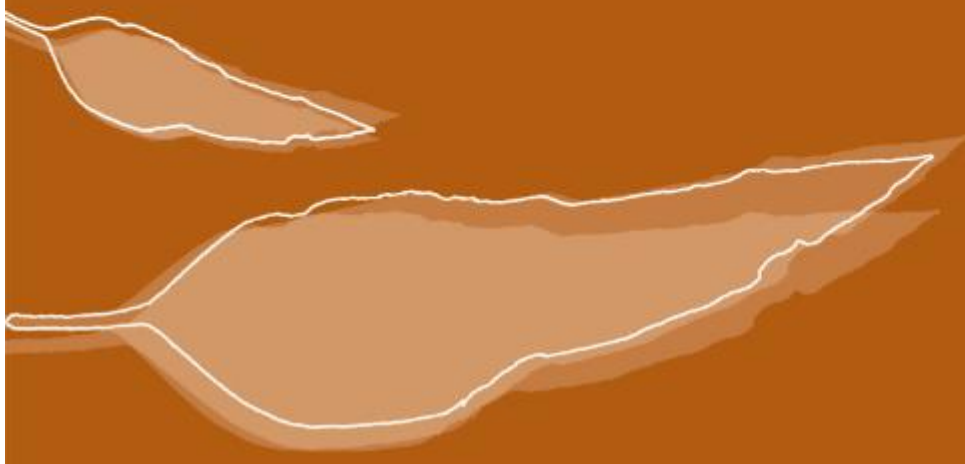




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Commonwealth Environmental Water Office
Murrumbidgee River System - Category 3
waterbird breeding monitoring summary report
July 2021



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Introduction

Colonial waterbird species, including ibis, herons, pelicans, egrets and cormorants, can nest in large numbers within floodplain wetlands. The Lowbidgee floodplain is one of the most important colonial nesting waterbird breeding sites in the Murray-Darling Basin (Kingsford and Thomas 2004; MDBA 2014). Eulimbah and Telephone Bank Swamps are the main areas that support large ibis colonies in the Gayini Nimmie-Caira. The neighbouring Redbank wetlands, which includes Yanga National Park, can also support large egret, heron and cormorant colonies. In the mid-Murrumbidgee while egret, heron, spoonbill and cormorant colonies were previously common in multiple locations (Briggs and Thornton 1999), only smaller, mainly cormorant colonies, have been detected in this region in recent years (Wassens et al. 2018).

Under the approved Murrumbidgee MER Monitoring and Evaluation Plan for 2019-2022 (Wassens et al. 2019) there is provision to undertake event-based waterbird breeding monitoring during years where active colonies are detected. Monitoring of waterbird breeding sites plays a critical role supporting water management decisions, particularly with respect to water delivery needed to maintain the depth and extent of inundation in colony sites and surrounding foraging habitats so that waterbirds can fledge their young successfully.

We use two approaches to evaluate waterbird breeding responses to environmental watering actions across the Murrumbidgee Selected Area see (Wassens et al. 2019):

- *Waterbird Breeding (Category 1)* targeting large ibis colonies in the Gayini (Nimmie-Caira) wetland zone and elsewhere in the Murrumbidgee Selected Area as required.
- *Waterbird Breeding (Category 3)* targeting egret, heron, spoonbills, cormorant, pelican and smaller ibis breeding sites in the Redbank, Gayini (Nimmie-Caira) and Mid-Murrumbidgee wetland zones to support the Murrumbidgee Selected Area evaluation.

The Category 3 methods differ to the Category 1 approach in that they focus on collecting data on the locations of all active colonies including total numbers of nests of each species and do not include quantitative measures of breeding success which are included in the Category 1 methods. The stage of breeding and water levels are

collected during both Category 1 and 3 methods, which can be used to inform water delivery to colony sites where needed.

Note that this report provides a summary of outcomes of the Category 3 monitoring undertaken in 2020-2021. More detailed evaluation of waterbird breeding outcomes will be presented in the Murrumbidgee MER annual report.

Relevant watering actions and objectives

Large areas of the Lowbidgee floodplain received Commonwealth and NSW environmental water over winter 2020 including areas known to support waterbird breeding and feeding habitat in Gayini Nimmie-Caira, South Redbank (Yanga National Park) and North Redbank (see Plate 1). Follow-up watering actions over spring and summer 2020-2021 were delivered to extend the inundation of colony sites.

There were four main watering actions that had objectives for supporting colonial waterbird breeding in the 2020-2021 water year:

- **Gayini Nimmie-Caira Floodways:** Environmental watering commenced in late July 2020 inundating wetlands through the Gayini Nimmie-Caira system west to Yanga National Park. Active colonies were detected in October 2020 annual and ground surveys with Commonwealth and NSW water for the environment delivered over summer months to maintain water levels in active colony sites.
- **Yanga National Park:** Environmental watering commenced in early July 2020 to fill the northern section of Yanga through to Yanga Lake joining with flows from the Gayini Wetlands by late November 2020. Maintenance flows were delivered from the late December 2020 to mid-February 2021 period to support active waterbird colonies and Australasian bittern breeding in the northern section of Yanga National Park.
- **North Redbank System:** Water for the environment was delivered from mid-August 2020 onwards to achieve whole of system watering. The wetlands in the central North Redbank system filled from early November 2020 with top-up flows from mid- to late December 2020.
- **Yarradda Lagoon:** Water for the environment was pumped into Yarradda Lagoon, in the Mid-Murrumbidgee wetlands, from early November to mid-December 2020.



Plate 1 (Clockwise from top left): Tarwille Swamp, Yanga National Park, October 2020 (Credit: Ali Borrell), Cormorant nests, Nap Nap Swamp, January 2021 (Credit: Sarah Talbot), Aerial view of Eulimbah Swamp and Suicide floodway, December 2020 (Credit: Ali Borrell), Two Bridges Swamp, Yanga National Park, January 2021 (Credit: S. Talbot, CSU).

Evaluation Questions

The responses of waterbirds to environmental watering actions in the 2020-2021 water year were assessed against two key evaluation questions to determine the extent to which the objectives were achieved.

- *Did Commonwealth environmental water contribute to waterbird breeding?*
- *What did Commonwealth environmental water contribute to waterbird fledging and survival?*

Methods

Waterbird surveys were completed over spring and summer months in 2020-2021 to document the location, size, number of breeding species and stage of nesting in active colonies in the Lowbidgee Floodplain and Mid-Murrumbidgee Wetlands. As done in 2016-2017 (Wassens et al. 2018), a range of monitoring methods were used to assess waterbird breeding responses to wetland inundation in the Murrumbidgee River Selected Area including aerial surveys, repeat ground surveys and drone-based surveys (see Table 1).

Table 1. Summary of waterbird monitoring coverage in the Murrumbidgee Selected Area in 2020-2021. ^Reproductive success data was only collected at Cat 1 monitoring sites (Eulimbah Swamp).

Data type	Oct	Nov	Dec	Jan	Feb
Waterbird species richness Waterbird abundance Breeding species (partly) Location of active colonies & estimates of colony size	Spring ground surveys UNSW annual spring aerial surveys		Colony aerial survey		Summer ground surveys
Colony size Breeding species Stage of nesting Water levels Water quality issues Impact of predation/disease Reproductive success data^	Cat 3: Colony ground surveys as part of annual spring surveys		Cat 3: Colony ground surveys	Cat 3: Colony ground surveys	Cat 3: Colony ground surveys as part of summer surveys
		Colony drone surveys completed in the Gayini Nimmie-Caria wetlands			
		Cat 1: Detailed nest monitoring (fortnightly visits) of large ibis colony in Eulimbah Swamp^			

Aerial surveys

The University of New South Wales (UNSW) completed an aerial survey on 13 October 2020 which provided information on colony activity across the Lowbidgee floodplain. This aerial survey was completed as part of the long-running Annual Waterbird Surveys of Eastern Australia (Porter et al. 2020) and MDBA funded aerial surveys that UNSW coordinate each spring (see Kingsford et al. 2020). The Flow-MER contingency funding supported a follow-up aerial survey in a fixed-wing aircraft of the Lowbidgee floodplain on 18 December 2020. During the colony aerial survey North and South Redbank and Gayini-Nimmie Caira wetland areas were flown over repeatedly specifically to check for waterbird colony activity.

Ground surveys

Initial colony ground assessments were completed at known historical colony sites (35 in total) during annual spring ground surveys at fixed wetland monitoring sites (see Appendix 1) undertaken in October 2020 across the Mid-Murrumbidgee Wetlands (12-15 October 2020) and Lowbidgee Floodplain (19-21 October 2020). Follow-up Category 3 colony ground surveys were completed in 18 colony sites over 7-11 December 2020 and 12-15 January 2021 (see Table 1).

Additional colony information was collected in the Gayini Nimmie-Caira wetlands as part of Murray-Darling Wetland Working Group (MDWWG) monthly waterbird surveys led by Ali Borrell and through additional drone surveys completed by UNSW (funded by NSW DPIE-EES) in January and February 2021 (see further details herein). Summer ground surveys were completed across the Mid-Murrumbidgee Wetlands (15-18 February 2021) and Lowbidgee Floodplain (22-25 February 2021), which included the final round of Category 3 monitoring at 18 colony sites.

Category 3 colony ground survey were done on foot or from a kayak or four-wheel drive vehicle and waterbirds were observed using binoculars and/or telescopes. During each ground survey, detailed assessment of a colony site was made to include estimates of colony extent, total number of nests of each species and stage of nesting (nest building, eggs, early (<2 weeks old) or late (>2 weeks old) nestling stages, or fledglings), water depths and evidence of predation or other mortality. Survey coverage was staggered across spring and summer months to ensure that the largest Category 3 sites (around 250 to 2,500 nests in size (see Table 2)), were

visited at around monthly intervals (see Table 1). Observations of non-colonial waterbird species and their breeding activity were also recorded during the colony ground surveys.

UNSW coordinated fortnightly visits to the Eulimbah ibis (Figure 1) colony in the Gayini Wetlands to document reproductive success, stage of nesting and site conditions as part of Category 1 monitoring over November 2020-February 2021, which included repeat drone surveys to document colony extent (Table 1). Briefly, the Category 1 methods involve monitoring a sub-set of nests throughout the breeding period (six trips in total) to assess reproductive success in relation to a range of environmental variables including water depth and water quality (also measured).

Note that the results of the Category 1 monitoring at Eulimbah Swamp will be presented in the final Murrumbidgee Selected Area report for 2020-2021. For more details on the Category 1 and Category 3 colony monitoring methods see the Murrumbidgee Selected Area Monitoring and Evaluation Plan (Wassens et al. 2019).

Drone surveys

Additional drone surveys were conducted by Gayini-Nimmie-Caira Land Managers and UNSW over the 2020-2021 season to assess waterbird breeding activity in parts of the Gayini Wetlands. Active nests were observed at Suicide Swamp during the aerial survey on 18 December 2020. The colony location in Suicide Swamp was difficult to survey on ground due to the dense lignum vegetation so drone surveys were undertaken to allow for an estimation of colony size and stage of nesting. Note that no active nesting was detected in Telephone Swamp during the drone surveys or during the aerial survey. UNSW flew transects over Suicide Swamp on the 5 January and 2 February 2021 with the aim of identifying breeding species, number of nests and stage of nesting (Francis and Brandis 2021). The drone was flown at 60m height, with an overlap of 75-80%, to acquire photography (see example in Plate 2) as per established drone survey methods for waterbird colonies documented in Lyons et al. (2018). The images were orthomosaiced and then inspected to manually count active waterbird nests. Species were identified based on their plumage and breeding stage was determined based on group behaviour (e.g. trampling, incubating or creching), and from sightings of eggs or chicks in nests (see further detail in Francis and Brandis 2021).



Plate 2. Active ibis and spoonbill nests detected at Suicide Swamp during drone survey on 5 January 2021 (Credit. R. Francis, UNSW).

Results and Discussion

What did Commonwealth environmental water contribute to waterbird breeding?

We detected 20 active waterbird colonies in the Murrumbidgee Selected Area during the October 2020 to February 2021 period. In total there were 17 sites that supported colonial waterbird nesting in the Lowbidgee Floodplain (see Figure 1, Table 2) and three active colonies in the Mid-Murrumbidgee Wetlands (Table 2). This included the large ibis colony at Eulimbah Swamp in the Gayini Wetlands monitored by UNSW, and five medium-sized and 14 much smaller-sized ibis, egret, spoonbill, heron and cormorant sites across the rest of the Murrumbidgee Selected Area (see Table 2).

In total 13 colonially-nesting species were recorded breeding including Australian white ibis, royal spoonbill, yellow-billed spoonbill, straw-necked ibis, glossy ibis, little pied cormorant, little black cormorant, Australasian darter, great cormorant, nankeen night-heron, white-necked heron, eastern great egret and intermediate egret. Nationally endangered Australasian bittern and NSW listed blue-billed duck

and freckled duck were also recorded at several sites in the Lowbidgee floodplain during the 2020-21 spring and summer waterbird surveys.

Most the colonies (16 sites in the Lowbidgee, two sites in the Mid-Murrumbidgee) were detected after the completion of the aerial and ground surveys completed from mid-October to mid-December 2020. During ground surveys completed in mid-January and late February 2021 most colony sites were completed or near completion with fledglings observed in several sites (Table 2). Nesting activity was also confirmed at Breer Swamp and Tala Lake in the Lowbidgee Floodplain, and Yarradda Lagoon in the Mid-Murrumbidgee Wetlands during the January surveys. Only a small number of new nests were observed at Nap Nap Swamp and House Creek during the late February 2021 surveys (Figure 1, Table 2).

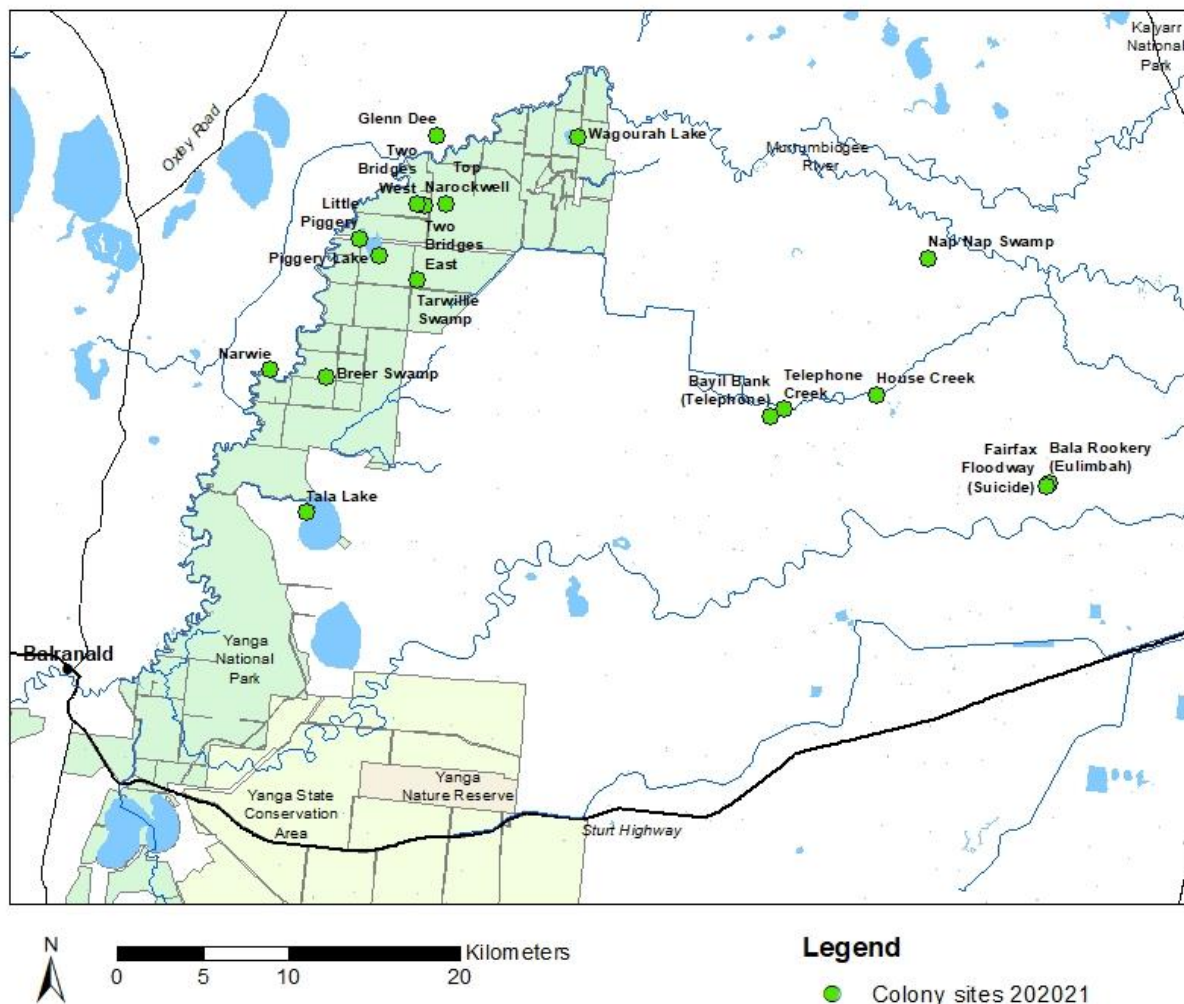


Figure 1. Overview of 17 colony locations in the Lowbidgee floodplain that supported waterbird breeding in the 2020-21 water year. There were a further 13 inactive colony sites across the Lowbidgee Floodplain that were checked in the 2020-21 surveys (see Appendix 1).

Table 2. Summary of active colony sites and monitoring coverage over spring and summer 2020-2021. Note Gayini wetland names will be updated in future reporting. *Results of UNSW monitoring of Eulimbah Swamp will also be reported separately as part of annual reporting. ^Colony size category: large colonies (>5000 nests), medium-sized colonies (>250-<5000 nests) and small (<250 nests) colonies.

Wetland region	Colony site	Colony size category^	Number of colonially-nesting species	Est. number of nests	Summary of observations
Gayini-Nimmie	Eulimbah Swamp*	Large	6	18,600	Category 1 fortnightly repeat monitoring of large ibis colony and drone surveys coordinated by UNSW. Small number of nesting royal spoonbill and cormorants also present.
Redbank	Tarwillie Swamp	Medium	10	2,600	Colony first established in mid-October. December aerial and ground surveys found colony grown substantially and large number of great egrets, cormorants and herons nesting at this site. Late February surveys found nests had nearly completed with fledglings observed.
	Two Bridges East	Medium	2	250	Colony first established in mid-October. Cormorant nests well advanced by mid-December and fledglings observed during late February surveys.
	Two Bridges West	Medium	5	550	Colony first established in mid-October. Cormorant nests well advanced by mid-December but new great egret nests detected. Some egret nests still with chicks during late February survey.
	Top Narockwell	Medium	3	480	Number of nests grown since mid-October surveys and site supported large numbers of nesting cormorants and white-necked herons in mid-December. No nesting birds observed during late February survey.
Gayini-Nimmie	Telephone Creek	Medium	9	670	Large number of nankeen night-heron fledglings, number of active cormorant nests during February survey. Some mortality in great cormorant nests was observed in the February survey.
	Nap Nap Swamp	Medium	8	280	Colony first established in mid-October. In late February most nests of egrets, herons, spoonbills had completed and there were new cormorant and Australian white ibis nests with small chicks. Water levels had dropped considerably since mid-January surveys.
Redbank	Breer Swamp	Small	2	5	No activity detected during October or February ground surveys or December aerial survey. Small number of fledging spoonbills and cormorants observed during late December bittern surveys (Herring, M., pers. obs., December 2020).
	Glenn Dee Swamp	Small	2	140	Large cormorant colony, advanced chicks during December visit and large number of fledglings during January survey. Very shallow in parts (0.2-0.3m) and almost completely dry by late February.

Wetland region	Colony site	Colony size category^	Number of colonially-nesting species	Est. number of nests	Summary of observations
	Little Piggery	Small	2	20	Small number of active cormorant nests in mid-December. No nesting observed during late February surveys.
	Narwie	Small	2	10	Small number of active cormorant nests in mid-December and mid-January surveys. No nesting birds observed during late February survey.
	Piggery Lake	Small	4	70	Small number of active cormorant and darter nests in October-February period. Fledglings and large chicks observed during late February surveys.
	Tala Lake	Small	1	Unknown	No activity detected during October ground or aerial surveys. Small number of used empty nests observed during late February survey. Large number of roosting cormorants also observed at this time.
	Wagourah Lake	Small	1	20	No activity detected during October surveys. Small number of active cormorant nests in mid-December survey. No nesting birds observed during February survey.
Gayini-Nimmie	House Creek	Small	4	65	Small number of active spoonbill and cormorant nests during October - December surveys. Active cormorant and darter nests still present during late February survey.
	Suicide Floodway	Small	5	425	New area with active ibis, spoonbill and night heron nests detected in December aerial surveys. UNSW drone surveys in early January and early February documented total number of nests (Francis and Brandis 2021).
	Telephone Bank	Small	2	50	Small number of white ibis suspected building nests here in mid-November surveys and areas of nesting night herons also observed (A. Borrell pers. obs., November 2020). No active nests observed during early January UNSW drone survey.
Mid-Murrumbidgee	Yarradda Lagoon (Mid-bidgee)	Small	2	15	No active nests observed in October or early December ground surveys. Nesting darters and cormorants observed during mid-January and late February surveys.
	Gooragool Lagoon (Mid-bidgee)	Small	1	20	Small number of cormorant nests detected in early October. Water levels low here in late November and most of the site was dry during February surveys.
	Yarradda West (Midbidgee)	Small	2	10	Small number of cormorant nests detected in early December ground survey. Juvenile darters and cormorants observed during late February survey.

Conclusions

Our monitoring documented widespread waterbird breeding in the Murrumbidgee River system in 2020-2021 following delivery of environmental water with 13 species recorded nesting across 20 colony sites. This outcomes differs from previous breeding events in that it was supported solely through environmental water. In the past breeding has been triggered by unregulated flows, with the colonies supported by water for the environment through to completion. For example, colonial waterbird breeding was recorded at 30 sites across the Lowbidgee floodplain in 2016-2017 (Wassens et al. 2018).

The colonial nesting waterbird breeding response following environmental water delivery in the Lowbidgee was the largest event recorded in the Murray-Darling Basin in 2020-2021. The 2020-2021 event was also the largest breeding event initiated and maintained purely with water for the environment. Managed flows delivered over winter months to inundate large areas of floodplain wetlands across the Gayini Nimmie-Caria and adjoining Redbank system were effective at priming the system before waterbird breeding began in spring 2020. Equally important was the continued delivery of NSW and Commonwealth environmental water over summer 2020-2021 to ensure water levels were maintained in key colony sites in the Gayini Nimmie-Caria wetlands and the northern part of Yanga National Park. These top-up flows were important for allowing waterbirds to raise their young from small chicks observed in the spring and early summer surveys through to fledglings observed in the late summer surveys.

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Appendices

Appendix 1 Waterbird ground survey sites

Murrumbidgee MER Zone	Site Code	Site Name [^]	Fixed sites for biannual surveys	Known colony site	Active in 2020-2021 water year
Gayini (Nimmie-Caira)	AVA	Avalon Swamp	Yes	Yes	No
Gayini (Nimmie-Caira)	EUL	Eulimbah Swamp	Yes	Yes	Yes
Gayini (Nimmie-Caira)	KIAL	Kia Lake	Yes		
Gayini (Nimmie-Caira)	KIAS	Kia Swamp	Yes		
Gayini (Nimmie-Caira)	LOO	Loorica Lake	Yes	Yes	Yes
Gayini (Nimmie-Caira)	NAP	Nap Nap Swamp	Yes	Yes	Yes
Gayini (Nimmie-Caira)	SUI	Suicide Swamp	Yes	Yes	Yes
Gayini (Nimmie-Caira)	TEL	Telephone Creek	Yes	Yes	Yes
Mid-Murrumbidgee	BEJ	Berry Jerry	Yes		
Mid-Murrumbidgee	NSF	Narrandera SF	Yes		
Mid-Murrumbidgee	COO	Coonacoocabil	Yes		
Mid-Murrumbidgee	YAA	Yanga Ag (McCaughneys)	Yes		
Mid-Murrumbidgee	TUK	Turkey Flats	Yes		
Mid-Murrumbidgee	EUR	Euroley	Yes		
Mid-Murrumbidgee	MOL	Molleys Lagoon	Yes		
Mid-Murrumbidgee	DRY	Dry Lake	Yes	Yes	No
Mid-Murrumbidgee	SUN	Sunshower Lagoon	Yes		
Mid-Murrumbidgee	GOO	Gooragool Lagoon	Yes	Yes	Yes
Mid-Murrumbidgee	YAR	Yarradda Lagoon	Yes	Yes	Yes
Mid-Murrumbidgee	MCK	McKennas Lagoon	Yes	Yes	No
Mid-Murrumbidgee	WILB	Wilbriggie (Darlington) Lagoon	Yes		
North Redbank	MUR	Murrundi	Yes		
North Redbank	NARH	Narwie Homestead Swamp	Yes		
North Redbank	NARW	Narwie West	Yes		
North Redbank	PCS	Paul Coates Swamp	Yes	Yes	No
North Redbank	RIV	Riverleigh	Yes	Yes	No
North Redbank	STE	Steam Engine Swamp	Yes	Yes	No
South Redbank	BRE	Breer Swamp	Yes	Yes	Yes
South Redbank	LPG	Little Piggery	Yes	Yes	Yes

Murrumbidgee MER Zone	Site Code	Site Name [^]	Fixed sites for biannual surveys	Known colony site	Active in 2020-2021 water year
South Redbank	MER	Mercedes Swamp	Yes	Yes	No
South Redbank	MON	Monkem Creek	Yes		
South Redbank	PIG	Piggery Lake	Yes	Yes	Yes
South Redbank	POC	Pococks Swamp	Yes	Yes	No
South Redbank	SHA	Shaws Swamp	Yes		
South Redbank	TBR	Two Bridges Swamp	Yes	See below	
South Redbank	WAG	Waugorah Lagoon	Yes	Yes	No
South Redbank	WAL	Waugorah Lake	Yes	Yes	Yes
South Redbank	YAN	Yanga Lake	Yes	Yes	No
South Redbank	NST	North Stallion	Yes	Yes	No
Western Lakes	HOBB	Hobblers – Penarie	Yes		
Western Lakes	PAIC	Paika Creek	Yes	Yes	No
Western Lakes	PAIK	Paika Lake	Yes	Yes	No
Western Lakes	CHER	Upper Cherax Swamp	Yes		
Gayini (Nimmie-Caira)	HOU	House Creek	No	Yes	Yes
Gayini (Nimmie-Caira)	TEB	Telephone Bank	No	Yes	Yes
North Redbank	GDEE	Glenn Dee	No	Yes	Yes
North Redbank	NAR	Narwie Colony	No	Yes	Yes
North Redbank	TORI	Tori Swamp	No	Yes	No
South Redbank	TALA	Tala Lake	No	Yes	Yes
South Redbank	TALC	Tala Creek	No	Yes	No
South Redbank	TARW	Tarwillie Swamp	No	Yes	Yes
South Redbank	TOPN	Top Narockwell	No	Yes	Yes
South Redbank	TBRE	Two Bridges (East)	No	Yes	Yes
South Redbank	TBRW	Two Bridges (West)	No	Yes	Yes
South Redbank	YCR	Yanga Creek	No	Yes	No

[^] Dry colony sites in the 2020-2021 surveys are shaded