Goulburn Wetlands

Seasonal Watering Proposal

2022-2023

GOULBURN BROKEN
CATCHMENT MANAGEMENT AUTHORITY

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Executive Summary

In this proposal the Goulburn Broken Catchment Management Authority has identified environmental water requirements for six wetlands in the Goulburn Catchment under a range of differing climate scenarios. These wetlands are Doctors Swamp, Gaynor Swamp, Horseshoe Lagoon, Kanyapella Basin, Loch Garry and Reedy Swamp. Three of these wetlands are proposed to be watered during 2022-2023, these are Gaynor Swamp, Horseshoe Lagoon and Kanyapella Basin. A drying regime for Doctors Swamp, Loch Garry and Reedy Swamp is proposed for 2022-2023.

The water regime of these wetlands has been highly modified with changes to the frequency, duration and timing of wetting and drying. Environmental water is currently being used to restore a more natural wetting regime to these sites to protect, enhance and restore the health of the wetlands.

Environmental watering objectives for Goulburn Catchment wetlands are to:

- Provide a wetting cycle that promotes healthy wetland vegetation communities.
- Provide feeding and breeding habitat for a range of waterbirds, amphibians and reptiles.
- Provide a drying period that assists with the completion of a nutrient cycle for wetlands.

Seasonal review 2021-2022

Environmental water deliveries were managed according to an average climate scenario and water was enabled at three Goulburn catchment wetlands in 2021-2022. A total of 3652ML was proposed to be delivered across all six wetlands, currently a total of 2052ML has been delivered.

The key objective of the 2021-2022 Seasonal Watering Proposal was to deliver environmental water to Horseshoe Lagoon and Kanyapella Basin in winter 2021, Loch Garry in spring 2021 and Doctors Swamp, Gaynor Swamp and Reedy Swamp in Autumn 2022.

Doctors Swamp and Gaynor Swamp had not received their environmental water allocation at the time of writing this plan.

Horseshoe Lagoon received an allocation of 52ML in winter 2021 as proposed and was still holding water at the time of writing this plan (March 2022). Kanyapella Basin's winter delivery was postponed to spring 2021 due to unforeseen circumstances. This did not have any detrimental effects on the 1000ML delivery which was divided up between the north-east edge (500ML) and north-west edge (500ML) of the Basin to encourage different EVC types to grow.

Loch Garry received its proposed allocation of 1000ML in spring 2021 and was still holding water at the time of writing this plan (March 2022).

Reedy Swamp was proposed to receive environmental water in Autumn 2022, however due to prolonged wetting from rainfall filling and keeping the swamp topped up it did not require water for the environment.

The 2021-2022 environmental water priorities, objectives and delivery status for Goulburn wetlands are summarised in Table 1.

Table 1: Watering priorities and delivery status for wetlands 2021-2022

Priority	Wetland	Flow Component	Flow Objective	Achievement in 2021-2022
1	Doctors Swamp	Partial Fill	Partially fill Doctors Swamp in autumn 2022 to a maximum depth of 60cm for 6 months, to maintain growth of EVCs and representative frog populations of native frog-communities.	Yet to be delivered
1	Gaynor Swamp	Fill	Fill Gaynor Swamp in Autumn 2022 to a variable depth of 0.5-1m for 6-9 months to promote growth of Cane Grass Wetland EVC, encourage growth of planted River Red Gum (*Eucalyptus camaldulensis*) saplings to improve Red Gum Swamp EVC extent and promote Brolga (*Antigone rubicunda*) scoping and potential breeding at the site. Maintain and promote growth of Spiny lignum (*Duma horrida subsp. horrida*).	Yet to be delivered
1	Horseshoe Lagoon	Partial Fill	Partially fill (top-up) Horseshoe Lagoon in winter 2021 to a variable depth of 0.5-2m for 8-10 months to maintain water level to promote recruitment and regeneration of Tall Marsh (821), Floodway Pond Herbland (810) and Aquatic Herbland (653) EVCs and threatened plant species (both planted and naturally occurring).	Water for the environment was delivered in winter 2021 to top-up the lagoon.
2 (changed to 1)	Kanyapella Basin	Partial fill	Partially fill Kanyapella Basin to a maximum depth of 300mm in winter 2021 for four months to promote and improve the diversity of EVCs and encourage threatened aquatic species populations to establish.	Winter watering did not occur – changed to spring watering which occurred September 2021.
1	Loch Garry	Partial fill	Partially fill Loch Garry in Spring 2021 to a variable depth of 0.5- 1.5m for 6-10 months to promote growth of EVCs, protect refugia for waterbirds and turtles and protect frog populations.	Watering occurred in 2021 and was successful.
1	Reedy Swamp	Fill	Fill Reedy Swamp in Autumn 2022 to a variable depth of 0.5-1m for 6-10 months to encourage growth of EVCs and maintain frog species at the site.	Watering did not occur due to swamp filling after large rainfall event and prolonged wetting.

Priorities for 2022-2023

In consultation with Traditional Owners, the Goulburn Broken Wetland Technical Reference Group and the Goulburn Broken Environmental Water Advisory Group, the GB CMA proposes to deliver water for the environment to three Goulburn wetlands - Gaynor's Swamp, Horseshoe Lagoon and Kanyapella Basin. The proposal for Kanyapella Basin is to deliver water for the environment in dry and average conditions only. It is currently forecast that deliveries in 2022-2023 will occur under an average climate scenario.

Priorities for environmental watering wetlands in the Goulburn catchment for 2022-2023 are as follows:

- Partially fill (top-up) Gaynor Swamp in spring/early summer 2022 to prevent nest abandonment by waterbirds if significant waterbird breeding event occurs and maintain vegetation growth to assist with recruitment.
- Partially fill (top-up) Horseshoe Lagoon in winter 2022 to maintain water level and promote recruitment and regeneration of EVCs and threatened plant species.
- Partially fill Kanyapella Basin in autumn 2023 to promote and improve diversity of EVCs and assist with establishment of threatened aquatic plant species.
- Promote drying of Doctors Swamp, Loch Garry and Reedy Swamp in 2022-2023.

This proposal considers environmental water deliveries under a range of possible climate scenarios from extremely dry to wet. The potential watering actions under the different climate scenarios are outlined below (Table 2). These have been categorised into Tier 1 and Not Applicable. Tier 1 watering actions are the critically important actions that should be achievable based on estimates of supply and other available resources under each planning scenario (VEWH 2021).

Table 2: Summary of potential water actions for 2022-2023

Priority	Wetland	Potential Watering Action	Climate Scenario and ML Water			
			Ex. Dry	**Dry**	**Average**	**Wet**
NA	Doctors Swamp	Allow swamp to draw down and dry for at least 6 months to complete nutrient cycle and to reach optimal drying period.	0	0	0	0
1	Gaynor Swamp	Partially fill (top-up) Gaynor Swamp in spring/ early summer 2022 to prevent nest abandonment by waterbirds if significant waterbird breeding event occurs. Maintain optimal ponding duration to promote vegetation growth and recruitment of EVCs.	1000	1000	1000	500
1	Horseshoe lagoon	Partially fill (top-up) Horseshoe Lagoon in winter 2022 to a variable depth of 0.5-2m for 8-10 months to maintain water level to promote recruitment and regeneration of Tall Marsh (821), Floodway Pond Herbland (810) and Aquatic Herbland (653) EVCs and threatened plant species (both planted and naturally occurring).	120	120	120	60
1	Kanyapella Basin	Partially fill Kanyapella Basin to a maximum depth of 300mm autumn 2023 for four months to promote and improve the diversity of EVCs and encourage threatened aquatic species populations to establish.	0 (Due to transition losses being too high en route)	1000	1000	0 (Due to site being classified as a flood retardation basin)
NA	Loch Garry	Allow Loch to draw down and dry for at least 6 months to complete nutrient cycle and to reach optimal drying period.	0	0	0	0
NA	Reedy Swamp	Allow swamp to draw down and dry for at least 6 months to complete nutrient cycle and to reach optimal drying period.	0	0	0	0
Total ML			**1120**	**2120**	**2120**	**560**

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Introduction

This seasonal watering proposal outlines the Goulburn Broken CMA's priorities for the use of environmental water for delivery to wetlands in the Goulburn catchment during 2022-2023 to protect and enhance their environmental values and health.

The purpose of the seasonal watering proposal is to:

- Identify the environmental water requirements of wetlands to adaptively manage their watering regime and enable water for the environment to be delivered under a range of climatic scenarios where applicable under a range of climatic scenarios.
- Identify the drying requirements of wetlands to assist with the completion of the nutrient cycle within wetlands.
- Provide information for the development of the VEWH seasonal watering plan as per section 192A of the *Water Act 1989* (Vic).

System overview

The Goulburn River Basin is Victoria's largest covering 1.6 million ha or 7.1 per cent of Victoria. The Goulburn River is 570 km long, flowing from the Great Dividing Range upstream of Woods Point to the Murray River east of Echuca. Stream flow along the Goulburn River has been modified by two major features: Eildon Reservoir and the Goulburn Weir. The Goulburn River downstream of the Goulburn Weir is listed in '*A Directory of Important Wetlands in Australia*' (EA 2001).

Within the catchment, several wetlands are formally recognised for their conservation significance. Four wetlands are listed in '*A Directory of Important Wetlands in Australia*' (EA, 2001) and three are listed as Bioregionally significant (CoA 2002). These wetlands have been prioritised due to their ecological values, significance to the community and traditional owners, but also because they have the infrastructure required to receive environmental water. As the wetland environmental program progresses, other wetlands of high ecological and cultural values will be considered for watering, provided they have the necessary infrastructure in place to deliver water and land manager approvals are met.

The six wetlands that can currently receive water in the Goulburn Catchment are Doctors Swamp, Gaynor Swamp, Horseshoe Lagoon, Kanyapella Basin, Loch Garry and Reedy Swamp (Figure 1). Three swamps with proposed delivery are discussed below.

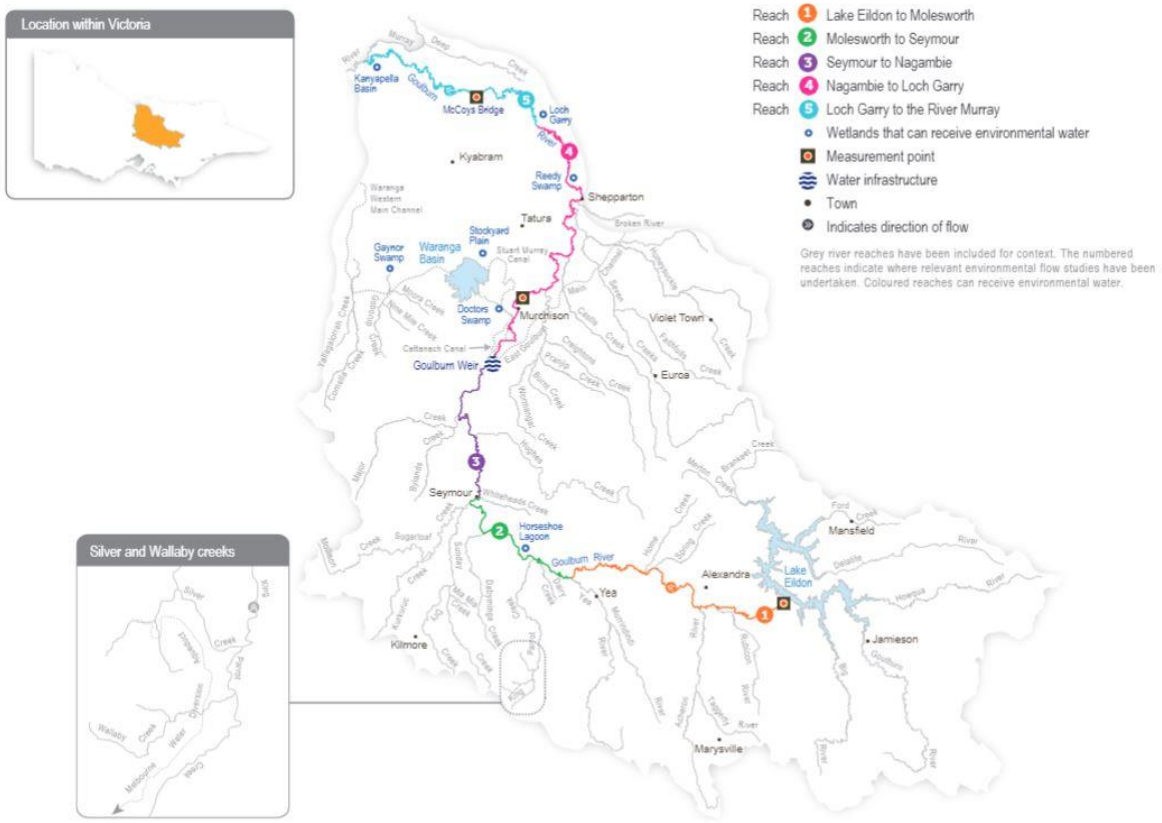

Figure 1: Goulburn Wetlands considered in this proposal

Gaynor Swamp

Gaynor Swamp is a 303-hectare cane grass dominated wetland located 7 km south-east of Corop. The swamp is part of the Gaynor Swamp Wildlife Reserve and is managed by Parks Victoria. The hydrology of the swamp changed during the 1940s & 1950s when irrigation was introduced to the area. This resulted in prolonged inundation causing the death of southern cane-grass and river red gums in the deepest part of the wetland.

Gaynor Swamp is listed under '*A Directory of Important Wetlands in Australia'* (EA 2001) under the Wallenjoe Wetlands. The wetland is valued for its rarity, species diversity and waterbird habitat (Figure 2) (GBCMA 2012). When wet, it supports thousands of waterbirds, including international migratory species and the threatened Brolga (*Antigone rubicunda*).

Figure 2: Gaynor Swamp – a Little Grassbird hides in Duma horrida sub sp. horrida during environmental watering in 2020

Gaynor Swamp is situated in a landscape that is dominated by paleo saline soils which results in increased surface water salinity at the site compared to other wetlands in the Goulburn Broken Catchment. Saline water can also enter the swamp via Lake Cooper during times of flood.

Because of these higher salt concentrations, different species of fauna can be found utilising the wetland. Species such as the Red-necked Avocet (*Recurvirostra novaehollandiae*) have been recorded at the swamp upon draw down when salinity levels are at their highest. Gaynor Swamp meets several criteria outlined in *Schedule 8* of the Basin Plan – *Criteria for identifying an environmental asset*. This includes criteria 1b, 3a (i and iii), 3b, 4c and 5a (refer to appendix 1 for criteria description).

To date 66 wetland dependent fauna species and 57 wetland dependent flora species have been recorded at Gaynor Swamp since 2012. Of these species 25 have been listed as threatened (refer to appendix 2a and 2b).

Horseshoe Lagoon

Horseshoe Lagoon is a former channel of the Goulburn River and is located between Kerrisdale and Trawool, approximately 15 km south-east of Seymour. The 20-hectare lagoon lies largely within the Horseshoe Lagoon Flora and Fauna Reserve, managed by Parks Victoria. A small area of the lagoon is on private property. Horseshoe lagoon received environmental water for the first time in 2019.

Horseshoe Lagoon is a site of high cultural significance to Taungurung people, particularly Taungurung women as it is central to their creation story. An Aboriginal Waterways Assessment (AWA) was undertaken at Horseshoe Lagoon in 2017. The AWA is a tool developed to assist Traditional Owners in the Murray Darling Basin to effectively participate in water planning and management. Taungurung Land & Water Council were involved in the development of the Environmental Water Management Plan for Horseshoe Lagoon (Jacobs 2019).

Horseshoe Lagoon meets several criteria outlined in *Schedule 8* of the Basin Plan – *Criteria for identifying an environmental asset*. This includes criteria 3a (i and iii), 4a and 4c (refer to appendix 1 for criteria description).

Figure 3: Horseshoe Lagoon during environmental water event in 2021

Horseshoe Lagoon provides habitat for a wide range of wetland and terrestrial species (Figure 3). To date 34 water dependant fauna species and 47 wetland dependant flora species have been recorded at the site. Of these 12 are listed as rare or threatened (refer to appendix 2a and 2b). There is no permanent infrastructure to deliver Environmental water to Horseshoe Lagoon. A temporary pump is brought on site and water is pumped directly from the Goulburn River.

Kanyapella Basin

The Kanyapella basin (Figure 4), classified as a shallow freshwater marsh, is situated on the floodplain of the Lower Goulburn and Murray Rivers 11 kilometres east of Echuca. At 2,950 hectares, Kanyapella Basin is one of the largest wetlands in the Goulburn Broken Catchment and is listed under *'A Directory of Important Wetlands in Australia'* (EA, 2001) as part of the Lower Goulburn River Floodplain. Land management is shared between Goulburn Murray-Water (2,479 ha) and Parks Victoria - Kanyapella Wildlife Reserve (486 ha). The Kanyapella basin and the surrounding catchment have a long history of traditional owner occupation by the Yorta Yorta Nations and are an important part of their cultural and spiritual heritage (GBCMA 2012).

Figure 4: Environmental water moving into the north-east corner of Kanyapella Basin in 2021

Kanyapella Basin meets several criteria outlined in *Schedule 8* of the Basin Plan – *Criteria for identifying an environmental asset*. This includes criteria 1b, 3a (i and iii), 4a and 5b (refer to appendix 1 for criteria description).

Kanyapella Basin provides habitat for a wide variety of water dependent and terrestrial fauna species. Historic information from local sources suggest that Kanyapella Basin was a large Ibis and Spoonbill rookery in the 1950s & 1960s. Reports of hundreds of Ibis, herons and cormorants breeding in the wetland after a flood event in 1993 have also been made (DPI 2007). To date 59 wetland dependent fauna species and 114 wetland dependent flora species have been recorded at the swamp. Of these 21 species are listed as threatened (refer to appendix 2a and 2b).

Environmental water can be delivered to the Basin via adjoining irrigation drains and regulators at a rate of up to an estimated 20 ML/day.

Engagement

This proposal was prepared by the Goulburn Broken CMA with input from Traditional Owners of Taungurung Land & Waters Council (1st March 2022), Yorta Yorta Nation Aboriginal Corporation (2nd March 2022), Goulburn Broken Wetland Technical Reference Group (GB WTRG) and the Goulburn Broken Environmental Water Advisory Group (GB EWAG).

The GB WTRG is made up of members from Rakali Consulting, Water's Edge Consulting and Senior Scientists from Department of Environment Land Water and Planning and Arthur Rylah Institute for Environmental Research. Traditional Owners were also invited to be part of this formal, scientific group in 2022. The group met via Microsoft Teams™ on the 23rd February 2022.

The GB EWAG meets at least three times a year and additionally if required to discuss findings from wetland monitoring, wetland condition, watering objectives and watering for the coming year. The group met via Microsoft™ Teams 24th February 2022 and members were provided with a copy of the draft proposal for comment. Comments have been incorporated into this report.

The GB EWAG (previously Goulburn Broken Wetland Management Group), established in 2012, is made up of delivery partners, Traditional Owners, industry, community groups and community members. Current membership includes Parks Victoria, Taungurung Land & Waters Council, Yorta Yorta Nation Aboriginal Corporation, Goulburn Murray Landcare Network, Goulburn-Murray Water, Moira Shire, City of Greater Shepparton, Victorian Environmental Water Holder and community members. Meetings are usually held two or three times a year to discuss the current conditions of the wetlands, the outcomes of the previous season's delivery of environmental water, and proposed watering. When possible, the group visits the wetlands to hear and see firsthand the delivery and wetland responses to environmental watering.

The Goulburn Broken CMA has agreements with Yorta Yorta Nation Aboriginal Corporation and Taungurung Land & Waters Council which outline the legal requirements the GB CMA need to abide by when undertaking natural resource management works in areas covered by these agreements.

The Land Use Activity Agreement (LUAA) forms *Schedule 9* of the Recognition and Settlement Agreement between Taungurung Land & Waters Council and the State of Victoria and is used when works activities are required on crown land. No formal notification is currently required for delivery of environmental water on Taungurung Country apart from involvement in the development of the Seasonal Watering Proposals. Consultation of proposed watering and endorsement of environmental watering at these sites is undertaken. A letter of support from Traditional Owner groups is also required.

The Aboriginal Cultural Heritage Land Management Agreement (ACHLMA) is an agreement between the GB CMA and Yorta Yorta Nation Aboriginal Corporation which is legislated by the *Aboriginal Heritage Act 2006*. This includes the following activities that are permissible under the agreement:

- Environmental Monitoring Activities at wetlands.
- Environmental water – returning natural flows at wetlands across the catchment.

Some wetlands are not included in this agreement which are in the Lower Goulburn National Park. This includes Reedy Swamp and Loch Garry.

The Goulburn Broken CMA will continue to build community understanding of how natural wetland wetting regimes have changed and how water for the environment is being used to protect and restore the wetlands. This will be achieved through reports, traditional and social media and direct contact with special interest groups and school groups.

The engagement process the Goulburn Broken CMA has undertaken during the development and implementation of this seasonal water proposal is outlined in Table 3. All communication activities will be undertaken in accordance with the communication and media protocols of the VEWH.

Table 3: Engagement undertaken in development of Seasonal Watering Proposal 2022-2023

Category	Who	IAP2 level of engagement	Engaged on 2022-2023 seasonal watering proposal	Engagement methods	Engagement Purpose
Government Agencies	Delivery Partners	Collaborate	Goulburn-Murray Water (River Operations Planning, Diversions) VEWH Parks Victoria Council of Greater Shepparton DELWP (Land Manger, Environmental Water)	Formal advisory group (GB EWAG) Direct engagement Review of draft proposal	Seek input into the development of the proposal. Ensure program partners understand the watering proposed and intended outcomes
Traditional Owners	Traditional Owners	Involve	Yorta Yorta Nation Aboriginal Corporation Taungurung Land & Water Council	Formal advisory groups (GB EWAG) Site visits	Seek input into the development of the proposal by reviewing document, providing feedback and writing a letter of endorsement. Assist with the delivery and monitoring of the watering events
Recreational Users	Field and Game Australia Local fishing clubs	Involve	Field and Game Trellys Fishing and Hunting	Formal advisory groups (GB EWAG) Direct engagement	Ensure understanding of the watering proposed and intended outcomes. Review SWP and provide feedback/ input.
Community Groups	Environment Groups	Involve	Goulburn Murray Landcare Network Goulburn Valley Environment Group Turtles Australia	Formal advisory groups (GB EWAG) Direct	Ensure understanding of the watering proposed and intended outcomes. Review SWP and provide feedback/ input.
Local Landholders	Landholders	Involve	Landowners that adjoin wetlands that receive environmental water and/or use the delivery channel	Direct engagement (one-on-one) or email/mail drop.	Ensure understanding of the watering proposed and intended outcomes. Seek feedback – local knowledge
Technical experts	Scientists and Consultants	Collaborate	Research Scientists from Arthur Rylah Institute Rakali Consulting Water's Edge Consulting	Formal advisory group (GB WTRG) Direct engagement	Seek input into the development of the proposal and ecological and hydrological objectives. Review SWP and provide feedback/ input.

Aboriginal cultural values and use of waterways

Two Traditional Owner groups are custodians of the land within the Goulburn region. They are Taungurung Land and Waters Council (TLaWC) and Yorta Yorta Nations Aboriginal Corporation (YYNAC).

The Taungurung people occupy much of central Victoria. Their country encompasses the area between the upper reaches of the Goulburn River and its tributaries north of the Dividing Range. From the Campaspe River to Kilmore in the West, eastwards to Mount Beauty, from Benalla in the north down to the top of the Great Dividing Range (Figure 5 shaded light green). Gaynor Swamp and Horseshoe Lagoon are both located within Taungurung country. TLaWC undertook an Aboriginal Waterway Assessment (AWA) at Horseshoe Lagoon in October 2017. The purpose of the AWA is for Traditional Owners to measure and prioritise river and wetland health to enable participation in water planning and management. TLaWC used the information gathered as part of the AWA when partnering with the GB CMA in the development of the Environmental Water Management Plan for Horseshoe Lagoon in 2019. In 2021, TLaWC, working with GB CMA managed the pumping and delivery of environmental flows to the site.

Yorta Yorta Nations Aboriginal Corporation country lands lie on both sides of the Murray River roughly from Cohuna to Albury / Wodonga. They include towns such as Echuca, Shepparton, Benalla, Corowa and Wangaratta and extend northwards to just south of Deniliquin (Figure 5 shaded dark green). Doctors Swamp, Kanyapella Basin, Loch Garry and Reedy Swamp are in Yorta Yorta country.

The GB CMA have engaged with both TLaWC and YYNAC to discuss potential watering of wetlands in 2022-2023, including on-line meetings and on country.

Figure 5. Traditional owner land within the Goulburn Broken Catchment

Traditional Owners were asked to complete the table below (Table 4 and 5) to assist the GB CMA in ensuring environmental water can support the cultural values of wetlands in our catchment. Yorta Yorta Nation Aboriginal Corporation have also approved this seasonal watering proposal by reviewing the proposed watering actions and providing a letter of endorsement.

Table 4. Taungurung Traditional Owner values and uses of wetlands in the Goulburn Catchment

Wetland	Traditional Owner Group	Values: Cultural NRM strategy (emerging) alignment	Values: Outcomes	How will this be considered in 2022-2023?
Horseshoe Lagoon	Taungurung	Healing Country	Supporting the health of cultural values and landscapes - protecting intangible cultural heritage and valued species, traditional food and medicine plants.	Fill/top up Horseshoe Lagoon in winter 2022 to protect and restore plant communities which include culturally important species.
			Actively fulfilling Caring for Country responsibilities - restoring a more natural water regimes to degraded significant sites, rehabilitation of habitat for native species	Continue to provide TLaWC / Biik Environmental staff with the opportunity to deliver environmental water with participation of the Taungurung water knowledge group (Baan Ganalina), as part of ongoing involvement in the assessment of biocultural values and management of the site.
		Healing Knowledge	Supporting and securing access for Taungurung contemporary cultural practices and uses, teaching places, reconnection to Country, camping sites.	Continuing involvement in the delivery of environmental water will allow the Taungurung community to maintain connections with this culturally important place through continuing to heal and care for it.
Gaynor Swamp	Taungurung	Healing Country	Supporting the health of cultural values and landscapes - protecting intangible cultural heritage and valued species, traditional food and medicine plants.	Maintain water level in spring 2022 to protect and restore plant communities, which include culturally important species.
			Exploring opportunities for reintroducing culturally informed management tools and practices	Provide TLaWC / Biik Environmental staff and the Taungurung water knowledge group (Baan Ganalina) members with the opportunity to participate in the delivery of environmental water, as part of ongoing involvement in assessment of biocultural values and management of the site.
		Healing Knowledge	Increase Taungurung internal capacity and confidence in water management following self-determination principles via engagement and joint management arrangements	Participating in the delivery of environmental water will strengthen connections of the Taungurung community with this culturally important place, strengthen knowledge about actions necessary to heal it, and help build relationships with partners needed to achieve this.

Table 5. Yorta Yorta Traditional Owner values and uses of wetlands in the Goulburn Catchment

Wetland	Traditional Owner Group	Values	How will this be considered in 2022-2023
Kanyapella Basin	Yorta Yorta	Supporting the health of cultural values and landscapes (e.g. creation storey – traditional food and medicine plants) Supporting contemporary cultural events such as cultural burns	Partially fill Kanyapella Basin in autumn 2023 to promote and improve the diversity of plant communities including culturally significant food and medicinal plants. Yorta Yorta will conduct cultural burning at site before watering event.

Social, recreational and economic values and uses of wetlands

Water for the environment is used to protect and restore the environmental condition of rivers and wetlands. In addition, there are recreational, social, economic, and Aboriginal cultural benefits in delivering environmental water. Environmental watering of wetlands increases opportunities and visitation of wetlands for bird watching, photography, walking, camping, and hunting (previously State Game Reserves reclassified as Wildlife Reserves). Wetlands provide resources for Traditional Owners for hunting, food, medicinal and traditional activities.

A summary of potential shared benefits of the 2022-2023 proposed environmental water deliveries in the Goulburn catchment are listed in Table 6.

Table 6. Shared benefits of watering wetlands in the Goulburn Catchment in 2022-2023

Wetland	Beneficiary	Connection to wetland	Value	How have these benefits been considered?
Gaynor Swamp	Bird watchers Photographers Walkers	Connection to country for Taungurung.	Environmental watering provides opportunities for activities such as walking, bird watching and photography.	Watering in Autumn increases growth of aquatic plants providing nesting material for Brolga. Brolgas are an attraction for bird watchers both locally and nationally.
Horseshoe Lagoon	Traditional Owners Bird watchers Photographers Walkers Campers Local landholders	Connection to country for Taungurung women.	Environmental water provides a connection to country for traditional owners, especially women from Taungurung Land and Waters Council.	Winter watering of the site promotes growth of wetland plants that are beneficial for roosting and foraging for waterbirds. The water provides the opportunity for traditional owner women to visit the site for their cultural beliefs, traditional foods, and medicines.
Kanyapella Basin	Local landholders Traditional Owners Bird watchers Photographers	Land holders have a close connection to the delivery path (Yambuna Creek) and an interest in maintaining its health. Traditional Owners have a cultural connection to Kanyapella and use the site to harvest medicinal plants.	Environmental water provides a connection to country for traditional owners. It also provides a connection for local landholders along the environmental water delivery path, increasing bird life and making the landscape aesthetically pleasing. Environmental water promotes the growth of some culturally significant medicinal plants. The timing of the watering to Kanyapella in 2020 promoted the growth of some medicinal plants at the site.	Watering could result in an increased number of water birds - providing opportunities for bird watching/photography. Cultural values as the sites include knowledge sharing and increased resources such as food and medicine plants. Applying environmental water at a time of year that promotes growth of medicinal plants for traditional owners is important to maintain relationships with traditional owners and respect their cultural heritage.

Seasonal review 2021-2022

Climatic conditions

Climatic conditions observed from the Tatura station (Station ID 081049), Shepparton airport (Station ID 81125) and Echuca (Station ID 080015) indicate that rainfall over the 2021 year was slightly below the long term mean average except for large rainfall events that occurred in Summer (January), Autumn (March), Winter (June, July) and Spring (October, November) (BoM 2022) (Figure 6). These large rainfall events contributed to a wet catchment and provided natural inflows that either filled or partially filled some of the wetlands including Horseshoe Lagoon and Reedy swamp. Water for the environment was still delivered to Horseshoe Lagoon, Kanyapella Basin and Loch Garry. At the time of writing this report deliveries to Doctors Swamp and Gaynor Swamp had not occurred.

Horseshoe Lagoon is currently holding water in its deeper northern section. Loch Garry is holding water in its main channel and Reedy Swamp is still holding water due to rainfall runoff in mid-January 2022. Gaynor Swamp, Doctors Swamp and Kanyapella Basin are currently dry. The wetting and drying pattern for each wetland from 2011-2022 is shown in Table 7. Further information regarding key observations and findings from the watering actions is provided in the Key observations and findings 2021/2022 section below.

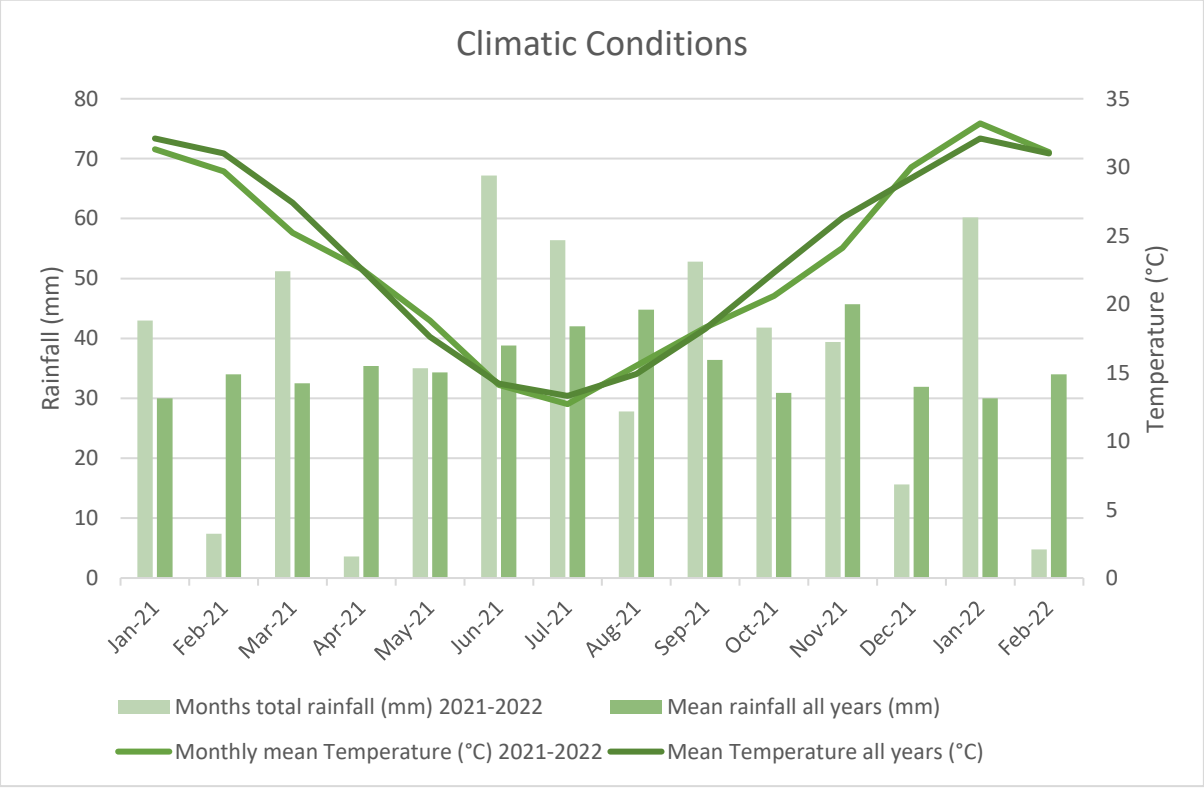

Figure 6: Climate conditions in the Goulburn region over 2021

Assessment of watering actions 2021-2022

The environmental watering objectives for the Goulburn Wetlands in 2021-2022 were to:

- Provide wetting cycles that promote healthy wetland vegetation communities; and
- Provide feeding and breeding habitat for a range of waterbirds, frogs and turtles.

The aim of the 2021-2022 seasonal watering proposal was to:

- Partially fill Doctors Swamp in autumn 2022 to maintain growth of EVCs and representative frog populations of native frog communities.
- Fill Gaynor Swamp in Autumn 2022 to promote growth of Cane Grass Wetland EVC, encourage growth of planted River Red Gum (*Eucalyptus camaldulensis*) saplings to improve Red Gum Swamp EVC extent and promote Brolga (*Antigone rubicunda*) scoping and potential breeding at the site. Maintain and promote growth of Spiny lignum (*Duma horrida subsp. horrida*).
- Partially fill (top-up) Horseshoe Lagoon in winter 2021 to maintain water level to promote recruitment and regeneration of Tall Marsh (821), Floodway Pond Herbland (810) and Aquatic Herbland (653) EVCs and threatened plant species (both planted and naturally occurring).
- Partially fill Kanyapella Basin to a maximum depth of 300mm to promote and improve the diversity of EVCs and encourage threatened aquatic species populations to establish.
- Partially fill Loch Garry in Spring 2021 to promote growth of EVCs, protect refugia for waterbirds and turtles and protect frog populations.
- Fill Reedy Swamp in Autumn 2022 to encourage growth of EVCs and maintain frog species at the site.

Table 7 outlines the planned potential watering actions from 2021-2022 and an assessment of how they were achieved and current delivery status.

Table 7: Watering priorities and delivery status for Goulburn wetlands 2021-2022

Priority	Wetland	Flow Component	Timing	Potential Watering Action	Achievement in 2021-2022
1	Doctors Swamp	Partial Fill	Autumn 2022	Partially fill Doctors Swamp in autumn 2022 to a maximum depth of 60cm for 6 months, to maintain growth of EVCs and representative frog populations of native frog-communities.	Yet to be delivered
1	Gaynor Swamp	Fill	Autumn 2022	Fill Gaynor Swamp in Autumn 2022 to a variable depth of 0.5-1m for 6-9 months to promote growth of Cane Grass Wetland EVC, encourage growth of planted River Red Gum (*Eucalyptus camaldulensis*) saplings to improve Red Gum Swamp EVC extent and promote Brolga (*Antigone rubicunda*) scoping and potential breeding at the site. Maintain and promote growth of Spiny lignum (*Duma horrida subsp. horrida*).	Yet to be delivered
1	Horseshoe Lagoon	Partial Fill	Winter 2021	Partially fill (top-up) Horseshoe Lagoon in winter 2021 to a variable depth of 0.5-2m for 8-10 months to maintain water level to promote recruitment and regeneration of Tall Marsh (821), Floodway Pond Herbland (810) and Aquatic Herbland (653) EVCs and threatened plant species (both planted and naturally occurring).	Winter watering occurred with a top-up due to natural inflows into the Lagoon occurring from mid-Autumn.
2 (changed to 1)	Kanyapella Basin	Partial fill	Winter 2021	Partially fill Kanyapella Basin to a maximum depth of 300mm in winter 2021 for four months to promote and improve the diversity of EVCs and encourage threatened aquatic species populations to establish.	Winter watering did not occur due to landholder paperwork not being signed in time – changed to spring watering which occurred September 2021.
1	Loch Garry	Partial fill	Spring 2021	Partially fill Loch Garry in Spring 2021 to a variable depth of 0.5- 1.5m for 6-10 months to promote growth of EVCs, protect refugia for waterbirds and turtles and protect frog populations.	Watering occurred in 2021
1	Reedy Swamp	Fill	Autumn 2022	Fill Reedy Swamp in Autumn 2022 to a variable depth of 0.5-1m for 6-10 months to encourage growth of EVCs and maintain frog species at the site.	Watering did not occur due to swamp filling after large rainfall event causing prolonged wetting.

Key observations and findings in 2021-2022

Doctors Swamp

Doctors Swamp is classified as a pristine swamp in the Goulburn Broken Catchment (Cook, 2010). A combination of both environmental water and unregulated flows have allowed the swamp to reach its optimum wetting regime of 5-7 years in 10 years (Tables 8 and 9). An Index of Wetland Condition (IWC) assessment of Doctors Swamp in 2010 showed the swamp was in good condition. Environmental water and unregulated flows into the swamp have been important in maintaining this condition. A 25mm rainfall event in January 2022 created some small inflows into Doctors Swamp (Figure 7 top right). At the time of writing this report, the proposed autumn 2022 environmental water delivery to Doctors Swamp had not occurred – this will be reported in the 2023-2024 Seasonal Watering Proposal.

Figure 7. Sulphur-crested Cockatoo Doctors Swamp partially wet (Jan 2022), dry July 2021

Gaynor Swamp

Gaynor Swamp has received a combination of both environmental water and unregulated flows over the last ten years. These have allowed the swamp to reach its optimum wetting regime of 5-7 years in 10 years (Tables 8 and 9). An Index of Wetland Condition (IWC) assessment of Gaynor Swamp in 2009 found the swamp to be in poor condition with wild oats (*Avena barbata*) being a major vegetation structure at the site. Environmental water and unregulated flows into the swamp have been important in improving this condition. Since the IWC assessment, the swamp flooded naturally in 2010, 2011 and 2012 and has since received partial natural inflows in 2016 and environmental water deliveries in 2018 and 2020. This has promoted native terrestrial and aquatic species growth within the swamp and increased floristic composition. At the time of writing this report, the proposed autumn 2022 environmental water delivery to Gaynor Swamp had not occurred - this will be reported in the 2023-2024 Seasonal Watering Proposal.

Horseshoe Lagoon

The optimum watering regime identified for Horseshoe Lagoon is the provision of flooding in eight in ten years with dry phases in the deepest parts of the Lagoon not exceeding six months. This wetting/drying regime will improve the diversity of native plant and animal species, including many of which are of high conservation significance such as the EPBC (1999) listed River Swamp Wallaby-grass (*Amphibromus fluitans).* Environmental Water is delivered to the lagoon by pumping from the Goulburn River.

Horseshoe Lagoon received its first delivery of Water for the Environment in Winter 2019 which filled the lagoon. The lagoon was dry by February 2020. High rainfall in Autumn 2020 resulted in the lagoon commence to fill from a small unregulated tributary. A small Environmental Water Delivery (17 ML) in August 2020 filled the wetland. The wetland held some water in the deepest sections through summer 2020-2021. The Lagoon was naturally inundated again in autumn 2021 when Taungurung Land and Waters Council were contracted to undertake an Environmental Water delivery in Winter 2021. 52 ML was delivered to the lagoon which fully inundated the main lagoon and surrounding fringing wetland habitats. Unfortunately, the delivery did not inundate the secondary lagoon due to time constraints. As of March 2022, the wetland was drawing down with the deepest section still retaining water.

The wetland vegetation has responded favourably to the watering with both the EPBC listed River Swamp Wallaby-grass (*Amphibromus fluitans)* and veiled fringe-sedge *(Fimbristylis velata)* populations expanding over the last three years. During spring into earlier summer much of the lagoon was covered in azolla (Figure 8). The azolla has since receded and did not seem to have any detrimental effects on the Lagoon. Over the last 12 months Parks Victoria and Taungurung Land and Waters Council have begun reintroducing aquatic plant species that are either missing or in low numbers to boost aquatic plant diversity and abundance.

Three species of freshwater turtles are known to use the lagoon – the Broad-shelled turtle, the Common Long Neck Turtle and the Murray River Turtle. All three species have been observed utilising the lagoon following Environmental Water deliveries. Predation of turtle nests by foxes is an ongoing problem and Parks Victoria are continuing to work with the surrounding landholders to control fox

numbers.

Figure 8. Filled Lagoon September 2021

Main Lagoon (top left), Acoustic recorder placed at popular frog calling spot (top right), Azolla in Lagoon September 2021 (bottom left), Myriophyllum crispatum (bottom right).

Kanyapella Basin

Kanyapella Basin received its first environmental water delivery in winter 2020 of 500ML (Figure 9). This delivery ponded at the site for approximately 3 months before drying. The 2009 Index of Wetland condition assessment rated the basin in moderate condition (GB CMA, 2012). The optimum regime for this site would be for annual flooding to occur over winter and spring to pond for approximately 1-8 months duration. The site has only been inundated twice in the last ten years (2011-2012 and 2016-2017) prior to receiving water for the environment (Tables 8 and 9). A 1000ML delivery occurred in September 2021 with 500ML being delivered to the north-east corner and 500ML to the north-west corner. This watering action aimed to promote different vegetation communities to establish and to gain a better understanding of the site's hydrological response to the delivery volume.

Surveys and incidental sightings and observations during and post the watering event showed frogs and some aquatic vegetation responding well to the watering. Waterbirds also responded well with large numbers of ducks observed feeding at the site.

Figure 9. Environmental water delivery to Kanyapella Basin 2021

Water moving into the north-east corner (left), water movement into the middle of the Basin (top right) and water moving into the north-west corner (bottom right) at Kanyapella Basin.

Loch Garry

Loch Garry received an environmental water delivery of 1000ML in September 2021 (Figure 10). The 2012 Index of Wetland Condition assessment rated the Loch in good condition (Jacobs, 2019b). The optimum regime for this site would be for flooding 8 in 10 years and to occur between autumn and spring, ponding for approximately 8 months. The site has been inundated nine in the last ten years including receiving water for the environment in 2020 and 2021 (Tables 8 and 9). This watering action aimed to promote different vegetation communities to establish and to gain a better understanding of the site's hydrological response to the delivery volume.

Over the warmer months of the delivery the Loch held water well, with the main channel still holding water in March 2022. Due to Covid-19 lockdowns and restrictions and a safety alert proposed at the site, monitoring was limited. However, frog and bird response to the watering was positive. At the time of writing this report, Collins Swamp had dried, however, the main channel was still holding water with waterbirds such as the Australasian Shoveler and frogs responding well to this.

Figure 10. Environmental water being delivered to Loch Garry September 2021

Delivery channel into Loch Garry (left), Aerial view of Loch Garry January 2022 (mid), Collins Swamp holding water at the Loch (Sept 2021). Photos by N. Wells and M. Price.

Reedy Swamp

Reedy Swamp filled naturally in April 2020 due to a large rainfall event and has remained holding water. In 2010, an Index of Wetland Condition assessment rated the swamp in moderate condition (GBCMA 2011). The optimum watering regime for this site would be for flooding 6 in 10 years and to occur between autumn and spring, ponding for approximately 6-10 months. The site has been inundated nine in the last ten years including receiving water for the environment in 2015, 2018 and 2019 (Tables 8 and 9). Natural rainfall events in 2012 kept the swamp wet until winter 2014 which is classed as a prolonged flooding period.

Waterbird response in 2021 was positive to the natural filling with large numbers of ducks and swans observed at the site (Figure 11). Terrestrial birds also benefited from the swamp holding water with a Tawny Frogmouth nesting at the site (Figure 12). Winter and spring rainfall kept the wetland filled until it began to dry in January 2021. February 2021 storms proceeded to partially fill the wetland and it has since stayed partially wet. To promote an optimal drying regime (6-10 months) environmental water will not delivered to the site in autumn 2022.

Figure 11. Reedy Swamp waterbirds 2021

Australian Reed Warbler (top left), Black Swan and cygnet (top right), Little Grass Bird (bottom left), Australasian Shoveler (bottom right).

Figure 12. Love was in the air at Reedy Swamp in 2021

Baby magpie in nest (left), Tawny Frogmouth on nest (top right), juvenile Superb Fairy Wren getting his colour patch ready for mating season (bottom right).

Table 8: Wetting and drying patterns for each wetland from 2012 to 2022

Wetland Name	2012-13				2013-14				2014-15				2015-16				2016-17				2017-18				2018-19				2019-20				2020-21				2021-22			
	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A
Doctors Swamp	U	D	D	D	U	U	D	U	U	DD	D	D	D	E	D	D	U	U	U	U	U	U	U	U	U	D	D	D	D	D	D	U/E	U	U	DD	DD	D	D	D/U	E
Gaynor Swamp	U	DD	D	D	D	D	D	D	D	D	D	D	D	D	D	D	U	U	U	D	D	D	D	E	E	E	DD	D	D	D	D	D	U	E	DD	D	D	D	D	E
Horseshoe Lagoon	U	U	U	U	U	U	U	U	U	U	D	D	D	D	D	U	U	U	U	U	U	U	U	D	U	DD	D	D	E	E	D	U	U/E	U	DD	DD	U/ E	E	DD	DD
Kanyapella Basin	U	U	U	D	D	D	D	U	DD	D	D	D	D	U	D	D	D	D	U	D	D	D	D	D	D	D	D	D	D	D	D	D	E	DD	D	D	D	E	D	D
Loch Garry	U	U	U	U	U	U	U	U	DD	D	D	D	D	D	D	D	D	U	U	U	U	U	DD	U	U	U	DD	D	D	D	D	E	U	DD	D	D	D	E	E	DD
Reedy Swamp	U	U	U	U	U	U	U	U	U	DD	D	D	D	E	DD	U	U	U	U	U	U	DD	D	D	D	E	DD	D	D	E	E/DD	U	U	U	DD	DD	U	U	DD	DD

Dry (D)	Unregulated and E-water event (U/E)	Drawing Down (DD)	Dry and unregulated event (D/U)	Environmental Water Event (E)	Unregulated flows (U)

Table 9. 2021-2022 Ecological outcomes for Goulburn Wetlands

	2021-2022 Ecological outcomes
Doctors Swamp	Watering of the site had not occurred at the time of writing this report
Gaynor Swamp	Watering of the site had not occurred at the time of writing this report
Horseshoe Lagoon	A delivery of 52ML occurred at Horseshoe Lagoon to top up the wetland after rainfall in April began to fill the site. Swans nested at the site. In Spring Azolla filled the main body of the lagoon. Populations of River Swamp Wallaby Grass have expanded. Three species of Fresh water Turtles were observed.
Kanyapella Basin	Kanyapella Basin received environmental water volume of 1000ML. Environmental water was split into two deliveries with 500ML being delivered for the first time to the north-east edge of the Basin. The other 500ML was delivered to the north-west edge of the swamp (which also received an environmental water allocation in 2020). Vegetation communities responded well to the watering with the promotion of new growth at both sites. Water birds also responded to the watering with numerous ducks observed in the deeper water in the north-east corner of the Basin.
Loch Garry	Loch Garry received 1000ML environmental water allocation (500ML was delivered in 2020). This promoted the growth of aquatic vegetation which in-turn supported waterbird and turtles at the site.
Reedy Swamp	No watering occurred at this site due to prolonged flooding. Flooding due to large rainfall events and significant events throughout 2021-2022 which kept the swamp holding water.

Shared benefits 2021-2022

A review of the shared benefits of the Goulburn wetlands in 2021-2022 is listed in Table 10 below.

Table 10: Shared benefits 2021-2022

Beneficiary	Review of benefits
Traditional Owners	Watering of wetlands and participation of Traditional Owners in delivering Environmental Water to sites allows these communities to meet cultural obligations and maintain connections with Country through continually healing and caring for it.
Landholders	Landholders adjoining the Yambuna Creek, which was the delivery conduit for environmental water delivery to Kanyapella Basin, were pleased with the environmental water delivery to Kanyapella Basin. Waterbirds including Spoonbills and Bush-stone Curlews were observed along the Yambuna Creek.
Recreational users/ local groups	The natural filling of most wetlands in the Goulburn Catchment and the environmental water delivery to Kanyapella Basin, Loch Garry and Gaynor Swamp allowed recreational users such as bushwalkers and bird watchers to utilise these areas and connect with nature. This also encouraged people to get out during COVID-19 lockdown and reconnect with nature.

Environmental Objectives

Long-term ecological and hydrological objectives have been established in Environmental Water Management Plans for the wetlands considered in this proposal. The ecological objectives for the Goulburn wetlands are outlined below in Tables 11-16. The objectives vary by wetland, with Gaynor Swamp, Horseshoe Lagoon and Kanyapella Basin all having objectives relating to either providing feeding and roosting habitat for waterbirds, waterbird breeding opportunities and/or maintaining/improving populations, turtle species and frog populations and species diversity of native wetland flora for 2022-2023. Doctors Swamp, Loch Garry and Reedy Swamp have the objective of drying for the 2022-2023 season.

Table 11. Promotion of drying at Doctors Swamp

Potential Watering action	Promote drying at site
Expected Watering Effects	None
Environmental Objectives	Allow swamp to draw down and dry for at least 6 months to complete nutrient cycle and to reach optimal drying period.
Rationale for proposed application in 2022-2023	Water will be delivered to the swamp in autumn 2022 to promote the growth of aquatic vegetation in-turn providing nesting and feeding material for waterbirds, especially Brolga. Allowing the swamp to draw down and dry for at least 6 months after this delivery will assist with the completion of the nutrient cycle and for the swamp to reach its optimal drying period.

Table 12: Potential watering actions and environmental objectives for Gaynor Swamp

Potential Watering action	Partially fill (top-up) Gaynor Swamp in spring 2022 through early summer 2023 to maintain optimal ponding duration of 6 months and prevent nest abandonment by waterbirds if waterbird breeding event occurs.
Expected Watering Effects	Prevent critical harm to waterbird hatchlings by maintaining water level in main body of swamp to at least 1m to safeguard against nest abandonment. Promote growth of vegetation to assist with recruitment.
Environmental Objectives	Protect and restore ecosystem functions at Gaynor Swamp by supporting waterbird breeding, especially Brolga (*Antigone rubicunda*). Maintain optimal ponding duration to promote vegetation growth and recruitment of EVCs.
Rationale for proposed application in 2022-2023	Waterbirds bred successfully at Gaynor Swamp in Spring 2020 due to maintained water levels and good growth of vegetation (nesting habitat). Water will be delivered to the swamp in autumn 2022 to promote the growth of aquatic vegetation in-turn providing nesting and feeding material for waterbirds, especially Brolga. If breeding begins and the threat of water loss via evapotranspiration is high, environmental water will be used to maintain the water level to allow young in nests to fledge.

Table 13. Potential water actions and environmental objectives for Horseshoe Lagoon

Potential Watering action	Partially fill (top-up) Horseshoe Lagoon in winter 2022 to a variable depth of 0.5-2m for 8-10 months
Expected Watering Effects	Inundate wetland to promote and improve growth of EVCs in both deeper (<2m) and fringing (=0.5m) parts of the wetland. Inundate wetland to margins to maintain soil moisture and supress growth of weeds to promote growth of natural and re-introduced threatened species such as River Swamp Wallaby-grass (*Amphibromus fluitans*), Green-top Sedge (*Carex chlorantha*), Veiled Fringe-sedge (*Fimbristylis velata*) and Hypsela (*Hypsela tridens*). Fill wetland to stimulate ecosystem functions to support food resources and create breeding conditions to support turtle populations including the Eastern long necked (*Chelodina longicollis*), Murray River (*Emydura macquarii*) and Broad-shelled (*Chelodina expansa*).
Environmental Objectives	Protect diversity, recruitment, and regeneration of target EVCs from the 2012 - 2019 benchmark by 2025. Maintain water level to promote recruitment and regeneration of Tall Marsh (821), Floodway Pond Herbland (810) and Aquatic Herbland (653) EVCs and threatened plant species (both planted and naturally occurring). Protect threatened plant species, including River Swamp Wallaby-grass (*Amphibromus fluitans*), Green-top Sedge (*Carex chlorantha*), Veiled Fringe-sedge (*Fimbristylis velata*), Hypsela and (*Hypsela tridens*) at Horseshoe Lagoon by 2030. Establish benchmark of condition these species by 2024. Protect Eastern long necked (*Chelodina longicollis*), Murray River (*Emydura macquarii*) and Broad-shelled (*Chelodina expansa*). at Horseshoe Lagoon by providing the feeding and breeding habitat needed to support life cycle processes, assessed by the presence of these species in 50% years to 2025.
Rationale for proposed application in 2022-2023	Horseshoe Lagoon filled naturally between April/ May 2021. The Lagoon was still holding water in March 2022, with deeper parts of the lagoon acting as refuge pools. Plantings of aquatic species were undertaken in November 2020, January 2021 and 2022 to promote and reinstate threatened species within the lagoon. Topping up or filling the lagoon (if it dries out) in winter 2022 will be necessary to promote growth of EVCs and encourage establishment of planted species.

Table 14. Promotion of drying at Loch Garry

Potential Watering action	Promote drying for 2022-2023
Expected Watering Effects	None
Environmental Objectives	Promote drying of Loch after prolonged wetting in 2021-2022.
Rationale for proposed application in 2022-2023	Loch Garry received its first environmental water allocation of 1000ML in Spring 2021 (it received 500ML in Autumn 2020). Large rainfall events and natural inflows have assisted with keeping the site wet into February 2022. The long-term inundation of the Loch has led to the depletion of the littoral zone seedbank and a variable water level is required to promote establishment of littoral vegetation and that without direct seeding this may take some time to achieve and will be dependent on upstream propagules arriving in natural and managed watering events. Promotion of a drying regime for at least 6 months will allow the completion of the nutrient cycle and allow the Loch to reach its optimal drying period.

Table 15. Potential watering actions and environmental objectives for Kanyapella Basin

Potential Watering action	Partially fill Kanyapella Basin to a maximum depth of 300mm in autumn 2023 for 4 months
Expected Watering Effects	Inundate deeper parts of wetland from both western and eastern edges to maintain soil moisture to promote Riverine Swamp Forest (814) and Sedgy Riverine Forest complex/ Riverine Swamp Forest complex (817). Inundate wetland in autumn to promote growth to maintain Rigid water-milfoil (*Myriophyllum porcatum)* and River Swamp Wallaby (*Amphibromus fluitans*) grass populations.
Environmental Objectives	Maintain or improve diversity (EVC benchmark), recruitment, and regeneration of Riverine Swamp Forest (814) and Sedgy Riverine Forest complex/ Riverine Swamp Forest complex (817). Ensure the protection of threatened plant species including River Swamp Wallaby-grass (*Amphibromus fluitans*) and Rigid Water-milfoil (*Myirophyllum porcatum*) both of which occur in EVCs 814 and 817.
Rationale for proposed application in 2022-2023	Kanyapella Basin received an environmental water delivery of 1000ML in spring 2021 (it received 500ML in winter 2020). The Basin held the water for 3 months before drying out. The expected extended ponding time mentioned in the 2020-2021 Goulburn Wetlands Seasonal Watering Proposal did not occur. This may have been due to the Basin being extremely dry before the delivery occurred with some loss into the soil profile. Partially filling the Basin in autumn 2023 will promote EVC growth allowing better establishment of aquatic vegetation. Autumn watering will promote growth of the EPBC listed Rigid Water-milfoil (*Myirophyllum porcatum*) and River Swamp Wallaby Grass (*Amphibromus fluitans*) maintaining these populations within the Basin. Discussions with the GB Scientific Technical Committee have confirmed that an autumn watering would be beneficial to the aquatic vegetation, priming the site for winter/ spring. If no rainfall events occur during winter 2023 an early spring delivery would be proposed to assist with targeting optimal ponding duration of 8 months.

Table 16: Promotion of drying at Reedy Swamp

Potential Watering action	Promote drying of the site
Expected Watering Effects	None
Environmental Objectives	Promote drying of the site to prevent prolonged inundation and allow swamp to reach optimal drying period.
Rationale for proposed application in 2022-2023	Reedy Swamp filled naturally in April 2021 due to a large rainfall event. Winter and spring rainfall kept the wetland filled and was still holding watering at the time of writing this plan (March 2022). To promote an optimal drying regime (6-10 months) water should not be delivered to the site until spring 2023 (dependent when site dries completely).

Scenario planning

The demand and utilisation of environmental water will vary according to climatic conditions. In drier periods reduced natural inflows and restricted water resources may mean that environmental water is not available. However, in wetter periods the ecological and hydrological objectives of a wetland may be largely met by natural inflows and only small volumes of environmental water may be required. Currently, good inflows in 2021-2022 and allocations reaching 100% early in the season there are reserves in the Goulburn system that will provide for an opening allocation under all inflow conditions (Table 17 – February 2022). There is also a large volume of environmental water carryover that will aid in delivering early season watering priorities (Table 17).

Table 17: Goulburn system outlook seasonal determination of high reliability shares

Inflow Conditions	1 July 2022	16 August 2022	15 October 2022	15 February 2023
Wet	100%	100%	100%	100%
Above Average	77%	100%	100%	100%
Average	65%	100%	100%	100%
Below Average	57%	85%	100%	100%
Dry	51%	67%	92%	100%
Very Dry	50%	61%	79%	92%
Extreme Dry	49%	52%	59%	67%

Scenarios are based on receiving catchment inflows with a Probability of Exceedance (PoE) and the likely availability of environmental water, based on data from Goulburn-Murray Water. The scenarios are extreme dry/drought (99% PoE), dry (90% PoE), average (50% PoE) and wet (10% PoE). These scenarios depict representative seasonal conditions with different natural inflows to the wetlands and the volume of environmental water required. Table 18 rationalises the volumes required for delivery at proposed watering sites for 2022-2023.

Table 18: Scenario planning for Goulburn Wetlands to be watered in 2022-2023.

Wetland	Scenario 1 Extreme Dry 99% PoE No natural inflow to wetlands	Scenario 2 Dry 90% PoE Little to no natural inflow to wetlands, rainfall	Scenario 4 Average 50% PoE Average natural inflow to wetland	Scenario 5 Wet 10% PoE Above average inflow to wetland
Gaynor Swamp	1000ML – provide drought refuge and maintain wetland to avoid critical loss	1000ML – provide refuge and maintain wetland to avoid critical loss	1000ML – maintain water levels or fill swamp if primed due to natural inflows. Provide conditions for bird breeding and improve or maintain EVCs.	500ML – maintain water levels if swamp holding water. Provide optimal conditions for bird breeding events and improve or maintain EVCs.
Horseshoe Lagoon	120ML - provide drought refuge and maintain wetland to avoid critical loss	120ML – provide refuge and maintain wetland to avoid critical loss	120ML - maintain water levels or fill swamp if primed due to natural inflows. Provide conditions for bird breeding and turtle nesting and improve or maintain EVCs.	60ML - maintain water levels if swamp holding water. Provide optimal conditions for bird breeding and turtle nesting events and improve or maintain EVCs.
Kanyapella Basin	0ML - due to transition losses being too high en route. The current delivery mechanism via the Coram Main Drain and Yambuna Creek would have high transition losses due to watering being lost in the soil profile.	1000ML - provide refuge and maintain wetland EVCs and threatened species to avoid critical loss. If some inflows had occurred and partially primed the delivery mechanisms.	1000ML - maintain water levels or fill swamp if primed due to natural inflows. Provide conditions for bird breeding, improved populations of threatened plant species and improve or maintain EVCs.	0ML - due to site being classified as a flood retardation basin. Kanyapella Bain con only receive an environmental water allocation of 1000ML on the west side and 1500ML on the eastern side. If there is a risk of potential flooding and environmental water had been delivered to the site, this could be detrimental to adjoining landholders and increase risk of flooding.

Potential watering actions 2022-2023

The environmental water management priorities currently being considered for inclusion in 2022-2023 Seasonal Watering Proposal are listed below (Table 19). These have been categorised into Tier 1 and Not Applicable. Tier 1 watering actions which are the critically important actions that should be achievable based on estimates of supply and other available resources under each planning scenario.

In 2022-2023, in all climatic scenarios from extremely dry to wet it is proposed to deliver water for the environment to Gaynor Swamp and Horseshoe Lagoon. The natural hydrological regime of these wetlands has been altered due to catchment changes and river regulation and require water for the environment to fill in all climatic conditions. The proposal is to deliver water for the environment to Kanyapella Basin in dry and average climatic scenarios only. If the forecast is for extremely dry conditions the transition losses are considered too great for the delivery to be effective. As Kanyapella Basin is classified as a flood retardation basin, designed to mitigate impacts of large flood events from the Lower Goulburn and Murray Rivers the delivery of water for the environment is not proposed for a forecast wet scenario. Environmental Water deliveries are not proposed for Doctors Swamp, Loch Garry or Reedy Swamp under any climate scenarios as they enter a drying phase.

Table 19: Potential Watering Actions 2022-2023

Priority	Wetland	Potential Watering Action	Climate Scenario and ML Water			
			Ex. Dry	**Dry**	**Average**	**Wet**
NA	Doctors Swamp	Allow swamp to draw down and dry for at least 6 months to complete nutrient cycle and to reach optimal drying period.	0	0	0	0
1	Gaynor Swamp	Partially fill (top-up) Gaynor Swamp in spring 2022 through early summer 2023 to prevent nest abandonment by waterbirds if waterbird breeding event occurs.	1000	1000	1000	500
1	Horseshoe lagoon	Partially fill (top-up) Horseshoe Lagoon in winter 2022 to a variable depth of 0.5-2m for 8-10 months to maintain water level to promote recruitment and regeneration of listed EVCs and associated threatened plant species (both planted and naturally occurring).	120	120	120	60
1	Kanyapella Basin	Partially fill Kanyapella Basin to a maximum depth of 300mm in autumn 2023 for four months to promote and improve the diversity of EVCs and encourage threatened aquatic species populations to establish.	0 (Due to transition losses being too high en route)	1000	1000	0 (Due to site being classified as a flood retardation basin)
NA	Loch Garry	Allow Loch to draw down and dry for at least 6 months to complete nutrient cycle and to reach optimal drying period.	0	0	0	0
NA	Reedy Swamp	Allow swamp to draw down and dry for at least 6 months to complete nutrient cycle and to reach optimal drying period.	0	0	0	0
Total ML			**1120**	**2120**	**2120**	**560**

Delivery constraints

Delivery constraints are physical, operational or administrative factors that can impact the delivery of environmental water to the wetlands. A notice period of one to two days minimum, preferably four days, is required for environmental water orders from Goulburn system storages. If constraints in making environmental water available are foreseen by Goulburn-Murray Water, the Environmental Water Manager will be advised accordingly. The physical delivery of environmental water to the wetlands may only take 1-15 days during the irrigation season depending on system demands.

Gaynor Swamp can receive 20ML/day via the Rochester Channel 14. Gaynor Swamp does not have a delivery share, therefore environmental water can only be delivered when there is spare capacity to carry water in the irrigation channel.

Horseshoe Lagoon can receive environmental water by pumping directly from the Goulburn River. A contractor is engaged to supply, install, operate, and remove a temporary pump. A service point (SP) number has been allocated by Goulburn-Murray Water for this site to facilitate future watering.

Kanyapella Basin can hold an estimated 20,000ML and plays a local flood retardation role. Due to this role Goulburn-Murray Water has stipulated that no more than 1500ML east of the Tongala drain or 1,000ML west of the Tongala drain should be delivered to the wetland (the Tongala drain runs north south through the wetland). Environmental water can be delivered to the wetland via adjoining irrigation drains and regulators at a rate of up to an estimated 20 ML/day.

The Goulburn Broken Catchment Management Authority will coordinate any planned delivery of environmental water in 2022-2023 with the VEWH, Goulburn-Murray Water, Parks Victoria, and adjoining landholders. Further delivery arrangements will be outlined in delivery plans.

The delivery constraints for wetlands in the Goulburn Catchment are summarised below in Table 20.

Table 20: Possible delivery constraints to wetlands in the Goulburn system in 2022-2023

Priority site	Delivery Constraint	Impact/Consequence	Mitigating Action	Temporary/Systemic Constraint
Gaynor Swamp	Gaynor Swamp can receive 20ML/day via the Rochester Channel 14. Gaynor Swamp does not have a delivery share, therefore environmental water can only be delivered when there is spare capacity to carry water in the irrigation channel.	Impact on delivery timing and duration if water not available. Impact on target waterbird breeding such as Brolga if scoping the area and no water available, may move on to other areas or may not breed.	GB CMA to discuss appropriate timing of watering with GMW to meet both irrigation demand and environmental water delivery requirements.	Systemic
Horseshoe Lagoon	Water needs to be pumped into the wetland from the adjoining Goulburn River via a portable pump. This requires adequate river flows, approvals, budget and labour.	Impact on delivery if river flows not high enough. If approvals not met, delivery cannot occur which may be detrimental to flora and fauna at the site. Budget costs and pressure on labour can be high. May not have the funding to hire a pump or may get burn out from staff/ TOs in managing pump. Impact on TO's as a cultural site, water in the lagoon may be an important part of connection to country and healing. This may not be able to take place if water not available.	GB CMA to ensure budget, approvals and labour in place well before planned delivery.	Temporary/Systemic
Kanyapella Basin	Kanyapella Basin is used by GMW for local flood retardation. Therefore, delivery of environmental water is restricted to 1,000ML to the west and 1,500ML to the east of the Tongala drain. Environmental water can only be delivered during the irrigation season when there is capacity in the channel system.	Impact on flora and fauna if watering requirements can be met. Lack of ability to water outside of the irrigation season limits variation in watering which can have an effect on the promotion of different vegetation types by watering at different times of the year.	GB CMA to discuss appropriate timing of watering with GMW to meet both irrigation demand and environmental water delivery requirements.	Systemic

Confounding Factors

Confounding factors are other environmental factors that have the potential to limit or impact desired environmental watering outcomes. Regulation of the Goulburn River and land use changes have altered the landscape reducing and changing vegetation and therefore habitat for many species. Species diversity and richness has been severely impacted which may result in some of the watering outcomes not able to be realised. Many wetlands are small and often disconnected from the main river channel and each other resulting in a disconnected landscape limiting the movement of plants and animals. Invasive animals and plants such as foxes, carp and blackberry can have serious impacts on native flora and fauna. Table 21 below identifies confounding factors for the Goulburn wetlands to be watered in 2022-2023 and the proposed and planned mitigating actions.

Table 21: Confounding factors

Wetland	Confounding factor	Mitigating Action
Gaynor Swamp	Foxes predating visiting water birds and raiding nests. Eating frogs and spreading weeds and disease. Gaynor Swamp is a State Game Reserve managed by Parks Victoria and is popular with duck hunters. Duck hunting reduces the number of waterbirds both directly and indirectly.	Work with Parks Victoria and surrounding landholders to undertake co-ordinated fox control program – baiting, soft jaw trapping, fox drives. Work with Parks Victoria to close swamp to duck hunters during delivery and if threatened waterbird species are present. Work with Field and Game Australia and Game Management Authority to get their support with this decision.
Horseshoe Lagoon	Foxes are a threat to turtle population by raiding nests and killing adults. Foxes also predate birds and frogs. Deer are impacting the vegetation and water quality at Horseshoe Lagoon. The invasive blackberry (WoNS) is present in large clumps. If left untreated it can take over native vegetation and it also harbours foxes Aquatic plant species absent, propagules not available for natural regeneration, therefore vegetation objectives may not be met. Lack of instream woody habitat limiting macroinvertebrates – food web.	Parks Victoria and the surrounding landholders are undertaking a coordinated fox control program. Baiting has occurred on the surrounding properties and soft jaw traps set within the lagoon. Parks Victoria organised a fox drive in April 2021. GB CMA and Parks Victoria have used turtle detector dogs to find turtle nest so they can be protected from them being raided. Work with Parks Victoria, TLaWC and surrounding landholders to come up with a plan to reduce impacts of the deer. Parks Victoria are organising a hunter too remove the deer in 2022. GB CMA engaged TLaWC in early 2022 to undertake 4 days of blackberry control. Continue to encourage Parks Victoria and adjoining landholders to undertake annual weed management. Parks Victoria and TlaWC have commenced planting aquatic species that are absent or in low numbers. GB CMA to consider reintroduction of woody habitat.
Kanyapella Basin	Introduction of carp to the wetland during delivery – impacts on aquatic vegetation and water quality.	GB CMA to install temporary carp screen prior to delivery.

Increasing Knowledge

WetMAP - Victoria's Wetland Monitoring and Assessment Program for environmental water is a state-wide monitoring program designed to assess the ecological response of vegetation, waterbirds, and fish to the delivery of environmental water in Victorian wetlands. The WetMAP program objectives are:

- Build on current knowledge and conceptual models to improve the understanding of the relationships between environmental flows and ecological response/ outcomes.
- Determine whether the current ecological objectives for environmental watering are being met.
- Inform environmental flow management for CMAs – inform the development of objectives and planning for environmental water delivery.
- Communicate the ecological outcomes of environmental water delivery in Victorian wetlands to the Minister, water industry stakeholders and broader community.
- Contribute to Victoria' Murray Darling Basin Plan reporting requirements.

WetMAP monitoring began at Doctors Swamp, Gaynor Swamp and Reedy Swamp in late 2017. Monitoring began at Horseshoe Lagoon, Kanyapella Basin and Loch Garry in 2020 (https://www.ari.vic.gov.au/research/wetlands-and-floodplains/assessing-wetland-response-to-water-for-the-environment). This monitoring will complement the monitoring being undertaken by the GB CMA staff.

Compliance monitoring is undertaken during the delivery of environmental water. This involves monitoring regulator operation and volumes of water delivered. GB CMA, Parks Victoria and Traditional Owners undertake field observations when possible. In the case of Horseshoe Lagoon Parks Victoria regularly install trail cameras to record turtles and other wildlife as well as feral animals. Acoustic recorders are deployed at all wetlands either during or shortly after the delivery to determine the presence and number of birds and frogs. The information collected has been highly valuable in informing the ongoing management of these wetlands, and for State Government and VEWH reporting.

During any environmental water delivery in 2022-2023 monitoring of the vegetation response including EPBC (1999) listed species Rigid water-milfoil (*Myriophyllum porcatum*) and River Swamp Wallaby-grass (*Amphibromus fluitans*) will occur on a regular basis at Horseshoe Lagoon, Loch Garry, and Kanyapella Basin.

In the event of wetlands naturally filling, waterbird monitoring, water depth and extent will be monitored on a regular basis in spring and summer to determine when and if environmental water is required. If environmental water is delivered to a wetland these attributes will continue to be monitored along with the volume of water delivered. Attention will be paid to water levels to ensure nests are not exposed by water losses and nests close to the water surface are not inundated by environmental water deliveries. Monitoring of ecological attributes such as vegetation will be dependent upon available funding and staff resources.

Knowledge Gaps and Limitations

One of the key knowledge gaps associated with wetland environmental water management is the limited information on the flood regime tolerances of aquatic dependent ecological vegetation communities and their associated flora species such as cane grass (*Eragrostis infecunda*) and the EPBC (1999) listed Rigid Water-milfoil (*Myriophyllum porcatum*) and River Swamp Wallaby-grass (*Amphibromus fluitans*).

Information is limited on the Alluvial Plains Semi-arid Grassland EVC which was discovered at Gaynor Swamp in January 2018 (Appendix 3). This EVC (#806) is uncommon in the catchment as it is usually localised to riverine areas in the north-western part of the state. The EVC occurs in areas with infrequent inundation and should be inundated less than 3 years in every 10 (Frood and Papas 2016).

These knowledge gaps do not prevent environmental water being delivered to the wetlands. However, more information on the flood regime tolerances of aquatic dependent ecological vegetation communities and their associated flora species would help refine wetland flood regimes and the management of environmental water.

The integration of traditional ecological knowledge for the purposes of informing wetland watering has not yet been carried out in a comprehensive way across the Goulburn catchment. Working closely with Traditional Owners, and facilitating Traditional Owner led assessments of biocultural values to identify cultural priorities for watering, including the tailoring of e-water deliveries to better align with cultural values such as the growth of medicinal plants, watering of sites at particular times for cultural activities, maintaining connection to Country, and healing of Country is extremely important.

Reporting

The first level of reporting is on the use of environmental entitlements. Weekly reporting advises environmental entitlement holders of progressive water use and on any adaptive water deployment decisions made.

The second level of reporting is on environmental outcomes achieved. Information on the use of environmental water, environmental outcomes recorded, and any knowledge gained will be reported to GB CMA partners and the board monthly and summarized in the 2023-2024 Goulburn System Wetlands Seasonal Watering Proposal. WETMAP also produces annual reports on the results of the program.

Risk Management

The risks associated with the proposed delivery of environmental water to the wetlands in the Goulburn Broken Catchment are outlined in Table 22 below, along with their mitigation actions and the organisation responsible for their implementation. These will be reviewed and updated prior to the delivery of environmental water in site specific environmental water delivery plans.

Table 22: Risk assessment of proposed water delivery to Goulburn System Wetlands

							Pre-Mitigation Risk					Residual Risk				
FY	Region	System	Waterway Manager	Risk ID	Risk category	Risk description	Likelihood	Consequence	Risk Rating	Mitigation actions	Lead organisn. for action	Likelihood	Consequence	Risk Rating	Remains medium/high after mitigation	Risk type Static or Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-01	Environment	Specified flow rates are insufficient to achieve the intended extent of wetland inundation or magnitude and duration of river flows, resulting in a failure to achieve planned environmental outcomes.	Possible	Major	Medium	• Include contingency allowance in estimated watering requirements, based on previous event data, and consider a contingency in the duration of the event to achieve desired wetland inundation. • Monitor event (especially for deliveries to new sites or for previously untested events) and adjust flows as necessary, or terminate event if it becomes clear that insufficient water is available. • Identify and address constraints that may limit the flow rates for environmental deliveries.	CMA CMA CMA/GMW					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-02	Reputational	Specified flow rates are insufficient to achieve the intended extent of wetland inundation or magnitude and duration of river flows, resulting in a failure to achieve planned environmental outcomes and loss of community support.	Possible	Major	Medium	• Communications on the environmental benefits of watering actions. • Monitor event (especially for deliveries to new sites or for previously untested events) and adjust flows as necessary, or terminate event if it becomes clear that insufficient water is available. • Communicate the need for complimentary measures to optimise the benefits of environmental watering actions.	CMA					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-03	Environment	Overestimates of environmental water demand prevents planning for supplying demands at other locations *Notes: Planning watering actions also includes decisions around the carryover and trade of water as alternatives to current year water use decisions.*	Possible	Minor	Low	• CMAs review demand estimates and targets met by unregulated flows throughout the delivery cycle and regularly advise VEWH of any changes so unused water can be reallocated. • CMAs review demand estimates at the conclusion of the watering year, prior to the development of the following seasonal watering proposal, so estimates of future requirements are more accurate. • River operators provide regular updates on flows, including through OAG meetings • Manage Water Holdings to maximise supply opportunities for all sites	CMA CMA MDBA/GMW VEWH					Static

2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-04	Environment	Inaccurate accounting and measurement or operational error results in target flows either not being achieved or being exceeded, leading to a failure to achieve planned environmental outcomes Occurring in Upper Broken CK below Casey's weir offtake due to weed growth, which is also limiting flow capacity (likelihood for Broken is "possible")	Unlikely	Moderate	Low	• Review accounting and measurement processes to be used to ensure that techniques are agreed, and monitoring/measurement sites are operational. - Apply agreed arrangements as documented in the Murray and Goulburn Systems Operating Arrangement documents - GMW to undertake additional gaugings - Weed control in Bkn Ck programmed for autumn (weather conditions permitting)	GMW (MDBA in some waterways such as Barmah) GMW/VEWH GMW GMW/CMA					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-05	Business Costs	Volumes of environmental water delivered or released exceed volumes approved for use in the event, leading to potential overdrawing of accounts or preventing other planned actions being undertaken. *Notes: Planning watering actions also includes decisions around the carryover and trade of water as alternatives to current year water use decisions.*	Unlikely	Major	Low	• Ensure that deliveries are reported progressively throughout the event and are monitored against ordered volume. • Ensure ordering and delivery procedures are kept up-to-date and adhered to. • Ensure metering and reporting processes for temporary pump operations are suitable and effective	CMA & GMW GMW/CMA/VEWH CMA					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-06	Environment	Environmental water account is overdrawn, leading to water not being available as per approved watering statement to complete planned actions and environmental benefits not being achieved. *Notes: Planning watering actions also includes decisions around the carryover and trade of water as alternatives to current year water use decisions.*	Unlikely	Major	Low	• Monitor ABA balances and undertake regular communications with CMA and RWC as part of portfolio management activities. • Ensure that deliveries are reported progressively throughout the event and are monitored against ordered volume.	VEWH CMA & GMW					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-07	Environment	Planned maintenance of water delivery infrastructure results in planned/specified flows not being achieved, leading to a failure to achieve planned environmental outcomes.	Likely	Minor	Low	• Undertake early planning and communications between the CMA and storage operator to minimise likelihood of constraints, enable scheduling of maintenance outside of high demand periods or identify alternative environmental water delivery windows to avoid scheduled maintenance activities. • Consider adding time contingencies to planned maintenance schedules to ensure works are completed prior to commencement of watering actions.	CMA and GMW CMA					Static

2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-08	Environment	Failure of poorly maintained environmental delivery infrastructure results in planned/specified flows not being achieved, reducing the ability to achieve planned environmental outcomes.	Likely	Moderate	Medium	• Asset ownership is clarified, and the asset owners perform regular maintenance, and pre-event asset inspections, on delivery infrastructure. **Note that insufficient resources are likely to limit the asset owner's ability to regularly inspect and maintain infrastructure. Increased resources for these activities may further reduce the likelihood and risk ratings.* • Report vandalism to police. • Review asset design to minimise opportunities for interference or damage. • For privately owned assets, arrange approvals to use/operate assets and undertake pre-delivery inspections • Communicate failures to the CMA • Initiate documentation of asset ownership and management arrangements in national parks.	Asset Owner Asset Owner Asset Owner CMA Asset Owner PV					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-09	Environment	Poor condition of delivery infrastructure results in the asset owner being unable to operate the structure due to OH&S risks, leading to failure to deliver environmental flows and to achieve environmental objectives. Note: This issue may affect multiple sites *GMW to confirm OH&S status and likelihood rating*	Likely	Moderate	Medium	• Asset owner to undertake regular maintenance and pre-event asset inspections on delivery infrastructure. **Note that insufficient resources are likely to limit the asset owner's ability to regularly inspect and maintain infrastructure. Increased resources for these activities may further reduce the likelihood and risk ratings.* • Communicate failures to the CMA • Develop design for new regulating structure and seek funding to implement necessary upgrades in conjunction with asset owner. *Note: PV proposing to issue operating licences for BMF regulators*	Asset Owner Asset Owner CMA (MDBA in Barmah Forest)					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-10	Environment	High operational and consumptive water demands lead to reduced access for environmental deliveries, with the result that target flows/volumes cannot be achieved, impacting on environmental outcomes Note: Goulburn R is a particular risk - see new separate Goulburn risk added	Likely	Minor	Low	• Event planning will seek to avoid peak demand periods, and events will be monitored and adjusted as necessary. • System operators to provide longer term forecasts for future consumptive demands as an input to planning watering proposals • Develop longer term agreements on river capacity access for environmental deliveries. • Investigate opportunities to undertake deliveries outside the irrigation season with consideration of appropriate delivery costs	CMA and GMW GMW/MDBA VEWH CMA and VEWH					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-12	Legal	Environmental releases, either on their own or potentially in combination with unexpected tributary inflows, cause unauthorised inundation of private land, resulting in impacts on landowner activities and assets.	Possible	Major	Medium	• Ensure currency of any landholder agreements for inundation of private land. • Release plans designed to avoid exceeding operational thresholds or unauthorised flooding. • Monitor events and adjust releases to avoid overbank flows. This may include limiting deliveries to daylight hours only, where feasible and consistent with watering requirements. • Monitor forecast rainfall and tributary inflows and adjust releases to avoid overbank flows. • Monitor deliveries to new locations to build an understanding of flow patterns and inundation thresholds and adjust releases accordingly.	CMA CMA GMW/MDBA GMW/MDBA CMA					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-13	Reputational	Public land and/or access routes into public land areas may be inundated by delivery of environmental water, leading to potential impacts on recreational opportunities for park users (e.g. access to boat ramps, fishing spots, firewood collection etc.).	Almost certain	Moderate	High	• Watering proposals to identify potential impacts. communication of planned events, access closures, alternative recreational opportunities and alternative access routes	CMA Land Manager					Static

2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-15	Business Costs	Public land visitor vehicles cause damage to tracks, or to other assets in the surrounding landscape, due to off-road activity (by users going off track to avoid floodwaters) during and after environmental watering	Likely	Moderate	Medium	Land Managers: • implement management activities to prevent access to flooded roadways (e.g. close roads, communicate planned events, install signage) • repair damage during and after environmental watering events • maintain key higher ground tracks to enable alternative access routes during environmental watering. **Note that insufficient resources may limit the land manager's ability to implement management activities and hence ability to effectively mitigate the described risk.*	Land Manager					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-17	Service Delivery	Access routes into public land areas may be inundated by delivery of environmental water, leading to potential impacts on land management and maintenance activities (e.g. fire mgmt. works)	Almost certain	Moderate	High	Early planning and communications of proposed actions with land manager to minimise likelihood of impacts, and scheduling of maintenance works outside of planned delivery periods.	CMA					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-18	Environment	Environmental water deliveries result in low dissolved oxygen (DO) levels, with adverse environmental impacts. *Note: Advice is that annual leaf litter accumulation is sufficient to cause risk, even if previously inundated* *- Rainfall rejection or high consumptive deliveries may drive risk issues here, rather than e-water*	Unlikely	Moderate	Low	• Where possible implement a full annual suite of flow components in river systems, including those designed to control build of organic matter (such as winter flushes). Plan deliveries with consideration of high temperature periods where appropriate. • Develop monitoring and response plans and reserve contingency volumes in delivery plans for dilution flows if DO concentrations drop to levels of concern. • Monitor leaf litter loads and avoid exceeding any flow thresholds likely create hypoxic black water events - where possible and considering temperature drivers - Assess new/proposed actions for DO impact potential and adjust watering plans as needed.	CMA					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-19	Reputational	Environmental water deliveries result in low DO levels, with adverse environmental impacts.	Unlikely	Major	Low	• Communicate benefits of environmental water management to the broader community and engage with recreational user peak bodies and management agencies. • Communicate the benefits of environmental water management and inform the local community of environmental water management activities and the underlying rationale, including black water mitigations. - Inform communities of black water vs hypoxic black water issues, to build understanding and support	VEWH CMA - VEWH/CEWO					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-20	Environment	Environmental water deliveries may generate or mobilise BGA blooms, with adverse water quality and/or health impacts (including to people, livestock and pets), resulting in cessation of releases and environmental impacts	Possible	Major	Medium	• Consider likelihood of initiating BGA blooms in event planning and amend as required to manage risk. • Land managers or water corporation implement a risk-based monitoring program during environmental watering events, and where issues are identified, activate BGA response processes. **Notes: Parks Victoria are currently writing a BGA risk management plan for Northern Victoria Region that considers the potential risk of environmental water events. This plan will outline proactive and reactive monitoring and management responsibilities that Parks Victoria commits to as a Local Waterway Manager for BGA. Adequate BGA resourcing is being considering as part of this plan.* • Regional monitoring and advice on BGA status.	CMA / GMW Land Manager GMW GMW					Static

2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-21	Reputational	Environmental water management activities may conflict with or not complement water based recreational objectives, leading to loss of community support for activities.	Almost certain	Moderate	High	• Communicate benefits of environmental water management to the broader community and engage with recreational user peak bodies. • Engage with local recreational user groups to inform them of environmental water management activities and the underlying rationale. • Adjust events or actions to reduce/avoid impact where practical without reducing environmental outcomes. • Communicate alternate recreational opportunities. • Enhance community understanding of water system operations and entitlement frameworks (water literacy).	VEWH CMA CMA Land Manager VEWH					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-22	Business Costs	Insufficient resources available (including staff, funding for maintenance of roads, regulators etc.) across partner organisations to deliver all planned environmental watering actions, leading to cancellation or interruptions of deliveries.	Possible	Major	Medium	• Partners notify the CMA and VEWH of resource constraints in advance of deliveries and VEWH convene OAG meetings to consider implications and potential solutions. • Continue to actively prioritise actions to match available resources and ensure key actions are delivered. • Reallocate tasks and available funds to ensure highest priority watering actions are delivered.	VEWH CMA CMA					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-23	Environment	Insufficient information and knowledge available to inform environmental water deliveries	Unlikely	Moderate	Low	• Identify important knowledge gaps and secure funding to improve scientific understanding. • Consider deferring deliveries until sufficient information is available to mitigate unacceptable risks. • Implement adaptive management processes and undertake trials to collect data.	CMA					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-24	Legal	Failure to recognise cultural heritage issues at a site targeted for watering may result in necessary permits and approvals not being obtained, leading to prosecution and fines.	Possible	Moderate	Medium	• Undertake desktop reviews and site assessments with archaeologists, traditional owners and land managers, to identify approval needs and contingency measures. • Obtain any necessary formal approvals/permits and implement required actions.	CMA					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-25	Cultural heritage	Environmental watering causes harm to identified cultural heritage *Note: difficult to assess consequence under cultural heritage category - needs further testing with TOs. Hard for non-TOs to try and assess, so doesn't really fit within a traditional risk assessment process*	Unlikely	Moderate	Low	• Work with Traditional Owners to ensure that the potential impact of environmental water deliveries on cultural heritage is understood and agreed, minimised or avoided. - Consider opportunities for additional resourcing for TO groups to engage in risk assessments	CMA DELWP/VEWH					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-26	Reputational	Inability to demonstrate outcomes achieved through environmental watering activities may lead to a loss of public/political support for activities	Possible	Major	Medium	• Rationalise and refocus current monitoring programs (e.g. Wetmap) to better identifying outcomes. • Seek additional funds to address gaps in monitoring programs and knowledge. • Communicate the benefits of environmental watering and monitoring results (Note: It may not be possible/affordable to address all monitoring gaps, so this risk may still be rated as medium after mitigation actions.)	DELWP VEWH CMA				Medium	Static

2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-27	Environment	Environmental deliveries improve conditions for non-native species (e.g. carp, invasive species, feral horses) and over-abundant native species (e.g. kangaroos, Red Gum encroachment) leading to adverse environmental impacts.	Likely	Moderate	Medium	• Study/understand life history of species and develop high level management strategies. • Develop and implement site specific management strategies aimed at eradication/control of existing populations (e.g. carp management strategy, willow removal program, water-lily spraying program, feral animal programs). - Implement pest reduction efforts prior to delivery of water, to ensure increases in populations remain within "tolerable" levels *(Note: This risk is still rated as **medium** after mitigation actions.)*	DELWP CMA/Land Manager				Medium	Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-28	Environment	Environmental watering actions trigger non-targeted environmental responses (e.g. bird breeding) causing unintended consequences (or lost opportunities) for other environmental values.	Likely	Moderate	Medium	• Undertake monitoring and communicate these issues as they arise and apply adaptive management and review of delivery plans. • Consider including contingency allowance in delivery plan water volumes to complete breeding events.	CMA					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-29	Environment	Ineffective planning and/or uncoordinated water ordering results in administrative obstacles that prevent watering opportunities.	Unlikely	Moderate	Low	• Enable the full range of watering actions possible in seasonal watering proposals and the seasonal watering plan (as per SWP guidelines) - Review and update the Murray system environmental watering ordering template	CMA/VEWH VEWH/MDBA					Static
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-32	Reputational	Sections of the community perceives (incorrectly) that high river flows are due to environmental releases in dry conditions, leading to a loss of support for watering activities.	Possible	Moderate	Medium	• Communications to inform the community on the drivers/reasons for high flows in river systems, especially under dry scenarios	System operator & CMA					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-33	Reputational	Community concern over environmental releases under dry seasonal conditions may lead to a loss of support for environmental watering actions.	Unlikely	Moderate	Low	• Communicate benefits of environmental watering to the community, especially in relation to strategic watering in dry periods. • Enhance community understanding of water system operations and entitlement frameworks (water literacy).	CMA VEWH					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-34	Reputational	Under dry conditions, community expectations of the extent of environmental watering that can be achieved are not met, leading to a loss of support for environmental watering actions. Note - e-water deliveries may be constrained in 22-23 due to high consumptive avail.	Possible	Moderate	Medium	• Communications to inform the community on the limits of environmental water holdings and the extent of actions possible under dry conditions. *Note that public concern in this regard may be heightened as a result of the Menindee 2019 fish death events.*	CMA					Dynamic
2019-20	Northern	Murray, Goulburn, Broken & Ovens	GBCMA & NECMA	NOGB2020-35	Environment	Limited environmental deliveries may reduce opportunities to test ecological responses to environmental flows, impacting on effectiveness of research projects.	Unlikely	Minor	Low	• Review monitoring program and adjust if possible. Reprioritise future flow targets.	CMA					Dynamic

2021-22	Northern	Goulburn	GBCMA & NECMA	NOGO2022-42	Reputational	Watering wetlands in wetter conditions leads to community concern over incr. flood risk resulting in loss of support for environmental watering program. Note: especially for Loch Garry flood protection district	Possible	Moderate	Medium	- communicate results of modelling to d/s landholders demonstrating low impacts - notification of planned delivery events to landholders - staged trial flows with increasing flows over several years to enable monitoring and assessment of outcomes	CMA					Dynamic
2021-22	Northern	Goulburn	GBCMA & NECMA	NOGO2022-44	Environment	High operational and consumptive water demands lead to reduced access for environmental deliveries, with the result that target flows/volumes cannot be achieved, impacting on environmental outcomes Note: Consumptive water en route may achieve some outcomes in Goulb, but limiting e-water from the Goulburn has d/s implications for environmental outcomes at downstream Victorian sites in the Murray system, as well as the Murray River and Lower Lakes	Likely	Moderate	Medium	• Event planning will seek to avoid peak demand periods, and events will be monitored and adjusted as necessary. - Ensure SCBEWC multi-site planning includes operational demands in its planning for downstream sites • System operators to provide longer term forecasts for future consumptive demands as an input to planning watering proposals • Develop longer term agreements on river capacity access for environmental deliveries.	CMA and GMW VEWH GMW/MDBA VEWH					Dynamic

Approval

I, Chris Cumming, the authorised representative of the Goulburn Broken Catchment Management Authority, approve the Seasonal Watering Proposal for the Goulburn Wetlands 2022-2023.

Signed for and on behalf of Goulburn Broken Catchment Management Authority

Signature of authorised representative

Name of authorised representative

Chris Cumming, CEO

Date: 13 April 2022

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Appendices

Appendix 1 - Schedule 8 – Criteria for identifying an environmental asset

Taken from the Basin Plan https://www.legislation.gov.au/Details/F2012L02240

Item	Criteria
Criterion 1: The water-dependent ecosystem is formally recognised in international agreements or, with environmental watering, is capable of supporting species listed in those agreements	
1	Assessment indicator: A water-dependent ecosystem is an environmental asset that requires environmental watering if it is: (a) a declared Ramsar wetland; or (b) with environmental watering, capable of supporting a species listed in or under the JAMBA, CAMBA, ROKAMBA or the Bonn Convention.
Criterion 2: The water-dependent ecosystem is natural or near-natural, rare or unique	
2	Assessment indicator: A water-dependent ecosystem is an environmental asset that requires environmental watering if it: (a) represents a natural or near-natural example of a particular type of water-dependent ecosystem as evidenced by a relative lack of post-1788 human induced hydrologic disturbance or adverse impacts on ecological character; or (b) represents the only example of a particular type of water-dependent ecosystem in the Murray-Darling Basin; or (c) represents a rare example of a particular type of water-dependent ecosystem in the Murray-Darling Basin.
Criterion 3: The water-dependent ecosystem provides vital habitat	
3	Assessment indicator: A water-dependent ecosystem is an environmental asset that requires environmental watering if it: (a) provides vital habitat, including: (i) a refugium for native water-dependent biota during dry spells and drought; or (ii) pathways for the dispersal, migration and movements of native water-dependent biota; or (iii) important feeding, breeding and nursery sites for native water-dependent biota; or (b) is essential for maintaining, and preventing declines of, native water-dependent biota.
Criterion 4: Water-dependent ecosystems that support Commonwealth, State or Territory listed threatened species or communities	
4	Assessment indicator: A water-dependent ecosystem is an environmental asset that requires environmental watering if it: (a) supports a listed threatened ecological community or listed threatened species; or Note: See the definitions of ***listed threatened ecological community*** and ***listed threatened species*** in section 1.07. (b) supports water-dependent ecosystems treated as threatened or endangered (however described) under State or Territory law; or (c) supports one or more native water-dependent species treated as threatened or endangered (however described) under State or Territory law.
Criterion 5: The water-dependent ecosystem supports, or with environmental watering is capable of supporting, significant biodiversity	
5	Assessment indicator: A water-dependent ecosystem is an environmental asset that requires environmental watering if it supports, or with environmental watering is capable of supporting, significant biological diversity. This includes a water-dependent ecosystem that: (a) supports, or with environmental watering is capable of supporting, significant numbers of individuals of native water-dependent species; or (b) supports, or with environmental watering is capable of supporting, significant levels of native biodiversity at the genus or family taxonomic level, or at the ecological community level.

Appendix 2a – Threatened fauna species recorded at Goulburn Wetlands

Common Name	Scientific Name	Doctors Swamp	Gaynor Swamp	Horseshoe Lagoon	Kanyapella Basin	Loch Garry	Reedy Swamp	EPBC	FFG	VROT
Australasian Bittern	*Botaurus poiciloptilus*	Y	Y					Endangered	Listed	Endangered
Australasian Shoveler	*Anas rhynchotis*		Y	Y	Y	Y	Y			Vulnerable
Australian Little Bittern	*Ixobrychus dubius*		Y				Y		Listed	Endangered
Australian Painted Snipe	*Rostratula australis*		Y		Y			Endangered		
Azure Kingfisher	*Alcedo azurea*			Y		Y				Near Threatened
Baillon's Crake	*Porzana pusilla*						Y		Listed	Vulnerable
Blue-billed Duck	*Oxyura australis*	Y	Y				Y		Listed	Endangered
Broad-shelled turtle	*Macrochelodina expansa*			Y						Endangered
Brolga	*Antigone rubicunda*	Y	Y		Y		Y		Listed	Vulnerable
Brown Quail	*Coturnix ypsilophora australis*		Y				Y			Near Threatened
Caspian Tern	*Hydroprogne caspia*		Y				Y		Listed	Near Threatened
Eastern Great Egret	*Ardea modesta*	Y	Y	Y	Y	Y	Y		Listed	Vulnerable
Eastern Long-necked Turtle	*Chelodina longicolis*	y		Y	Y	Y	Y			Data deficient
Freckled Duck	*Stictonetta naevosa*		Y				Y			Endangered
Glossy Ibis	*Plegadis falcinellus*		Y				Y			Near Threatened
Hardhead	*Aythaya australis*		Y	Y	Y	Y	Y			Vulnerable
Intermediate Egret	*Ardea intermedia*		Y		Y	Y	Y			Endangered
Latham's Snipe	*Gallinago hardwickii*		Y				Y			Near Threatened
Lewins Rail	*Rallus pectoralis pectoralis*		Y				Y			Vulnerable
Little Egret	*Egretta garzetta nigripes*		Y		Y				Listed	Endangered
Magpie Goose	*Anseranas semipalmata*	Y								Near Threatened
Murray River Turtle	*Emydura macquarii*			Y	Y		Y			Vulnerable
Musk Duck	*Bizura lobata*	Y	Y		Y	Y	Y			Vulnerable
Nankeen Night Heron	*Nycticorax caledonicus*	Y			Y	Y	Y			Near Threatened
Pied Cormorant	*Phalacrocorax varius*				Y		Y			Near Threatened
Royal Spoonbill	*Platalea regia*	Y	Y		Y	Y	Y			Near Threatened
Sloane's Froglet	*Crinia sloanei*	Y						Endangered		
Whiskered Tern	*Chlidonias hybridus javanicus*		Y		Y	Y	Y			Near Threatened
White-bellied Sea Eagle	*Haliaeetus leucogaster*		Y		Y	Y	Y		Listed	Vulnerable

Appendix 2b – Threatened flora recorded at Goulburn wetlands

Common Name	Scientific Name	Doctors Swamp	Gaynor Swamp	Horseshoe Lagoon	Kanyapella Basin	Loch Garry	Reedy Swamp	EPBC	FFG	VROT
Annual Bitter-cress	*Cardamine paucijuga s.s (type form)*				Y		Y			Rare
Annual Bitter-cress	*Cardamine paucijuga s.l*						Y			Vulnerable
Annual Buttercup	*Ranunculus sessiliflorus*				Y					Vulnerable
Bluish Raspwort	*Haloragis glauca f. glauca*		Y							Poorly known
Branching Groundsel	*Senecio cunninghamii var. cunninghamii*		Y							Rare
Dwarf Brooklime	*Gratiola pumilo*				Y					Rare
Floodplain Fireweed	*Senecio campylocarpus*				Y	Y				Rare
Green-top Sedge	*Carex chlorantha*			Y						Poorly known
Grey Spike Sedge	*Eleocharis macbarroni*	Y								Poorly known
Groundsel	*Senecio campylocarpus*						Y			Rare
Hypsela	*Hypsela tridens*			Y						Poorly known
Long Eryngium	*Eryngium paludosum*	Y			Y					Vulnerable
Narrow-fruited Water-starwort	*Callitriche palustris*	Y								Poorly known
Open Marshwort	*Nymphoides geminate*	Y								Rare
Pale Spike-sedge	*Eleocharis pallens*				Y					Poorly known
Red Swainson-pea	*Swainsona plagiotropis*				Y			Vulnerable	Listed	Endangered
Rigid Water-milfoil	*Myriophyllum porcatum*				Y			Vulnerable	Listed	Vulnerable
River Swamp Wallaby-grass	*Amphibromus fluitans*			Y	Y	Y		Vulnerable		Poorly known
Riverine Bitter-cress	*Cardamine moirensis*	Y			Y					Rare
Salt Paperbark	*Melaleuca halmaturorum subsp. halmaturorum*		Y						Listed	Vulnerable
Sand Rush	*Juncus psammophilius*						Y			Rare
Slender Darling-pea	*Swainsona murryana*				Y			Vulnerable	Listed	Endangered
Slender Water-ribbons	*Triglochin dubia*	Y	Y							Rare
Small Scurf Pea	*Cullen parvum*						Y		Listed	Endangered
Smooth Nardoo	*Marsilea mutica*	Y								Poorly known
Spiny Lignum	*Duma horrida subsp. horrida*		Y							Rare
Swamp Buttercup	*Ranunculus undosus*				Y					Vulnerable
Swamp Early Nancy	*Wurmbea dioica subsp.lacunaria*				Y					Poorly known
Veiled Fringe-sedge	*Fimbristylis velata*			Y						Rare
Western Bitter-cress	*Cardamine lineariloba*		Y							Vulnerable
Winged Water-starwort	*Callitriche umbonata*		Y		Y					Rare
Woolly Knotweed	*Persicaria lapthifolia (floccose form)*						Y			Poorly known
Yarra Burgan	*Kunzea leptospermoides*			Y						Poorly known

Appendix 3 – EVC 806

Alluvial Plains Semi-arid Grassland EVC 806

EVC description

Defining characteristics: Turf grassland (to herbland) of low-lying areas within relatively elevated riverine terraces. Shrubs incidental if present. Flood-promoted flora that potentially includes a wide range of opportunistic ephemeral/annual species. Localised to riverine areas in north-western Victoria.

Indicator species: *Sporobolus mitchellii*, *Calocephalus sonderi*, *Sclerochlamys brachyptera*, *Plantago cunninghamii* and *Brachyscome* spp.

Ecological overview

Inundation of habitat containing this EVC varies, with shallow depressions on higher terraces of the floodplain generally experiencing brief shallow flooding, which may be to some extent supported by winter waterlogging. Variants around lake margins may be more deeply inundated and remain wetter for longer, but are prone to drying out on subsequent drawdown. Generally sustained inundation does not greatly exceed 30 cm.

Phase context of EVC representation

Continuous

Frequency of inundation

Category	Description	EVC preference
Intermittent	Inundated less than 3 years in every 10	Common

Maximum event duration

Duration of waterlogging	Duration of inundation	EVC preference
1–6 months	<1 month	Common
1–6 months	1–6 months	Common

Water depth

Category	Range (cm)	EVC preference
Very shallow	<30	Common
Shallow to medium	30–100	Common

Salinity

Category	Range (mg/L)	EVC preference
Fresh	0–3,000	Common
Hyposaline	>3,000–10,000	Occasional

Management considerations

If subject to delivery of environmental water (e.g. around lake verges), allow natural drawdown and avoid frequent inundation.