Broken Wetlands Seasonal Watering Proposal 2024-2025

GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

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Document Control

STATUS	VERSION	AUTHOR	DATE	DESCRIPTION
Template	1.0	Ashley Macqueen	21/11/2023	Prepopulated content incorporated into template ready for issue to CMA.
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1 CONTEXT

This Seasonal Watering Proposal (SWP) outlines the Goulburn Broken Catchment Management Authority's (GB CMA) priorities for the use of environmental water for delivery to wetlands in the Broken catchment during 2024-2025 to protect and enhance their environmental values and health.

The purpose of this 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.
- Identify the drying requirements of wetlands to assist with the completion of the nutrient cycle, control pest species and the spread of some native or exotic vegetation within wetlands.
- Provide information for the development of the VEWH seasonal watering plan as per section 192A of the *Water Act 1989* (Vic).

The SWP is informed by scientific studies and reports that identify the watering regime required to meet the ecological objectives of the wetlands. It was prepared in consultation with key stakeholders and partners and was approved by the CEO of the GB CMA.

You may notice that the format of this Seasonal Watering Proposal is different to previous years. The Victorian Environmental Water Holder (VEWH) has amended the Seasonal Watering Proposal guidelines in 2024-25 and reduced the length of the document whilst still retaining the key information including:

- what environmental watering actions may be delivered during 2024-25;
- the rationale for delivering these environmental watering actions;
- a summary of the engagement undertaken; and
- risk management.

2 SYSTEM OVERVIEW

Of some 3,600 natural wetlands in the Goulburn Broken region, only three in the Broken catchment have infrastructure that allows them to receive environmental water: Black Swamp, Kinnairds Wetland and Moodie Swamp.

The three wetlands are on the Country of the Yorta Yorta People, whose knowledge and practice are evident throughout the landscape; for example, Black and Moodie Swamps have evidence of old cooking mounds around their perimeter. Kinnairds Wetland and Black Swamp are red gum swamps near Numurkah. Moodie Swamp is a cane grass wetland adjacent to upper Broken Creek at Waggarandall that provides excellent breeding habitat for brolga.

The water regimes of these wetlands are influenced by their position in the landscape. The development and operation of the Shepparton and Murray Valley irrigation districts have changed the natural flow paths and the timing, frequency, volume and duration of natural flooding to these and other wetlands in the region. The existing irrigation system infrastructure enables water for the environment to be delivered to the three wetlands, but under existing agreements, irrigation deliveries have priority within the channel system. This limits the volume of water that can be delivered to the wetlands. The VEWH, waterway managers and storage managers adjust the timing and rate of environmental deliveries where possible to optimise environmental outcomes within the current system constraints.

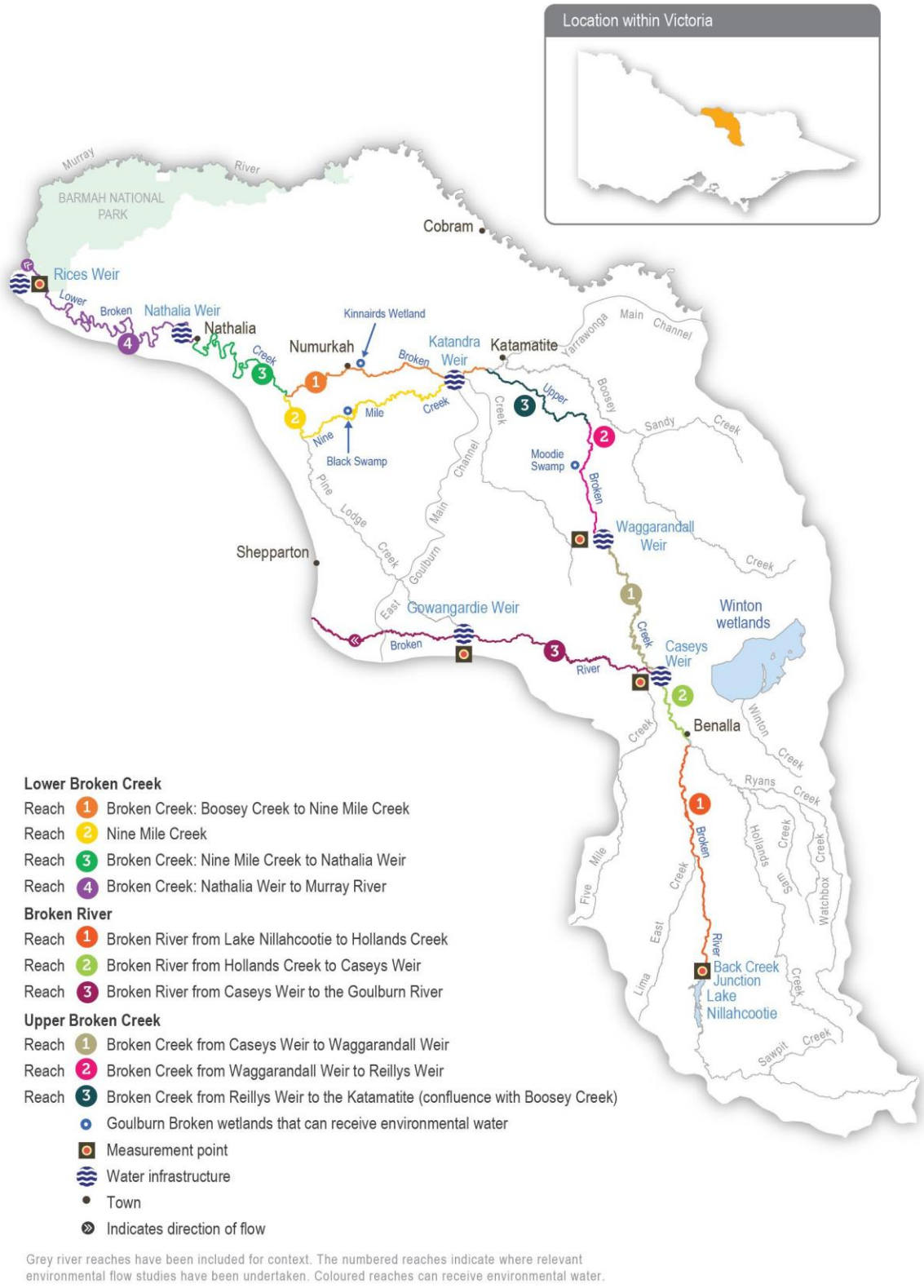

Figure 1: Broken Wetlands considered in this proposal

2.1 Black Swamp

Black Swamp is a 16.5-hectare red gum swamp managed by Parks Victoria and is part of the Black Swamp Wildlife Reserve (Figure 2). Prior to European settlement Black Swamp would have filled on a near annual basis from rainfall and flooding from the Nine-Mile Creek. Due to the wetlands relatively shallow depth it would have dried out most years over the summer-autumn period. The water regime of the wetland changed in the 1960's when irrigation was introduced to the area resulting in higher flows into the wetland during the irrigation season (August-May). In the 1970's a channel was constructed from Nine Mile Creek to flood the wetland during duck hunting season. The high irrigation flows in Nine Mile Creek and construction of the channel caused the swamp to become almost permanently inundated, reducing the diversity and abundance of biota found at the swamp. In 2008, the GB CMA upgraded water delivery infrastructure and delivered environmental water to the wetland for the first time. This has reinstated a more natural wetting and drying regime to the swamp.

Figure 2: Black Swamp in relation to Nine Mile Creek and link channel

Note: Green line indicates link channel connection between Nine Mile Creek and Black Swamp

Environmental water can be delivered by a link channel connected to the swamp from Nine Mile Creek (Figure 2). Black Swamp is listed as bioregionally significant in the *National Land and Water Resource Audit* (Cth 2002). Environmental flows can only be delivered to the swamp when flows in the Nine Mile Creek exceed 100ML/day (GBCMA 2011). This regularly occurs during the irrigation season (August – May). The wetland may only require environmental water during extended dry periods or to enhance natural inundation events to ensure the success of bird breeding events or to provide optimal growth conditions for water dependent vegetation. Black Swamp also meets several criteria under *Schedule 8* of the Basin Plan – *Criteria for identifying an environmental asset*. This includes criteria 3a (i), 3a (iii), 3b, 4a and 4c (refer to appendix 1 for criteria description).

Black Swamp provides habitat for a wide variety of aquatic and terrestrial fauna and flora species. To date 67 wetland dependent fauna and 82 wetland dependent flora species have been recorded at the

site. Wetland dependent fauna and flora species listed as threatened can be found in Appendix 2a and 2b. Black Swamp contains a significant population of the *Environmental Protection Biodiversity Conservation Act 1999* (EPBC 1999) listed River Swamp Wallaby-grass (*Amphibromus fluitans*) which emerges in autumn. Water Nymph (*Najas tenuifolia*), which is classified as rare in Victoria was first recorded at Black Swamp in February 2016.

2.2 Kinnairds Wetland

Kinnairds Wetland is a 96-hectare red gum swamp jointly managed by Goulburn-Murray Water and Moira Shire (Figure 3). It is located on the floodplain of the lower Broken Creek, approximately two kilometres north-east of Numurkah. It consists of a natural depression, part of which has been modified into a constructed wetland. It is a significant wetland for Royal Spoonbill (*Platalea regia*) breeding and has the largest known recorded population of the EPBC (1999) listed Ridged Water Milfoil (*Myriophyllum porcatum*) in Victoria. The numerous walking tracks, bird hides, picnic shelters, interpretive signage and opportunities to spot wildlife attracts 100's of visitors to the wetland each year.

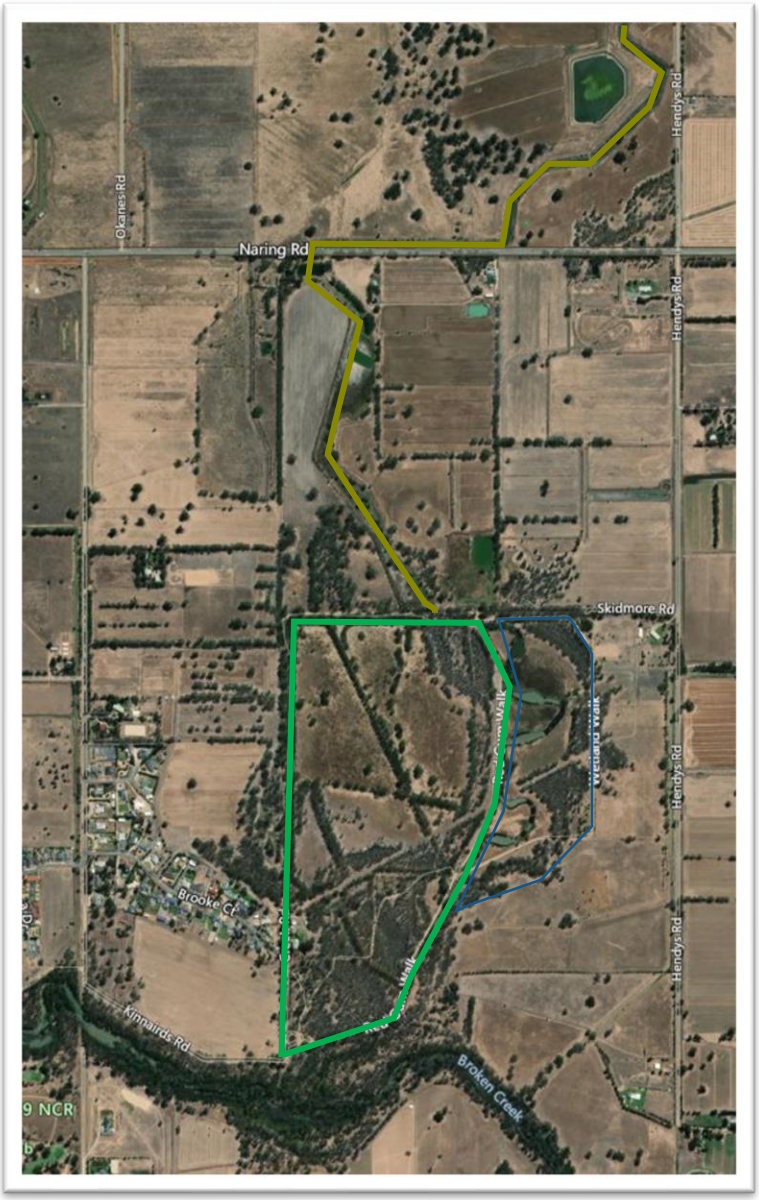

Figure 3: Kinnairds Wetland

Note: Olive Green line indicates Muckatah Depression entering Kinnairds Wetland. Bright Green outline depicts Moira Shire managed area of Kinnairds Wetland. Blue outline depicts Goulburn Murray Water managed area.

Environmental Water is currently delivered to the wetland by out-falling water from an irrigation channel (MV5/3) into the Muckatah Depression (Figure 3) approximately 16 km upstream of the wetland (GBCMA 2011). The water takes approximately one week to reach the wetland and can take

40-50 days to deliver the required volume of water. A project to design new water delivery infrastructure is currently underway and if constructed would significantly improve the efficiency, measurement, flexibility and control of environmental water deliveries to the wetland.

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

A total of 83 wetland dependent fauna species and 85 wetland dependent flora species have been recorded at the site. Of these species, 26 are listed as threatened (refer to appendix 2a and 2b).

2.3 Moodie Swamp

Moodie Swamp is a 180-hectare Southern Cane-grass (*Eragrostis infecunda*) wetland managed by Parks Victoria and is part of the Moodie Swamp Wildlife Reserve (Figure 4). It is located on the floodplain of the upper Broken Creek approximately 40 km north of Benalla. The wetland is listed under '*A Directory of Important Wetlands in Australia'* (EA 2001) as part of the Broken Creek.

Figure 4: Moodie Swamp

Note: Green line indicates delivery channel (Gearys channel) from Broken Creek to Moodie Swamp

Water can be delivered to Moodie swamp via a water delivery channel (Figure 4) from the upper Broken Creek (GBCMA 2012). There has been no survey or modelling of catchment conditions to determine changes to the natural frequency and duration of flooding events at Moodie Swamp. However, it is likely the frequency and duration of flooding at Moodie Swamp has been reduced by the regulation of the Broken River and Broken Creek (SKM 2006). Therefore, the wetland may require environmental water to provide a more natural flooding regime and enhance natural inundation events to ensure the success of bird breeding events or to provide optimal growth conditions for water dependent vegetation.

Moodie Swamp 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).

Moodie Swamp provides important Brolga (*Antigone rubicunda*) breeding habitat and habitat for other wetland dependent fauna species. Since monitoring of the site began in 2008, 65 species of wetland dependent fauna and 42 species of wetland dependent flora have been recorded at the site. Of these species 26 are listed as threatened (refer to appendix 2a and 2b).

Flora at Moodie Swamp continues to change as a more natural wetting and drying regime has been returned with the assistance of environmental water. Monitoring in 2008 indicated that Southern Cane-grass (*Eragrostis infecunda*) was a dominant species within the wetland. Since the wetland's watering regime has changed, it has begun to show signs of an aquatic herb land EVC. This includes a large population of the EPBC (1999) listed Rigid Water-milfoil (*Myriophyllum porcatum*).

3 TRADITIONAL OWNER CULTURAL VALUES AND USES

Moodie Swamp, Kinnairds Wetland and Black Swamp support various native plants and animals that provide many cultural values and uses for the Yorta Yorta People. Black Swamp and Kinnairds Wetland support multiple varieties of nardoo (a food source), native grasses (such as old man weed, which have medicinal uses) and sedges and rushes (used for basket weaving). Basket-weaving sedges also grow at Moodie Swamp.

Each year, the Goulburn Broken CMA meets with the Yorta Yorta Nation Aboriginal Corporation about the management of water for the environment in the Broken system, including the Broken wetlands. The Yorta Yorta Nation Aboriginal Corporation is also a member of the Goulburn Broken Wetlands Environmental Water Advisory Group, which meets with the CMA two or three times a year.

Increasing the involvement of Traditional Owners in environmental water management and progressing opportunities towards self-determination in the environmental watering program is a core commitment of the VEWH and its agency partners. This is reinforced by a range of legislation and policy commitments, including the *Water Act 1989*, the *Victorian Aboriginal Affairs Framework*, the 2016 *Water for Victoria*, the *Water is Life: Traditional Owner Access to Water Roadmap 2022*, and in some cases, agreements under the *Traditional Owner Settlement Act 2010*.

Where Traditional Owners are more deeply involved in the planning and/or delivery of environmental flows for a particular site, their contribution is acknowledged in **Error! Reference source not found.** with an icon. The use of this icon is not intended to indicate that these activities are meeting all the needs of Traditional Owners but is incorporated in the spirit of valuing that contribution.

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

4 SOCIAL, RECREATIONAL AND ECONOMIC VALUES AND USES

In planning potential environmental watering actions annually, the Goulburn Broken CMA considers how environmental flows could support values and uses, including:

- water-based recreation (such as canoeing)
- wetland recreation and amenity (such as birdwatching, camping, picnicking, photography, walking and hunting)
- community events and tourism (such as community gatherings at Kinnairds Wetland and the Walk and Squawk event)
- socioeconomic benefits (such as tourism, which is a large contributor to the local economy).

Environmental watering in the wetlands increases recreational opportunities such as 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.

Due to no watering actions being requested for 2024-25, promotion of drying at all three Broken wetlands is recommended. However, if natural filling does occur at these sites, shared benefits are listed in Table 1 below.

Table 1: Shared benefits at Broken Wetlands in 2024-2025

Wetland	Beneficiary	Connection to wetland	Value	How have these benefits been considered?
Black Swamp	Yorta Yorta People Bird watchers Photographers Walkers Hunters	Connection to country for Yorta Yorta People.	Environmental watering provides opportunities for activities such as walking, bird watching and photography. Hunting within the area can increase local economy and recreation at Black Swamp.	Environmental watering will provide passive recreational activities such as naturalists/bird watching and photography through increased communications around planned delivery via social media, radio, and local newspaper notifications. The GB CMA is constantly revising its communications strategy to expand networks to capture new audiences. Black Swamp is classified as a Wildlife Reserve meaning hunting can occur in season however this does not align with the proposed drying of the site in 2024-25.
Kinnairds Wetland	Local council Traditional Owners Bird watchers Photographers	Local council run activities such as "walk and squawk" at the wetland which is beneficial for local and visiting travellers.	Environmental watering provides opportunities for activities such as walking, bird watching and photography.	Watering could result in an increased number of flora and fauna - providing opportunities for naturalists/photographers.
Moodie Swamp	Traditional Owners Bird watchers Photographers Walkers Local landholders	Connection to country for Yorta Yorta people.	Environmental water provides a connection to country for traditional owners.	Cultural values at the site includes knowledge sharing and increased resources such as food and medicine plants. Moodie Swamp is classified as a Wildlife Reserve meaning hunting can occur in season however this does not align with the proposed drying of the site in 2024-25. Local landholders are advocates for Moodie Swamp and the Brolga and waterbirds that reside at the site. The site is aesthetically pleasing for landholders and waterbirds such as Ibis will move onto neighbouring properties to feed at times, feeding on pests and aerating the soil. These are all environmentally beneficial for the landholders.

5 ENVIRONMENTAL VALUES AND OBJECTIVES

Moodie Swamp, Kinnairds Wetland and Black Swamp support a great diversity of vegetation communities ranging from river red gum to cane grass. The wetlands contain state and nationally threatened vegetation communities and species, including rigid water-milfoil and river Swamp Wallaby grass. The wetlands also provide food resources and breeding habitat for bird species of high conservation significance, plumed egret, including eastern great egret, Latham's snipe, white-bellied sea eagle, Australasian bittern, brolga, royal spoonbill, yellow-billed spoonbill, Australasian shoveler and glossy ibis. Many of these species are listed in international agreements and conventions. Moodie Swamp also supports the EPBC listed Sloane's Froglet.

Table 2: Environmental objectives and values for Broken Wetlands

Environmental objectives in the Broken wetlands
A1 - Provide breeding habitat for frogs
V1 - Improve the cover, diversity, recruitment/regeneration and growth of native wetland plant species, consistent with ecological vegetation class benchmarks V2 - Reduce the cover and diversity of exotic plant species V3 - Maintain populations of ridged water-milfoil V4 – Maintain populations of river swamp Wallaby grass
B1 - Provide breeding habitat for waterbirds B2 - Provide feeding and roosting habitat for waterbirds
CN – Restore carbon and nutrient cycling within the wetlands to increase ecosystem productivity

In 2024-25, no active deliveries of water for the environment are planned for the Broken wetlands. The environmental objectives are considered long-term aspirational goals for the system, based on the achievement of multi-year water regimes that involve wetting and drying cycles. Wetland drawdown and drying contribute to important ecosystem processes (such as nutrient cycling and ecosystem productivity). These, in turn, support the achievement of the long-term environmental objectives.

6 ENGAGEMENT

This proposal was prepared by the GB CMA with input and support from Goulburn Broken Wetland Technical Reference Group (GB WTRG) and the Goulburn Broken Environmental Water Wetlands Advisory Group (GB EWWAG) and the Broken Environmental Water Advisory Group (Broken EWAG).

The GB WTRG is made up of members from Wetland Revival Trust (WRT), Water's Edge Consulting and Senior Scientists from Department of Energy, Environment and Climate Action (DEECA) and Arthur Rylah Institute (ARI) for Environmental Research. A meeting was unable to be held online with the GB WTRG to discuss and seek their advice on proposed watering or drying phases for the Goulburn wetland sites. Instead, the proposed watering and drying phases were emailed to the TRG for review (23 November 2023) and feedback to inform the GB EWWAG.

The GB EWWAG, 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. The GB EWWAG meets at least three times a year (online and in person) and additionally if required to discuss the outcomes from previous waterings including findings from wetland monitoring, and review wetland condition, watering objectives and watering for the coming year. The group met via Microsoft™ Teams on the 29th of February 2024, and members were presented and provided in the minutes with a copy of the proposed actions for comment. Comments have been incorporated into this report.

The Broken EWAG is made up of delivery partners, traditional owners, Goulburn Valley Environment Group and local landholders. The group meets quarterly and met on 19th March 2024 to discuss the water objectives and watering for the 2024-2025 season. Comments have been incorporated into this report.

The Goulburn Broken CMA has an agreement with Yorta Yorta Nation Aboriginal Corporation 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 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.

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: Summary of stakeholder engagement that informed this Seasonal Watering Proposal

Stakeholder(s)	Engagement method	Engagement purpose
Government agencies • Goulburn-Murray Water (River Operations Planning, Diversions) • VEWH • Parks Victoria • Council of Greater Shepparton • Moira Shire	• Goulburn Broken Environmental Water Wetlands Advisory Group (EWWAG) 0 29th February 2024 • Direct engagement (one-one-one) or via email • Broken EWAG meeting (19 March)	• Seek input to the development of the proposal. • Review previous environmental watering actions and seek feedback on any outcomes or observations. • Ensure program partners understand the purpose and objectives of the environmental watering program in the Broken wetlands. • Provide an opportunity to review and contribute to the proposed watering actions and intended outcomes. • Identify opportunities to achieve shared benefits.
Traditional Owners • Taungurung Land and Waters Council (TLAWC) • Yorta Yorta Nation Aboriginal Corporation (YYNAC)	• Goulburn Broken Environmental Water Wetlands Advisory Group (EWWAG) – YYNAC couldn't attend but received meeting minutes. • Broken EWAG meeting (19 March) - Couldn't attend but received meeting minutes.	• Seek input to the development of the proposal. • Review previous environmental watering actions and seek feedback on any outcomes or observations. • Ensure program partners understand the purpose and objectives of the environmental watering program in the Broken wetlands. • Provide an opportunity to review and contribute to the proposed watering actions and intended outcomes. • Identify opportunities to achieve shared benefits.
Environment Groups • Goulburn Valley Environment Group (GVEG) • Turtles Australia	• Goulburn Broken Environmental Water Wetlands Advisory Group (EWWAG) - Couldn't attend but received meeting minutes. • Turtles Australia - Couldn't attend but received meeting minutes. • Broken EWAG meeting (19 March) - Couldn't attend but received meeting minutes.	• Seek input to the development of the proposal. • Review previous environmental watering actions and seek feedback on any outcomes or observations. • Ensure program partners understand the purpose and objectives of the environmental watering program in the Broken wetlands. • Provide an opportunity to review and contribute to the proposed watering actions and intended outcomes. • Identify opportunities to achieve shared benefits.
Recreational users/ local community • Trellys Fishing and Hunting	• Goulburn Broken Environmental Water Wetlands Advisory Group (EWWAG) – Couldn't attend but received meeting minutes. • Direct engagement via phone call after meeting.	• Seek input to the development of the proposal. • Review previous environmental watering actions and seek feedback on any outcomes or observations.

		• Ensure program partners understand the purpose and objectives of the environmental watering program in the Broken wetlands. • Provide an opportunity to review and contribute to the proposed watering actions and intended outcomes. • Identify opportunities to achieve shared benefits.
Landholders • Broken EWAG members • GB EWAG members	• Direct engagement (one-on-one) or via email/mail • Broken EWAG meeting (19 March)	• Ensure landowners understand the purpose and objectives of the environmental watering program in the Broken wetlands. • Seek feedback through local knowledge.

7 SCOPE OF ENVIRONMENTAL WATERING

The GBCMA is planning that the Broken wetlands will now go into a drying phase (which has been attempted for the last 12 months). If Black Swamp and Kinnairds Wetland dry over summer 2024-25 a Spring 2025 watering may occur if optimal drying periods are reached.

PWA for 2024-25 – Promote drying of Moodie Swamp over 2024-25.

Moodie Swamp has been wet since August 2021 and is now in an extended wet period. Vegetation has changed over the past 2 years from a mix of Cane-grass and aquatic herbs such as potamogeton, marsh wort and nardoo to a thick carpet of Upright Water-milfoil (*Myriophyllum crispatum*). The wetland has naturally flooded and/or filled four times in the past two years, January 2022, October 2022, October 2023 and January 2024. The wetland has exceeded its optimal and maximum wetting period and now needs to dry for at least 12 months to assist with and complete its nutrient cycle.

PWA for 2024-25 – Promote drying of Black Swamp over 2024-25.

Black Swamp is wet again after flooding in October 2023. Black Swamp was meant to receive an environmental water allocation in autumn 2023, but due to the large rainfall event and flooding of the swamp in October 2022, this did not occur. The swamp reached its optimal wetting regime in March 2023 before beginning to draw down in April 2023. The swamp then refilled in June 2023 after a large rainfall event over the long weekend. GB CMA staff headed out to the site to inspect it after this rain event as it didn't look wet on sentinel hub. The swamp was covered in a thick layer of River Swamp-wallaby grass and very wet underneath. The swamp has remained wet since, and refilled in October 2023 after another large rainfall event filled and spilled the swamp. The swamp was then topped-up in January 2024 by another large rainfall event. The swamp has passed its optimal watering regime and now requires a drawdown and drying event to complete its nutrient cycle. If the swamp dries for at least 6-9 months, a spring watering in 2025 (2025-26 watering season) could occur to promote EVC growth and maintenance.

PWA for 2024-25 – Promote drying of Kinnairds Wetland over 2024-25.

Kinnairds Wetland filled in October 2022 due to flooding of the area. It remained wet until March 2023 when it began to drawdown and dried by April 2023. May 2023 saw some inflows into the swamp after a large rainfall event which were topped up in June. The wetland then flooded in October 2023 after a large rainfall event on 4th October. The wetland refilled in January 2024 after another large rainfall event. The wetland has exceeded its optimal wetting regime and requires draw down and drying to complete its nutrient cycle. If the wetland dries for at least nine months, a spring watering in 2025 (2025-26 watering season) could occur to promote EVC growth and maintenance.

Table 4: Potential Watering Actions in 2024-25

Potential environmental watering action	Expected watering effects	Environmental objectives
Black Swamp (promote drying)	Drawdown to dry to enable nutrient cycling.	CN
Kinnairds Wetland (promote drying)	Drawdown to dry to enable nutrient cycling.	CN
Moodie Swamp (promote drying)	Drawdown to dry to enable nutrient cycling.	CN

8 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 less environmental water is available and hence strategic planning of sites that provide refuge or require protection to avoid critical loss. 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.

According to the latest weather outlook information from the Bureau of Meteorology, March to May has below median rainfall and warmer than median temperature conditions in the Goulburn and Broken Catchments. As of 12 April 2024, Lake Nillahcootie is 82.78% full and water is continuing to be released to meet irrigations demands. At the same time last year Lake Nillahcootie was 80.81% full.

The current (February 2024 – Table 5) Broken system outlook for seasonal determinations indicate:

- an opening high security water share seasonal determination of 38 % in a wet Climate scenario, 11% in average scenario and 0% in dry and extreme dry scenarios;
- a high security water shares seasonal determination of 100% by October 2024 in wet and average Climate scenarios and 29% in a dry Climate scenario; and
- a high security water shares seasonal determination of 0% in July, August and October 2024 and 3% in February 2025 in an extreme Climate scenario.

Table 5: Broken system outlook for seasonal determination of high reliability shares

Climate Scenario	1 July 2024	15 August 2024	16 October 2024	17 February 2025
Wet	38%	43%	100%	100%
Average	11%	43%	100%	100%
Dry	0%	2%	29%	49%
Extreme Dry	0%	0%	0%	3%

The 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 were chosen as they may result in different natural inflows to the wetlands and the volume of environmental water required. No watering is proposed for any of the Broken wetlands during 2024-2025.

No scenario planning is required at this stage for Broken wetlands as they all require a drawdown and drying period. The long-range forecast from the Bureau of Meteorology (issued 11th April), suggests that El Nino is decaying. The climate outlook from June to August 2024 suggests a 50% chance of rainfall to be above median rainfall for the Broken Catchment. This increases the risk of wetlands remining wet due to unregulated flows and with storages currently holding high percentage volumes of water and catchments retaining soil moisture.

Black Swamp is currently holding water after flooding in October 2023. Black Swamp was meant to receive an environmental water allocation in autumn 2023, but due to the large rainfall event and flooding of the swamp in October 2022, this did not occur. The swamp reached is optimal wetting regime in March 2023 before beginning to draw down in April 2023. The swamp then refilled in June 2023 after a large rainfall event over the long weekend. GB CMA staff headed out to the site to inspect it after this rain event as it didn't look wet on sentinel hub. The swamp was covered in a thick layer of River Swamp-wallaby grass and very wet underneath. The swamp has remained wet since then and

refilled in October 2023 and again in January 2024 after another large rainfall event filled and spilled the swamp. It is recommended that the swamp draw down and dry until Spring 2025.

Kinnairds Wetland filled in October 2022 due to flooding of the area. It remained wet until March 2023 when it began to drawdown and dried by April 2023. May 2023 saw some inflows into the swamp after a large rainfall event which were topped up in June. The wetland then flooded in October 2023 after a large rainfall event on 4th October and was topped up in January 2024, again by a large rainfall event. It is currently still holding some water in the deeper sections of the wetland. It is recommended that the wetland now be dry until Spring 2025.

Moodie Swamp has been wet since August 2021 and is now in an extended wet period. Vegetation has changed over the past 3 years from a mix of Cane-grass and aquatic herbs such as potamogeton, marsh wort and nardoo, to a thick carpet of Upright Water-milfoil. This is not uncommon and historic records indicate that Upright Water-mifoil can dominate the wetland during long periods of wet. The wetland now requires a drawdown and drying period for at least 12 months. The wetland has naturally flooded four times in the past two years, January 2022, October 2022, October 2023 and January 2024. It is recommended that until the wetland draws down and dries that no environmental watering occur for at least the next 12 months.

9 RISK MANAGEMENT

The risks associated with the proposed delivery of environmental water to the wetlands in the Broken Catchment are outlined 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.

					Pre-Mitigation Risk					Residual Risk		
Risk ID	**Risk category**	**Relevant to Wetlands**	**Requires inclusion and tailoring in delivery plan**	**Risk description**	**Likelihood**	**Consequence**	**Risk Rating**	**Mitigation actions**	**Lead organisation for action**	**Likelihood**	**Consequence**	**Risk Rating**
NOGB2020-01	Environment	Yes	Yes - depends on the volume of the delivery (affects consequence rating). Treatment may be similar, however.	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	Possible	Minor	Low
NOGB2020-02	Reputational	Yes	Yes - depends on the volume of the delivery (affects consequence rating).	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	Unlikely	Minor	Low
NOGB2020-03	Environment	Yes	No- generic risk that is mitigated prior to delivery plan process	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	Unlikely	Minor	Low

NOGB2020-04	Environment	Yes	Yes – consequence level likely to vary depending on volume and needs to be actively managed during delivery	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	Unlikely	Minor	Low
NOGB2020-05	Business Costs	Yes	Yes – consequence level likely to vary depending on volume and needs to be actively managed during delivery	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	Unlikely	Minor	Low
NOGB2020-06	Environment	Yes	Yes – depends on the volume of the delivery (affects consequences rating). Treatment may be similar however.	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	Unlikely	Minor	Low
NOGB2020-07	Environment	Yes (where delivered via infrastructure)	No, managed prior to delivery plan development	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	CMA and GMW CMA	Unlikely	Minor	Low

								schedules to ensure works are completed prior to commencement of watering actions.				
NOGB2020-08	Environment	Yes	Yes, requires consideration, if possible, for the site during delivery plan process (i.e.: where site is known to have poorly maintained infrastructure)	Failure of poorly maintained environmental delivery infrastructure results in planned/specified flows not being achieved, reducing the ability to achieve planned environmental outcomes. (Including failure or damage due to vandalism) Requires site specific risk assessment - relevant to wetlands, not rivers and streams, apart from perhaps Warrigal Creek (not targeted with e-water). Risk only relevant to wetlands sites - residual risk rating to be assessed at Delivery Plan/Event Plan phase	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. Consider monitoring options to detect vandalism, interference, or failure of assets at individual sites with elevated risks.	Asset Owner Asset Owner Asset Owner CMA Asset Owner PV			
NOGB2020-09	Environment	Yes – where delivered via infrastructure	Yes, requires consideration, if possible, for the site during delivery plan process (i.e.: where site is known to have poorly maintained infrastructure)	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)	Unlikely	Minor	Low
NOGB2020-10	Environment	Yes	Yes	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	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	CMA and GMW GMW/MDBA VEWH CMA and VEWH	Possible	Minor	Low

				a particular risk - see new separate Goulburn risk added				undertake deliveries outside the irrigation season with consideration of appropriate delivery costs				
NOGB2020-12	Legal	Yes	Yes, where relevant	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. Note that 2022 floods have caused erosion or damage to the riverbanks which may result in Environmental releases (at previously acceptable flow rates) causing 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. • Investigate post flood to determine commence to flow of major erosion in the Mid Goulburn (and other systems as required). • Seek advice from storage operator of any known changes in bank levels and commence to flow levels.	CMA CMA GMW/MDBA GMW/MDBA CMA CMA/Storage operator	Unlikely	Moderate	Low
NOGB2020-13	Reputational	Yes	Yes	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.). Applies to Lower Goulburn	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	Almost certain	Minor	Medium
NOGB2020-15	Business Costs	Yes	Yes	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. Risks only relevant to wetland sites – residual risk rating to be assessed at delivery plan phase.	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*	Land Manager			

								mitigate the described risk.				
NOGB2020-17	Service Delivery	Yes	Yes	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) Risks only relevant to wetland sites – residual risk rating to be assessed at delivery plan phase.	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			
NOGB2020-19	Reputational	Yes	No- generic risk with treatment at program level	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	Unlikely	Moderate	Low
NOGB2020-20	Environment	Yes	Possible inclusion in delivery plan. Site level consideration and mitigation.	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	Unlikely	Minor	Low

NOGB2020-21	Reputational	Yes	Yes if known issues at site and specific actions required	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	Possible	Minor	Low
NOGB2020-22	Business Costs	Yes	Possible inclusion in delivery plan. Site level consideration and mitigation.	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. Risk only relevant to wetlands sites - residual risk rating to be assessed at Delivery Plan phase (e.g. Gaynor Swamp + NE sites - rely on others to monitor pumps). Not as much of an issue for rivers/creeks post-COVID.	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			
NOGB2020-23	Environment	Yes	Possible – mitigated through other processes at existing sites, however, could be included at a new site where watering is being undertaken as a trial to collect this information.	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. • Seek necessary resources to undertake approvals and assessments.	CMA	Unlikely	Minor	Low
NOGB2020-24	Legal	Yes	No	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			

NOGB2020-25	Cultural heritage	Yes	Possible	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 DEECA/VEWH	Unlikely	Moderate	Low
NOGB2020-26	Reputational	Yes	No	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.)	DEECA VEWH CMA	Possible	Minor	Low
NOGB2020-27	Environment	Yes	Yes	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.)*	DEECA CMA/Land Manager	Likely	Moderate	Medium
NOGB2020-28	Environment	Yes	Yes – risk to be assessed for delivery	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	Possible	Minor	Low
NOGB2020-29	Environment	Yes	No	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	Unlikely	Moderate	Medium
NOGB2020-33	Reputational	Yes	No	Community concern over environmental releases under dry seasonal conditions may lead to a	Unlikely	Moderate	Low	• Communicate benefits of environmental watering to the community, especially in relation to strategic watering	CMA VEWH	Unlikely	Minor	Low

				loss of support for environmental watering actions.				in dry periods. • Enhance community understanding of water system operations and entitlement frameworks (water literacy).				
NOGB2020-34	Reputational	Yes	No	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	Unlikely	Minor	Low
NOGB2020-35	Environment	Yes	No	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	Unlikely	Minor	Low
NOGO2022-42	Reputational	Yes	Yes	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			

10 APPROVAL, ENDORSEMENT AND CONSENT

WATERWAY MANAGER APPROVAL OF THE SEASONAL WATERING PROPOSAL
I, the authorised representative of the agency shown below, approve the Seasonal Watering Proposal for the Broken Wetlands in 2024-25. SIGNED FOR AND ON BEHALF OF Goulburn Broken CATCHMENT MANAGEMENT AUTHORITY Signature of authorised representative:  Name of authorised representative: Chris Cumming Position of authorised representative: Chief Executive Officer Date: 19/04/2024

ENDORSEMENT OF THE SEASONAL WATERING PROPOSAL

I, the authorised representative of the agency shown below, approve the Seasonal Watering Proposal for the Broken Wetlands in 2024-25.

Role	Endorsing partner	Representative Role	Status Date	Notes/Comments
Water Corporation	Goulburn Murray Water	Andrew Shields River Operations Manager	☒ Endorsed. Date: 08/04/2024	*NA*
Land Manager	Parks Victoria	Kane Weeks Regional Director	☒ Endorsed. Date: 17/04/2024	*Provided in endorsement letter*
Traditional Owner	Yorta Yorta Nation Aboriginal Corporation	Jay Whittaker Whole of Country Manager	☒ Endorsed. Date: 16/04/2024	*NA*
Local Shire	Moira Shire	Environmental Sustainability Officer - Biodiversity	☒ Endorsed. Date: 18/04/2024	*NA*

CONSENT TO USE OF CONTENT

Role	Endorsing partner	Delegate Role	Content	For use in the		Notes
				Seasonal Watering Proposal	Seasonal Watering Plan	
Traditional Owner	Yorta Yorta Nation Aboriginal Corporation	Jay Whittaker Whole of Country Manager	Chapter 3	☒ Consent provided. Date: 16/04/2024	☒ Consent provided. Date: 16/04/2024	*NA*

11 REFERENCES

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GBCMA (2011). Black Swamp Environmental Water Management Plan. Shepparton, Goulburn Broken Catchment Management Authority.
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SKM (2006). Moodies Swamp water management recommendations. Armadale, Sinclair Knight Merz.

12 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 Broken Wetlands

Common Name	Scientific Name	Black Swamp	Kinnairds Wetland	Moodie Swamp	EPBC	FFG
Australasian Bittern	*Botaurus poiciloptilus*	Y	Y	Y	Endangered	Critically Endangered
Australasian Shoveler	*Anas rhynchotis*	Y	Y	Y		Vulnerable
Australian Little Bittern	*Ixobrychus dubius*	Y				Endangered
Blue-billed Duck	*Oxyura australis*		Y	Y		Vulnerable
Brolga	*Antigone rubicunda*		Y	Y		Endangered
Caspian Tern	*Hydroprogne caspia*			Y		Vulnerable
Eastern Great Egret	*Ardea modesta*	Y	Y	Y		Vulnerable
Freckled Duck	*Stictonetta naevosa*	Y	Y			Endangered
Hardhead	*Aythaya australis*	Y	Y	Y		Vulnerable
Lace monitor	Varanus varius	Y				Endangered
Little Egret	*Egretta garzetta nigripes*		Y			Endangered
Magpie Goose	*Anseranas semipalmata*	Y	Y			Vulnerable
Musk Duck	*Bizura lobata*			Y		Vulnerable
Plumed Egret	*Ardea intermedia plumifera*	Y	Y	Y		Critically Endangered
Sloane's Froglet	*Crinia sloanei*	Y		Y	Endangered	Endangered
White-bellied Sea Eagle	*Haliaeetus leucogaster*	Y	Y	Y		Endangered
White-throated Needletail	*Hirundapus caudactus*		Y		Vulnerable	Vulnerable

Appendix 2b – Threatened flora species recorded at Broken Wetlands

Common Name	Scientific Name	Black Swamp	Kinnairds Wetland	Moodie Swamp	EPBC	FFG
River Swamp Wallaby-grass	*Amphibromus fluitans*	Y			Vulnerable	
Winged Water-starwort	*Callitriche umbonata*	Y	Y	Y		Endangered
Riverine Bitter-cress	*Cardamine moirensis*		Y	Y		Endangered
Small-flower Mud-mat	*Glossostigma cleistanthum*		Y			Endangered
Dwarf Brooklime	*Gratiola pumilo*			Y		Endangered
Smooth minuria	*Minuria integerrima*	Y				Vulnerable
Slender Water-milfoil	*Myriophyllum gracile var. lineare*		Y	Y		Endangered
Rigid Water-milfoil	*Myriophyllum porcatum*		Y	Y	Critically Endangered	Critically Endangered
Water Nymph	*Najas tenuifolia*	Y				Endangered
Wavy Marshwort	*Nymphoides crenanta*			Y		Endangered
Floodplain Fireweed	*Senecio campylocarpus*	Y		Y		Endangered