Seasonal Watering Plan 2022-23

Section 2

VICTORIAN ENVIRONMENTAL WATER HOLDER

VICTORIA State Government

Section 2
Gippsland region

2.1 Gippsland region overview

The systems in the Gippsland region that can receive water from the VEWH's environmental entitlements are *Durt-Yowan* (Latrobe River), lower Latrobe wetlands, *Carran Carran* (Thomson River), Heyfield wetlands and *Wirn wirndook Yeerung* (Macalister River). The Snowy River also receives environmental flows, but these are managed by the New South Wales Department of Planning, Industry and Environment.

Environmental values, recent conditions, objectives, and planned actions for delivering water for the environment for each system in the Gippsland region are presented in the system sections that follow.

Traditional Owners in the Gippsland region

Traditional Owners in the Gippsland region have an intrinsic connection to Country that has endured for tens of thousands of years. This includes inherent rights and cultural obligations to Country and community.

The Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC), on behalf of the Gunaikurnai, hold Native Title and is a Registered Aboriginal Party over an area that extends from near Warragul, east to the Snowy River and north to the Great Dividing Range. This area includes *Durt-Yowan* (Latrobe River), *Carran Carran* (Thomson River), *Wirn wirndook Yeerung* (Macalister River), the Snowy River and the lower Latrobe wetlands covered by this section of the seasonal watering plan.

The Victorian Government has entered into a recognition and settlement agreement with the Gunaikurnai. The recognition and settlement agreement, executed under the *Traditional Owner Settlement Act 2010*, affords the Gunaikurnai rights relating to the use of public land within their agreement area.

Other Registered Aboriginal Parties in this geographic area are the Bunurong Land Council Aboriginal Corporation and Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation, but their boundaries do not extend to the waterways managed with water for the environment in the Gippsland region.

In the context of Treaty negotiations in Victoria and the Victorian Government's commitment to self-determination for First Nations, program partners in the environmental watering program are aware that structural changes (such as legislative, policy and governance changes) to how water is managed may be made in the future in recognition of Aboriginal water rights. Program partners have heard for many years that Traditional Owners want empowerment and agency in water management, and in many cases, they want to manage water on Country on their own terms.

Engagement

Seasonal watering proposals are informed by community and program partner engagement, including Traditional Owner engagement. Program partners and communities help to identify priorities and opportunities for the delivery of water for the environment in the coming year.

Longer-term regional catchment strategies, regional waterway strategies, relevant technical studies (such as environmental flows studies), environmental water management plans and Traditional Owner Country plans (and associated documents) also inform seasonal watering proposals. These strategies, plans and technical reports collectively describe a range of environmental, economic, social and Traditional Owner perspectives and longer-term integrated catchment and waterway management objectives that influence actions and priorities for water for the environment.

The VEWH and its program partners consider cultural, social, economic and recreational values and uses of waterways when planning for water for the environment. Where possible, opportunities to support these values and uses are incorporated into watering decisions, provided they do not compromise environmental outcomes. Cultural, social, economic and recreational values considered for each system in the Gippsland region are presented in the system sections that follow.

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 planning process for water for the environment. Table 2.1.1 shows the IAP2 Spectrum categories and participation goals.

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Table 2.1.1 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.

Table 2.1.2 shows the partners, stakeholder organisations and individuals with which West Gippsland CMA engaged when preparing the *Durt-Yowan* (Latrobe River), lower Latrobe wetlands, Thomson (which includes the Heyfield wetlands) and Macalister 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 seasonal watering proposals by CMAs.

The table also shows the level of engagement between West Gippsland CMA and stakeholders of the environmental watering program in the Gippsland region based on the West Gippsland CMA's 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, roles and responsibilities of organisations in managing a site or system, and potential interaction of proposed watering with other activities on the waterway. For example, in the Gippsland region, Parks Victoria is more involved in the planning for and management of water for the environment for the lower Latrobe wetlands than for the other Gippsland systems, because it is the land manager for Dowd Morass and Sale Common and it operates the regulators used to release water to these sites.

External factors also influence engagement opportunities. COVID-19 restrictions restricted engagement efforts across Gippsland, reducing opportunities for face-to-face meetings with the community and Traditional Owners.

Table 2.1.2 Partners and stakeholders engaged by West Gippsland Catchment Management Authority in developing seasonal watering proposals for the Latrobe, lower Latrobe wetlands, Thomson and Macalister systems and other key foundation documents that have directly informed the proposals (grouped in alphabetical order)

	Latrobe River	Lower Latrobe wetlands	Thomson system	Macalister system
Community groups and environment groups	**IAP2 level: Inform** • Greening Australia • Latrobe Valley Field Naturalist Club Inc. • Native Fish Australia	**IAP2 level: Involve** • Birdlife Australia	**IAP2 level: Collaborate** • Heyfield Wetlands Committee of Management	**IAP2 level: Involve** • Environment Victoria • Maffra and Districts Landcare Network • Native Fish Australia
			IAP2 level: Involve • Cowwarr Landcare Group • Waterwatch volunteers	
		IAP2 level: Inform • Greening Australia • Latrobe Valley Field Naturalist Club Inc. • Native Fish Australia	**IAP2 level: Inform** • Birdlife Australia	

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	Latrobe River	Lower Latrobe wetlands	Thomson system	Macalister system
Government agencies	**IAP2 level: Collaborate** • Parks Victoria • Southern Rural Water	**IAP2 level: Collaborate** • Parks Victoria	**IAP2 level: Collaborate** • Melbourne Water • Southern Rural Water	**IAP2 level: Collaborate** • Southern Rural Water
	IAP2 level: Consult • Gippsland Water	**IAP2 level: Consult** • Gippsland Water	**IAP2 level: Involve** • Gippsland Water	**IAP2 level: Involve** • Gippsland Water
	IAP2 level: Inform • Department of Environment, Land, Water and Planning • East Gippsland CMA • Victorian Fisheries Authority	**IAP2 level: Inform** • Department of Environment, Land, Water and Planning • East Gippsland CMA • Victorian Fisheries Authority	**IAP2 level: Inform** • Department of Environment, Land, Water and Planning • Victorian Fisheries Authority	**IAP2 level: Inform** • Department of Environment, Land, Water and Planning • Victorian Fisheries Authority
Landholders/farmers	**IAP2 level: Inform** • Individual landholders	**IAP2 level: Collaborate** • Field & Game Australia (Heart Morass)	**IAP2 level: Involve** • Individual landholders	**IAP2 level: Involve** • Macalister Irrigation District irrigators/diverters • Other landholders
		IAP2 level: Inform • Individual landholders		
Local businesses	**IAP2 level: Inform** • Port of Sale Heritage Cruises	**IAP2 level: Inform** • Port of Sale Heritage Cruises		
Recreational users	**IAP2 level: Inform** • Field & Game Australia • VRFish	**IAP2 level: Collaborate** • Field & Game Australia (Dowd Morass and Sale Common)	**IAP2 level: Involve** • Tourism operators • VRFish	**IAP2 level: Involve** • VRFish
		IAP2 level: Inform • VRFish		
Technical experts	**IAP2 level: Collaborate** • Arthur Rylah Institute		**IAP2 level: Collaborate** • Arthur Rylah Institute	**IAP2 level: Collaborate** • Arthur Rylah Institute
Traditional Owners	**IAP2 level: Collaborate** • Gunaikurnai Land and Waters Aboriginal Corporation	**IAP2 level: Collaborate** • Gunaikurnai Land and Waters Aboriginal Corporation	**IAP2 level: Collaborate** • Gunaikurnai Land and Waters Aboriginal Corporation	**IAP2 level: Collaborate** • Gunaikurnai Land and Waters Aboriginal Corporation

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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 of water for the environment in the Gippsland region will not be fully met without simultaneously addressing issues such as barriers to fish movement, high nutrient loads, loss of streambank 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 complementary programs that are likely to support environmental flows outcomes in the Gippsland region include:

- works to protect and enhance stream banks along priority reaches of rivers and their tributaries, including fencing to exclude stock, revegetation of riverbanks, willow removal and erosion control
- work with farmers along *Carran Carran* (Thomson River) and *Wirn wirndook Yeerung* (Macalister River) on grazing and soil management and on nutrient and water-use-efficiency projects that help to improve water quality and river health
- construction of a fishway on *Carran Carran* (Thomson River) to improve fish passage near the heritage-listed Horseshoe Bend Tunnel, completed in August 2019. The fishway now allows Australian grayling, which are specifically targeted with releases of water for the environment, and other migratory fish, to access over 200 km of river habitat from the upper reaches of the Aberfeldy River down to *Durt-Yowan* (Latrobe River). Tupong have since been found above the Horseshoe Bend Tunnel in surveys conducted by the Arthur Rylah Institute
- a weed and willow control program in remote parts of the Snowy River catchment, which led to 200 km of the river now being willow-free. Surveys and ongoing control of willows in areas that were burnt by the 2019-20 bushfires will be a particular focus over the next five years.

For more information about integrated catchment management programs in the Gippsland region, refer to the West Gippsland and East Gippsland regional catchment strategies and regional waterway strategies.

Risk management

During the development of the seasonal watering proposals for the Latrobe, Thomson and Macalister systems, environmental watering program partners assessed risks associated with the potential delivery of water for the environment in 2022-23 and identified appropriate mitigating strategies. Risks and mitigating actions are continually assessed by program partners throughout the year (see subsection 1.3.6).

In the Snowy system, when weather conditions increase the risk of flooding, the New South Wales Department of Planning, Industry and Environment works with the Bureau of Meteorology, East Gippsland CMA, New South Wales State Emergency Service and the VEWH to inform the community about the management of planned releases. Releases may be cancelled or rescheduled to limit flood impacts on private land.

Seasonal outlook 2022-23

Rainfall in the Gippsland region in 2021-22 was well above the long-term average for the second consecutive year, and temperatures were close to the long-term average. Widespread flooding occurred in June and November 2021, and major flooding occurred in Traralgon Creek, Tanjil River, Avon River, *Wirn wirndook Yeerung* (Macalister River) and *Carran Carran* (Thomson River) in June.

Delivery of water for the environment in rivers and wetlands within the West Gippsland CMA region was managed in line with a wet scenario during 2021-22, and all planned watering actions were achieved. Natural flows from spilling reservoirs and local catchment run-off met most of the planned watering actions during the year. Water for the environment was used to deliver several freshes in *Carran Carran* (Thomson River) and autumn/winter low flows and freshes in *Wirn wirndook Yeerung* (Macalister River) to support native fish migration and breeding, but was not needed in *Durt-Yowan* (Latrobe River); and there will likely be moderate-to-large carryover volumes for 2022-23. The three lower Latrobe wetlands (Sale Common, Dowd Morass and Heart Morass) received their first full flushing flows since 2010-11, and salinity levels in Lake Wellington remained low for a second consecutive year.

The Snowy River received its highest allocation of water for the environment since the Victorian Environmental Water Holder was established. The water was used to mimic seasonal snow melt patterns to enhance the river's ecological and physical conditions.

The Bureau of Meteorology forecasts above-average rainfall and above-average temperature for the Gippsland region during winter and spring 2022. With greater-than-average soil moisture and relatively high storage levels, the risk of flooding remains for the Gippsland region in the first half of 2022-23.

High storage levels and forecast wet conditions for the start of 2022-23 are likely to result in high allocations to environmental entitlements in the Gippsland systems. There will also be a moderate-to-large carryover of unused environmental allocation from 2021-22, and although some of the carryover may be lost if storages spill, the combination of high allocations and carryover means there will be sufficient supply to deliver planned watering actions under all climate scenarios during 2022-23.

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The approach to delivering water for the environment in the Gippsland region is to maintain enough flow in dry times to minimise stress on existing plant and animal populations and deliver larger flows in wetter conditions to enhance the condition of and increase recruitment in those populations. Wet conditions over the last two years have resulted in strong native fish recruitment in all of the Gippsland systems that receive water for the environment. While certain flows will be delivered at a lower magnitude under drier climate scenarios, the forecast high water availability means that delivery of water for the environment to consolidate the environmental gains of the last two years and to support additional recruitment where possible should still be possible under all scenarios in 2022-23. Efforts to boost migratory fish populations in the Latrobe, Thomson and Macalister rivers are particularly important to increase numbers across the broader Gippsland region and help recover populations in systems that were affected by the 2019-20 bushfires.

Delivery of water for the environment in the lower Latrobe wetlands in 2022-23 will also aim to consolidate and, where possible, improve the environmental gains of the last two years. This will involve keeping all three wetlands at least partially full under all climate scenarios and looking for opportunities to provide flushing flows if there are high flows through the lower Latrobe River.

The water year for the Snowy system starts in May and finishes in April the following year, which differs from how water is managed in the other Gippsland systems. The total volume for release and daily release targets for the Snowy River from May 2022 to April 2023 were endorsed by the Snowy Advisory Committee in March 2022. The agreed daily releases will not vary unless flows increase the risk of flooding downstream or operational constraints prevent delivery.

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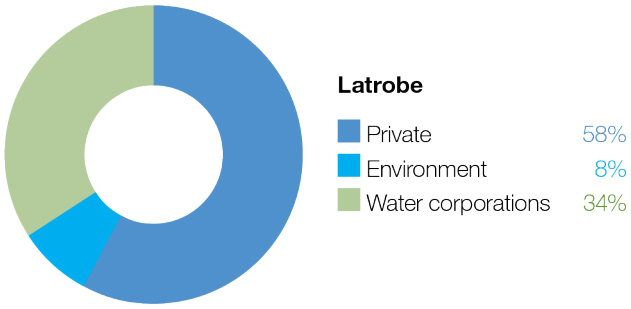
2.2 Latrobe system

Waterway manager – West Gippsland Catchment Management Authority

Storage manager – Southern Rural Water

Environmental water holder – Victorian Environmental Water Holder

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



The Latrobe system includes *Durt-Yowan* (Latrobe River) and lower Latrobe wetlands: Sale Common, Heart Morass and Dowd Morass.

2.2.1 *Durt-Yowan* (Latrobe River)

System overview

***Durt-Yowan* (Latrobe River) originates on the Baw Baw Plateau and passes through relatively flat to undulating plains, which have been largely cleared for agriculture, before flowing into Lake Wellington (the westernmost point of the Gippsland Lakes) (Figure 2.2.1). Notable tributaries include the Tanjil River, Narracan Creek, Morwell River, Tyers River, Traralgon Creek and *Carran Carran* (Thomson River).**

Water for the environment is supplied to *Durt-Yowan* (Latrobe River) from Blue Rock Reservoir on the Tanjil River. Blue Rock Reservoir also supplies water for urban supply and for electricity generators and a paper mill in the Latrobe Valley.

Durt-Yowan (Latrobe River) from Rosedale to the *Carran Carran* (Thomson River) confluence (reach 5) is the priority reach for delivering water for the environment because it contains endangered plant communities that have good potential for rehabilitation. Capacity constraints within reach 5 mean that some of the larger freshes required to meet environmental objectives in reaches 4, 5 and 6 cannot be delivered without flooding private land. Until this can be resolved, environmental flows will be managed to within-channel levels. Where possible, flows in *Durt-Yowan* (Latrobe River) are coordinated with freshes in *Carran Carran* (Thomson River) to meet targets for the Latrobe River estuary.

Options to deliver water for the environment to *Durt-Yowan* (Latrobe River) via the Tyers River may be investigated in 2022-23. These options include a physical transfer of water from Blue Rock Reservoir to Moondarra Reservoir via existing infrastructure operated by Gippsland Water or a temporary administrative transfer arrangement. Delivering water via the Tyers River would increase the proportion of the Latrobe catchment that could receive water for the environment without compromising outcomes in the main target reaches of *Durt-Yowan* (Latrobe River). If adopted, these options are expected to benefit native in-stream and streamside vegetation and non-migratory fish within the Tyers River.

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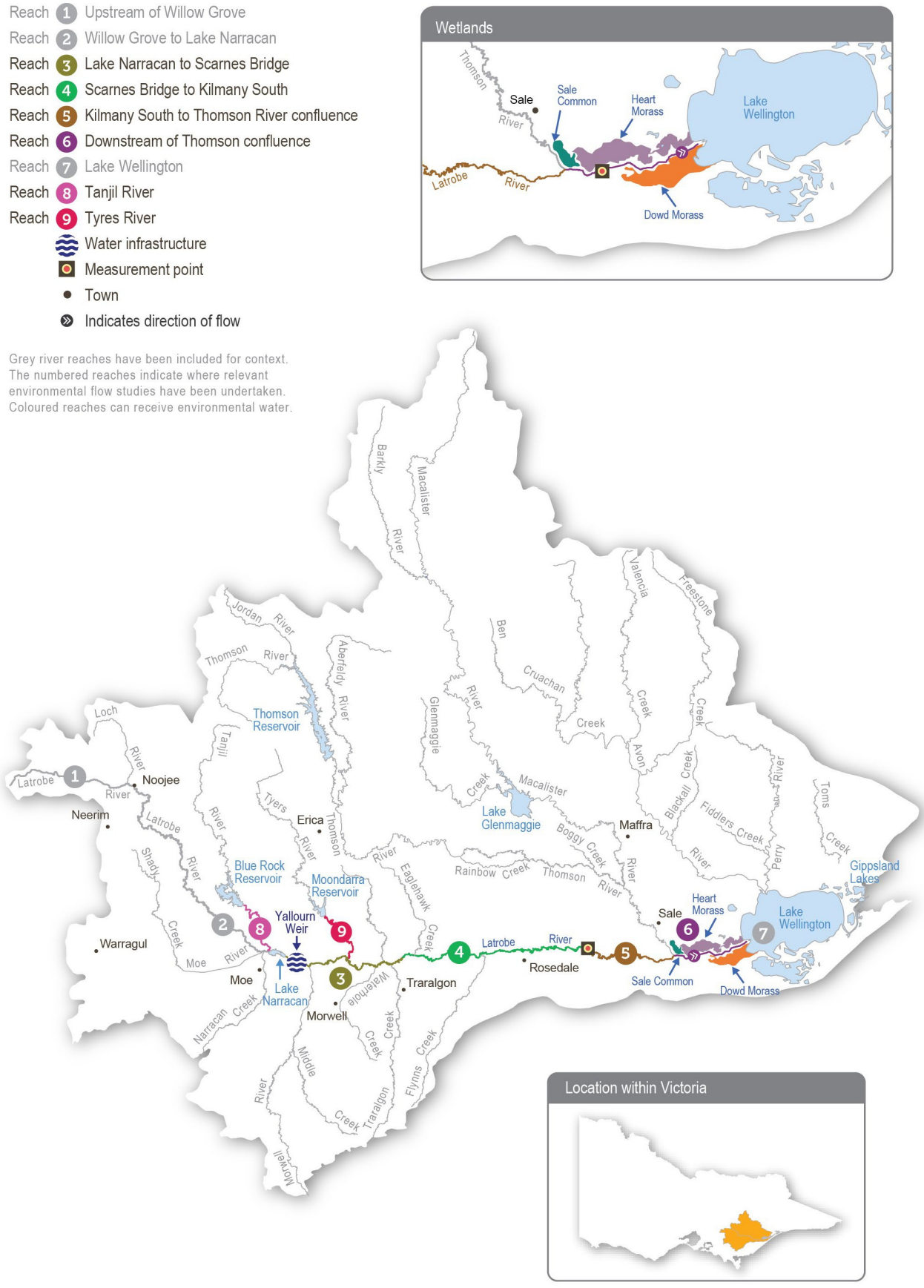
Figure 2.2.1 The Latrobe system



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Environmental values

The upper reaches of *Durt-Yowan* (Latrobe River) flow through state forest and are relatively intact and ecologically healthy. They have continuous stands of river red gums and intact streamside vegetation, and they support native animals, including barred galaxias, river blackfish, Gippsland spiny crayfish and nankeen night herons.

Durt-Yowan (Latrobe River) below Lake Narracan is regulated and highly degraded due to historic river management practices. Most large woody habitat has been removed from the river, and many sections have been artificially straightened. These practices have caused significant erosion and widened the channel, which has in turn reduced the quality and quantity of habitat for aquatic plants and animals.

Endangered and vulnerable vegetation is found in all but the most modified sections of *Durt-Yowan* (Latrobe River). The banks along the lower reaches support stands of swamp scrub, characterised by swamp paperbark and tea tree. Mature river red gums grow adjacent to the lower Latrobe wetlands and provide nesting habitat for sea eagles and other birds of prey that hunt in the wetlands. *Durt-Yowan* (Latrobe River) supports several native estuarine and freshwater fish, including black bream, Australian bass, Australian grayling and short- and long-finned eel. The river also provides habitat and supports feeding and breeding conditions for platypus, rakali (water rats) and freshwater turtles.

Durt-Yowan (Latrobe River) and its tributaries provide an essential source of freshwater to the Gippsland Lakes system, of which the lower Latrobe wetlands are an important component.

Environmental watering objectives in the *Durt-Yowan* (Latrobe River)

Icon	Environmental objectives in the Latrobe River
	Maintain or increase native fish (migratory, resident and estuary) populations
	Maintain or increase in-stream geomorphic diversity
	Maintain or improve the extent of platypus and rakali (water rats) populations
	Maintain the abundance of freshwater turtle populations
	Improve the condition and increase the extent and diversity of submerged, emergent and streamside native vegetation Reduce the extent and density of invasive plants
	Increase the abundance of all macro- and micro-invertebrates
	Avoid adverse water-quality conditions (such as high salinity) in the lower reaches of *Durt-Yowan* (Latrobe River) and its estuary

Traditional Owner cultural values and uses

The Gunaikurnai have had a continued connection to Gunaikurnai Country for over 27,000 years, including with the waterways in the Latrobe system.

For the Gunaikurnai as traditional custodians, there are immense challenges to heal, protect and manage Country, which has been drastically altered since colonisation. The Gunaikurnai see all of Country as interconnected with only separation between clan groups, not cultural landscapes of land, waterways, coasts, oceans and natural and cultural resources. The cultural landscape is dependent on culture and Aboriginal management.

Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) is working with the West Gippsland CMA to determine how to express Gunaikurnai objectives for water in a way that contributes to seasonal watering proposals from the perspective of Traditional Owners with traditional knowledge. Traditional Owners' guidance about objectives and values was received from GLaWAC via the Gunaikurnai Cultural Water Team. This engagement is planned to continue in the 2022-23 water year.

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GLaWAC is working in partnership with West Gippsland CMA to determine how cultural values and uses can be considered in planning for water for the environment. For the Latrobe system, this includes:

- undertaking Aboriginal Waterways Assessments to examine cultural values and uses and incorporating the findings of assessments into the Latrobe Environmental Water Requirements Investigation
- identifying primary objectives under the modified water regime
- expressing preliminary outcomes: watering actions that recognise and promote:
  - healthy Country
  - the importance of the Latrobe River system to the Gunaikurnai songline of pelican and musk duck and their water quality and habitat requirements
  - implementation of cultural resource management
  - waterways as meeting places, pathways and boundaries
  - preliminary accommodation of the water quality and management requirements of species with cultural values and uses.

GLaWAC is sharing with the West Gippsland CMA its knowledge of plant and animal species of cultural significance in and around the waterways of the Latrobe Valley and the importance of specific watering decisions to support them.

Watering requirements to support cultural values and uses include:

- timing the delivery of water for the environment planned in partnership with GLaWAC to support a seasonal flow regime and wet and dry periods that embody healthy Country
- maintaining freshwater supply to Latrobe estuary, Dowd Morass, Sale Common and Heart Morass, and associated freshwater habitats as the lower Latrobe wetlands are an important resource for the Gunaikurnai
- providing connectivity between reaches and onto floodplains to support dependent plants and animals with cultural values and uses of significance to the Gunaikurnai
- maintaining water quality to support the health of native plants and animals with cultural values and uses of significance to the Gunaikurnai.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 2.2.1, West Gippsland CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as fishing and water skiing)
- riverside recreation and amenity (such as birdwatching)
- socioeconomic benefits (such as commercial fishing, tourism and improved water quality for domestic, irrigation and stock use).

If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in Table 2.2.1 with the following icon.

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

West Gippsland CMA coordinates with the Lake Narracan Ski Club to plan the timing of releases of water for the environment so that they do not affect water levels in the lake during water skiing events held between January and March.

Recent conditions

The *Durt-Yowan* (Latrobe River) catchment experienced above-average temperatures throughout most of 2021-22, and above-average rainfall during winter and spring resulted in several overbank flood events and sustained high flows for most of the year. A large rain event in June 2021 caused Blue Rock Reservoir to spill, resulting in widespread flooding in the lower reaches and the estuary, with a high flow peak of 34,000 ML/d recorded at Kilmany. Due to above-average inflows and only minor use of water for the environment since 2018-19, the full environmental entitlement was available at the start of the 2021-22 water year and was sustained throughout the season.

Water for the environment was managed in line with a wet climate scenario throughout 2021-22, and all planned watering actions were met or exceeded with natural flows for the second consecutive year. These natural flows provided several large flow events that are needed to support key ecological and geomorphological processes and cannot be delivered through managed releases of water for the environment. A flow constraint in reach 5 of *Durt-Yowan* (Latrobe River) currently limits the ability to deliver the full environmental water entitlement from Blue Rock Reservoir under average-to-wet conditions, and this is the third year in a row where all deliverable flow components required for *Durt-Yowan* (Latrobe River) have been achieved with high natural flows throughout winter and spring. This has helped freshen the Latrobe estuary and enhanced environmental outcomes in all reaches.

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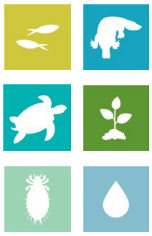
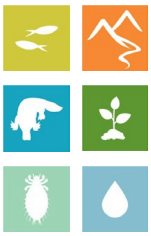
Flows over the past year have created the perfect conditions in the Latrobe estuary for fish breeding, with commercial eel fishers in the area observing estuary perch and Australian bass recruitment at a scale that many have never seen before. Fish surveys conducted in *Durt-Yowan* (Latrobe River) and its tributaries in early 2021 and 2022 detected many young-of-year tupong and Australian bass and a 25 percent reduction in the carp population since 2015. Fish ecologists from the Arthur Rylah Institute for Environmental Research advised that maintaining minimum low-flow targets throughout 2022-23 will continue to facilitate the upstream dispersal and increase the survival of new tupong recruits.

Scope of environmental watering

Table 2.2.1 describes the potential environmental watering actions in 2022-23, their expected watering effect (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 2.2.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for *Durt-Yowan* (Latrobe River)

Potential environmental watering action	Expected watering effects	Environmental objectives
***Durt-Yowan* (Latrobe River) (targeting reach 5)**		
Winter/spring low flow (620 ML/day during July to November 2022 and June 2023)	• Wet benches to maintain habitat, support the growth of emergent macrophyte vegetation and limit the encroachment of terrestrial vegetation • Maintain oxygen levels in pools and maintain sediment (sands and silts) in suspension to prevent pools from filling and depositing on substrates, helping to maintain habitat for waterbugs, turtles, aquatic mammals and breeding substrate for river blackfish • Maintain longitudinal connectivity to allow movement/dispersal of native fish, turtles, platypus and rakali (water rats)	
Summer/autumn low flow (250-380 ML/day during December to May)	• Maintain an adequate depth in pool habitat to support native fish, turtles, platypus and rakali (water rats) and submerged vegetation • Limit encroachment by terrestrial vegetation and support the growth of emergent macrophyte vegetation • Mix pools to maintain oxygen levels suitable for aquatic animals	
Summer/autumn river freshes (three to six freshes of 920 ML/day for one to five days during December to May) 	Water-quality fresh (one-day duration): • freshen water quality in pools to support fish, waterbug and zooplankton communities • provide sufficient velocity to turn over and flush sediments (sands and silts) from pools, scour algae from hard surfaces and clean fine sediment from substrates, including river blackfish nesting habitats Fish and vegetation fresh (three to five days duration): • Objectives listed for the one-day fresh and additional objectives: • wet benches to support the growth of emergent macrophyte vegetation • provide longitudinal connectivity (including over benches for Australian grayling) for native fish, platypus and rakali (water rats)	

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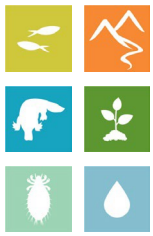
Potential environmental watering action	Expected watering effects	Environmental objectives
***Durt-Yowan* (Latrobe River) (targeting reach 6)**		
Summer/autumn estuary fresh(es) (one to three freshes of 2,200 ML/day for seven to 10 days during December to May) *Note: this is a combined magnitude with Carran Carran (Thomson River) over the equivalent period; a contribution of at least 1,280 ML/day from Carran Carran (Thomson River) is required.* 	Objectives listed for the three-to-five-day river fresh and additional objectives for the Latrobe River estuary: • upper estuary: fully flush with freshwater to support submerged vegetation, provide adequate oxygen levels for aquatic animals, transport silt, wet benches and deliver freshwater to connected wetlands • mid-estuary: partially/fully flush the upper layer of the water column to improve water quality, support emergent macrophytes, provide freshwater habitat and associated food sources for freshwater fish and provide breeding opportunities for estuary fish • lower estuary: partially flush the upper layer of the water column; a flow of this magnitude will also provide opportunities to fill the lower Latrobe wetlands	

Scenario planning

Table 2.2.2 outlines potential environmental watering and expected water use under a range of planning scenarios. The estimated water demands for planned watering actions presented in Table 2.2.2 do not account for potential unregulated flows. As seen in recent years, natural tributary inflows are likely to achieve many of the planned watering actions under wetter climate scenarios, so most or all of the tier 1a and tier 1b actions proposed for the Latrobe River under wet and possibly average scenarios should be achievable with the available supply.

Maintaining target low flows throughout the year to provide habitat and support vegetation growth, and delivering summer/autumn freshes to maintain water quality and provide specific opportunities for fish movement, are high priorities under all climate scenarios. These flows are necessary to consolidate environmental outcomes achieved on the back of wetter conditions in 2020-21 and 2021-22.

Most of the recommended flows are likely to be fully achieved through a combination of natural events, operational releases, passing flows and environmental deliveries under average and wet climate scenarios. The magnitude and duration of low flows and freshes can be lower under drought and dry climate scenarios, where the focus is on maintaining current ecological values rather than improving them. However, there will be less natural inflow and lower operational releases under drought and dry climate scenarios, and there may not be enough water for the environment to deliver all of the required watering actions, even at the lower end of their recommended range.

Under drought and dry climate scenarios, the available water for the environment will be used to deliver summer/autumn low flows and a small number of summer/autumn freshes. Summer/autumn flows are prioritised, because critically low flow at this time of year can lead to poor water quality and reduce available habitat, which in turn will threaten populations of native fish, platypus and turtles. Passing flows and natural inflows from unregulated tributaries are likely to provide some flow through the system during winter and spring. Water for the environment will only be used in winter or spring under drier climate scenarios if a lack of flow represents an immediate risk to aquatic fauna.

It is unlikely that target summer/autumn low flows will be able to be maintained continuously from December to May under a drought scenario, and up to four freshes will likely be needed to prevent adverse water-quality events in reach 5. There may only be enough supply to deliver three summer/autumn freshes under a drought scenario, and at least one of these should be delivered for three to five days to provide an opportunity for fish movement and to water native vegetation on low channel benches. More freshes with larger magnitudes and longer durations (up to 10 days) may be coordinated with flows in *Carran Carran* (Thomson River) under dry, average and wet climate scenarios to meet environmental flow objectives in the Latrobe River estuary.

There are no true carryover provisions in the Latrobe system. Rather, the VEWH maintains an ongoing share of storage capacity in Blue Rock Reservoir. Under a drought scenario, it will be important to ensure a minimum of 2,500 ML is maintained in storage at the end of 2022-23 to help deliver critical watering actions in 2023-24. Natural inflows are likely to meet some of the planned watering actions under dry to wet climate scenarios in 2022-23 and result in some leftover water at the end of the year. This leftover water will help support potential watering actions in 2023-24, and no specified carryover target has been set or prioritised for those scenarios.

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Table 2.2.2 Potential environmental watering for *Durt-Yowan* (Latrobe River) under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• Small contributions to low flows from unregulated reaches and tributaries • Passing flows reduced, more likely over summer/autumn	• Possible spills from storages in spring, minor flood levels may occur • Some natural flows contributing to low flows and freshes • Passing flows may be reduced, more likely over summer	• Regular spills from storages in spring, and minor to moderate flood levels may occur • Natural flows and/or passing flows likely to meet low-flow requirements	• Large and frequent spills from storages, and moderate to major flood levels may occur • Natural flows and/or passing flows likely to meet low-flow requirements
Expected availability of water for the environment	• 18,700 ML	• 20,700 ML	• 25,700 ML	• 33,700 ML
Potential environmental watering – tier 1 (high priorities)	Tier 1a (can be achieved with predicted supply)			
	• Summer/autumn low flow (partially delivered) • Summer/autumn river freshes (two of lower duration, one of mid-duration [four days])	• Summer/autumn low flow • Summer/autumn river freshes (four of lower duration and two of mid-duration [three days]) • Replace one mid-duration summer/autumn river fresh with an estuary fresh, if conditions allow	• Winter/spring low flow (continuous) • Summer/autumn low flow • Summer/autumn river fresh (one of lower duration and three of mid-duration [four days]) • Replace all mid-duration summer/autumn river freshes with estuary freshes, if conditions allow	• Winter/spring low flow • Summer/autumn low flow • Summer/autumn river fresh (one of lower duration and three of upper-duration [five days]) • Replace all mid-duration summer/autumn river freshes with estuary freshes, if conditions allow
	Tier 1b (supply deficit)			
	• Winter/spring low flow (lower duration) • Summer/autumn low flow (continuous) • Tier 1a mid-duration summer/autumn river fresh replaced with a summer/autumn estuary fresh (delivered for seven days) • One additional summer/autumn river fresh (of lower duration)	• Winter/spring low flow (lower duration) • One additional summer/autumn estuary fresh	• N/A	
Potential environmental watering – tier 2 (additional priorities)	• N/A			

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Possible volume of water for the environment required to achieve objectives	• 16,200 ML (tier 1a) • 28,300 ML (tier 1b)	• 14,400-20,400 ML (tier 1a) • 13,400 ML (tier 1b)	• 7,400-27,200[1] ML (tier 1a)	• 8,600-15,200 ML (tier 1a)

Planning scenario	Drought	Dry	Average	Wet
Priority carryover requirements for 2023-24	• 2,500 ML	• 0 ML		

1 While the upper demand is in excess of available supply, it is expected that some of the events will be at least partially met with natural inflows under an average scenario

2.2.2 Lower Latrobe wetlands

System overview

The lower Latrobe wetlands (Dowd Morass, Heart Morass and Sale Common) are an important component of the internationally recognised Gippsland Lakes Ramsar site and provide habitat for a variety of waterbirds of state, national and international conservation significance. The wetlands are located on the floodplain of *Durt-Yowan* (Latrobe River) between its confluence with *Carran Carran* (Thomson River), and they form part of the Gippsland Lakes system.

River regulation and water extraction from *Durt-Yowan* (Latrobe River), *Carran Carran* (Thomson River) and *Wirn wirndook Yeerung* (Macalister River) have reduced the frequency of small- and medium-sized floods that naturally wet the lower Latrobe wetlands. Construction of levees and drains and the filling of natural depressions have also altered water movement into and through the wetlands. The drainage and flooding regime in all three wetlands is now managed to some extent with regulators connected to *Durt-Yowan* (Latrobe River).

Environmental values

Sale Common is one of only two remaining freshwater wetlands in the Gippsland Lakes system. It provides sheltered feeding, breeding and resting habitat for a large range of waterbirds, including the Australasian bittern.

Dowd Morass is a large, brackish wetland that regularly supports rookeries of colonial nesting waterbirds, including Australian white ibis, straw-necked ibis, little black and little pied cormorants, royal spoonbills and great egrets.

Heart Morass is also a large brackish wetland, with open expanses providing shallow feeding habitat for waterbirds including black swans, Eurasian coots and a variety of ducks, including the musk duck.

Together, the lower Latrobe wetlands function as a diverse and complementary ecological system. Colonial nesting waterbirds breed among swamp paperbark trees at Dowd Morass in spring. Migratory shorebirds feed on the mudflats that are exposed as the wetlands draw down and dry over summer. Waterfowl and fish-eating birds use open-water habitat at the wetlands year-round. The wetlands also support threatened vegetation communities, including swamp scrub, brackish herbland and aquatic herbland.

Environmental watering objectives in the lower Latrobe wetlands

Icon	Environmental objectives in the lower Latrobe wetlands
	Maintain the abundance of frog populations
	Maintain the abundance of freshwater turtle populations
	Maintain or restore a variety of self-sustaining submerged and emergent aquatic vegetation types Maintain or restore the diversity, condition and/or extent of native streamside vegetation fringing wetlands Discourage the introduction and reduce the extent and density of undesirable/invasive plants (Sale Common)
	Maintain or enhance waterbird breeding, recruitment, foraging and sheltering opportunities
	Provide suitable physio-chemical conditions to support aquatic life Avoid catastrophic water-quality conditions (such as acid sulfate soil exposure) (Heart Morass)

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Traditional Owner cultural values and uses

The Lower Latrobe wetlands are a place of spiritual and cultural connection for the Gunaikurnai people. Over many thousands of years, customs and lore have been passed orally between generations about the cultural values and uses of the wetlands and their importance to all Gunaikurnai people. The wetlands are on the lands of the Brayakaulung clan of the Gunaikurnai.

For the Gunaikurnai, the overarching objective for the wetlands is to provide and maintain healthy Country. Healthy Country includes the importance of place and the health of the entire ecosystem, including maintaining water quality, controlling pest species and maintaining a natural, seasonal flow regime and overbank flood events.

Environmental objectives for the delivery of water for the environment for the lower Latrobe wetlands should take a cultural landscape approach.

Watering requirements to support cultural values and uses include:

- timing the delivery of water for the environment planned in partnership with the Gunaikurnai Land and Waters Corporation (GLaWAC) to support a seasonal flow regime and wet and dry periods that embody healthy Country
- maintaining freshwater supply to the Latrobe River estuary, Dowd Morass, Sale Common and Heart Morass and associated freshwater habitats
- providing connectivity between reaches and onto floodplains and maintaining water quality to support cultural values and uses of significance to the Gunaikurnai.

The wetlands support many keystone species important to the Gunaikurnai, and *boran* (pelican) and *tuk* (musk duck) are the mother and father in the Gunaikurnai creation story. If *boran* and *tuk* are living and breeding at the wetlands, it is a sign Country is healthy. If they are not, flows should be provided to promote required habitat and ecosystem services.

Other birds are important for *woorngan* (hunting) and food, including *nalbong* (water hens), *gidai* (black swans), *boyangs* (eggs) and *koortgan* (ducks except for tuk). *Gidai* require submerged and softer emergent vegetation to make nest mounds, placing them on a small island or floating them in deeper water. *Gidai* breed in late winter to early spring after the water level rises. Actions that fill the large wetlands and support the growth of *loombrak* (water ribbon) and submerged aquatic plants will support *gidai*. Ensuring that the lower wetlands and floodplain depressions (for example, billabongs) receive freshwater flows in winter/spring will provide the conditions for submerged and emergent aquatic plants to grow and provide food and nesting materials for the waterbirds.

GLaWAC is developing a vision for the wetlands that aligns with GLaWAC's *Gunaikurnai Whole-of-Country Plan*. Key aspects of the vision include:

- **healthy Country:** reflecting the spiritual and cultural values of the Gunaikurnai custodians; healthy Country contributes to the well-being of the Gunaikurnai
- **water access:** access to water is crucial for many cultural values, including identity and relational values, future economic values and place values, among many others. Access to water, through ownership or management, means water made available to the Gunaikurnai on the Latrobe system and the Thomson system that provides freshwater to the wetlands. Every effort should be made to maintain freshwater-dependent values, which in turn deliver cultural values
- **cultural and economic use:** returning to cultural practices and Gunaikurnai-informed management at the lower Latrobe wetlands is key to returning to a more freshwater habitat for cultural uses and cultural species. It will also provide for water-based tourism, cultural education and ecotourism (camping) experiences
- **connection:** GLaWAC takes its responsibility very seriously to work closely with the people it represents on management decisions concerning Country and the health of Country. Gunaikurnai cultural obligations reflect Gunaikurnai views on healthy Country and, in turn, help the Gunaikurnai continue their ongoing connection to the land and waters of Country
- **climate change:** the Gunaikurnai have cared for Country for thousands upon thousands of years, through many cycles of climatic change, and they understand how to manage the landscape as it too changes. When cared for using traditional knowledge, Country can be healed. Mitigation of climate change factors affecting the lakes, rivers and other waterways of the lower Latrobe wetlands can be effective with resources and empowerment provided to the Gunaikurnai.

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 legislative and policy commitments, including 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 2.2.3 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 their contribution and indicating progress towards deeper involvement.

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

GLaWAC and West Gippsland CMA are exploring opportunities to enhance environmental flows with Gunaikurnai outcomes in the lower Latrobe wetlands. In 2022-23, this is planned to include a jointly managed Gunaikurnai event to deliver water for the environment in Dowd Morass.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 2.2.3, West Gippsland CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing and fishing)
- riverside recreation and amenity (such as birdwatching, camping and duck hunting)
- socioeconomic benefits (such as commercial eel and carp fishing).

Recent conditions

The Latrobe catchment experienced above-average temperatures throughout most of 2021-22 and above-average rainfall during early winter and throughout spring (in particular during November) 2021 for a second consecutive year. Significant flooding occurred in June 2021 and was followed by several smaller floods in late winter and spring. These floods, as well as other high-flow events in the Latrobe, Macalister and Thomson rivers, flushed the lower Latrobe wetlands for the first time since 2010-11, and salinity in Lake Wellington was at its lowest since 2004.

Environmental flows at the lower Latrobe wetlands were managed in line with a wet climate scenario in 2021-22. All planned watering actions were fully achieved with a combination of natural overbank flows and managed deliveries of water for the environment through inlet-regulating structures. It was the second consecutive year that all planned watering actions had been met, following relatively dry conditions in 2018-19 and 2019-20.

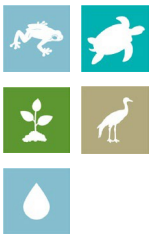
Routine monitoring at the wetlands detected improved water quality and vegetation condition at all sites as well as extensive growth of water-dependant eel grass, and there was evidence of successful breeding of green and golden bell frogs at Heart Morass. According to one anecdotal report, the level of frog breeding at Heart Morass was the highest in 30 years. More than 300 colonial waterbird nests, including royal spoonbills, little black cormorants, pied cormorants and Australian darter, were observed at Dowd Morass, making it the largest breeding event since the 2010-11 floods. Delivery of water for the environment in 2022-23 aims to build on the achievements of 2020-21 and 2021-22 and continue to enhance high-priority environmental values and support key ecohydrological functions.

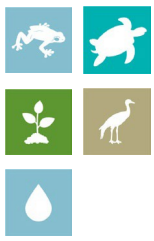
Scope of environmental watering

Table 2.2.3 describes the potential environmental watering actions in 2022-23, their expected watering effect (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 2.2.3 Potential environmental watering actions, expected watering effects and associated environmental objectives for the lower Latrobe wetlands

Potential environmental watering action	Expected watering effects	Environmental objectives
Sale Common		
Top-up (anytime, following bird breeding event if required)	• Prolong wetting of reed beds to maintain habitat and food resources for nesting waterbirds and protect chicks from predators	
Partial fill (in July to August[1] with top-ups as required to maintain water depth of at least 0.3 m AHD and surface coverage year-round)	• Encourage the growth and flowering of semi-aquatic plants • Provide appropriate wetland habitat for frogs and turtles • Provide conditions that support waterbug communities and food resources for waterbirds	

Potential environmental watering action	Expected watering effects	Environmental objectives
Fill (with top-ups as required during August to November to maintain a water depth of 0.4 m AHD for two months)	• Wet the outer boundaries of the wetland to support the growth and flowering of streamside and fringing wetland plants, increasing foraging opportunities for waterbirds • Encourage bird and turtle breeding by providing nesting habitat • Provide connectivity between the river and wetlands and increase habitat and feeding opportunities for frogs and turtles	
Trigger-based fill or top-up to 0.5 m AHD (during December to January, if required to drown out invasive vegetation)	• Wet key habitats within the wetland for a sufficient duration to discourage invasive plants, particularly the excessive spread of giant rush	
Partial drawdown (during December to March)	• Oxygenate sediments to enable aquatic vegetation germination and recruitment • Provide water level fluctuations for emergent vegetation reproduction and expansion (particularly swamp scrub and tall marsh) • Break down organic matter and promote nutrient cycling • Expose mudflats and create shallows to facilitate waterbird foraging	
Dowd Morass		
Top-up (any time, following bird breeding event if required)	• Prolong wetting of reed beds to maintain habitat and food resources for waterbirds and protect chicks from predators, following an observed breeding event	
Fill to control salinity (anytime)	• Dilute salt concentrations within the wetland that may be caused by king tides from Lake Wellington (likely occurring between March to May) or other sources • This watering action is likely to be triggered[1] if electrical conductivity is rising and reaches 7,000 µS/cm	
Partial fill (with top-ups as required to maintain surface coverage during July to December 2022 and April to June 2023[2]) 	• Provide seasonal variation in water depth throughout the wetland to support the growth and flowering of semi-aquatic plants • Wet vegetation and soils at middle elevations within the wetland to increase the abundance of waterbugs and other food resources for frogs, turtles and waterbirds • Provide connectivity between the river and wetlands and between wetlands, increasing available habitat for frogs and turtles • Support bird breeding (when delivered in spring/early summer following earlier fill) by maintaining wetted habitat around reed beds	
Fill (with top-ups as required to maintain water depth of 0.6 m AHD during August to November)	• Wet reed beds and deep water next to reedbeds to provide waterbird nesting habitat and stimulate bird breeding • Wet high-elevation banks and the streamside zone to support vegetation growth, creating nesting habitat for waterbirds • Wet vegetation and soils at higher elevations to stimulate ecosystem productivity and increase the abundance of waterbugs and other food resources for frogs, turtles and waterbirds • Provide connectivity between the river and wetlands and between wetlands, increasing available habitat and food resources for frogs and turtles • Reduce the impact of saltwater incursion from Lake Wellington	
Partial drawdown (during January to March)	• Oxygenate sediments to enable aquatic vegetation germination and recruitment • Provide water level fluctuations for emergent vegetation reproduction and expansion (particularly swamp scrub and tall marsh) • Break down organic matter and promote nutrient cycling • Expose mudflats and create shallows to facilitate waterbird foraging	

Potential environmental watering action	Expected watering effects	Environmental objectives
Heart Morass		
Top-up to permanently maintain water level above -0.3 m AHD (anytime)	• Minimise the risk of acid sulfate soils developing by keeping known high-risk areas wet • Respond to decreasing pH from the rewetting of exposed acid sulfate soils (most likely during high-wind events) • Dilute salt concentrations within the wetland that may be caused by king tides from Lake Wellington or other sources. This watering action is likely to be triggered3 if wetland overtopping appears likely; based on rising water levels at Lake Wellington (reaching or exceeding +0.5 m AHD)	
Top-up (anytime, following bird breeding event if required)	• Prolong wetting of reed beds to maintain habitat and food resources for waterbirds and protect chicks from predators, following an observed breeding event	
Fill and partial flushing flow (during July to November[4])	• Wet high-elevation banks and streamside zone to support vegetation growth, create nesting and foraging habitat for waterbirds and provide food resources for terrestrial birds • Provide connectivity between the river and wetlands and between wetlands, increasing available habitat and providing food resources for frogs and turtles • Export accumulated salts and sulfates and allow the import and export of nutrients, dissolved organic carbon and seed dispersal between *Durt-Yowan* (Latrobe River) and Heart Morass	
Partial fill (with top-ups as required to maintain a minimum water depth of 0.3 m AHD during August to December[1])	• Support the growth and flowering of semi-aquatic plants • Provide appropriate wetland fringing habitat for frogs and turtles • Provide conditions that support waterbug communities and food resources for frogs, turtles and waterbirds	
Partial drawdown (during January to March)	• Oxygenate sediments to enable aquatic vegetation germination and recruitment • Provide water level fluctuations for emergent vegetation reproduction and expansion (particularly swamp scrub and tall marsh) • Break down organic matter and promote nutrient cycling • Expose mudflats and create shallows to facilitate waterbird foraging	

1 If the salinity level in the Latrobe River exceeds 15,000 µS/cm, a fill will not be provided.
2 This is the likely timing under a drought scenario. Note, under an average or wet scenario, a fill event may occur during this period, as detailed in Table 2.2.4.
3 If the salinity level in the Latrobe River exceeds 10,000 µS/cm, a top-up will not be provided.
4 If a partial flushing flow is not possible until the end of November, top-ups will be provided to maintain a fill with a minimum water depth of 0.5 m AHD.

Scenario planning

Table 2.2.4 outlines potential environmental watering and expected water use under a range of planning scenarios.

The main priority for environmental flows at the lower Latrobe wetlands in 2022-23 will be to fill each wetland as much as possible in winter/spring and prevent complete drying over summer and autumn. The proposed watering actions aim to consolidate environmental outcomes from 2020-21 and 2021-22 to further enhance recovery from extended drying in 2018-19 and 2019-20 and build ecosystem resilience ahead of future dry periods. The wetlands can only be filled when water levels and water quality in the lower reaches of *Durt-Yowan* (Latrobe River) are suitable, and therefore the timing and extent of water delivery will be heavily influenced by natural climatic conditions and flow in *Durt-Yowan* (Latrobe River). It is likely that only partial fills will be possible under a drought scenario, and natural overbank floods are likely at any time of year under a wet scenario. Trigger-based inflows to address a potential acid sulfate soil risk, support a natural waterbird breeding event or control invasive vegetation will be delivered when needed and possible, even if the timing of these actions compromises other planned wetting or partial drawdown events. Specific watering plans for each wetland under different climate scenarios are described below.

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Sale Common

The minimum aim for Sale Common is to partially fill the wetland in winter and provide top-ups as needed to maintain water levels above 0.3 m AHD throughout the year, which will wet about half of Sale Common. Maintaining at least a partial fill is considered ecologically important to support wetland plant communities (which experienced near-complete drying in 2018-19 and 2019-20) and provide habitat for frogs, turtles and waterbirds. This is likely to be the maximum water level achieved under a drought scenario.

Providing a fill to the wetland for at least two months from late winter or early spring is a high priority where possible to connect the wetland to *Durt-Yowan* (Latrobe River), stimulate recruitment of plant communities at the outer margins of the wetland and provide nesting habitat for breeding waterbirds. This is likely to be achieved under average and wet scenarios, and it may be achieved under a dry scenario if there is sufficient flow and water quality in *Durt-Yowan* (Latrobe River) at the required time.

The wetland will be allowed to draw down naturally over the warmer months, although there may be limited drawdown under average and wet climate scenarios. Facilitated drawdown (via opening regulator gates) is not proposed in 2022-23 unless it is deemed necessary, such as to control the excess proliferation of carp. If climatic conditions only allow a limited drawdown in 2022-23, the wetland may be actively drawn down in 2023-24 to facilitate nutrient cycling and other dry-phase ecosystem processes.

Dowd Morass

The plan at Dowd Morass is to fill or partly fill the wetland in winter and spring, then allow a controlled partial drawdown in summer. Top-ups would be provided as needed to support waterbird breeding and from April to June 2022 to prevent water levels from dropping below 0.3 m AHD and so increase available habitat for frogs and turtles by maintaining connectivity between the river and wetlands. A partial fill will support some vegetation outcomes and help maintain habitat and food for waterbirds, frogs and turtles. Achieving a complete fill at Dowd Morass is a lower priority in 2022-23, but it may occur naturally via overbank flows from *Durt-Yowan* (Latrobe River) in an average and wet climate scenario. A partial drawdown is planned in summer and autumn under drought and dry scenarios to support a wider range of wetland vegetation communities and facilitate carbon and nutrient cycles, but it may be limited under average and wet scenarios if there is significant local rainfall or high flows in *Durt-Yowan* (Latrobe River).

Heart Morass

Acidity and salinisation represent a high risk to environmental values at Heart Morass, and maintaining water levels above -0.3 m AHD at all times is a high priority to avoid exposing potential acid sulfate soils. Heart Morass was fully flushed in 2021-22, which removed accumulated salt and sulphides and reduced the immediate risk of acid sulfate soils. Flushing flows are likely to occur again in 2022-23 under wet and possibly average climate scenarios, but they will not be delivered without a natural flood. The preferred watering strategy under drought and dry scenarios involves providing a partial fill to the wetland from winter to early summer and maintaining water levels above -0.3 m AHD for the rest of the year. The partial fill in winter and spring will support established wetland plant communities and provide additional habitat and food for frogs, turtles and waterbirds. The partial drawdown in summer and autumn will expose shoreline habitat to increase the diversity of vegetation communities, allow nutrient cycling and provide foraging habitat for shorebirds. Significant drawdown is unlikely under an average or wet climate scenario.

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Table 2.2.4 Potential environmental watering for the lower Latrobe wetlands under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river and wetland conditions	• No natural inflow from *Durt-Yowan* (Latrobe River), and wetlands are likely to dry completely	• Minor natural inflow from *Durt-Yowan* (Latrobe River) in winter/ spring; expect moderate to substantial drying in summer	• Moderate winter/ spring flow in *Durt-Yowan* (Latrobe River) is likely to fill or partially fill the wetlands; expect minor drying in summer	• Major flow in *Durt-Yowan* (Latrobe River) in winter/spring and possibly autumn/ winter is likely to fill all wetlands with very little drying in summer
Sale Common				
Potential environmental watering – tier 1 (high priorities)[1]	• Top-up (any time, following bird breeding) • Partial fill (with top-ups as required) • Trigger-based fill or top-up to 0.5 m AHD (during December to January, if required) • Partial drawdown (during December to March)	• Top-up (any time, following bird breeding) • Fill (with top-ups as required during August to November) • Partial fill (with top-ups as required) • Trigger-based fill or top-up to 0.5 m AHD (during December to January, if required) • Partial drawdown (during December to March)	• Top-up (any time, following bird breeding) • Fill (with top-ups as required during August to November) • Trigger-based fill or top-up to 0.5 m AHD (during December to January, if required) • Partial fill (with top-ups as required during December to June) • Partial drawdown (during December to March) if triggered	
Dowd Morass				
Potential environmental watering – tier 1 (high priorities)[1]	• Top-up (any time, following bird breeding) • Fill (any time to control salinity) • Partial fill (with top-ups as required in August to December and April to June) • Partial drawdown (during January to March)		• Top-up (any time, following bird breeding) • Fill (any time to control salinity) • Partial fill (with top-ups as required in July and April to June) • Fill (with top-ups as required during August to November)	
Heart Morass				
Potential environmental watering – tier 1 (high priorities)[1]	• Top-up (any time to permanently maintain water level above -0.3 m AHD) • Top-up (any time, following bird breeding) • Partial fill (with top-ups as required during August to December) • Partial drawdown (during December to March)		• Top-up (any time to permanently maintain water level above -0.3 m AHD) • Top-up (any time, following bird breeding) • Fill and partial flushing flow (during July to November)	

1 Potential environmental flows at the lower Latrobe wetlands are not classified as tier 1a, tier 1b or tier 2 because there is no limitation on the volume of water that can be supplied to the site from *Durt-Yowan* (Latrobe River). Water can be diverted to the lower Latrobe wetlands at any time of the year when flows are above -0.7 m AHD at *Durt-Yowan* (Latrobe River) at the Swing Bridge gauging station.

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2.3 Thomson system

Waterway manager – West Gippsland Catchment Management Authority

Storage managers – Melbourne Water (Thomson Reservoir), Southern Rural Water (Cowwarr Weir)

Environmental water holder – Victorian Environmental Water Holder

System overview

***Carran Carran* (Thomson River) flows from the slopes of the Baw Baw Plateau to join *Durt-Yowan* (Latrobe River) south of Sale (Figure 2.3.1). The major tributaries of *Carran Carran* (Thomson River) are the Aberfeldy and Jordan rivers in the upper reaches and *Wirn wirndook Yeerung* (Macalister River) in the lowest reach. Most natural flow originates from the Aberfeldy River. Two major structures regulate flow on *Carran Carran* (Thomson River): Thomson Reservoir — the largest water supply storage for metropolitan Melbourne — and Cowwarr Weir — a regulating structure that supplies irrigation water to parts of the Macalister Irrigation District.**

Thomson Reservoir harvests most of the flow from the upper catchment of *Carran Carran* (Thomson River) and has a significant effect on the flow in all downstream reaches. The natural flow from the Aberfeldy River, which meets *Carran Carran* (Thomson River) below Thomson Reservoir, is essential for providing natural freshes and high flows in *Carran Carran* (Thomson River).

Water for the environment is held in the Thomson Reservoir and released into the river as required. Reach 3 of *Carran Carran* (Thomson River) (from the Aberfeldy River confluence to Cowwarr Weir) is the highest priority for delivery of water for the environment due to its heritage river status, high-value native streamside vegetation, high-quality in-stream habitat and low abundance of exotic fish species.

At Cowwarr Weir, *Carran Carran* (Thomson River) splits into the old *Carran Carran* (Thomson River) course (reach 4 a) and Rainbow Creek (reach 4b) (see Figure 2.3.1). Passing flows throughout the year are split two-thirds down reach 4 a and one-third down 4b to avoid impacts to irrigators located on Rainbow Creek. Water for the environment is primarily delivered to the old *Carran Carran* (Thomson River) course (reach 4 a) to support fish migration because Cowwarr Weir impedes fish movement through Rainbow Creek.

The Heyfield wetlands is a cluster of pools located between *Carran Carran* (Thomson River) and the township of Heyfield. Due to the construction of levees and weirs along *Carran Carran* (Thomson River), river water rarely enters the wetlands; and while the largest pool receives stormwater from the Heyfield township, smaller ponds rely on rainfall or pumped water for the environment to maintain environmental values. These values include wetland plant communities that have been planted as part of a comprehensive revegetation program in recent years.

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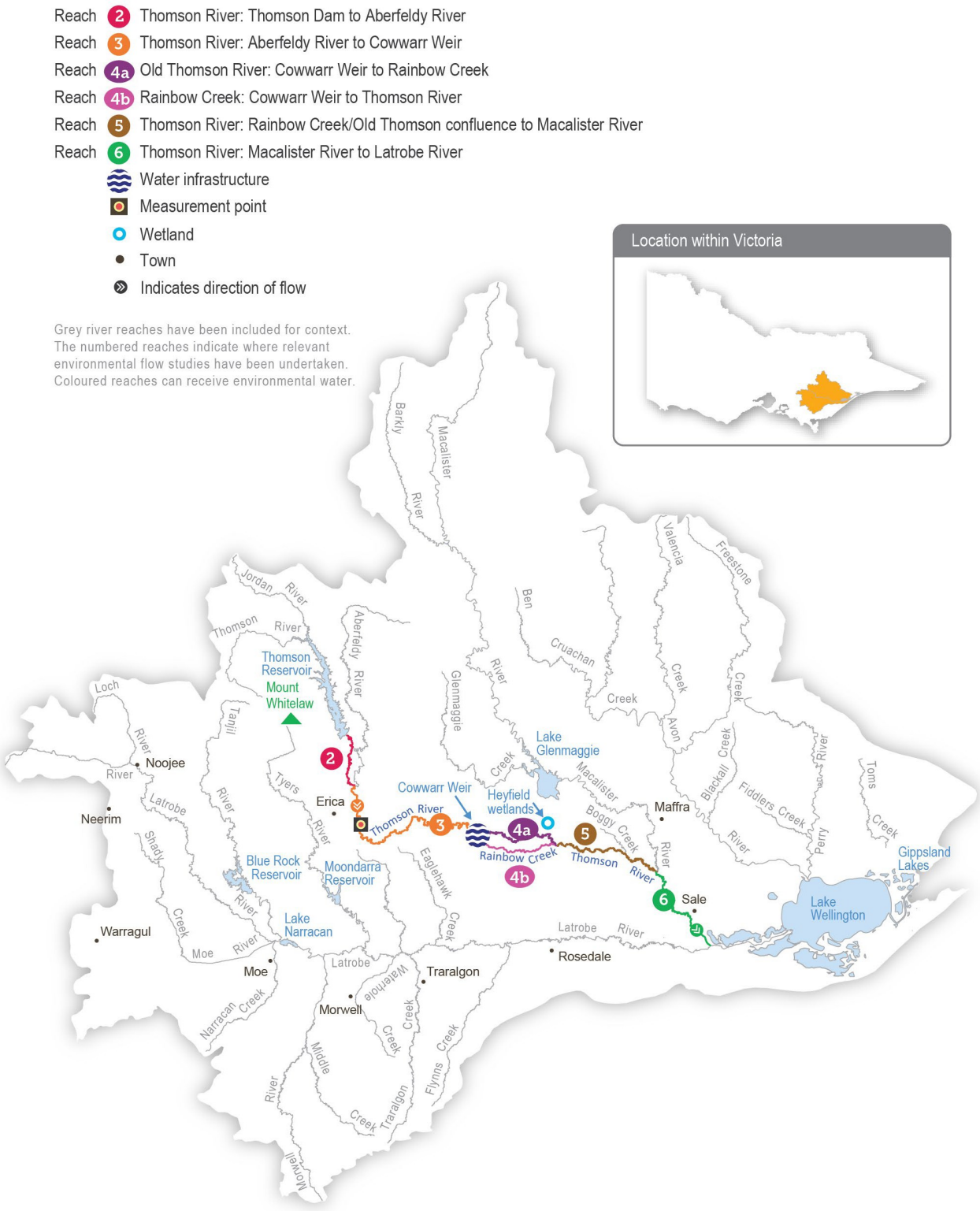
Figure 2.3.1 The Thomson system



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Environmental values

Carran Carran (Thomson River) supports native species of migratory fish that need to move between the sea and freshwater environments to complete their life cycles, including Australian grayling, tupong, short- and long-finned eel, Australian bass and pouched and short-headed lamprey. A focus for environmental flows management is the Australian grayling, which is listed as a threatened species in Victoria. Australian grayling spawn in response to autumn freshes, and the larvae and juveniles spend time at sea before returning to the freshwater sections of coastal rivers.

The composition and condition of streamside vegetation vary throughout the Thomson River catchment. The vegetation is intact and in near-natural condition above Thomson Reservoir in the Baw Baw National Park. Streamside vegetation between Thomson Reservoir and Cowwarr Weir is mostly in good condition but is affected by exotic weeds, including blackberry and gorse. Below the Cowwarr Weir, the vegetation is degraded due to stock access and widespread weed invasion.

The Heyfield wetlands are one of the few remaining freshwater wetland sites in the Gippsland Plains landscape area. They provide habitat for aquatic and terrestrial animals, including threatened migratory birds that prefer shallow, slow-moving waterbodies.

Environmental watering objectives in the Thomson system

Icon	Environmental objectives in the Thomson system
	Restore populations of native fish, specifically Australian grayling Maintain/enhance the structure of native fish communities
	Maintain the existing frog population and provide suitable habitat
	Maintain or enhance the physical form of the channel to provide a variety of channel features and habitats for aquatic animals Maintain or enhance river function by maintaining substrate condition and enabling carbon cycling
	Increase the abundance of platypus
	Maintain and restore the structural diversity and appropriate distribution (zonation) of streamside vegetation along the riverbank and reduce terrestrial encroachment/invasion (*Carran Carran* [Thomson River]) Increase the recruitment and growth of native in-stream, fringing and streamside vegetation (*Carran Carran* [Thomson River]) Maintain the existing vegetation and promote the growth and establishment of semi-aquatic species (Heyfield wetlands) Enhance the resilience of semi-aquatic species (Heyfield wetlands)
	Maintain the natural invertebrate community
	Provide freshwater habitat for migratory and non-migratory wetland birds within the Gippsland Plains landscape
	Improve water quality in the Thomson River estuary

Traditional Owner cultural values and uses

The Gunaikurnai have had a continued connection to Gunaikurnai Country for over 27,000 years, including with the waterways in the Latrobe system, into which *Carran Carran* (Thomson River) feeds. For the Gunaikurnai as Traditional Owners, there are immense challenges to heal, protect and manage Country which has been drastically altered since colonisation. The Gunaikurnai see all of Country as interconnected with only separation between clans, not cultural landscapes of land, waterways, coasts, oceans and natural and cultural resources. The cultural landscape is dependent on culture and Aboriginal management.

The Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) is working with the West Gippsland CMA to determine how to express Gunaikurnai objectives for water in a way that contributes to seasonal watering proposals from the perspective of traditional custodians with traditional knowledge. This has included GLaWAC membership on the Steering Committee and Project Advisory Group for the 2020 review of the *Carran Carran* (Thomson River) FLOWS study and GLaWAC membership of the newly formed Thomson and Latrobe Environmental Water Advisory Groups (EWAGs).

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GLaWAC cultural water officers have recently completed an Aboriginal Waterways Assessment on *Carran Carran*, and they are assessing how to document, protect and further the river's cultural values and uses. Traditionally, *Carran Carran* was an important meeting place and a place to camp. Today, most of *Carran Carran* is inaccessible to the Gunaikurnai, making it difficult to meet and yarn along the river.

Assessments for watering requirements of *Carran Carran* for the Gunaikurnai have been based on cultural indicators, including:

- the condition of the lower Latrobe wetlands (which *Carran Carran* helps supply)
- the condition and prevalence of plants and animals with cultural values and uses
- species known to be indicators of water quality, water regimes and healthy Country.

GLaWAC is sharing with the West Gippsland CMA its knowledge of plant and animal species of cultural significance in and around the waterways of the Latrobe Valley and the importance of specific watering decisions to support them.

Watering requirements to support cultural values and uses include:

- timing of deliveries of water for the environment planned in partnership with GLaWAC to support a seasonal flow regime and wet and dry periods that embody healthy Country
- maintaining freshwater supply to the Latrobe River estuary, Dowd Morass, Sale Common and Heart Morass, and associated freshwater habitats; the lower Latrobe wetlands are an important resource for the Gunaikurnai
- providing connectivity between reaches and onto floodplains to support dependent plants and animals with cultural values and uses of significance to the Gunaikurnai
- maintaining water quality to support the health of native plants and animals with cultural values and uses of significance to the Gunaikurnai.

West Gippsland CMA engaged with the GLaWAC Cultural Water Team on watering priorities for 2022-23.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 2.3.1, West Gippsland CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as kayaking, canoeing, fishing and swimming)
- riverside recreation and amenity (such as birdwatching, camping, hiking and duck hunting)
- community events and tourism (such as community education, events at the Heyfield wetlands and visitation by locals and non-locals)
- socioeconomic benefits (such as maintaining bankside vegetation and preventing erosion and the potential loss of private and public land).

If the timing or management of planned environmental flows may be modified to align with a community benefit, this is acknowledged in Table 2.3.1 with the following icons.

	Watering planned to support water sports activities (canoeing and kayaking)
	Watering planned to support peaks in visitation

Autumn, winter and spring freshes in *Carran Carran* (Thomson River) create ideal white water rafting conditions for kayakers and canoers. The timing of environmental flows may be adjusted to optimise opportunities to support these recreation activities, where it does not compromise environmental outcomes. For example, a fresh that aims to cue the migration of Australian grayling and other native fish may be timed to coincide with recreation events or holiday periods when people take advantage of the white water rafting conditions. Kayaking and rafting activities have inherent risks, and large environmental flows are ramped up and down over several days to avoid sudden changes in water levels that may affect river users. The West Gippsland CMA also provides notification of planned large releases of water for the environment to alert river users about potential increases in the water level and velocity.

Interested community members can register on the West Gippsland CMA website to receive notification of upcoming watering events.

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Recent conditions

The Thomson River catchment had average to above-average rainfall and above-average temperatures throughout much of 2021-22. A significant rainfall event in June 2021 caused major flooding, with flow peaking at 74,000 ML/d upstream of Cowwarr Weir. Two other separate natural bankfull flows in spring also helped to achieve environmental objectives that cannot be achieved with managed releases of water for the environment. High rainfall throughout winter and spring boosted inflows to Thomson Reservoir and provided significant increases to allocations. Most water for the environment for the Thomson system is allocated up-front at the start of the water year, with additional allocation throughout the year based on inflows to Thomson Reservoir.

Delivery of water for the environment in the Thomson system was managed according to a wet scenario in 2021-22, and all the high priority (tier 1) planned environmental flows were met. Natural flows from the Aberfeldy River helped to achieve or exceed environmental flow recommendations in reach 3 of the Thomson River throughout most of the year. Water for the environment was used during 2021-22 to deliver a spring fresh of 800 ML per day for seven days in late October to encourage the recruitment of juvenile migratory fish species, a summer fresh of 350 ML per day for seven days to maintain and support the growth of aquatic and fringing vegetation, and an autumn fresh of 800 ML per day for seven days to trigger the migration of adult and juvenile native fish. Significant rainfall across the catchment filled the Heyfield wetlands in winter, eliminating the need for planned environmental water deliveries. Water levels in the wetlands were maintained throughout spring, providing habitat for waterbirds, frogs and turtles.

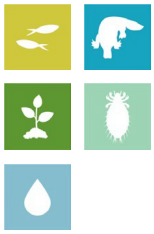
Water for the environment that was not used in 2021-22 will be carried over to support watering actions in 2022-23 or beyond. However, Thomson Dam was 90 percent full in May 2022, and if high rainfall continues over winter and spring 2022, some of the carried-over water may be forfeited (in line with entitlement rules) if the dam operator needs to make spill releases.

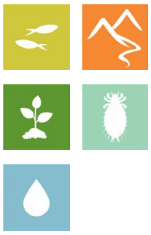
The Thomson River catchment has had wetter-than-average conditions for the past two years, which have delivered many large flow events. Fish surveys conducted in the middle and lower reaches of the Thomson River have detected Australian grayling, river blackfish and the strong recruitment of tupong. These results highlight the importance of spring and autumn freshes, which support the spawning and recruitment of migratory native fish species. Tupong were also detected upstream of the newly constructed Horseshoe Bend fishway in 2021 and 2022, indicating fish are migrating upstream and using the fishway to access habitat in the upper reaches of the Thomson and Aberfeldy rivers.

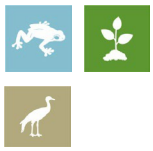
Scope of environmental watering

Table 2.3.1 describes the potential environmental watering actions in 2022-23, their expected watering effect (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 2.3.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Thomson system

Potential environmental watering action	Expected watering effects	Environmental objectives
***Carran Carran* (Thomson River) (targeting reach 3)**		
Winter/spring/autumn low flow (125-350 ML/day during July to November 2021 and April to June 2022)	• Maintain a minimum level of habitat and maintain water quality in pools and riffles for waterbugs and fish (when delivered at 125 ML/day); habitat availability and condition are increased when delivered at greater magnitudes • Regulate the water temperature and wet large woody debris to provide food and shelter for waterbugs and fish • Maintain sufficient water depth to facilitate platypus and fish movement between localised habitats and increase foraging opportunities (further enhanced when delivered at greater magnitudes) • Wet low-lying benches (when delivered at greater magnitudes) to prevent encroachment by invasive plants and permit seed dispersal Additional benefits to the Thomson River estuary (reach 6) are expected when provided at 350 ML/day magnitude: • partially flush the upper water column, helping to sustain waterbug communities and fish by maintaining oxygen levels • prevent high salinity levels, helping to maintain emergent macrophyte vegetation • provide freshwater to the Latrobe system	

Potential environmental watering action	Expected watering effects	Environmental objectives
Spring fresh(es) (one to two freshes of 800-900 ML/day for five to seven days during September to November)  	• Trigger the migration of adult and juvenile native fish (in particular, the upstream migration of juvenile Australian grayling and Australian bass from marine/estuarine habitats) • Improve and maintain streamside vegetation by inundating the benches and providing variable water levels for plant zonation • Carry plant seeds from the upper catchment for deposition downstream • Deposit fine particulate sediments on the benches and prevent pools from infilling • Scour substrates to remove accumulated fine sediment and biofilms to improve habitat and food for waterbugs Additional benefits to Thomson River and its estuary (reach 6) are expected when provided at 900 ML/day magnitude: • wet vegetation on higher benches • partially flush the upper water column in the Thomson River estuary, helping to sustain waterbug communities and fish by maintaining oxygen levels • prevent high salinity levels, helping to maintain emergent macrophyte vegetation • provide freshwater to the Latrobe system	
Summer/autumn low flow (125 ML/day during December to March)	• Maintain habitat and water quality in pools and riffles for waterbugs and fish • Facilitate localised movement between habitat types for small-bodied native fish and platypus • Prevent encroachment into the in-stream channel by invasive plants	
Summer/autumn fresh(es) (one to two freshes of 230-350 ML/day for seven days during December to March)	• Wet aquatic and fringing vegetation to maintain its condition and support its growth • Wet low-lying benches to prevent encroachment by invasive plants and enable vegetation zonation • Provide velocity and depth diversity and prevent sediment smothering by fine sediments When delivered in February-March (at 230 ML/day), the fresh also aligns with and supports native fish movement: • trigger downstream migration of adult short- and long-finned eel and upstream movement of juvenile Australian bass • increase the water depth over riffles to facilitate local movement between habitats for large-bodied native fish	
Autumn freshes (two freshes of 800 ML/day for five to seven days during April to May)	• Trigger the migration of adult and juvenile native fish, in particular: • the downstream migration and spawning of adult Australian grayling (April) • the downstream migration of adult tupong and upstream migration of adult and juvenile Australian bass (May) • Carry plant seeds and propagules from the upper catchment for deposition downstream and help maintain zonation of vegetation • Prevent infilling of pools by mobilising fine sediments and depositing them on existing bars and benches to provide substrate for vegetation • Scour substrates to remove accumulated fine sediment	

Potential environmental watering action	Expected watering effects	Environmental objectives
Heyfield wetlands		
Fill (in August)	• Wet ponds to capacity to stabilise the banks and support the spring growth of semi-aquatic vegetation • Provide freshwater habitat for waterbirds and frogs (such as growling grass frogs and golden bell frogs)	
Top-ups as required to maintain water level (during September to December)	• Top up ponds before summer to maintain vegetation and enhance recruitment by triggering seed release • Maintain habitat for waterbirds and frogs (such as growling grass frogs and golden bell frogs)	
Partial drawdown (during December to February)	• Oxygenate surface soils, break down accumulated organic matter and cycle nutrients • Enhance waterbird food availability by exposing the mudflats and providing access to burrowing invertebrates	

Scenario planning

Table 2.3.2 outlines potential environmental watering and expected water use under a range of planning scenarios.

It is important to deliver a mix of low flows and freshes throughout the year in *Carran Carran* (Thomson River), but the magnitude, duration and frequency of these events will generally be lower under drought and dry climate scenarios than under average and wet scenarios. However, a large carryover from 2021-22 and forecast high allocations at the start of 2022-23 mean the available supply of water for the environment will likely be high under all climate scenarios, which may allow flows to be delivered at greater-than-normal rates under the dry and drought scenarios. The estimated water demands for planned watering actions presented in Table 2.3.2 do not account for potential unregulated flows. As seen in recent years, natural tributary inflows are likely to achieve many of the planned watering actions under wetter climate scenarios, and therefore, most or all of the tier 1a and tier 1b actions proposed for the Thomson River under wet and possibly average scenarios should be achievable with available supply.

Under all climate scenarios, the highest-priority watering actions for *Carran Carran* (Thomson River) are 800 ML per day freshes in autumn and spring (in October/November), which target migratory fish movement into or out of the system. These events are essential to cue the spawning and recruitment of the threatened Australian grayling population and other native migratory fish species, which have shown positive signs of recruitment over the last two years. These events are necessary every year under average and wet climate scenarios to ensure regular recruitment and to align with environmental cues in the broader landscape. They are generally less important in dry or drought scenarios, but they are considered important to deliver even under drier conditions in 2022-23 to consolidate recent population growth and to potentially supplement populations in east Gippsland that were affected by the 2019-20 bushfires. Where possible, the spring and autumn freshes may be timed to coincide with long weekends to provide additional recreational benefits for river users. Two autumn freshes will likely be delivered under all climate scenarios, but under drought and dry scenarios, the duration may be reduced from seven to five days to conserve water. Freshes that last for five days are expected to trigger some fish migration, although total fish movement is likely to be less than for a seven-day fresh. Providing an additional 800-900 ML per day fresh in September is important under all scenarios to support vegetation outcomes, but there is unlikely to be enough water for the environment to actively deliver these events in drought or dry climate scenarios. It will be important to deliver two summer/autumn freshes under all climate scenarios to clear fine silt and biofilms from in-stream habitat and facilitate the movement of native fish and platypus.

Delivery of low flows throughout the year is expected to change, depending on the climate scenario. A flow of 125 ML per day in reach 3 is the target magnitude from December to March, and it is the minimum recommended flow between May and November. This flow magnitude is expected to be delivered with operational passing flows under all climate scenarios. Increasing the low-flow magnitude up to 350 ML per day between July and November and April to June is preferred under all climate scenarios, to improve outcomes for fringing and streamside vegetation. If water for the environment is limited under drier scenarios, the low flow may likely only be raised in July (to 300 ML per day) and May to June (to 230 ML per day) to help fish and platypus move throughout the reach at critical breeding and dispersal times.

The recommended water regime for the Heyfield wetlands is the same under all climate scenarios to help recently planted semi-aquatic and terrestrial fringing plants to establish and promote natural recruitment. Water for the environment will likely be needed to fill and top up the wetlands under drought and dry climate scenarios. Natural run-off is likely to meet some or all of the recommended watering actions at the Heyfield wetlands under average and wet climate scenarios.

Under all climate scenarios, a minimum of 2,600 ML is prioritised for carryover into 2022-23 to meet critical early-season, low-flow requirements in *Carran Carran* (Thomson River).

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Table 2.3.2 Potential environmental watering for the Thomson system under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• Passing flow and limited natural flow from Aberfeldy River and other tributaries contribute to low flow • A large volume of consumptive water is released from storage	• Passing flow and natural flow from Aberfeldy River and other tributaries contribute to low flow and some freshes • A moderate volume of consumptive water is released from storage	• Passing flow and natural flow from Aberfeldy River and other tributaries contribute to low flow and periods of high flow and freshes • A small volume of consumptive water is released from storage	• Natural flow from Aberfeldy River and other tributaries is expected to meet most low-flow requirements, provide large freshes and sustained high flow • Minimal volume of consumptive water released from storage
Expected availability of water for the environment	• 25,000-28,000 ML	• 28,000-31,000 ML	• 31,000-34,000 ML	• 34,000-37,000 ML
***Carran Carran* (Thomson River) (targeting reach 3)**				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Winter/spring/ autumn low flow (partially delivered: 300 ML/day in July 2022, 230 ML/ day in June 2023 and 125 ML/day at other times) • Spring fresh (one fresh, of lower duration and magnitude) • Summer/autumn low flow • Summer/autumn freshes (two freshes, one at upper, one at lower magnitude) • Autumn freshes (two freshes, one of lower duration [in May])	• Winter/spring/ autumn low flow (partially delivered: 300 ML/day in July 2022 and 230 ML/ day in May to June 2023 and 125 ML/ day at other times) • Spring fresh (one fresh, of longer duration but lower magnitude) • Summer/autumn low flow • Summer/autumn freshes (two freshes, one at upper, one at lower magnitude) • Autumn freshes (two freshes)	• Winter/spring/ autumn low flow (partially delivered: 300 ML/day in July 2022 and 350 ML/d in May to June 2023 and 125 ML/day at other times) • Spring fresh (one fresh, of longer duration but lower magnitude) • Summer/autumn low flow • Summer/autumn freshes (two freshes, one at upper, one at lower magnitude) • Autumn freshes (two freshes)	• Winter/spring/ autumn low flow (partially delivered: at 350 ML/day in July 2022 and April to June 2023 and 125 ML/day at other times) • Spring freshes (two freshes, of longer duration but lower magnitude) • Summer/autumn low flow • Summer/autumn freshes (two freshes, of upper magnitude and duration) • Autumn freshes (two freshes)

Planning scenario	Drought	Dry	Average	Wet
	Tier 1b (supply deficit)			
	• Winter/spring/ autumn low flow (at 350 ML/day during July to November 2022) • Spring freshes (two freshes [one replacing tier 1a fresh], delivered of longer duration and one additional spring fresh of longer duration and lower magnitude) • Autumn fresh (tier 1a fresh delivered of longer duration [in May])	• Winter/spring/ autumn low flow (at upper magnitude continuously) • Spring fresh (one additional fresh, of longer duration and lower magnitude)	• Winter/spring/ autumn low flow (at upper magnitude continuously) • Spring fresh (one additional fresh, of longer duration and lower magnitude) • Summer/autumn freshes (deliver both tier 1a freshes at upper magnitude)	• Winter/spring/ autumn low flow (at upper magnitude continuously) • Spring fresh (one tier 1a fresh at upper magnitude)
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Heyfield wetlands				
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Fill (in August) • Top-ups (two, in September-December) • Partial drawdown (during December to February)			
	Tier 1b (supply deficit)			
	• N/A			
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 21,000 ML (tier 1a) • 22,500 (tier 1b)	• 26,000 ML (tier 1a) • 25,700 ML (tier 1b)	• 33,400 ML (tier 1a) • 21,200 ML (tier 1b)	• 43,500 ML[1] (tier 1a) • 14,600 ML (tier 1b)
Priority carryover requirements for 2023-24	• 2,600 ML			

1 While the demand is in excess of available supply, it is expected that some of the events will be at least partially met with natural inflows under a wet scenario.

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2.4 Macalister system

Waterway manager – West Gippsland Catchment Management Authority

Storage manager – Southern Rural Water

Environmental water holder – Victorian Environmental Water Holder

System overview

***Wirn wirndook Yeerung* (Macalister River) flows from Mt Howitt in the Alpine National Park and joins *Carran Carran* (Thomson River) south of Maffra (Figure 2.4.1). The river winds its way in a south-easterly direction through mostly forested, confined valleys and narrow floodplains above Lake Glenmaggie. The downstream reaches flow through wide alluvial floodplains that have been cleared for agriculture. The Wellington River and Glenmaggie Creek are the main tributaries of *Wirn wirndook Yeerung* (Macalister River).**

Lake Glenmaggie is the major water-harvesting storage regulating *Wirn wirndook Yeerung* (Macalister River). Maffra Weir is a small diversion weir located further downstream in Maffra.

Before the construction of Lake Glenmaggie, *Wirn wirndook Yeerung* (Macalister River) would regularly receive high and medium flows in winter and spring. Although Lake Glenmaggie regularly spills, high flows are less frequent than natural because much of the water is captured by the storage. A notable impact of irrigation and water-harvesting is reversed seasonality of flows between Lake Glenmaggie and Maffra Weir. Summer flows through this reach are much greater than natural due to the delivery of irrigation water. Winter flows in this reach are lower than natural because a high proportion of the inflows are captured, and there are no irrigation demands over winter. Most irrigation water is diverted at Maffra Weir, and flow downstream of the weir is lower than natural year-round. The changed hydrology restricts fish migration, limits the growth and recruitment of in-stream and streamside plants and reduces the quality of in-stream habitat.

Water for the environment is stored in Lake Glenmaggie and released to *Wirn wirndook Yeerung* (Macalister River). The river is divided into two reaches for the purposes of managing environmental flows: Lake Glenmaggie to Maffra Weir (reach 1) and Maffra Weir to *Carran Carran* (Thomson River) (reach 2).

Maffra Weir is a major barrier to fish movement along the river, so delivery of water for the environment for migratory fish objectives mainly focuses on reach 2. All other objectives apply to both reaches 1 and 2.

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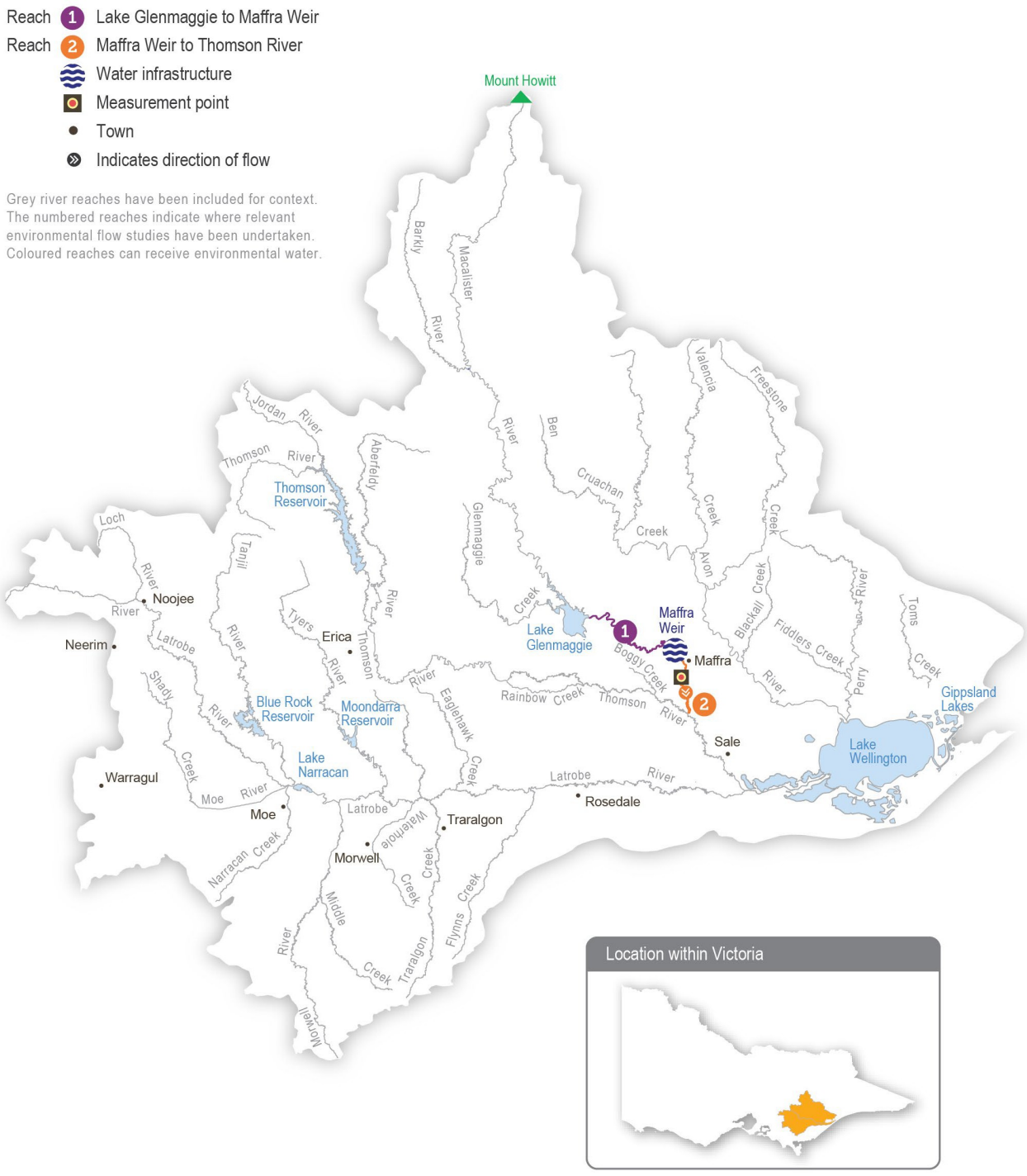
Figure 2.4.1 The Macalister system



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Environmental values

Seven migratory native fish species move between *Wirn wirndook Yeerung* (Macalister River), the estuary and the sea to complete their life cycle. These species include the Australian grayling, short-finned eel, long-finned eel, tupong, Australian bass, short-headed lamprey and common galaxias. Yellow-eye mullet, which is an estuarine species, has been recorded in the river. Platypus and rakali (water rats) are widely distributed through *Wirn wirndook Yeerung* (Macalister River) and its tributaries.

The streamside vegetation corridor along the regulated reaches of *Wirn wirndook Yeerung* (Macalister River) is fragmented. Immediately below Lake Glenmaggie, the vegetation is in good condition and includes remnant river red gums and good-quality stands of shrubs, particularly in areas where revegetation has occurred in combination with stock exclusion. Further downstream, the vegetation is degraded. In recent years, the cover of in-stream vegetation has declined, which may be due to a combination of increased water turbidity, erosion and a lack of an appropriate water regime to encourage plant growth. The cover of non-woody plants (such as reeds, sedges and rushes) along the fringes of the river is patchy.

Environmental watering objectives in the Macalister system

Icon	Environmental objectives in the Macalister system
	Increase the distribution, recruitment and abundance of all native fish, and increase opportunities for the spawning and recruitment of native migratory fish (such as the Australian grayling)
	Improve and maintain the form of the riverbank and bed to provide physical habitat for aquatic animals and plants
	Increase the abundance of platypus and rakali (water rats)
	Improve native emergent (non-woody) and fringing (woody) vegetation in the streamside zone Reinstate submerged aquatic vegetation
	Increase the abundance and number of functional groups of waterbugs

Traditional Owner cultural values and uses

“Traditionally, the Macalister River is a very important river to the Gunaikurnai people. It is a pathway that connects from the Alps to the heart of Gippsland. It is a pathway to ceremonial grounds and a known, special men’s place to Elders. Its traditional name is *Wirn wirndook Yeerung*, which translates to ‘song of the male fairy wren’.

“*Yeerung* is the men’s totem. This river has many cultural resources and extensive important sites along the whole system.”

The Gunaikurnai have had a continued connection to Gunaikurnai Country for over 27,000 years, including with the waterways in the Latrobe system (into which *Wirn wirndook Yeerung* [Macalister River] feeds). For the Gunaikurnai as Traditional Owners, there are immense challenges to heal, protect and manage Country, which has been drastically altered since colonisation. The Gunaikurnai see all of Country as interconnected with only separation between clan groups, not cultural landscapes of land, waterways, coasts, oceans and natural and cultural resources. The cultural landscape is dependent on culture and Aboriginal management.

The Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) is working with the West Gippsland CMA to determine how to express Gunaikurnai objectives for water in a way that contributes to seasonal watering proposals from the perspective of traditional custodians, with traditional knowledge.

GLaWAC expressed that more water needs to go down *Wirn wirndook Yeerung* (Macalister River) between Lake Glenmaggie and Lake Wellington, to improve water quality, including the threat of salinity, and to support plants and animals with cultural values and uses.

The timing of watering events has also been raised by GLaWAC. This includes providing increased water depth to promote downstream fish migration and spawning, deeper water pools to prevent water-quality degradation, and more variation in water levels to better mimic natural conditions.

Traditionally the landscape – which includes *Wirn wirndook Yeerung* (Macalister River), anabranches and associated floodplains – has been a rich source of food, medicine and resources for the Gunaikurnai people. In the area, there are many sites of cultural significance near the river and around Lake Glenmaggie. The Gunaikurnai have moved through the landscape along the waterways for thousands of years, sourcing food and plants along the way.

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From the perspective of the Gunaikurnai, the land and waterways flowing to the Gippsland Lakes are interconnected and cannot be considered separately where decisions made can impact downstream. The lower Latrobe wetlands and the rivers that feed them, including *Wirn wirndook Yeerung* (Macalister River), have important cultural significance to the Gunaikurnai.

Watering requirements to support cultural values and uses include:

- timing the delivery of water for the environment planned in partnership with GLaWAC to support a seasonal flow regime and wet and dry periods that embody healthy Country
- maintaining freshwater supply to the Latrobe River estuary, Dowd Morass, Sale Common and Heart Morass, and associated freshwater habitats. The lower Latrobe wetlands are an important resource for the Gunaikurnai
- providing connectivity between reaches and onto floodplains to support dependent plants and animals with cultural values and uses of significance to the Gunaikurnai
- maintaining water quality to support the health of native plants and animals with cultural values and uses of significance to the Gunaikurnai.

West Gippsland CMA engaged with the GLaWAC Cultural Water Team about watering priorities for 2022-23.

Social, recreational and economic values and uses

In planning the potential watering actions in Table 2.4.1, West Gippsland CMA considered how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing, kayaking and swimming)
- riverside recreation and amenity (such as fishing)
- socioeconomic benefits (such as preventing erosion and the potential loss of private and public land).

Recent conditions

Rainfall and temperatures in the Macalister catchment were above average throughout most of 2021-22, with periods of very much above-average rainfall in spring 2021. It was the second consecutive year of naturally wet conditions. Strong inflows to Lake Glenmaggie in July 2021 saw the storage quickly fill and spill, and there were multiple bankfull flow events above 4,000 ML/d in reaches 1 and 2. Allocations of high-reliability water shares opened at 100 percent, and low-reliability water share allocations reached 100 percent by March 2022. Carryover from 2020-21 was lost when Lake Glenmaggie spilled, but there was a sufficient supply of water for the environment to meet planned demands.

Delivery of water for the environment in the Macalister system was managed according to a wet climate scenario throughout 2021-22. All planned watering actions for 2021-22 were met, mainly through a combination of natural and operation flows. Water for the environment is expected to be used to help deliver an autumn fresh to cue fish migration and facilitate fish passage.

Wet conditions throughout Gippsland in 2020 provided ideal breeding conditions for many native fish, and large numbers of young-of-year tupong were detected in the Macalister River in March 2021. Follow-up fish surveys in February 2022 also found large numbers of juvenile tupong and older fish, which indicates conditions in 2021 contributed to high survival rates and the second year of successful breeding. These results show that the Macalister River continues to provide important habitat for coastal migratory fish species within the Gippsland region.

Scope of environmental watering

Table 2.4.1 describes the potential environmental watering actions in 2022-23, their expected watering effect (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.

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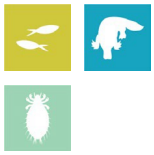
Table 2.4.1 Potential environmental watering actions, expected watering effects and associated environmental objectives for the Macalister system

Potential environmental watering action	Expected watering effects	Environmental objectives
***Wirn wirndook Yeerung* (Macalister River) (targeting reach 2)[1]**		
Winter/spring low flow (300 ML/day for at least 120 days during July to November 2022 and June 2023)	• Provide permanent wetted habitat for waterbugs and maintain water depth over riffles to enable fish passage between local habitats • Provide sustained wetting of low-level benches to limit the encroachment of terrestrial vegetation	
Spring fresh (one fresh of 700 ML/day for five days during September to November)	• Cue the upstream migration of adult fish (e.g. short-headed lamprey) and the recruitment of juveniles (e.g. Australian grayling, tupong, common galaxias, Australian bass and short- and long-finned eels) from marine/ estuarine environments • Wet mid-level benches to water woody vegetation, limit the encroachment of terrestrial vegetation and facilitate the dispersal of emergent and fringing vegetation seeds and propagules throughout the reach	
Spring/summer fresh following spill (one fresh peaking at 1,500-1,800 ML/day for three to 10 days during September to December)	Shape the recession of a 1,500 ML/day or 3,000 ML/day spill to: • wet mid- and higher-level benches to water emergent and woody vegetation and move organic matter into the channel to transport food resources downstream • provide flow with sufficient shear stress to scour biofilms and flush fine sediment from pools and small gaps in the substrate to improve geomorphic habitat and food resources for waterbugs • cue the upstream migration of adult fish (e.g. short-headed lamprey) and the recruitment of juveniles (e.g. Australian grayling, tupong, common galaxias, Australian bass and short- and long-finned eels) from marine/ estuarine environments	
Spring/summer low flow (60-90 ML/day during September to February)	• Maintain the water depth in pools and hydraulic habitat for native fish • Maintain permanent wetted habitat in pools and riffles for waterbugs • Provide longitudinal connectivity for local movement of platypus and rakali (water rats), as well as protection from predation, access to food sources and maintenance of refuge habitats Note: At 90 ML per day, expected watering effects are met in reach 1 and 2. At 60 ML per day, expected watering effects are met in reach 2 only.	
Trigger-based summer/ autumn low flow (40-60 ML/day for five to 13 days during December to May) *Trigger: extended periods of reduced passing flow or no flow being released from Lake Glenmaggie*	• Maintain permanent wetted habitat in pools and riffles for fish and waterbugs to survive • Provide shallow, slow-flowing habitat to maintain in-stream vegetation • Maintain a minimum depth in pools to allow for turnover of water and to slow degradation of water quality to support aquatic life	
Summer/autumn fresh(es) (one to three freshes of 140 ML/day for three to five days during December to March)	• Increase water depth to allow fish to move throughout the reach • Flush pools to maintain water quality for aquatic animals • Flush substrates and improve the quality of existing waterbug habitat and food supply • Wet low benches to facilitate the dispersal of seeds and propagules from emergent vegetation throughout the reach • Provide flow with sufficient shear stress to flush fine sediment from small gaps to improve geomorphic habitat	

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Potential environmental watering action	Expected watering effects	Environmental objectives
Autumn fresh (one fresh of 350 ML/day for five days during April to May)	• Cue the downstream migration of Australian grayling towards the estuary for spawning • Additional benefits for *Carran Carran* (Thomson River) and the Latrobe system are expected when delivered for greater than three days: • fully flush the upper Thomson River estuary when delivered for greater than three days and combined with freshes in *Carran Carran* (Thomson River), and contribute freshwater to the lower reaches of *Durt-Yowan* (Latrobe River) and wetlands	
Autumn/winter low flow (60-90 ML/day during March to August)	• Maintain pool and riffle habitat for waterbugs and a minimum depth over riffles to allow fish (e.g. Australian grayling, tupong and Australian bass) to migrate downstream towards the estuary habitat to spawn or breed • Provide connectivity throughout the river for the local movement of platypus and rakali (water rats) as well as protection from predation and access to food • Provide low-velocity flow and clear water to enable the establishment of submerged vegetation Note: At 90 ML per day, expected watering effects are met in reach 1 and 2. At 60 ML per day, expected watering effects are met in reach 2 only.	
Autumn/winter fresh (one fresh of 700 ML/day for five days during July to August 2022 or May to June 2023)	• Cue the downstream migration towards the estuary of Australian bass for spawning and of tupong for breeding • Increase the wetted area and improve water quality by flushing pools, providing habitat and conditions for waterbugs • Wet low and mid-level benches to facilitate the dispersal of emergent and fringing vegetation seeds and propagules throughout the reach	

1 All freshes target reach 2 specifically. Low flows target both reach 1 and 2, but the magnitudes targeted apply to both reaches.

Scenario planning

Table 2.4.2 outlines potential environmental watering and expected water use under a range of planning scenarios.

Providing year-round low flows to maintain habitat connectivity for aquatic animals in *Wirn wirndook Yeerung* (Macalister River) is the highest-priory watering action under all climate scenarios. Year-round operational passing flows of 60 ML per day will meet the minimum low-flow objectives for reach 2. Increasing flows to 90 ML per day has additional benefits for environmental values in reach 1 and is therefore preferred. It is expected to be achieved under all scenarios unless carryover from 2021-22 is lost due to managed spill releases, and it may cause a deficit in supply for the remaining priorities, which is possible under average and wet scenarios. If this occurs, increasing the magnitude to 90 ML per day will only be prioritised in November after the delivery of a spring fresh and during mid-April to mid-August, when water from the upper catchment is harvested to fill Lake Glenmaggie, and little to no consumptive orders on top of the operational passing flow are released downstream. Low flows delivered at the upper end of the recommended range aim to provide more habitat and food to help grow waterbug, fish and platypus populations and exclude terrestrial vegetation from the main channel.

Under a wet scenario, increasing the low flow to 300 ML per day during winter and spring is preferred to wet the lower benches over a sustained period. The estimated water demand for this action presented in Table 2.4.2 does not account for potential unregulated flows. As seen in recent years, natural tributary inflows are likely to achieve many of the planned watering actions under wetter climate scenarios, so most or all of the tier 1a and tier 1b actions proposed for the Macalister River under the wet scenario should be achievable with the available supply.

Under drought and dry climate scenarios, low inflows to Lake Glenmaggie may trigger reduced operational passing flows any time over summer and autumn. Maintaining low flows of at least 60 ML per day is the target under all scenarios, but if that cannot be achieved under drought or dry scenarios, water for the environment may be used to deliver trigger-based low flows of 40 ML per day for five to 13 days and then a summer/autumn fresh. This combination of actions aims to avoid a serious water-quality outcome and the loss of environmental values — regular water quality monitoring would occur if that was likely — while also conserving available supply. Additional summer/autumn freshes may be provided under average and wet climate scenarios.

Delivering at least one fresh of 350 ML per day in autumn and 700 ML per day in spring (both for five days) is a high priority under all climate scenarios to provide a migration trigger for native fish to move into or out of the system to complete their life cycles. An additional 700 ML per day fresh may be delivered in late autumn or winter to increase fish migration. These events are necessary every year under average and wet climate scenarios to ensure regular recruitment and align with environmental cues in the broader landscape. They are generally less important in dry our drought scenarios, but they are important

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to deliver even under drier conditions in 2022-23 to consolidate recent population growth and to potentially supplement populations in east Gippsland that were affected by the 2019-20 bushfires. Several other large freshes are recommended to slow the recession following spills from Lake Glenmaggie, but they are a lower priority and will likely be at least partly met by operational releases under most scenarios.

Under all climate scenarios, a minimum of 1,900 ML is prioritised for carryover into 2023-24 to meet critical early-season low-flow requirements in *Wirn wirndook Yeerung* (Macalister River).

Table 2.4.2 Potential environmental watering for the Macalister system under a range of planning scenarios

Planning scenario	Drought	Dry	Average	Wet
Expected river conditions	• Limited natural flow; freshes or high flows are unlikely • Passing flows at Maffra Weir may be reduced	• Possible spills from Lake Glenmaggie in spring, minor flood levels may occur • Passing flows at Maffra Weir may be reduced	• Regular spills from Lake Glenmaggie in spring, minor to moderate flood levels may occur	• Large and frequent spills from Lake Glenmaggie, moderate to major flood levels may occur
Expected availability of water for the environment	• 21,700 ML	• 25,000 ML[1]	• 27,000 ML[1]	• 31,500 ML[1]
Potential environmental watering – tier 1 (high priorities)	**Tier 1a (can be achieved with predicted supply)**			
	• Spring fresh (one fresh) • Spring/summer low flow (partial: delivered at upper magnitude in November only, following fresh) • Trigger-based summer/autumn low flow • Summer/autumn fresh (one fresh, of lower duration) • Autumn fresh (one fresh) • Autumn/winter low flow • Autumn/winter fresh (one fresh)	• Spring fresh (one fresh) • Spring/summer low flow • Trigger-based summer/autumn low flow • Summer/autumn fresh (one fresh, of lower duration) • Autumn fresh (one fresh) • Autumn/winter low flow • Autumn/winter fresh (one fresh)	• Spring fresh (one fresh) • Spring/summer low flow[2] • Spring/summer fresh following 1,500 ML/d spill (one fresh)[3] • Summer/autumn freshes (three freshes) • Autumn fresh (one fresh) • Autumn/winter low flow[2] • Autumn/winter fresh (one fresh)	• Spring fresh (one fresh) • Spring/summer low flow[2] • Spring/summer fresh following 3,000 ML/d spill (one fresh) • Summer/autumn freshes (three freshes) • Autumn fresh (one fresh) • Autumn/winter low flow[2] • Autumn/winter fresh (one fresh)
	Tier 1b (supply deficit)			
	• Spring/summer low flow (upper magnitude continuous)	• N/A		• Winter/spring low flow
Potential environmental watering – tier 2 (additional priorities)	• N/A			
Possible volume of water for the environment required to achieve objectives	• 18,200 ML (tier 1a) • 4,000 ML (tier 1b)	• 21,800 ML (tier 1a)	• 25,200 ML (tier 1a)	• 24,100 ML (tier 1a) • 28,800 ML (tier 1b)
Priority carryover requirements for 2023-24	• 1,900 ML			

1 Carryover from 2021-22 may be forfeited in the event of spill releases from Lake Glenmaggie.
2 Continuous delivery is a tier 1a action unless carryover is lost to spill. If this occurs, delivering the low flow at the upper magnitude is prioritised from July to August 2022, November 2022 and April to June 2023 (60 ML per day at other times).
3 Tier 1a action unless carryover lost to spill: this action will not be prioritised if there is insufficient supply.

2.5 Snowy system

Waterway managers – East Gippsland Catchment Management Authority and New South Wales Department of Planning and Environment

Storage manager – Snowy Hydro Limited

Environmental water holders – Victorian Environmental Water Holder and New South Wales Department of Planning and Environment

System overview

The Snowy River originates on the slopes of Mount Kosciuszko. It drains the eastern slopes of the Snowy Mountains in New South Wales before flowing through the Snowy River National Park in Victoria and into Bass Strait (Figure 2.5.1).

There are four major dams and multiple diversion weirs in the upper Snowy River catchment that capture and divert water to the Murrumbidgee and Murray River valleys. The hydrological effects of the Snowy Mountains Scheme are substantial, but they are partly alleviated by the contribution of flows from tributaries (such as the Delegate River in NSW and the Buchan and Brodribb rivers in Victoria).

The construction and operation of the Snowy Mountains Hydro-electric Scheme previously diverted 99 percent of the Snowy River's mean annual natural flow at Jindabyne. The loss of flow changed the structure and function of the river, reduced the opening of the Snowy River entrance to Bass Strait and resulted in a decline in environmental values.

The Victorian, NSW and Commonwealth governments agreed to recover some of the water and in 2002 delivered the first environmental flow to the Snowy River below Jindabyne Dam to help restore the damage done by decades of limited flow. The Victorian share of water for the environment available for use in the Snowy system is held in the Victorian Murray, Goulburn and Loddon systems. The NSW share of water for the environment available for use in the Snowy system is held in the NSW Murray and Murrumbidgee systems. Collectively, the water is made available for environmental flows in the Snowy River via a substitution method, whereby water for the environment allocated in Victoria and NSW replaces water that was earmarked for transfer from the Snowy to Victoria and NSW to support irrigation demands. The NSW Department of Planning and Environment plans environmental flows in the Snowy River in consultation with the Snowy Advisory Committee. The committee includes representatives of the Aboriginal community, local community, the Victorian Government, NSW Government and environmental experts. The committee brings together local knowledge and expert advice to help inform the management and delivery of water for environmental outcomes.

The water year in the Snowy system runs from 1 May to 30 April, and the daily flow regime is planned in advance by the Snowy Advisory Committee. Water for the environment is delivered daily to the Snowy River below Jindabyne Dam. The annual allocation of water for the environment varies based on water availability, rainfall and inflows. Environmental releases aim to deliver an average of 212,000 ML per year, the equivalent to 21 percent of the average annual natural flows before the construction of the Jindabyne Dam.

Environmental values

Environmental values in the upper reaches and tributaries of the Snowy River include water-dependant plants and animals, including freshwater native fish (such as river blackfish and Australian grayling), platypus and frogs. The lower reaches support estuary perch and Australian bass that move between saltwater and freshwater systems. The estuary contains estuarine and saltwater species (such as flathead and black bream). The floodplain wetlands of the Snowy River near Marlo provide feeding and breeding areas for wetland and migratory birds.

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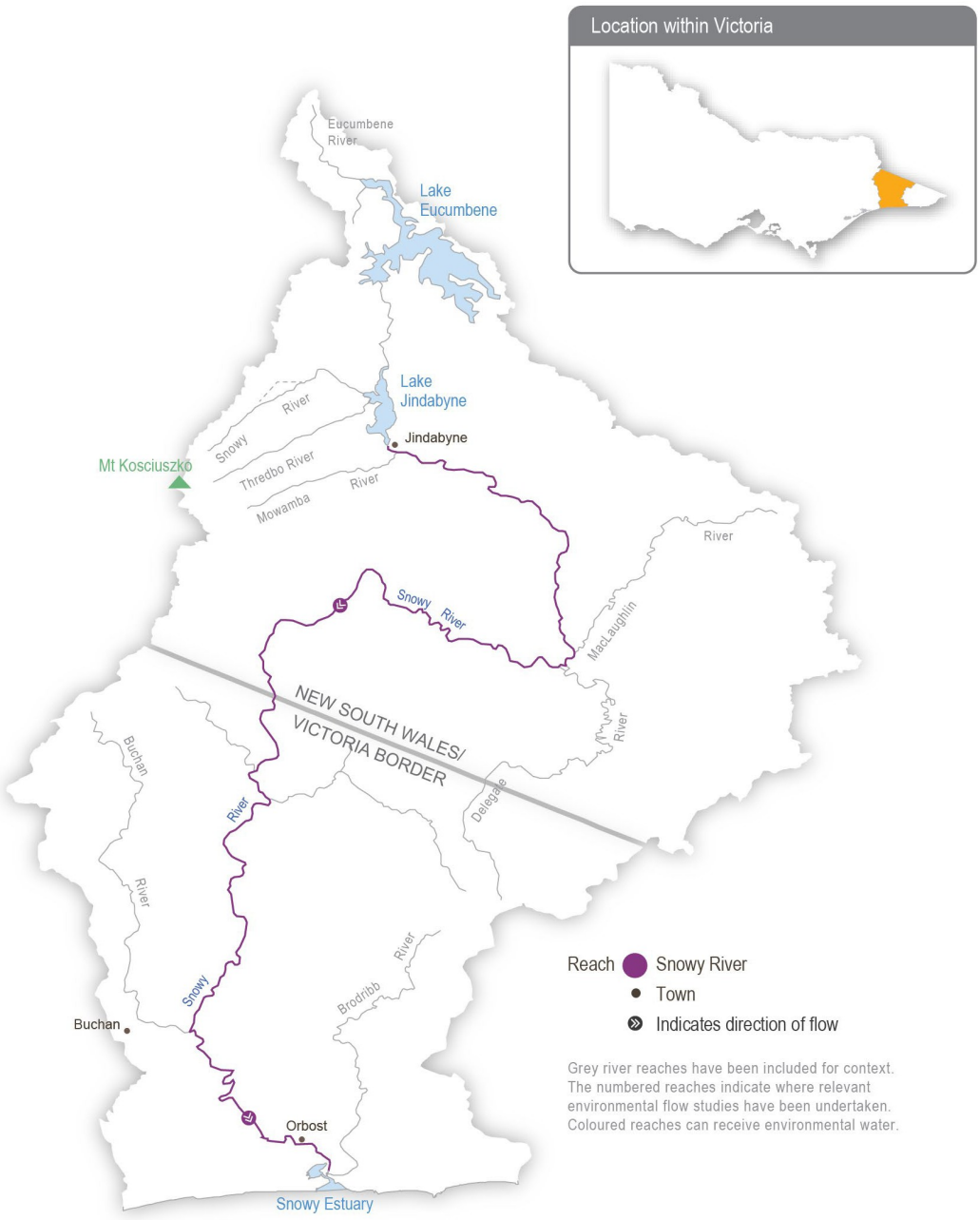
Figure 2.5.1 The Snowy system



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Recent conditions

Rainfall in the Snowy River catchment in 2021-22 was significantly above the long-term average, with some areas receiving their highest recorded monthly totals. Jindabyne Dam spilled in December 2021, and the storage manager made several airspace releases over subsequent months. These spills and natural inflows from downstream tributaries delivered regular floods in the lower Snowy River during the year. Flows peaked above 20,000 ML per day in the lower Snowy River several times during winter, spring, summer and autumn. The December flood peaked at 130,000 ML per day at Jarrahmond, near Orbost.

Water availability for environmental flows in the Snowy River is determined by allocations in the Murray, Goulburn, Loddon and Murrumbidgee rivers. In 2021-22, 209,577 ML[1] was allocated for environmental releases in the Snowy River system. This was the highest allocation since 2011 and more than twice the 2020-21 allocation of 91,176 ML.

The high allocation allowed river managers to deliver larger flows for longer durations than 2020-21. Five winter/spring high-flow events were released (one more than in 2020-21), and a flushing flow occurred in October 2021.

Environmental monitoring in the lower reaches of the Snowy River and its estuary over the last decade indicates that environmental flows are improving physical and ecological processes, increasing ecosystem productivity and improving aquatic habitat. Extensive bushfires in December 2019 and January 2020 affected most of the Snowy catchment. Although rivers and streams had poor water quality, particularly after heavy rain events, in-stream and riparian vegetation are beginning to regenerate. It will take years for the catchment to recover from impacts of this scale.

Scope of environmental watering

The total volume available for release to the Snowy River in 2022-23 is 205,110 ML. That is one of the highest volumes of water for the environment ever available for the Snowy River.

Due to operating rules in the system, the daily flow regime that will be delivered in 2022-23 is pre-planned. The storage manager will make daily releases of varying magnitudes from Lake Jindabyne between May 2022 and April 2023 to mimic the typical flow patterns of a mixed snowmelt/rainfall river system characteristic of the Snowy Mountains. A ‘natural flow scaling’ approach is applied, and the continuous daily releases aim to support ecological processes in the Snowy River below Jindabyne Dam and maintain a healthy river that is much smaller than the natural channel that existed before the river was regulated.

Following a wet year in 2021-22, water availability for the environment will again allow for a large number of high-flow releases in 2022-23, which will aim to improve ecological conditions and build additional resilience into the system. The flow pattern is similar to previous years and mimics a snowmelt river, with greater flows during winter and spring. Five high-flow releases are scheduled between May and November 2022 to move sediment and improve in-stream habitat for native fish, platypus, frogs and waterbugs. The largest release is planned for October 2022. It has a target peak flow rate equivalent to 5,000 ML per day, which will be held for about eight hours to flush fine sediment and wet high benches and backwaters. Other peak flows will mimic winter rainfall and spring snowmelt events. Moderate-to-high flow rates will be sustained from the end of May to December 2022 to mix water in the estuary to benefit plants and fish (such as Australian bass). Lower flow rates will be maintained from January until the end of the water year in April 2023.

For further information, visit the NSW Department of Planning and Environment’s Water for the environment website at https://www.environment.nsw.gov.au/topics/water/water-for-the-environment/snowy-and-montane.

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1 The actual release volume that was delivered in 2021-22 may alter slightly due to accounting adjustments and will be verified in Snowy Hydro Limited’s Annual Water Operating Plan.