Summer/ autumn freshes (two freshes)	• Winter/spring low flow • Summer/ autumn low flow • Summer/ autumn freshes (two freshes)
	Tier 1b (supply deficit)				
	• Winter/spring low flow • Summer/ autumn freshes (two freshes)	• Winter/spring low flow • Summer/ autumn fresh (one additional fresh)	• Winter/spring low flow	• N/A	
Glenelg River (targeting reach 1b)					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• Summer/ autumn low flow	• Summer/ autumn low flow • Summer/ autumn fresh (one fresh)	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)	• Winter/spring freshes (five freshes) • Summer/ autumn low flow • Summer/ autumn freshes (two freshes)
	Tier 1b (supply deficit)				
	• Winter/spring low flow • Winter/spring fresh (one fresh) • Summer/ autumn freshes (two freshes)	• Winter/spring low flow • Winter/spring fresh (one fresh) • Summer/ autumn fresh (one additional fresh)	• Winter/spring low flow • Winter/spring freshes (two freshes)	• Winter/spring low flow • Winter/spring freshes (three freshes)	• Winter/spring low flow

Table 4.2.2 Potential environmental watering for the Glenelg River under a range of planning scenarios *(continued)*

Planning scenario	Drought	Very dry	Dry	Average	Wet
Glenelg River (targeting reach 2)					
Potential environmental watering – tier 1 (high priorities	**Tier 1a (can be achieved with predicted supply)**				
	• Summer/ autumn low flow	• Summer/ autumn low flow • Summer/ autumn fresh (one fresh)	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)
	Tier 1b (supply deficit)				
	• Winter/spring low flow • Winter/spring fresh (one fresh) • Summer/ autumn freshes (two freshes)	• Winter/spring low flow • Winter/spring fresh (one fresh) • Summer/ autumn fresh (one additional fresh)	• Winter/spring low flow • Winter/spring freshes (two freshes)	• Winter/spring low flow • Winter/spring freshes (three freshes)	• Winter/spring low flow • Winter/spring freshes (five freshes)
Glenelg River (targeting reach 3)					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• N/A	• Summer/ autumn fresh (one fresh)	• Summer/ autumn freshes (two freshes)	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)
	Tier 1b (supply deficit)				
	• Summer/ autumn low flow • Summer/ autumn freshes (two freshes)	• Summer/ autumn low flow • Summer/ autumn fresh (one additional fresh)	• Winter/spring low flow • Summer/ autumn low flow	• Winter/spring low flow	• Winter/spring low flow
Possible volume of water for the environment required to achieve objectives	• 10,155 ML (tier 1a) • 43,843 ML (tier 1b)	• 11,440 ML (tier 1a) • 41,017 ML (tier 1b)	• 13,935 ML (tier 1a) • 38,503 ML (tier 1b)	• 25,660 (tier 1a) • 34,457 ML (tier 1b)	• 30,514 ML (tier 1a) • 42,118 ML (tier 1b)

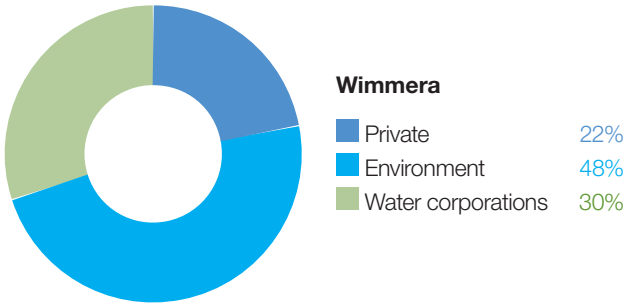


4.3 Wimmera system

Waterway manager – Wimmera Catchment Management Authority

Storage manager – GWMWater

Environmental water holders – Victorian Environmental Water Holder, Commonwealth Environmental Water Holder



Proportion of water entitlements held across the Wimmera and Glenelg basins held by private users, water corporations and holders of water for the environment on 30 June 2020.

The Wimmera-Mallee System Headworks captures runoff from the Wimmera and Glenelg catchments. Entitlements to water held in this system cannot be accounted for separately in the two river basins, so this figure shows the proportion of entitlements across both systems.

Did you know...?

The Wimmera River is known as *Barringgi Gadyin* to the Wotjobaluk Traditional Owners and is a key feature of the local creation stories.

Top: Wimmera River at Horsham, by David Fletcher
Above: Ranch Billabong following water for the environment delivery, by Wimmera CMA

System overview

Barringgi Gadyin (Wimmera River) rises in the Pyrenees Range near Elmhurst and flows through Horsham, Dimboola and Jeparit before terminating at Lake Hindmarsh, which is Victoria's largest freshwater lake and the first of a series of terminal lakes. The Wimmera River receives flows from several regulated tributaries including the MacKenzie River, Mount William Creek and Burnt Creek (Figure 4.3.1). These tributaries, and Bungalally Creek and the Wimmera River below Mount William Creek, can receive environmental flows. In exceptionally wet periods, Lake Hindmarsh will overflow into Outlet Creek and on to Lake Albacutya, which is an internationally recognised Ramsar-listed wetland. There are numerous wetlands beyond Lake Albacutya as well, which have not filled with water for decades.

Water in the Wimmera system is stored in three on-stream reservoirs (Lake Wartook on the MacKenzie River, Lake Lonsdale on Mount William Creek and Lake Bellfield on Fyans Creek), and in several off-stream storages (Taylors Lake, Lake Fyans and Toolondo Reservoir). A channel system enables water to be moved between several storages. Water can also be transferred from Rocklands Reservoir in the Glenelg system to the Wimmera system via the Rocklands-Toolondo Channel and from Moora Moora Reservoir via the Moora Channel. The connected storages and channels are collectively called the Wimmera-Mallee System Headworks. Water that is harvested in the system headworks is used for towns and stock and domestic supply throughout the Wimmera catchment and parts of the Avoca, Hopkins, Loddon, Glenelg and Mallee catchments. Passing flows are provided to the Wimmera River and lower Mount William and Fyans creeks.

Priority reaches in the Wimmera system that can receive water for the environment are Wimmera River reaches 3 and 4, MacKenzie River reaches 2 and 3, upper and lower Mount William Creek, upper and lower Burnt Creek and Bungalally Creek.

Yarriambiack Creek is a distributary of the upper Wimmera River that would have naturally received some flows during high-flow events. Modifications to the Yarriambiack Creek offtake increase flow rates in Yarriambiack Creek compared to what would have naturally happened, but they reduce the flow rates to the high-priority reaches of the Wimmera River. During very dry years, flows entering Yarriambiack Creek may be blocked to ensure watering objectives in the Wimmera River are not compromised.

Two wetlands in the Wimmera system have been included in the environmental watering program in recent years.

Dock Lake, one of the Wimmera's large terminal lakes near Horsham, would have naturally filled via spills from nearby Green Lake when there was significant runoff from the northern edge of the Grampians. In the 1930s, Dock Lake was modified to allow it to be used as a water storage for irrigation supply in the Wimmera-Mallee system. Dock Lake was removed from the supply system after the completion of the Wimmera-Mallee pipeline in 2010. Water can be actively delivered to Dock Lake from Green Lake via a gravity-fed channel.

Ranch Billabong, near Dimboola, is located on land managed by Barengi Gadjin Land Council Aboriginal Corporation. The billabong was disconnected from the Wimmera River by changes to a road that traverses land between the river and the billabong. Restoring elements of the natural water regime at Ranch Billabong aims to improve habitat for native animal and plant communities and is an important outcome for Traditional Owners and their Nations.

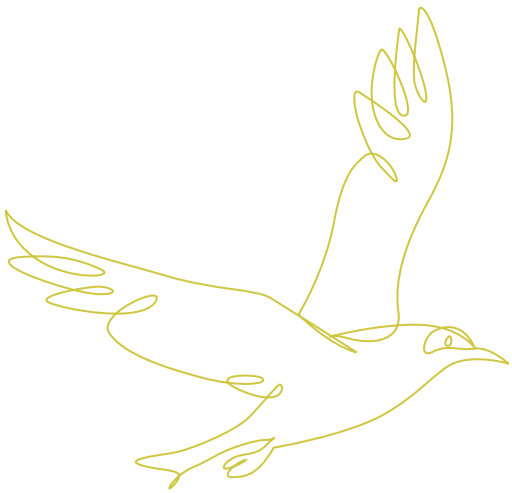
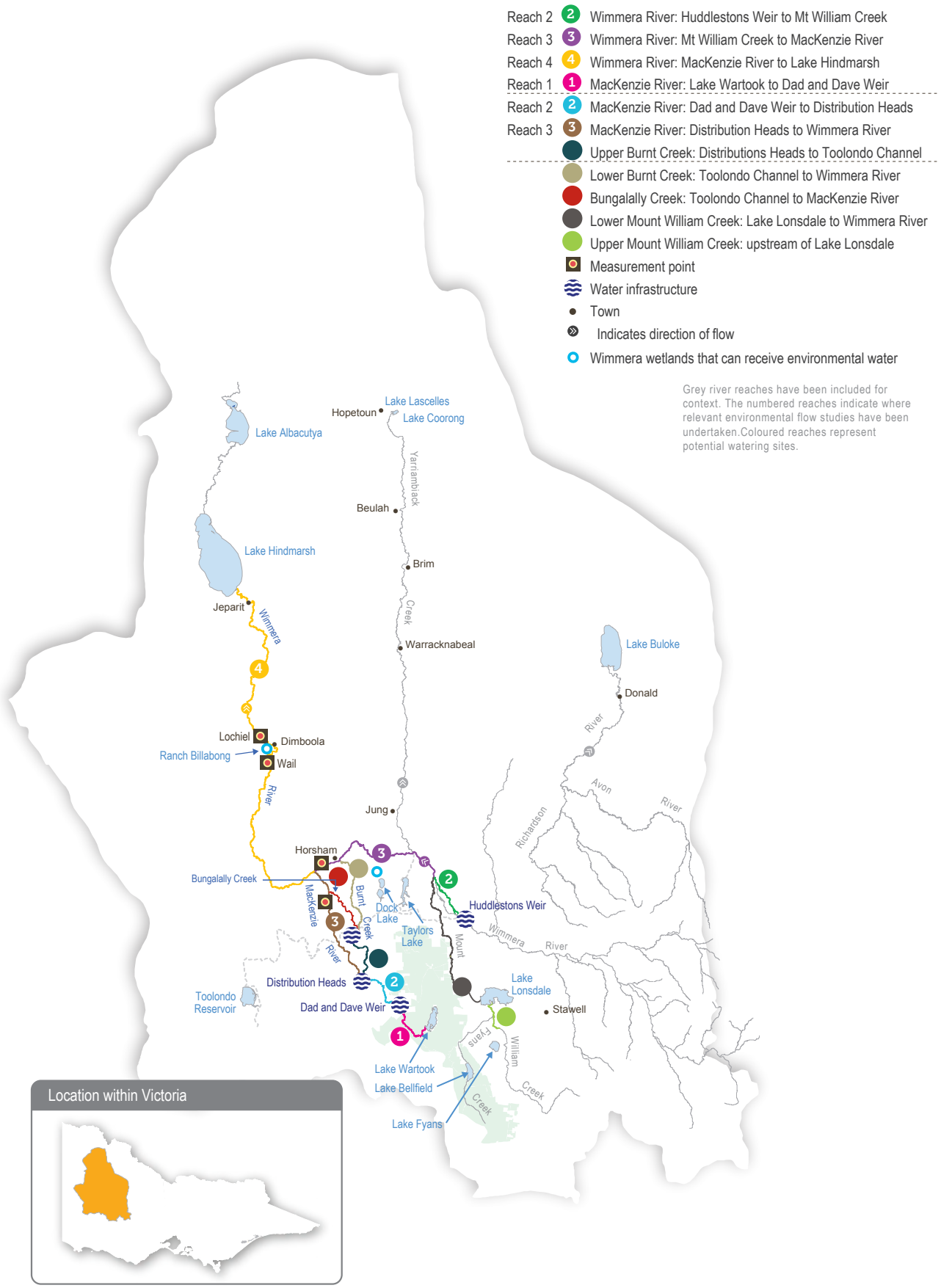


Figure 4.3.1 The Wimmera system



Environmental values

The Wimmera River supports abundant native fish populations including one of Victoria's few self-sustaining populations of freshwater catfish. The Wimmera River also supports native waterbird, turtle, frog and rakali (water rat) populations.

The MacKenzie River contains the only population of platypus in the Wimmera system and supports locally important populations of native fish including river blackfish and southern pygmy perch. It also supports populations of threatened Glenelg spiny crayfish and western swamp crayfish and turtles as well as the critically endangered Wimmera bottlebrush. During dry periods, the middle and upper reaches of the MacKenzie River maintain regular flow (due to managed releases from Lake Wartook for urban supplies and environmental watering) and provide refuge for these populations.

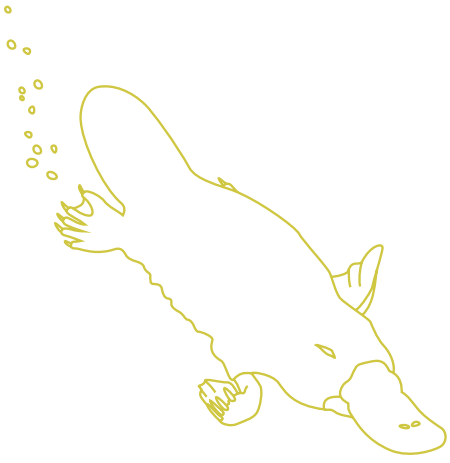
Vegetation along Burnt and Bungalally creeks provide habitat corridors for terrestrial wildlife, and upper Burnt Creek contains an important native fish community and a population of threatened western swamp crayfish. Mount William Creek supports regionally important populations of river blackfish, southern pygmy perch and rakali (water rats).

Dock Lake is a natural wetland that was modified and used as part of the Wimmera-Mallee System Headworks until 2010. When it is wet, Dock Lake supports large populations of feeding and breeding waterbirds and frogs.

Ranch Billabong is a small wetland near Dimboola that supports river red gums, a variety of aquatic plant species, waterbirds and frogs.

Environmental watering objectives in the Wimmera River system

- Protect and increase populations of native fish including one of Victoria's few self-sustaining populations of freshwater catfish
- Maintain the frog population by providing feeding and breeding habitat
- Maintain channel capacity and diversity and prevent the colonisation of waterways by terrestrial plant species
- Increase the abundance and distribution of platypus populations by providing places to breed and feed, as well as opportunities for juveniles to disperse
- Maintain the turtle population by providing feeding and breeding habitat
- Improve the condition, abundance and diversity of native aquatic, emergent and streamside vegetation
- Increase the waterbird population by providing roosting, feeding and breeding habitat in floodplain wetlands
- Increase the abundance and diversity of waterbugs to break down dead organic matter and support the waterway's food web
- Maintain crayfish populations by providing feeding and breeding habitat
- Maintain water quality to provide suitable conditions for waterbugs, native fish and other water-dependent plants and animals



Traditional Owner cultural values and uses

The Wimmera's waterways are important to the Wotjobaluk people and there are heritage values throughout the landscape. Native title is held along much of the lower Wimmera River, reinforcing the cultural significance of these values. In planning for environmental flows in the Wimmera River, the Barengi Gadjin Land Council and Wimmera CMA considered these values as well as opportunities to enhance contemporary cultural events (such as the Wotjobaluk festival).

Increasing the involvement of Traditional Owners in environmental water planning and management, and ultimately providing opportunities to progress towards self-determination within and beyond the environmental watering program, is a core commitment of the VEWH and its agency partners. This is reinforced by a range of legislation and policy commitments (for example the *Water Act 1989*, the Victorian Aboriginal Affairs Framework, *Water for Victoria* (2016)) and, in some cases, agreements under the *Traditional Owner Settlement Act 2010*. Where Traditional Owners are more deeply involved in the planning and/or delivery of environmental flows for a particular site, their contribution is acknowledged in Table 4.3.1 with an icon. The use of this icon is not intended to indicate that these activities are meeting all the needs of Traditional Owners but is incorporated in the spirit of valuing that contribution, and indicating progress towards this objective.

Watering planned and/or delivered in partnership with Traditional Owners to support cultural values and uses

In the Wimmera system, Wimmera CMA and the Barengi Gadjin Land Council on behalf of the Wotjobaluk people work in partnership to provide Aboriginal environmental outcomes at Ranch Billabong. The delivery of water for the environment at Ranch Billabong aims to return a more natural flooding regime, restore indigenous plant and animal habitats, control selected weed species and improve the site's amenity and suitability for gatherings and events (such as earth oven and bark canoe recreations).

Water for the environment has been delivered to Ranch Billabong consecutively for the last three years (2018, 2019, 2020). Notable ecological enhancements at the site include improved water quality and vegetation condition, consistent with the aspirations of the Traditional Owners. The Barengi Gadjin Land Council manages the site, and is controlling weed species and enhancing accessibility by building walking tracks and boardwalks. Following on from this work, Wimmera CMA and Barengi Gadjin Land Council will continue to work together to deliver environmental water.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 4.3.1, Wimmera CMA considered how environmental flows could support values and uses including:

- water-based recreation (such as canoeing, fishing, rowing and water skiing)
- riverside recreation and amenity (such as birdwatching, cycling, running and walking)
- community events and tourism (such as fishing competitions at Dimboola, Jeparit and Horsham; Dimboola [rowing] Regatta; Kannamaroo Festival at Horsham, Wimmera River Duck Race; Wimmera River Park Run, Peter Taylor Memorial Barefoot Water Ski Tournament and Night Jump at Dimboola, and general visitation)
- socio-economic benefits (such as improved water quality for consumptive water users including irrigation and stock and domestic users).

If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in Table 4.3.1 with the following icons.

Watering planned to support angling activities

Watering planned to support water sports activities (e.g. canoeing, kayaking, rowing, swimming and water skiing)

Water for the environment can be used to temporarily raise water levels in the Horsham, Dimboola and Jeparit weir pools to improve conditions for community events including fishing competitions and water skiing and rowing events. Water for the environment held in the weir pools is released after the community events, to support ecological objectives further downstream when required.

Recent conditions

The Wimmera region had near-average rainfall, average temperatures but well-below average streamflow during 2020-21, continuing the very low streamflows experienced in the region since 2017. The Wimmera-Glenelg environmental entitlement received 57 percent allocation in 2020-21. The CEWH did not receive any allocation in the Wimmera system for the fourth year in a row, and carryover from previous years was exhausted in 2019-20.

Natural and passing flows delivered low flows and several freshes to the Wimmera River throughout winter and spring 2020. A large rainfall event in October 2020 caused flow in the Wimmera River at Horsham to peak at 636 ML per day and another event in late January–early February 2021 delivered a peak flow of 1,825 ML per day. The February event was the largest flow in the Wimmera River since 2016, and it washed a high load of organic material into the river, which caused a hypoxic blackwater event for parts of the river from near Horsham to Dimboola. Water for the environment was released from Taylors Lake during and after the event to help dilute the blackwater and prevent widespread fish deaths. Water for the environment was also used to meet recommended low-flow targets and deliver some additional freshes during summer and autumn.

Some of the planned passing flows from Lake Lonsdale were suspended in winter and spring 2020, and the accumulated water was used to protect refuge pools in lower Mount William Creek in December 2020.

Water for the environment was used to support environmental values in Ranch Billabong in winter 2021. The MacKenzie River and Burnt Creek had lower-than-average natural flow during winter and spring 2020, and water for the environment was delivered to these systems from late spring 2020 to help maintain aquatic habitat and refuge pools for native fish, crayfish and platypus.

Limited supply in the Wimmera-Glenelg environmental entitlement meant deliveries of water for the environment in the Wimmera system were managed in line with the drought climate scenario, even though local climatic conditions were closer to a dry scenario. All planned watering actions under the drought scenario were either fully or partially met in 2020-21 with a combination of environmental, unregulated and passing flows. Environmental monitoring in autumn 2021 detected an increased distribution of western swamp crayfish in the lower reaches of Burnt Creek. This finding may have implications for the future management of lower Burnt Creek.

Scope of environmental watering

Table 4.3.1 describes the potential environmental watering actions in 2021-22, their expected watering effects (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objectives they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects.

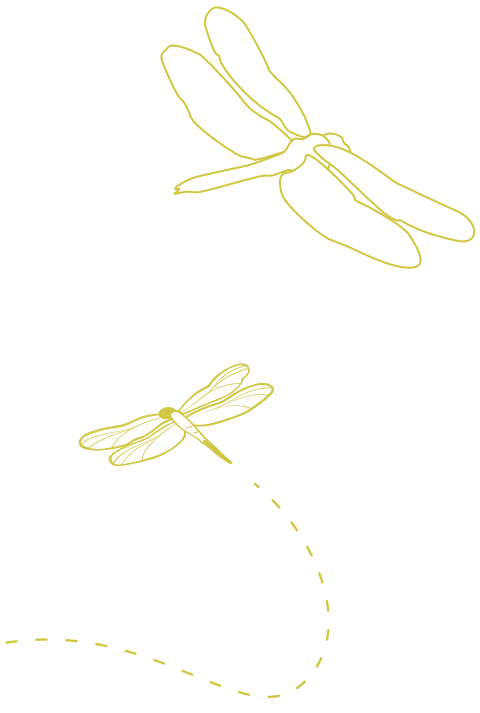


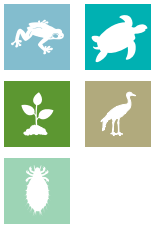
Table 4.3.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Wimmera system

Potential environmental watering action	Expected watering effects	Environmental objectives
Wimmera River (reach 4)		
Winter/spring low flows (30 ML/day during June to November)	• Maintain access to habitat for native fish, waterbugs and in-stream vegetation	
Small winter/spring fresh(es) (one to five freshes of 70 ML/day for one to five days during June to November)	• Increase water depth to provide a stimulus for fish movement • Provide flow variability to maintain water quality and diversity of fish habitats	
Large winter/spring fresh(es) (one to three freshes of 200 ML/day for one to three days during June to November)	• Wet lower benches, entrain organic debris and maintain habitat for waterbugs and fish	
Summer/autumn low flows (15 ML/day or natural during December to May)	• Maintain edge habitats in deeper pools and in-stream habitat to support native fish populations and waterbugs • Maintain soil moisture for streamside vegetation and near-permanent inundated stream channel for aquatic vegetation and prevent the growth of terrestrial plants in the stream bed	
Summer/autumn fresh(es) (one to five freshes of 70 ML/day for two to four days during December to May)	• Flush pools to prevent a decline in water quality and to maintain habitat for fish and waterbugs • Provide fish passage to allow fish to move through the reach	
MacKenzie River (reach 3)		
Year-round low flows (10 ML/day or natural, year-round)	• Maintain edge habitats and deeper pools and runs for waterbugs • Maintain soil moisture for streamside vegetation and near-permanent inundated stream channel for aquatic vegetation and prevent the growth of terrestrial plants in the stream bed • Maintain pool habitat for native fish and crayfish populations • Facilitate the dispersal of juvenile platypus downstream during autumn and winter	
Small winter/spring fresh(es) (one to five freshes of 35 ML/day for two to seven days during June to November)	• Stimulate fish movement by increasing flow rates and water depth and increase habitat availability for platypus and waterbugs • Flush pools to prevent a decline in water quality • Maintain soil moisture for streamside vegetation	

Table 4.3.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Wimmera system *(continued)*

Potential environmental watering action	Expected watering effects	Environmental objectives
Large winter/spring fresh (one fresh of 190 ML/day for one to two days during June to November)	• Disturb biofilms on rocks or woody debris to stimulate new growth and provide food for waterbugs • Maintain soil moisture for streamside vegetation • Stimulate fish and platypus movement by increasing flow rates and water depth	
Summer/autumn freshes (three to four freshes of 35 ML/day for two to seven days each during December to May)	• Flush pools to prevent a decline in water quality and to increase habitat availability for waterbugs and native fish	
Upper Burnt Creek		
Year-round low flows targeting upper Burnt Creek (1 ML/day or natural, year-round)	• Maintain edge habitats and shallow-water habitat for waterbugs • Maintain soil moisture for streamside vegetation and near-permanent inundated stream channel for aquatic vegetation and prevent the growth of terrestrial plants in the stream bed • Maintain a sufficient area of pool habitat for native fish and crayfish populations	
Small winter/spring fresh(es) (one to five freshes of 55 ML/day for three to seven days during June to November)	• Allow fish to move throughout the reach • Flush sediments from hard substrates to increase biofilm production and food for waterbugs	
Large winter/spring fresh(es) (one to three freshes of 160 ML/day for one to three days during June to November)	• Disturb biofilms on rocks or woody debris to stimulate new growth and provide food for waterbugs • Allow fish to move throughout the reach • Inundate streamside vegetation to maintain plant condition and facilitate recruitment	
Summer/autumn freshes (three freshes of 30 ML/day for two to seven days each during December to May)	• Prevent a decline in water quality by flushing pools in the low flow season • Allow fish to move throughout the reach • Flush sediments from hard substrates to increase biofilm production and food for waterbugs	
Lower Burnt Creek		
Bankfull fresh (one fresh of 45 ML/day for two days at any time)	• Inundate streamside vegetation to maintain plant condition and facilitate recruitment • Move organic debris in the channel to support waterbugs • Maintain the structural integrity of the channel	
Overbank fresh (one fresh of 90 ML/day for one day during August to November)	• Inundate floodplain vegetation to maintain plant condition and facilitate recruitment • Move organic debris from the floodplain to support waterbugs in the channel • Maintain the structural integrity of the channel and floodplain	
Bungalally Creek		
Bankfull (one fresh of 60 ML/day for two days at any time)	• Inundate the streamside zone to maintain its condition and facilitate the recruitment of streamside vegetation communities • Maintain the structural integrity of the channel and prevent the loss of channel capacity	

Table 4.3.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Wimmera system *(continued)*

Potential environmental watering action	Expected watering effects	Environmental objectives
Upper Mount William Creek		
Top up pools (winter/spring and summer/autumn	• Maintain edge and shallow-water habitat for native fish and waterbugs • Maintain water quality	
Lower Mount William Creek		
Year-round low flow (5 ML/day or natural)	• Maintain edge habitats and shallow-water habitat for waterbugs and endemic fish • Maintain soil moisture for streamside vegetation and near-permanent inundated stream channel for aquatic vegetation and prevent the growth of terrestrial plants in the stream bed	
Winter/spring fresh(es) (one to five freshes of 100 ML/day for one to seven days during June to November)	• Wet benches to entrain organic debris and allow native fish to move throughout the reach • Flush surface sediments from hard substrates to support waterbugs • Inundate the streamside zone to maintain its condition and facilitate the recruitment of streamside vegetation communities	
Summer/autumn freshes (three freshes of 20-30 ML/day for two to seven days during December to May)	• Prevent a decline in water quality by flushing pools during low flow • Provide variable flows and allow the movement of fish and waterbugs throughout the reach during the low-flow season	
Dock Lake		
Winter/spring partial fill	• Trigger the growth and germination of wet-phase wetland vegetation communities • Support feeding and breeding habitat for waterbirds, frogs, waterbugs and turtles	
Ranch Billabong		
Top-ups (winter/spring and summer/autumn) 	• Inundate wetland vegetation to maintain plant condition and facilitate recruitment • Improve water quality for frogs and waterbirds	

Scenario planning

Table 4.3.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

In the Wimmera system, water for the environment is delivered to support particular ecological objectives in the different rivers and creeks. If dry conditions continue in the Wimmera system, the type of environmental watering actions that can be delivered to individual reaches will likely be influenced by water availability in the storages directly above each target reach. This is especially true for the MacKenzie River and Burnt Creek that rely on water from Lake Wartook and Moora Moora Reservoir, and for lower Mount William Creek that relies on water from Lake Lonsdale.

Wimmera River

In the Wimmera River, the highest-priority potential watering actions under all climate scenarios are the delivery of winter/spring and summer/autumn low flows and freshes. Under drought and very dry climatic conditions, there will not be enough water for the environment to deliver the recommended flows all season, and the available supply will be delivered intermittently and at lower magnitudes to maintain pool habitats for native fish and prevent adverse water quality (such as low oxygen and high salinity). The main objective under drought and very dry conditions will be to minimise the loss of aquatic plants and animals. Under a dry scenario, there should be enough water to deliver low flows for part of each season and some freshes to maintain the current condition of native fish populations. Increased water availability, as well as more natural catchment flows under average and wet climate scenarios, will allow low flows to be delivered most of the time as well as more freshes, which will help to further improve the ecological health of the river.

MacKenzie River/Burnt Creek/Bungalally Creek

In the MacKenzie River and Burnt Creek under drought and dry climate scenarios, the highest priority will be to deliver small volumes of water to critical drought refuges in Burnt Creek and reach 3 of the MacKenzie to protect populations of native fish, platypus and crayfish that have re-established in those reaches after the Millennium Drought. Under average and wet conditions, water for the environment will be delivered to increase flowing habitat (including providing continuous flow through the MacKenzie River to connect it to the Wimmera River), improve the health of aquatic and emergent vegetation, and support native fish movement through to the lower section of Burnt Creek. Maintaining the connection between reach 3 of the MacKenzie River and the Wimmera River is a high priority under average and wet climate scenarios, to allow fish to move between the two systems to help grow the populations and increase genetic diversity. A bankfull flow may also be delivered to Bungalally Creek under average and wet climate scenarios, to improve the health of streamside vegetation.

Mount William Creek

Poor water quality and low water availability in Lake Lonsdale are likely to prevent the targeted delivery of water for the environment to lower Mount William Creek under drought, very dry and dry climate scenarios. Any available water under these scenarios will be used to deliver low flows and small freshes to lower Mount William Creek and to top up refuge pools immediately upstream of Lake Lonsdale (upper Mount William Creek) to improve water quality and habitat availability for native fish populations. Increased water availability under average or wet climate scenarios will be used to deliver a mix of low flows and freshes through the whole lower Mount William Creek system and connect it to the Wimmera River. These larger flows are necessary to allow small-bodied native fish to disperse, to help recover populations that have been impacted by multiple years of below-average flow and extended cease-to-flow conditions.

Ranch Billabong and Dock Lake

Under all climatic conditions, small top-ups are planned to inundate Ranch Billabong to improve water quality and support the ongoing recovery of the river red gum and associated understorey vegetation surrounding the billabong. Environmental watering objectives for Dock Lake require large volumes of water that can only be achieved with significant contributions from natural events, so environmental watering is only a priority at Dock Lake under wet conditions.

Reserving water for carryover into the 2022-23 water year will be a priority under all scenarios, to ensure sufficient water to deliver the highest-priority flows during summer and autumn 2022-23. The volume carried over against the Wimmera-Glenelg environmental entitlement will be decided in consultation with the Wimmera and Glenelg Hopkins CMAs during the year, and it will be based on use during 2021-22, environmental conditions and seasonal outlooks for 2022-23.

Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios

Planning scenario	Drought	Very dry	Dry	Average	Wet
Expected river conditions	• No passing flows or unregulated flows	• Some passing flows and minor contributions from unregulated flows	• Some passing flows and minor contributions from unregulated flows	• Passing and unregulated flows particularly in winter/spring	• Passing flows and unregulated flows year-round
Predicted supply of water for the environment	• 21,742 ML	• 25,392 ML	• 35,532 ML	• 46,078 ML	• 55,812 ML
Wimmera River (targeting reach 4)					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• Winter/spring low flow (one month) • Summer/autumn low flow (one month)	• Winter/spring low flow (two months) • Summer/autumn low flow (two months)	• Winter/spring low flow (two months) • Winter/spring fresh (one fresh, small) • Summer/autumn low flow (two months) • Summer/autumn freshes (two freshes)	• Winter/spring low flow (four months) • Winter/spring freshes (three freshes, small) • Summer/autumn low flow (four months) • Summer/autumn freshes (two freshes)	• Winter/spring low flow (four months) • Winter/spring freshes (three freshes, small) • Winter/spring freshes (two freshes, large) • Summer/autumn low flow (four months) • Summer/autumn freshes (three freshes)
	Tier 1b (supply deficit)				
	• Winter/spring low flow (increased duration) • Winter/spring fresh (one fresh, small) • Summer/ autumn low flow (increased duration) • Summer/autumn fresh (one fresh)	• Winter/spring low flow (increased duration) • Winter/spring fresh (one fresh, small) • Summer/ autumn low flow (increased duration) • Summer/autumn fresh (one fresh)	• Winter/spring low flow (increased duration) • Winter/spring freshes (three freshes, small) • Winter/spring fresh (one fresh, large) • Summer/ autumn low flow (increased duration) • Summer/autumn freshes (three freshes)	• Winter/spring low flow (increased duration) • Winter/spring freshes (two freshes, small) • Winter/spring freshes (two freshes, large) • Summer/ autumn low flow (increased duration) • Summer/autumn freshes (three freshes)	• Winter/spring low flow (increased duration) • Winter/spring freshes (two freshes, small) • Winter/spring fresh (one fresh, large) • Summer/autumn freshes (two freshes)

Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios *(continued)*

Planning scenario	Drought	Very dry	Dry	Average	Wet
MacKenzie River (targeting reach 3)[1]					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• Winter/spring low flow (one month) • Summer/autumn low flow (one month) • Summer/autumn freshes (four freshes, small)	• Winter/spring low flow (two months) • Summer/autumn low flow (two months) • Summer/autumn freshes (four freshes, small)	• Winter/spring low flow (two months) • Summer/autumn low flow (two months) • Summer/autumn freshes (four freshes, small)	• Winter/spring low flow (four months) • Winter/spring fresh (one fresh, small) • Summer/autumn low flow (four months)	• Winter/spring low flow (four months) • Winter/spring freshes (two freshes, small) • Summer/autumn low flow (four months) • Summer/autumn fresh (one fresh, small)
	Tier 1b (supply deficit)				
	• Winter/spring low flow (increased duration) • Winter/spring freshes (five freshes) • Summer/autumn low flow (increased duration) • Summer/autumn freshes (increased duration)	• Winter/spring low flow (increased duration) • Winter/spring freshes (five freshes) • Summer/autumn low flow (increased duration) • Summer/autumn freshes (increased duration)	• Winter/spring low flow (increased duration) • Winter/spring freshes (five freshes) • Summer/autumn low flow (increased duration) • Summer/autumn fresh (one fresh, small) • Summer/autumn freshes (increased duration)	• Winter/spring low flow (increased duration) • Winter/spring freshes (four freshes, small) • Winter/spring fresh (one fresh, large) • Summer/autumn low flow (increased duration) • Summer/autumn freshes (four freshes)	• Winter/spring low flow (increased duration) • Winter/spring freshes (three freshes, small) • Winter/spring fresh (one fresh, large) • Summer/autumn low flow (increased duration) • Summer/autumn freshes (four freshes)
Upper Burnt Creek					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• Winter/spring low flow (one month) • Summer/autumn low flow (one month)	• Winter/spring low flow (two months) • Summer/autumn low flow (two months)	• Winter/spring low flow (two months) • Summer/autumn low flow (three months)	• Winter/spring low flow (four months) • Winter/spring freshes (five freshes, small) • Summer/autumn low flow (four months) • Summer/autumn freshes (three freshes)	• Winter/spring low flow (four months) • Winter/spring freshes (five freshes, small) • Summer/autumn low flow (four months) • Summer/autumn freshes (three freshes)

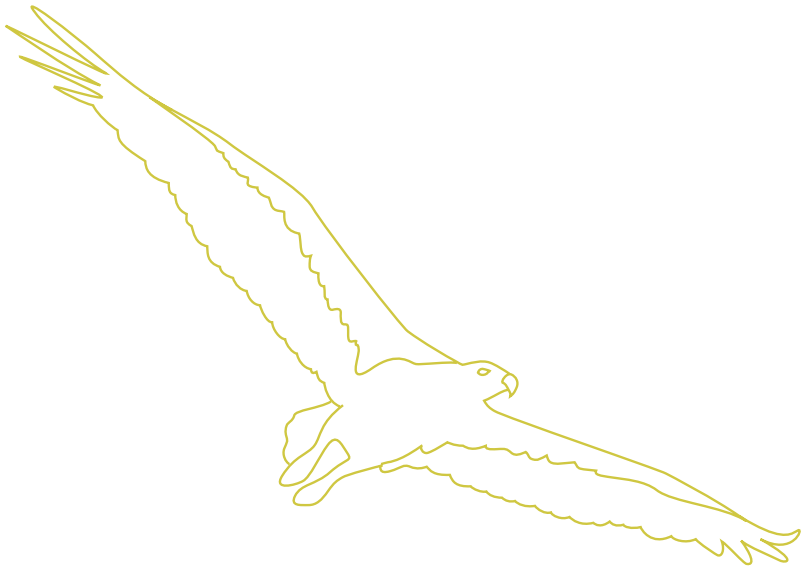
Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios *(continued)*

Planning scenario	Drought	Very dry	Dry	Average	Wet
Potential environmental watering – tier 1 (high priorities)	**Tier 1b (supply deficit)**				
	• Winter/spring low flow (increased duration) • Winter/spring fresh (one fresh, small) • Summer/ autumn low flow (increased duration) • Summer/autumn freshes (three freshes)	• Winter/spring low flow (increased duration) • Winter/spring freshes (two freshes, small) • Summer/ autumn low flow (increased duration) • Summer/autumn freshes (three freshes)	• Winter/spring low flow (increased duration) • Winter/spring freshes (three freshes, small) • Summer/ autumn low flow (increased duration) • Summer/autumn freshes (three freshes)	• Winter/spring low flow (increased duration) • Winter/spring fresh (one fresh, large) • Summer/ autumn low flow (increased duration) • Summer/ autumn freshes (increased duration)	• Winter/spring low flow (increased duration) • Winter/spring freshes (three freshes, large) • Summer/ autumn low flow (increased duration) • Summer/ autumn freshes (increased duration)
Lower Burnt Creek					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• N/A			• Bankfull	• Bankfull
Bungalally Creek					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• N/A			• Bankfull	• Bankfull
Upper Mount William Creek					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• Top-ups				
Lower Mount William Creek					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• N/A		• Year-round low flow (two months) • Winter/spring freshes (three freshes) • Summer/autumn freshes (three freshes)	• Year-round low flow (three months) • Winter/spring freshes (five freshes) • Summer/autumn freshes (three freshes)	• Year-round low flow (four months) • Winter/spring freshes (five freshes) • Summer/autumn freshes (three freshes)

Table 4.3.2 Potential environmental watering for the Wimmera system under a range of planning scenarios *(continued)*

Planning scenario	Drought	Very dry	Dry	Average	Wet
Potential environmental watering – tier 1 (high priorities)	**Tier 1b (supply deficit)**				
	• Year-round low flow • Summer/autumn freshes (three freshes)	• Year-round low flow • Winter/spring fresh (one fresh) • Summer/autumn freshes (three freshes)	• Year-round low flow (increased duration) • Winter/ spring freshes (increased duration) • Summer/ autumn freshes (increased duration)	• Year-round low flow (increased duration) • Winter/ spring freshes (increased duration) • Summer/ autumn freshes (increased duration)	• Year-round low flow (increased duration) • Winter/ spring freshes (increased duration) • Summer/ autumn freshes (increased duration)
Dock Lake					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• N/A				• Partial fill
Ranch Billabong					
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**				
	• Top-ups				
Possible volume of water for the environment required to achieve objectives	• 6,120 ML (tier 1a) • 26,660 ML (tier 1b)	• 7,070 ML (tier 1a) • 29,510 ML (tier 1b)	• 11,120 ML (tier 1a) • 26,535 ML (tier 1b)	• 18,100 ML (tier 1a) • 20,415 ML (tier 1b)	• 21,000 ML (tier 1a) • 24,975 ML (tier 1b)

1 Potential watering actions targeting reach 3 of the MacKenzie River will also benefit reach 2.



4.4 Wimmera-Mallee wetlands

Waterway managers – Mallee, North Central and Wimmera catchment management authorities

Storage manager – GWMWater

Environmental water holder – Victorian Environmental Water Holder

Did you know...?

Citizen scientists make an invaluable contribution by collecting environmental data across the Wimmera-Mallee wetlands. During the past year, community volunteers have contributed to the collection of data about bird species and their abundance, frog species and microbat recordings. This information indicates to land and water managers which species are at these sites and their ecological response to watering.

Top: White-plumed honeyeaters at Mutton Swamp, by Jenny Stephens
Above: Swamp wallaby at Tarkedia Dam, by Michael Gooch

System overview

The Wimmera-Mallee wetlands include 52 wetlands on public and private land spread across north-west Victoria (Figure 4.4.1). From the late 1800s until the construction of the Wimmera Mallee Pipeline Project (WMPP) in 2010, the deeper areas of these wetlands received water most years from the open channels associated with the Wimmera Mallee Domestic and Stock Channel System.

The WMPP replaced stock and domestic supply dams with tanks, and the open-channel distribution system with pipelines, to improve water efficiency. A portion of the water savings from the WMPP was converted to an environmental entitlement to improve the condition of the area's flow-stressed rivers, creeks and wetlands; the rest was used to create regional development opportunities and boost the reliability of supply for other users. The WMPP reduced the amount of open-water habitat in areas that were formerly supplied by the open-channel system, so a separate 1,000 ML environmental entitlement was created to water some of the wetlands that were previously supplied through the channel system. There are 52 priority wetlands that can receive water from this environmental entitlement.

Water for the environment can only be delivered to the wetlands when there is sufficient capacity in the Wimmera-Mallee pipeline system, which can be affected by demand from other pipeline customers. The North Central, Mallee and Wimmera CMAs work closely with GWMWater and land managers (including Parks Victoria, the Department of Environment, Land, Water and Planning and private landowners) to take account of pipeline capacity constraints when ordering environmental deliveries to wetlands.

Environmental values

There are many wetland types in the Wimmera-Mallee wetlands system including freshwater meadows, open freshwater lakes and freshwater marshes. This diversity provides a range of different wetland habitats for plants and animals across the Wimmera-Mallee region. The wetlands also vary in size and support different vegetation communities. Some are home to native waterbird populations including brolgas, egrets, blue-billed ducks, freckled ducks, Australian painted snipes and glossy ibis. The wetlands are used by the vulnerable growling grass frog, turtles and many other native animals that may use them as drought refuges and drinking holes. Rare and vulnerable vegetation species (such as spiny lignum, ridged water milfoil, chariot wheel and cane grass) are also present in some wetlands.

Environmental watering objectives in the Wimmera-Mallee wetlands

- Maintain and increase the population of frogs
- Maintain and increase the population of turtles
- Provide watering holes for native animals and terrestrial birds across the landscape
- Maintain and improve the condition of aquatic and fringing plants including lignum, river red gum and black box communities
- Improve the diversity of wetland vegetation communities
- Maintain and increase populations of waterbirds and other native birds by providing resting, feeding and breeding habitat

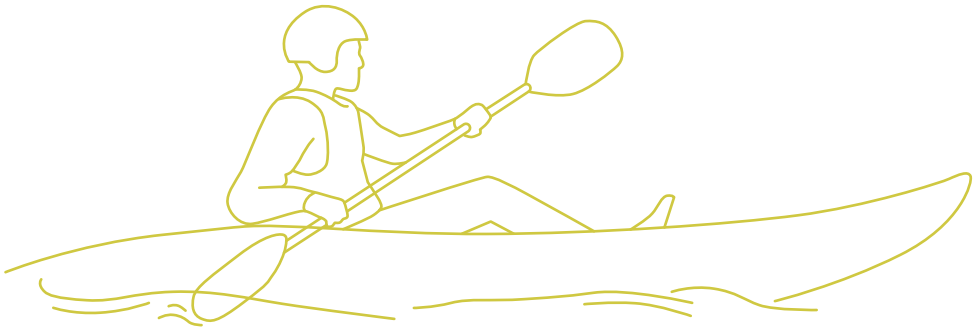
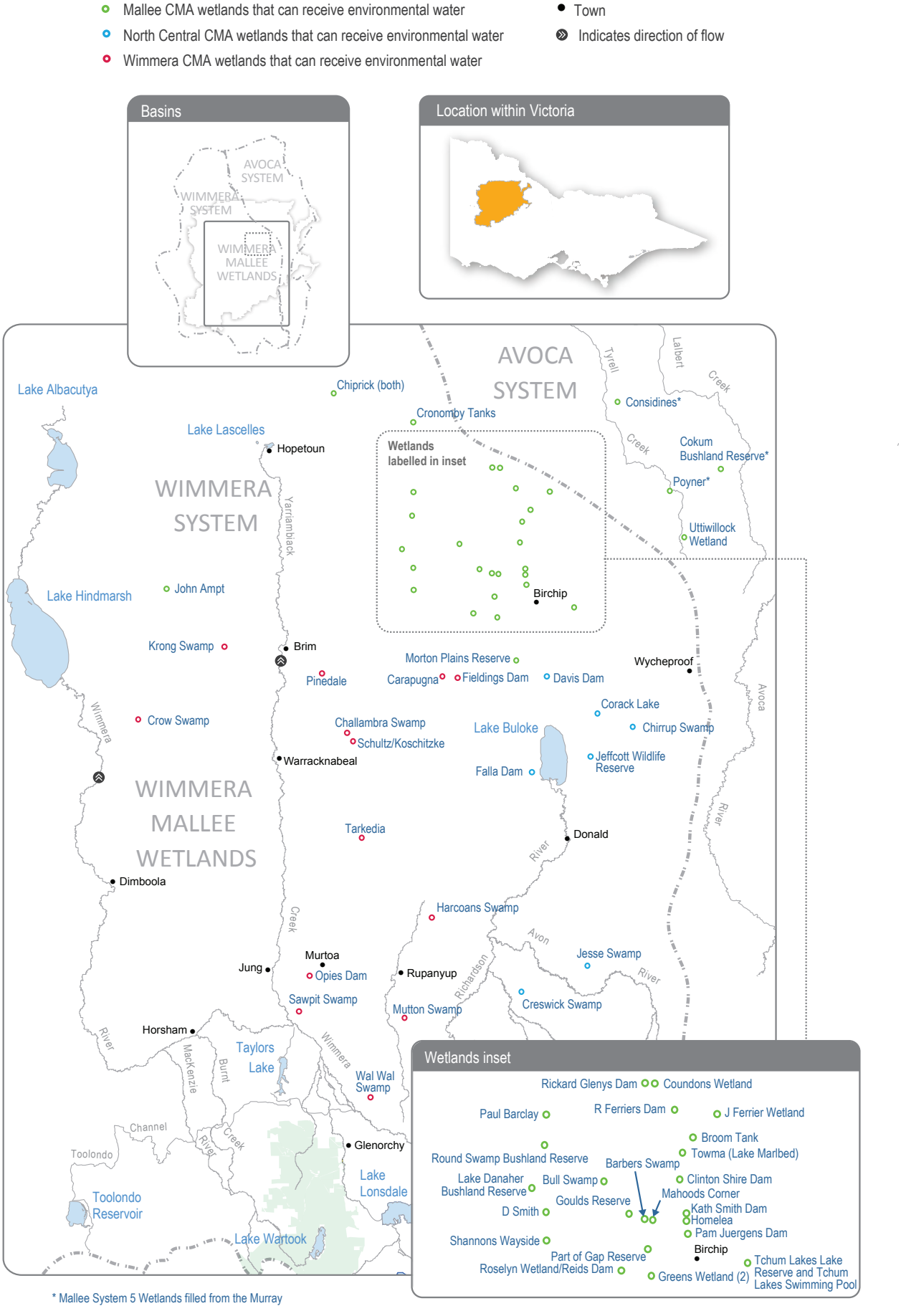


Figure 4.4.1 The Wimmera-Mallee wetlands



* Mallee System 5 Wetlands filled from the Murray

Traditional Owner cultural values and uses

Spanning a broad geographic area, several Wimmera-Mallee wetlands show indications of the longstanding cultural heritage and importance of these sites to the Traditional Owners of the region, including but not limited to those represented by the Barengi Gadjin Land Council and the Dja Dja Wurrung Clans Aboriginal Corporation. Some sites have artefacts and scar trees recorded in or adjacent to them, and further cultural surveys could better inform management of water for the environment at those sites.

The Barengi Gadjin Land Council is the Registered Aboriginal Party for a significant land area of the Wimmera-Mallee wetlands. The Barengi Gadjin Land Council represents the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagalk. The Barengi Gadjin Land Council has discussed the significance of the wetlands and their aspiration to undertake work at these sites in future, and it provided the following statement to Mallee CMA when discussing environmental watering:

> *The Wimmera-Mallee is living cultural landscape and there is a lack of recorded data regarding the cultural values over many sections of the Wimmera-Mallee Pipeline. Several highly significant places are outlined through our Country Plan, but like all places across our Country, the rivers, creeks, lakes, wetlands and swamps, and all other landscape features in this area are of high cultural significance. We wish to care for Country again through our traditional land management practices and revive and share the ancient narrative of this area. Mapping the cultural values of places along the Wimmera-Mallee pipeline will be essential in contributing to integrated catchment management.*
>
> *We are unable to identify places of particular cultural values and uses confidently until Aboriginal Water Assessment/Cultural Heritage Surveys are systematically undertaken across Wimmera-Mallee pipeline sites. All of the swamps, wetlands and soaks of this area are of high cultural significance as they are linked to Traditional trading routes that extend in all directions. It is essential that all of these places are managed correctly and water quality and biodiversity are improved.*

Social, recreational and economic values and uses

In planning the potential watering actions in Table 4.4.1, the Mallee, North Central and Wimmera CMAs considered how environmental flows could support values and uses including:

- water-based recreation (such as fishing, kayaking, swimming and yabbying)
- riverside recreation and amenity (such as birdwatching, duck and quail hunting, photography, picnicking and walking)
- community events and tourism (such as citizen science including the collection of data about bird species and abundance, frog species and microbat recordings).

Recent conditions

Rainfall across the Wimmera-Mallee region was close to the long-term average during 2020-21, but inflows to storages in the Wimmera-Mallee System Headworks were low and did not replenish storage levels, which are low due to much drier-than-average conditions in the past four years. The Wimmera-Mallee pipeline wetland environmental entitlement received no allocation in 2020-21, and all deliveries of water for the environment to the wetlands in 2020-21 were supplied with water carried over from previous years.

Deliveries of water for the environment to the Wimmera-Mallee wetlands were made in accord with a dry climate scenario. Watering objectives for 2020-21 were almost fully achieved, with water for the environment deliveries or natural inflows providing the required water regime for 38 of the 42 wetlands planned under a dry climate scenario. Landowners' consent could not be obtained in time to support planned environmental watering actions at two wetlands, one wetland did not receive water due to unauthorised grazing by livestock, and a planned watering action at another wetland was met by local runoff. Water for the environment was delivered to 23 wetlands in the Mallee CMA region, ten wetlands in the Wimmera CMA region and five wetlands in the North Central CMA region in winter/spring 2020 and/or autumn/winter 2021. Some wetlands received water once during 2020-21, while others received additional top-ups to maintain their water-dependent values.

Visual surveys at the wetlands across the region have found that water for the environment delivered to the Wimmera-Mallee wetlands provided feeding and breeding habitat for many animals (such as eastern long-necked turtles, frogs, yabbies, rainbow bee-eaters, ducks, grebes and other water and woodland birds). Many wetlands had a noticeable increase of new growth of aquatic and semi-aquatic plants including nardoo, water milfoil, water ribbons and cane grass. Fringing plant species including black box trees, chariot wheels (a nationally threatened forb species) and lignum plants had new canopy growth and greater abundance at some watered wetlands. If dry conditions continue in 2021-22, water for the environment will be essential to maintain aquatic and semi-aquatic plants and provide habitat for water-dependant animal species. Under wetter conditions, water for the environment will be used to complement natural inflows and wet a larger proportion of fringing vegetation (such as black box and lignum), to improve its resilience in future dry years.

Scope of environmental watering

Table 4.4.1 describes the potential environmental watering actions in 2021-22, their expected watering effects (that is, the intended physical or biological effects of the watering action) and the longer-term environmental objective(s) they support. Each environmental objective relies on one or more potential environmental watering actions and their associated physical or biological effects. Two wetlands — Bull Swamp and Homelea — are not planned to receive water for the environment in 2021-22, to allow them to draw down and dry before a planned fill in 2022-23.

Table 4.4.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Wimmera-Mallee wetlands

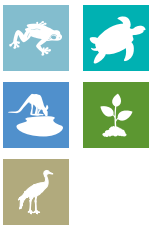
Potential environmental watering action	Expected watering effects	Environmental objectives
Mallee wetlands		
Barbers Swamp Goulds Reserve Lake Danaher Bushland Reserve Morton Plains Reserve Tchum Lakes Reserve (North Lake – wetland) Tchum Lakes Swimming Pool (North Lake – dam)	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species • Stimulate the growth of aquatic and fringing vegetation and allow the plants including ridged water milfoil, black box and spiny lignum to complete their life cycles	
Cokum Bushland Reserve Part of Gap Reserve Rickard Glenys Dam	• Stimulate the growth of aquatic and fringing vegetation and allow the plants including ridged water milfoil, black box and spiny lignum to complete their life cycles • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, turtles, waterbirds and terrestrial species	
Broom Tank Clinton Shire Dam Greens Wetland J Ferrier Wetland	• Stimulate the growth of aquatic and fringing vegetation and allow the plants including black box and lignum to complete their life cycles • Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species	
Considines Cronomby Tanks	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs and turtles	
Newer Swamp	• Stimulate the growth of aquatic and fringing vegetation and allow the plants including black box and lignum to complete their life cycles	
Chiprick Coundons Wetland D Smith Wetland John Ampt Kath Smith Dam Mahoods Corner Pam Juergens Dam Paul Barclay Poyner R Ferriers Dam Shannons Wayside	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds, turtles and terrestrial species	

Table 4.4.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Wimmera-Mallee wetlands *(continued)*

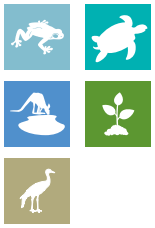
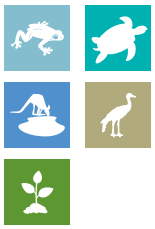
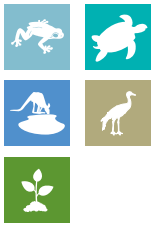
Potential environmental watering action	Expected watering effects	Environmental objectives
Roselyn Wetland Uttiwillock Wetland	• Stimulate the growth of aquatic and fringing vegetation and allow the plants including black box and lignum to complete their life cycles • Provide a permanent water source for refuge and to support feeding and breeding opportunities for waterbirds, frogs, turtles and terrestrial species	
Towma (Lake Marlbed)	• Stimulate the growth of aquatic and fringing vegetation and allow the plants including black box and lignum to complete their life cycles • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, turtles and terrestrial species	
North central wetlands		
Chirrup Swamp	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds and turtles	
Corack Lake	• Provide a permanent water source for refuge and nursery habitat for turtles and frogs • Maintain varying depths of water to support aquatic and fringing plants' life cycles • Maintain varying depths of water to support a variety of feeding habitats for waterbirds	
Creswick Swamp	• Maintain varying depths of water to support the life cycle of aquatic plants including threatened marbled marshwort • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs and turtles • Maintain water levels to prolong wetting and ensure successful waterbird breeding events, if they start	
Davis Dam	• Wet black box and rare cane grass to allow plants to complete their life cycles and to support juvenile plants • Provide a semi-permanent water source in the larger wetland footprint to support refuge and feeding and breeding opportunities for frogs • Provide a permanent water source in deeper pool section of wetland for refuge and to support feeding and breeding opportunities for waterbirds and terrestrial species	
Falla Dam	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds and terrestrial species • Stimulate frog and turtle breeding by providing a deep, semi-permanent water source in spring • Stimulate aquatic and fringing vegetation growth in winter/spring	

Table 4.4.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Wimmera-Mallee wetlands *(continued)*

Potential environmental watering action	Expected watering effects	Environmental objectives
Jeffcott Wildlife Reserve	• Maintain a minimum depth of water to support the life cycles of aquatic plants • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds and turtles	
Jesse Swamp	• Maintain varying depths of water to support aquatic and fringing plant life cycles • Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, waterbirds and terrestrial species	
Wimmera wetlands		
Carapugna Challambra Swamp Crow Swamp Fieldings Dam Harcoans Swamp Krong Swamp Mutton Swamp Opies Dam Pinedale Sawpit Swamp Schultz/Koschizke Tarkedia Dam Wal Wal Swamp	• Provide a permanent water source for refuge and to support feeding and breeding opportunities for frogs, turtles waterbirds and terrestrial species • Stimulate the growth of aquatic and fringing vegetation and allow the plants including chariot wheels, sneezeweed, ridged water milfoil and spiny lignum to complete their life cycles	

Scenario planning

Table 4.4.2 outlines the potential environmental watering and expected water use under a range of planning scenarios.

The potential watering actions for 2021-22 have been determined by considering the environmental values, watering requirements and recent watering histories of the Wimmera-Mallee wetlands, as well as available water supply and ability to deliver water to individual sites. The list of wetlands to be watered under each scenario was determined according to the following principles.

Under drought conditions, the highest priority is to provide permanent water in the deeper sections of the wetlands, to provide drought refuge for waterbirds, frogs, turtles and terrestrial animals across the landscape and to support the growth and life cycles of wetland plants. Under wetter scenarios, water for the environment may be delivered, depending on the capacity in the pipeline system, to water larger areas of the wetland. Large rainfall events and catchment inflows may partially or completely fill some wetlands, and water for the environment may be used to top up, fill or overtop wetlands to improve fringing wetland plant communities and provide additional habitat for waterbirds, frogs and turtles.

Allocations to the environmental entitlement to supply the wetlands in the Wimmera-Mallee wetland system is highly variable, and the ability to carry over unused water from one year to another allows waterway managers and the VEWH to effectively manage the systems in dry periods. Reserving water for carryover into the 2022-23 water year will be a priority under all scenarios, to ensure sufficient water is available to support critical environmental demands in 2022-23 and beyond. The volume carried over against the Wimmera-Glenelg environmental entitlement will be decided in consultation with the North Central, Mallee and Wimmera CMAs during the year, and it will be based on use during 2021-22, seasonal conditions and seasonal outlooks for 2022-23.

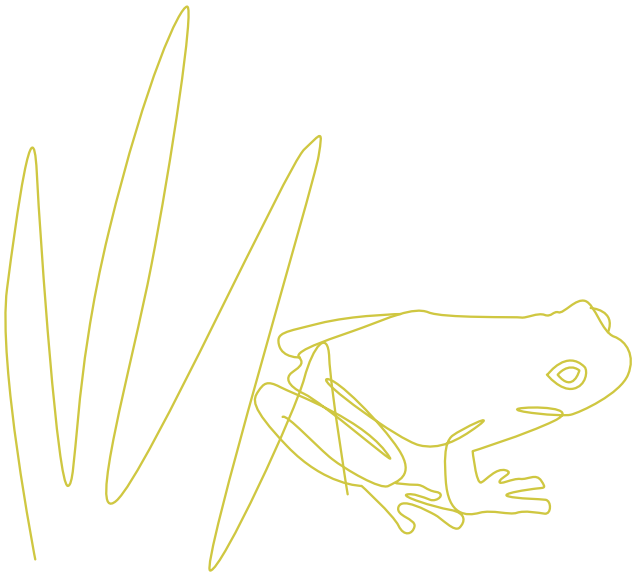


Table 4.4.2 Potential environmental watering for the Wimmera-Mallee wetlands under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Predicted supply of water for the environment	• 375 ML	• 375 ML	• 395 ML	• 735 ML
Potential environmental watering – tier 1 (high priorities)	• Barbers Swamp • Broom Tank • Carapugna • Challambra Swamp • Chirrup Swamp • Clinton Shire Dam • Cokum Bushland Reserve • Considines • Corack Lake • Creswick Swamp • Cronomby Tanks • Crow Swamp • Davis Dam • D Smith • Fieldings Dam • Greens Wetland • Harcoans Swamp • Jeffcott Wildlife Reserve • Jesse Swamp • J Ferrier • John Ampt • Krong Swamp • Mahoods Corner • Morton Plains • Mutton Swamp • Opies Dam • Paul Barclay • Pinedale • Poyner • R Ferrier • Rickard Glenys • Roselyn Wetland • Sawpit Swamp • Schultz/Koschitzke • Tarkedia • Towma (Lake Marlbed) • Uttiwillock Wetland • Wal Wal Swamp	• Barbers Swamp • Broom Tank • Carapugna • Challambra Swamp • Chiprick • Chirrup Swamp • Clinton Shire Dam • Cokum Bushland Reserve • Considines • Corack Lake • Coundon Wetland • Creswick Swamp • Cronomby Tanks • Crow Swamp • Davis Dam • D Smith • Falla Dam • Fieldings Dam • Greens Wetland • Harcoans Swamp • Jeffcott Wildlife Reserve • Jesse Swamp • J Ferrier • John Ampt • Kath Smith • Krong Swamp • Lake Danaher Bushland Reserve • Mahoods Corner • Morton Plains • Mutton Swamp • Opies Dam • Pam Juergens • Part of Gap Reserve • Paul Barclay • Pinedale • Poyner • R Ferrier • Rickard Glenys • Roselyn Wetland	• Barbers Swamp • Broom Tank • Carapugna • Challambra Swamp • Chiprick • Chirrup Swamp • Clinton Shire Dam • Cokum Bushland Reserve • Considines • Corack Lake • Coundon Wetland • Creswick Swamp • Cronomby Tanks • Crow Swamp • Davis Dam • D Smith • Falla Dam • Fieldings Dam • Goulds Reserve • Greens Wetland • Harcoans Swamp • Jeffcott Wildlife Reserve • Jesse Swamp • J Ferrier • John Ampt • Kath Smith • Krong Swamp • Lake Danaher Bushland Reserve • Mahoods Corner • Morton Plains • Mutton Swamp • Newer Tank • Opies Dam • Pam Juergens • Part of Gap Reserve • Paul Barclay • Pinedale • Poyner • R Ferrier	• Barbers Swamp • Broom Tank • Carapugna • Challambra Swamp • Chiprick • Chirrup Swamp • Clinton Shire Dam • Cokum Bushland Reserve • Considines • Corack Lake • Coundon Wetland • Creswick Swamp • Cronomby Tanks • Crow Swamp • Davis Dam • D Smith • Falla Dam • Fieldings Dam • Goulds Reserve • Greens Wetland • Harcoans Swamp • Jeffcott Wildlife Reserve • Jesse Swamp • J Ferrier • John Ampt • Kath Smith • Krong Swamp • Lake Danaher Bushland Reserve • Mahoods Corner • Morton Plains • Mutton Swamp • Newer Tank • Opies Dam • Pam Juergens • Part of Gap Reserve • Paul Barclay • Pinedale • Poyner • R Ferrier

Table 4.4.2 Potential environmental watering for the Wimmera-Mallee wetlands under a range of planning scenarios *(continued)*

Planning scenario	Drought	Dry	Average	Wet
Potential environmental watering – tier 1 (high priorities) *(continued)*		• Sawpit Swamp • Schultz/Koschitzke • Shannons Wayside • Tarkedia • Tchum Lakes – Swimming Pool • Towma (Lake Marlbed) • Uttiwillock Wetland • Wal Wal Swamp	• Rickard Glenys • Roselyn Wetland • Sawpit Swamp • Schultz/Koschitzke • Shannons Wayside • Tarkedia • Tchum Lakes – Swimming Pool • Tchum Lakes – Wetland • Towma (Lake Marlbed) • Uttiwillock Wetland • Wal Wal Swamp	• Rickard Glenys • Roselyn Wetland • Sawpit Swamp • Schultz/Koschitzke • Shannons Wayside • Tarkedia • Tchum Lakes – Swimming Pool • Tchum Lakes – Wetland • Towma (Lake Marlbed) • Uttiwillock Wetland • Wal Wal Swamp
Possible volume of water for the environment required to achieve objectives	• 150 ML	• 199 ML	• 464 ML	• 608 ML