Department of Planning, Housing and Infrastructure

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Fivebough and Tuckerbil Wetlands

Adaptive Environmental Management Plan

August 2025

Acknowledgement of Country

The Department of Planning, Housing and Infrastructure – Crown Lands acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land, and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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Contents

Figures

Tables

Acronyms and Abbreviations

AEMP	Adaptive Environmental Management Plan
ANZECC	Australian and New Zealand Environment and Conservation Council
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BDAR	Biosecurity Development Assessment Report
Biosecurity Act	*Biosecurity Act 2015* (NSW)
BMP	Biodiversity Management Plan
CAMBA	China-Australia Migratory Bird Agreement
Cth	Commonwealth
CEWH	Commonwealth Environmental Water Holder
CLMA	*Crown Lands Management Act 2016*
CPHR	Conservation Programs, Heritage, and Regulation Group – NSW DCCEEW – Environment and Heritage
DCCEEW	(Cth)Department of Climate Change, Energy, Environment and Water
NSW DCCEEW	Department of Climate Change, Energy, Environment and Water
DP	Deposited Plan
DO	Dissolved Oxygen
DPHI	Department of Planning, Housing and Infrastructure
ECD	Ecological Character Description
EEC	Endangered ecological community – as defined under relevant law applying to the proposal
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EWMS	Environmental Work Method Statements
ha	Hectares
Heritage Act	*Heritage Act 1977* (NSW)

JAMBA	Japan-Australia Migratory Bird Agreement
Km	Kilometres
m	Metres
ML	Megalitre (1 million litres)
MNES	Matters of National Environmental Significance under the EPBC Act
NPW Act	National Parks and Wildlife Act 1974 (NSW)
NPWS	National Parks and Wildlife Service
NSW	New South Wales
PCT	Plant Community Type
RAOU	Royal Australasian Ornithologists Union
REF	Review of Environmental Factors
REP	Regional Environmental Plan
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
Sp/spp	Species/multiple species
STP	Sewage Treatment Plant
TARP	Trigger Action Response Plan
TSS	Total Suspended Solids
TPZ	Tree Protection Zone
UNESCO	The United Nations Educational, Scientific and Cultural Organisation

1 Executive Summary

Fivebough and Tuckerbil Wetland reserves (the wetlands) are located north-west of Leeton in Wiradjuri Country and within Leeton Shire Council area. The wetlands were designated in 2002 under the Ramsar Convention as Wetlands of International Importance for conserving biological diversity. Combined, the wetlands meet the Ramsar criteria in relation to species, ecological communities and waterbirds.

The wetlands are managed by Crown Lands with input from the Fivebough and Tuckerbil Wetlands Advisory Committee which comprises representatives from Federal, State and Local Government, Leeton Local Aboriginal Land Council, private industry and community groups within the Leeton district. The overarching management aim for the site, in line with the Australian Ramsar management principles, is to maintain the ecological character of the wetlands and promote its sustainable wise use. Of key importance is to conserve and enhance the range of habitats available for waterbirds, in particular threatened and migratory species, by maintaining a mosaic of habitats able to sustain the wide variety of species that flock to the wetlands.

The Ecological Character Description, prepared to document the ecological character of Fivebough and Tuckerbil Wetlands at the time of its listing as a Wetland of International Importance in 2002 (updated in 2011), describes Fivebough Wetland as comprising of permanent and intermittent fresh-brackish, shallow wetlands and Tuckerbil Wetland as a seasonal, shallow, brackish-saline wetland, with both supporting a high abundance and diversity of waterbirds, including migratory shorebirds and threatened species.

An ecological review of the wetlands, carried out for development of this current version of the Adaptive Environmental Management Plan, suggests a declining trend in waterbird species diversity and abundance. However incomplete and fragmented ecological datasets, particularly from 2020 to 2024, including a lack of concurrent vegetation and hydrological monitoring, hindered efforts to confidently assess ecological trends. The lack of data and undocumented ecological shifts highlight the need for robust monitoring and regular reporting to truly understand the condition of the wetlands, their response to management actions and opportunities for adaptive management.

An effective governance structure is an essential part of achieving the objectives of this plan. There is an opportunity to further strengthen partnerships and the management of the wetlands through establishing subcommittees that align with the management strategies. Establishing sub-committees provides an opportunity to enhance focus, expertise, and efficiency.

This adaptive management plan is built around an understanding of the ecological character of the site and the key threats to these values. It includes a robust monitoring and implementation strategy to address data limitations and improving ecological reporting and monitoring to ensure the wetlands long term ecological function as critical habitat for waterbirds, while providing a strategic approach and clear outcomes for land managers, government, industry, community and land users of the Fivebough and Tuckerbil Ramsar Site.

This plan was written by Alluvium Consulting in 2025.

Table 1 Summary of management actions and objectives

Objective 1. To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, including threatened species, migratory waders, and those species found at the site in numbers greater than 1% of their population estimate.				
Management Strategy A. Water Management				
Action	**Activity ID**	**Activity**	**Responsibility**	**Timing**
Strategic delivery of environmental water in line with annual watering plan	1	Environmental water decision framework	Crown Lands (in collaboration with Commonwealth and NSW environmental water managers)	To be completed December 2025
	2	Annual water planning	Crown Lands (in collaboration with Commonwealth and NSW environmental water managers)	Start of each water year
Improvement and maintenance of infrastructure	3	Infrastructure improvement	Crown Lands MI	To be completed by April 2027
	4	Infrastructure maintenance	Crown Lands and MI with support from Commonwealth and NSW environmental water managers	Ongoing: start of each water year
Management Strategy B. Weed, pest and fire mitigation				
Weed control	5	Weed control	Crown Lands Grazing Licence Holders	Annual and as threats are identified
Targeted pest animal control	6	Pest animal control	Crown Lands	As threats are identified
Sustainable grazing regime implemented	7	Implementation of sustainable grazing regime	Grazing Licence Holders Crown Lands	As per the grazing guidelines

Objective 1. To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, including threatened species, migratory waders, and those species found at the site in numbers greater than 1% of their population estimate.				
Hazard reduction	8	Manage Fire Risk	Crown Lands	Annually, prior to fire season
	9	Trial cool burn	Crown Lands	As a trial if hazard reduction cannot be achieved through other measures.
Objective 2. To respect and celebrate the cultural significance of the wetlands to the local Indigenous people				
Actions identified in Cultural Management Plan are implemented	10	Cultural Management Plan	Local Aboriginal Lands Council	To be completed June 2026
	11	Actions identified in Cultural Management Plan are implemented	Local Aboriginal Lands Council	As identified in the Cultural Management Plan
Cultural access licence is used to manage cultural values at the wetlands	12	Use of Cultural Water Access Licence	NSW environmental water managers and Local Aboriginal Lands Council	As identified in the Cultural Management Plan
Objective 3. To support use of the wetlands for social and recreational values				
Maintenance of facilities	13	Facilities at the wetlands are maintained and improved	Crown Lands Leeton Shire Council	As per the infrastructure and maintenance schedule
Promotion of the wetlands to locals and visitors	14	Updated visitation strategy	Leeton Council	To be completed June 2026
	15	Promotion of the wetlands	Leeton Council	As identified in the updated visitation strategy
Objective 4. To create lasting partnerships that contribute meaningfully to the long-term management of the wetlands				
This objective is achieved through the successful implementation of actions 1-15 and the effective collaboration of those responsible with support of the Fivebough and Tuckerbil Wetlands Advisory Committee and establishment of subcommittees.				

2 Introduction

Vision for Fivebough and Tuckerbil Wetlands

For Fivebough and Tuckerbil Wetlands to be healthy wetland ecosystems that provide habitat for threatened and endangered waterbird populations and foster cultural and social connection.

2.1 Development of the Plan

This plan has been developed for the NSW Department of Planning, Housing and Infrastructure – Crown Lands (Crown Lands) by Alluvium Consulting in consultation with the Fivebough and Tuckerbil Wetland Management Advisory Committee (Advisory Committee), the local community and other stakeholders using the following process:

- Review of existing literature and the Fivebough and Tuckerbil Wetlands Adaptive Management Plan Five Year Review (2020)
- Ecological assessment of Fivebough and Tuckerbil wetlands site and subsequent report (Attachment A – Stage 1 Ecological Report)
- Consultation with Crown Lands on their needs and requirements for the plan.
- Consultation with the community, through an interview process and workshop collaboration collecting community perspectives
- Revised Fivebough and Tuckerbil Wetlands Adaptive Environmental Management Plan reviewed by Crown Lands
- Final plan.

2.1.1 Aim, objectives and purpose of the Plan

Aim

This Fivebough and Tuckerbil Wetlands Adaptive Environmental Management Plan (the Plan) has been developed in accordance with the principles for the management of wetlands of international importance (Ramsar sites) as set out Under Schedule 6 of the *Environment Protection and Biodiversity Conservation Regulations 2000*. In accordance with these principles, the Plan aims to promote and describe actions to maintain the wetlands' ecological character (components, processes, and services) and ensuring their wise and sustainable use for the benefit of all people, without impacting on the natural properties of the ecosystem.

Objectives

1. To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, including threatened species, migratory waders, and those species found at the site in numbers greater than 1% of their population estimate.
2. To respect and celebrate the cultural significance of the wetlands to the local Indigenous people.
3. To support use of the wetlands for social and recreational values.

4. To create lasting partnerships that contribute meaningfully to the long-term management of the wetlands.

Purpose

The purpose of the Plan is to outline strategies for the adaptive management of the Fivebough and Tuckerbil Wetlands, managing the site in accordance with Section 1.4 of the *Crown Land Management Act 2016* management principles.

This Plan is built around an understanding of the ecological character of the site and the key threats to these values, where ecological character refers to the combination of the ecosystem components, processes, and benefits/services that characterise the wetland at a given point in time. This provides a strategic approach and clear outcomes for land managers, government, industry, community and land users of the Fivebough and Tuckerbil Ramsar Site.

The Plan provides an update to the previous management plan for the site (reviewed and developed in 2020) to:

- fulfil the recommendations of regular review set out in the previous plan (recommended five-yearly review)
- fulfil the requirements set out by the Australian Ramsar management principles under the *Environment Protection and Biodiversity Conservation Regulations 2000* for management plan review at seven-year intervals; and to
- incorporate findings of the Ecological Character Description for the site, developed in 2011.

This plan is to be reviewed at 5-year intervals by the Crown Lands. This is to be done in conjunction with the annual review of monitoring and evaluation of the management strategies and actions to be conducted by the Fivebough and Tuckerbil Wetlands Advisory Committee (occurring in December every 5 years since 2014).

2.2 Relevant Treaties, Legislation, and Government Policy

2.2.1 International Treaties

Ramsar Convention

The Australian Government is a Contracting Party to the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention). The Ramsar Convention is an inter-governmental treaty whose mission is 'the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world'.

Adherence to this mission statement should ensure that activities that might affect wetlands will not lead to the loss of biodiversity or diminish the many ecological, hydrological, cultural, or social values of wetlands that contribute to the sites unique ecological character. In achieving this, parties to the Convention are expected to formulate and implement management practices and planning to promote the conservation of the wetlands and sustainable use of resources.

Wise-use concept

The concept of 'wise use' is central to the implementation of the Ramsar Convention, recognising the interdependence of people and their environment.

> 'Wise use of wetlands is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development'
>
> Ramsar Convention Secretariat, 2010[1]

'Ecosystem approaches' refers to the planning processes for promoting the delivery of wetland ecosystem benefits and services, implemented in the context of the maintenance or enhancement of wetland ecological character.

Development of an adaptive management plan, effective monitoring and information exchange, underpin the implementation of the wise use principles, and provide the basis for this plan.

Other treaties

Australia is also a contracting party to various other international treaties concerned with the conservation of wetlands and migratory species habitat:

- Agreement between the Government of Australia and the Government of the People s Republic of China for the Protection of Migratory Birds in their Environment (CAMBA).
- Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Habitats (JAMBA).
- Agreement between the Government of Australia and the Government of the Republic of Korea for the Protection of Migratory Birds and exchange of notes (ROKAMBA).
- The Partnership for the Conservation of Migratory Waterbirds and the Sustainable Use of their Habitats in the East
- Asian Australasian Flyway (Flyway Partnership).
- Convention on Biological Diversity Conservation of Migratory Species of Wild Animals (Bonn Convention)
- Rio Declaration on Environment and Development of World Network of Biosphere Reserves (Man and the Biosphere Program, UNESCO).

2.2.2 National (Cth) Legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) provides for the management and protection of Australia's Ramsar wetlands. The EPBC Act and the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) (EPBC Regulations) includes guidelines for managing wetlands of international importance and for the assessment and approval of actions that may impact on the ecological values of a Ramsar site. These guidelines have been addressed in this Plan.

The EPBC Act may impact on the ability of the Site Manager to implement management actions as is specifies that the Australian Government Environment Minister must review any development likely to have a significant impact on a wetland listed under the Ramsar Convention. Any activity or action occurring within or outside a declared Ramsar wetland must have the submission reviewed by the Commonwealth Department of Climate Change, Energy, the Environment and Water (Cth DCCEEW), which will advise if the action must undergo a formal impact assessment.

[1] Ramsar Convention Secretariat 2010. Wise use of wetlands: Concepts and approaches for the wise use of wetlands. Ramsar handbooks for the wise use of wetlands, 4th edition, vol. 1. Ramsar Convention Secretariat, Gland, Switzerland.

Actions that are identified by the EPBC Act to likely have a significant impact on the wetland. and therefore, requiring review, assessment and approval are listed in Appendix A – Legislation and Policy.

Because the EPBC Act operates separately from NSW legislation, proposals will also need to satisfy state laws in relation to possible impacts.

2.2.3 State Legislation and Policy

NSW legislation and policy requiring consideration includes the following, with detail on the function of each legislation and policy in Appendix A – Legislation and Policy.:

- *Crown Land Management Act 2016*
- *Biodiversity Conservation Act 2016* (BC Act)
- *Water Management Act 2000*
- *Water Sharing Plan for the Murrumbidgee Unregulated River Water Source 2012*

  Note: the 2012 water sharing plan expires in June 2025. The new water sharing plan, to come into effect 1 July 2025, will include Fivebough and Tuckerbil Wetlands as a Prescribed Wetland and may include rules prohibiting new or amended surface water supply works being constructed within, or within 3km upstream of the wetlands.
- Murrumbidgee Long Term Water Plan 2020
- *Local Land Services Act 2013*
- *Environmental Planning and Assessment Act 1979*
- *Biosecurity Act 2015*
- *Rural Fires Act 1997*
- *Fisheries Management Act 1994*
- *Protection of the Environment Administration Act 1991* (POEA Act)
- *Protection of the Environment Operations Act 1997* (POEO Act)
- NSW Wetlands Policy 2010

2.2.4 Local Government

Leeton Shire Council administers the Local Environmental Plan (LEP) 2014. Under the LEP the Fivebough and Tuckerbil Wetlands are zoned 'E2 – Environmental Conservation' and are subject to the corresponding protection and planning approvals. The land surrounding Tuckerbil Wetland and to the east of Fivebough Wetland is largely zoned 'RU1 – Primary Production'. West of Fivebough Wetland the zonings include 'R2 – Low Density Residential', 'R5 – Large Lot Residential' and 'E4 – Environmental Living'.

Environmental Living (E4) zones are on the immediate wetland boundary. North of Fivebough Wetland the zoning is 'RU1 – Primary Production' and south a small parcel of land is zoned SP2 – Infrastructure (Sewage Systems).

3 The Fivebough and Tuckerbil Wetland Sites

3.1 Site description

3.1.1 Location

Fivebough and Tuckerbil Wetlands are located north-west of Leeton NSW in Wiradjuri Country and within Leeton Shire Council area. The wetlands were designated in 2002 under the Ramsar Convention as Wetlands of International Importance for conserving biological diversity. They have been notified in the Government Gazette as Reserve 1030008 for 'Environmental Purposes and Public Recreation' on 3 December 2010. Figure 1 below shows the wetlands location respective of Leeton. Detailed maps of each wetland can be found in Attachment A – Stage 1 Ecological Report. Fivebough Wetland Ramsar Site is located on Crown Land (400 ha) comprising Lot 7303 DP 1159880[2]. The approximate wetland area of Fivebough Wetland is 342 ha.

Tuckerbil Wetland Ramsar Site is located on Crown Land (389 ha) comprising Lots 139, 165, 166, 167 and 283 in DP 751735. The Tuckerbil Wetland Ramsar Site boundary is the cadastral boundary of these properties except along the south-western boundary. From where the contour drain intersects the south-eastern cadastral boundary of Lot 167, the Ramsar boundary follows the contour drain from 146°21'00" E 34°29'46" S, west to 146°20'55" E 34°29'46" S and then northwest to 146°20'23" E 34°29'2" S where it exits the western side of Lot 139. The contour drain is not included in the Ramsar site. The approximate wetland area of Tuckerbil Wetland is 283 ha.

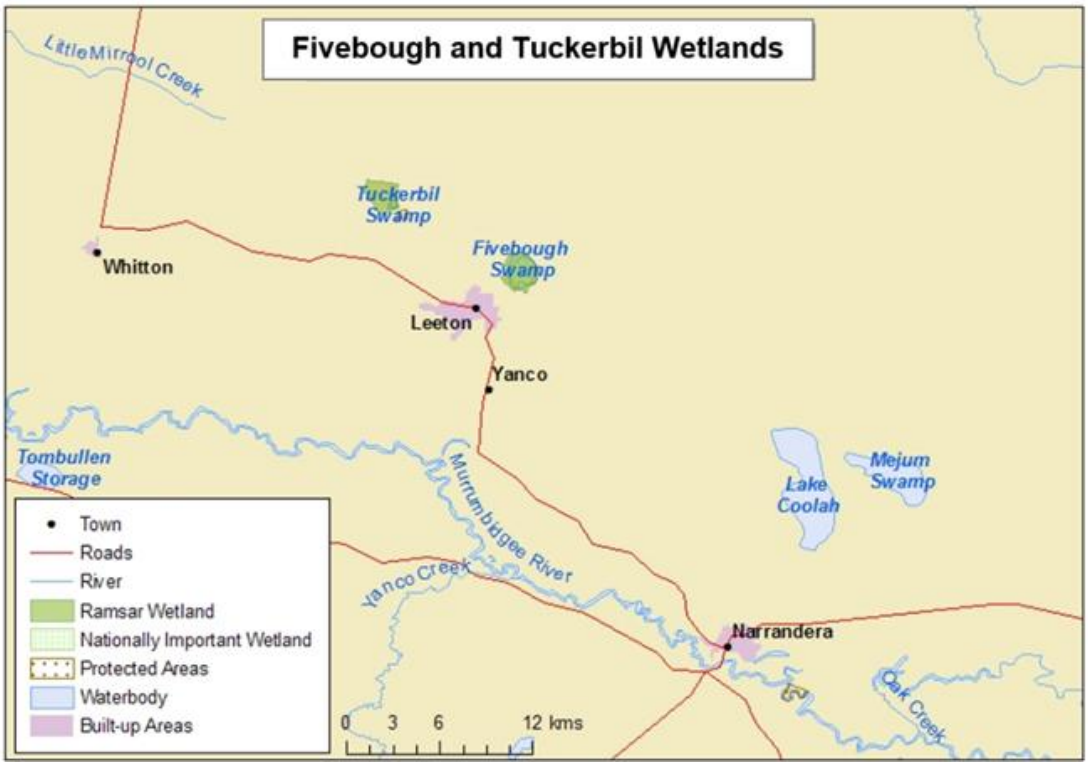


Figure 1 Fivebough and Tuckerbil Wetlands Map[3]

[2] NGH 2020, Fivebough and Tuckerbil Wetland Adaptive Environmental Management Plan Five Year Review. NSW

[3] DCCEEW. (2019, November 12). Ramsar Wetlands - Fivebough and Tuckerbil Swamps. Retrieved from Australian Wetlands Database: https://www.environment.gov.au/cgi-bin/wetlands/ramsardetails.pl?refcode=62

3.1.2 Land Use

Both Fivebough and Tuckerbil Wetlands are reserved for environmental protection and public recreation. Tuckerbil Wetland does not have public access. The wetlands are used for flood mitigation during periods of heavy rainfall. Sections of the wetlands are under grazing licence agreements, appointed under the *Crown Lands Management Act 2016* (CLMA Act). Grazing licence have been issued for the purpose of Environmental Protection and Sustainable Grazing to limit negative impacts on the wetlands.

The land surrounding the wetlands is currently being used in a variety of ways including farms, horticulture, infrastructure, agricultural, rural residential, and residential freehold lands. Leeton Shire Council utilises Fivebough Wetland to discharge tertiary treated effluent. The Leeton Sewerage Treatment Plant (STP) has been operating since 1937 and is located at the southern end of Fivebough Wetland.

As Tuckerbil Wetland does not have public access only Fivebough Wetland is used for local passive recreational activities like bushwalking and other nature-based recreation. Improvements to the access and infrastructure within the Fivebough Wetland have enabled greater use of the educational resources and tourism interests (both on a national and international scale). There is no commercial tourism at either Fivebough or Tuckerbil Wetlands.

Both wetlands are Ramsar listed and are of national and international importance because of the presence, abundance and diversity of waterbirds that have been recorded there. This includes migratory shorebirds and threatens species, as both wetlands operate as important waterbird habitat and refuge within an agricultural landscape. Some habitat values stem from the human uses of the areas such as grazing, flood mitigation and sewage treatment. As such, the site is a good demonstration of the Ramsar wise use principle and also has considerable potential for the further development of waterbird-related eco-tourism.

3.1.3 History and Management

The timeline below (Figure 2) outlines the critical events that have shaped the management of the Fivebough and Tuckerbil Wetlands.

The group responsible for managing the wetlands has evolved over time (Figure 2). Most recently, the Fivebough and Tuckerbil Advisory Committee (the Advisory Committee) has been functioning to provide advice, local perspective and liaison with the project managers. The Advisory Committee is made up of members comprising State Government, Local Government, local interest groups and community representatives.

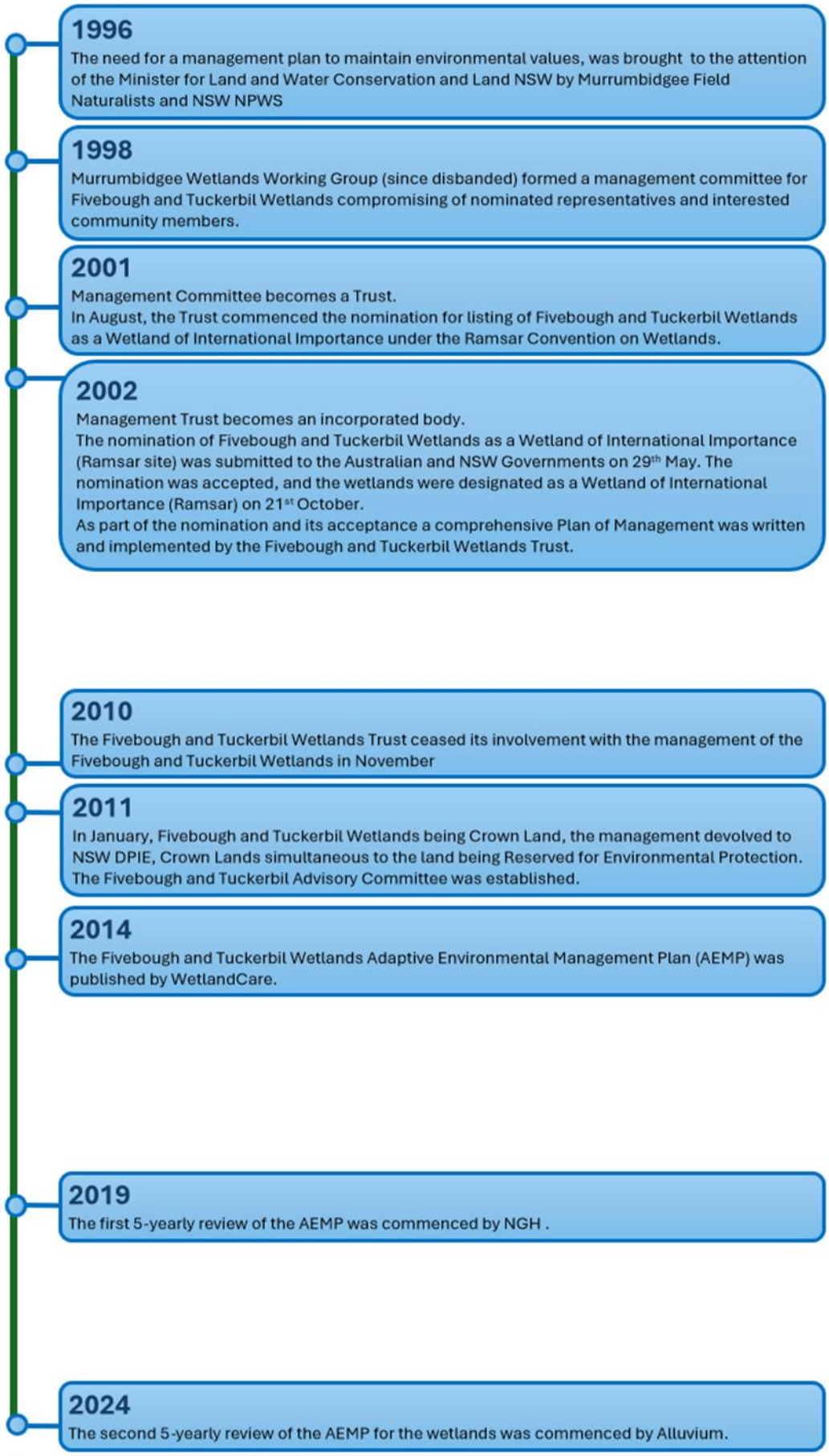


Figure 2 Timeline of the Management Events of the Fivebough and Tuckerbil Wetlands

3.2 Ramsar Listing Criteria

The Fivebough and Tuckerbil Wetlands are designated under the Ramsar Convention as Wetlands of International Importance for conserving biological diversity. Together they meet criteria in relation to species, ecological communities and waterbirds under four of the nine Ramsar listing criteria:

- Criterion 2: Rare species and threatened ecological communities
- Criterion 3: Biological diversity
- Criterion 4: Support during critical life cycle stage or in adverse conditions
- Criterion 6: >1% waterbird population

Please refer to Appendix B– Fivebough and Tuckerbil met Criterion Descriptions.

3.3 Ecological Character

The principal undertaking of the Contracting Parties to the Ramsar Convention with respect to listed wetlands is to promote their conservation with the aim of preventing human-induced adverse changes to their ecological character.

> Ecological character is defined as the combination of the ecosystem components, processes, and benefits/services that characterise the wetland at a given point in time.
>
> Change in ecological character of a wetland is defined as the alteration of any ecosystem component, process, and/or benefit/service.

Under Australia's general principles for the management of Ramsar sites as set out under Schedule 6 of the *Environment Protection and Biodiversity Conservation Regulations 2000*, a key purpose of this plan is to maintain the ecological character of the wetland. A description of the ecological character of a site underpins the management of a Ramsar Wetland and provides the benchmark from the time of listing by which ecological change can be measured.

Historically, Fivebough supported a Black Box (*Eucalyptus largiflorens*) grassy woodland-fringed freshwater sedgeland, while Tuckerbil was characterised by swamp grassland with a Black Box–Lignum (*Duma florulenta*) woodland fringe. These wetlands were shaped by natural cycles of inundation and drying, which maintained a dynamic mosaic of vegetation types and supported a diverse array of waterbird species.

The numbers and diversity of waterbirds at Fivebough and Tuckerbil Wetlands are a function of the hydrology and vegetation of the site. Areas of dense wetland vegetation such as Cumbungi (*Typha* spp.) and Marsh Club-rush (*Bolboschoenus caldwelli*) provide shelter for some species, while the extent of bare areas and sparse vegetation cover, which are shallowly inundated or drying, are important for wader bird habitat.

However, extensive clearing, grazing, fire, and altered hydrological regimes have reshaped these ecosystems. Fivebough, once an ephemeral wetland, has been converted into a permanent yet fluctuating fresh-brackish system, while Tuckerbil, historically a shallower and more transient wetland, has experienced substantial vegetation shifts due to prolonged modifications to its natural water regimes. The altered hydrology has led to Black Box dieback in Fivebough and the expansion of Cumbungi (*Typha spp.*) and Water Couch (*Paspalum distichum*), resulting in a highly modified yet still ecologically valuable landscape.

Today, Fivebough Wetland provides habitat for a succession of waterbird species throughout its annual wetting-drying cycle. Different species use the wetland at various stages as water levels recede, each responding to preferred foraging depths. Fivebough now supports a mosaic of tall marsh, grassland, shrubland, and woodland. Black Roly-poly (*Sclerolaena muricata*) has begun colonising, and some Black Box regeneration is occurring at the margins. In 2024,

five distinct waterbird habitat types were identified (see Appendix C), corresponding to several Plant Community Types (PCTs) in moderate condition.

Tuckerbil Wetland remains a swamp grassland, though its vegetation is now strongly structured by hydrological gradients. Pale Spike-rush (*Eleocharis pallens*), Marsh Club-rush, and Swamp Canegrass (*Eragrostis australasica*) dominate different zones, while the historical Black Box–Lignum woodland has largely transitioned to shrubland and grassland. Tuckerbil generally dries out before Fivebough, providing shallow water and exposed mudflats that are crucial for smaller wader species when water levels in Fivebough remain too high.

Both wetlands continue to respond dynamically to fluctuating hydrological regimes and an increasingly variable climate. Their future ecological character will depend on ongoing water management and conservation efforts to maintain the balance between vegetation structure, habitat availability, and waterbird diversity.

The range and extent of waterbird habitat types are described in Appendix F – Waterbird and vegetation water requirements and illustrated in Attachment A‑ Stage 1 Ecological Report. Further information surrounding habitat types can be found in Section 3.4 below.

As set out by the Ecological Character Description for this site[4], the ecological character of the wetland and limits of acceptable change (LAC) are described in Table 2 and

Table 3.

Table 2 Ecological Character of both the Fivebough and Tuckerbil Wetlands under the Ramsar Site as defined by its Ecological Character Description4,[5]

Ecosystem Services	Description	Limits of Acceptable Change
Supports a threatened wetland species (Australasian Bittern).	Over any ten-year period, Australasian Bittern occurs at Fivebough Wetland every year and at Tuckerbil Wetland in at least five years.	Australasian Bittern occurs at Fivebough wetland on average in eight of every ten years. Australasian Bittern Occurs at Tuckerbil Wetland on average in five of every 12 years.
Supports a threatened wetland species (Painted Snipe).	Over any ten-year period, Painted Snipe occurs at Fivebough Wetland in at least three years.	Painted Snipe occurs at Fivebough Wetland on average in two of every ten years.
Supports a high diversity of wetland species.	Over any ten-year period, Fivebough Wetland supports about 84 waterbird species and Tuckerbil about 69 species.	The total number of species at Fivebough Wetland should not decline substantially over a ten-year period: i.e. no less than 79 species (95%) should occur. The total number of species at Tuckerbil Wetland should not decline substantially over a ten-year period: i.e. no less than 65 species (95%) should occur.

[4] DEC (Department of Environment and Conservation) (2011). Ecological Character of the Fivebough and Tuckerbil Swamps Private Ramsar Site. Final Report.

[5] This table has been adapted from the 2020 Review of the 2014 AEMP conducted by NGH.

Ecosystem Services	Description	Limits of Acceptable Change
Supports shorebird migration.	Over any ten-year period, Fivebough Wetland supports at least 19 species of migratory shorebird, and Tuckerbil Wetland supports at least ten species, and there is substantial occurrence of shorebirds every year. Several thousand migratory shorebirds (principally Sharp-tailed Sandpipers) occur at Fivebough Wetland and several thousand at Tuckerbil Wetland, and in both wetlands, this happens in at least five of every ten years.	Over any ten-year period, occurrence of less than 18 migratory shorebird species (95%) at Fivebough Wetland or less than nine migratory shorebird species (95%) at Tuckerbil Wetland, would be unacceptable. Substantial occurrence of migratory shorebirds at Fivebough Wetland or at Tuckerbil Wetland in less than nine of every ten years, would be unacceptable. Occurrence of less than 1,000 migratory shorebirds at either Fivebough Wetland or Tuckerbil Wetland, in less than four of every ten years, would be unacceptable.
Supports roosting by waterbirds.	A substantial number of Brolgas roosts at Tuckerbil Wetland each year. Substantial numbers of Glossy Ibis (at least thousands) and Whiskered Terns (at least many hundreds) roost seasonally at Fivebough Wetland in most years.	Over a ten-year period, use of Tuckerbil for roosting by substantial numbers of Brolga in less than nine years would be unacceptable. Over a ten-year period, use of Fivebough for roosting by less than 1,000 Glossy Ibis, in less than eight years, would be unacceptable. Over a ten-year period, use of Fivebough for roosting by less than 1,000 Whiskered Terns, in less than five years, would be unacceptable.
Supports 1% of the size of a waterbird population (Sharp- tailed Sandpiper).	Over a ten-year period, more than 1% of the Flyway population of Sharp-tailed Sandpiper occurs at Fivebough Wetland and at Tuckerbil Wetland in at least five years.	Occurrence of more than 1550 Sharp-tailed Sandpipers at Fivebough Wetland in less than four of every ten years would be unacceptable. Occurrence of less than 1550 Sharp-tailed Sand pipers at Tuckerbil Wetland in less than four of every ten years would be unacceptable.
Flood mitigation.	Fivebough Wetland plays an important role in alleviating flooding in the irrigation and urban drainage system that surrounds the wetland. During prolonged or heavy rainfall, excess water in the drainage system is directed into Fivebough Wetland.	Identified as a supplementary benefit of the wetlands in Ecological Character Description. LAC threshold not identified to assess against.
Supports predators (Ibises) of agricultural pests.	The principal native predator of agricultural pests (crickets, grasshoppers) in this region is the Straw-necked Ibis, which commonly feeds on the pests in dryland areas but also depends on nearby wetlands for roosting and/or breeding. Up to 1,200 birds have been recorded at Fivebough Wetland and up to 1,750 at count at Tuckerbil Wetland.	Identified as a supplementary benefit of the wetlands in Ecological Character Description. LAC threshold not identified to assess against.

Ecosystem Services	Description	Limits of Acceptable Change
Existence of Indigenous cultural heritage in or closely associated with the wetlands.	The Narrungadera Wiradjuri community has traditional and ongoing connections with the wetlands. A major burial ground (Koonadan Historic Site) occurs beside and is inherently associated with Tuckerbil Wetland. Occupation sites exist at Fivebough Wetland.	Identified as a supplementary benefit of the wetlands in Ecological Character Description. LAC threshold not identified to assess against.
Frequency of inundation.	Habitat suitable for feeding and roosting by Glossy Ibises occurs extensively at Fivebough Wetland in spring-summer each year: this comprises shallow open water or inundated couch grassland, of variable depth. Extensive areas of shallow water (i.e. average depth less than 3 cm and/or is suitable for wading and feeding by shorebirds) occur in Fivebough and Tuckerbil Wetlands every year. Over any ten-year period, Fivebough Wetland (permanent and temporary zones, including Zone 1) are inundated to at least 45 cm depth in eight years and Tuckerbil Wetland is inundated to at least 30 cm depth in five years.	Availability of extensive shallow water at Fivebough Wetland in less than nine of every ten years would be unacceptable. Inundation of Fivebough Wetland (Zone 1) to at least 45 cm in less than seven of every ten years, or inundation of Tuckerbil Wetland to at least 30 cm in less than four of every ten years, would be unacceptable.
Extent of vegetation/habitat types.	A substantial area of healthy Cumbungi and/or tall sedge vegetation is present each year at Fivebough Wetland (principally in the zone of temporary inundation) and is present (to lesser area extent) in most years at Tuckerbil Wetland. Substantial areas that are bare or that have sparse or patchy vegetation cover, and which are shallowly inundated or muddy, and have adjacent wet mud, are normally present each year at Fivebough Wetland and are often extensive. Habitat suitable for feeding and roosting by Glossy Ibises occurs extensively at Fivebough in spring/summer each year: this comprises shallow open water or inundated couch grassland, of variable depth.	No more than a 25% reduction in the total area of healthy Cumbungi and/or tall sedge vegetation (from date of listing), at both Fivebough and Tuckerbil Wetlands. A reduction by more than 25% in the area of habitat for Painted Snipe (shallowly inundated, sparse or patchy vegetation cover with adjacent wet mud) at Fivebough Wetland would be unacceptable. A reduction by more than 25% in the area of habitat for shorebirds (bare or sparse vegetation cover, and shallowly inundated or muddy) at Fivebough or Tuckerbil Wetlands would be unacceptable. Loss of extensive areas of shallow open water of variable depth (Glossy Ibis habitat) would be unacceptable.
Diversity of waterbird habitats.	A diverse assemblage of wetland habitats including woodland and shrubland (limited extent), Cumbungi beds, sedgeland, grassy meadows, and bare open areas is normally present (collectively) at Fivebough and Tuckerbil.	A reduction in the total area of any one of these habitats at Fivebough Wetland or Tuckerbil Wetland, constituting more than 25% of the area at date of listing, would be unacceptable. *
Diversity of nesting habitats.	A diverse assemblage of wetland habitats including Cumbungi beds, sedgeland, grassy meadows, and bare open areas is normally present at Fivebough Wetland.	A reduction in the total area of any one of these habitats at Fivebough Wetland, constituting more than 25% of the area at date of listing, would be unacceptable. *

Ecosystem Services	Description	Limits of Acceptable Change
Availability of waterbird roosting sites.	Habitat suitable for waterbird roosting occurs extensively at Fivebough Wetland in spring-summer each year: for the most abundant species (Glossy Ibis and Whiskered Tern) this comprises shallow open water or inundated couch grassland of variable depth and with some dry patches.	Loss of extensive areas of shallow open water of variable depth would be unacceptable.
Availability of undisturbed roosting sites.	Habitat suitable for waterbird roosting occurs extensively at Tuckerbil and at Fivebough in spring summer each year: for the Brolga, this comprises open dry land near open water, whereas for the abundant Glossy Ibis and Whiskered Tern this comprises shallow open water or inundated couch grassland of variable depth and with some dry patches.	Loss of extensive areas of shallow open water with adjacent open dry land would be unacceptable. Loss of extensive areas of shallow open water of variable depth would be unacceptable.

*Note that there was insufficient data to make these assessments during the 2025 review.

Table 3 Ecological Character applicable to Fivebough Wetlands under the Ramsar Site as defined by its Ecological Character Description[6]5

Ecosystem Services	Description	Limits of Acceptable Change
Supports substantial breeding efforts by waterbirds.	Over any ten-year period, Fivebough Wetland supports breeding by at least 22 waterbird species.	Over any ten-year period, the number of breeding species remains at least 90% (20 species) of the number at the date of listing.
Supports 20,000 waterbirds.	At least 20,000 waterbirds occur at Fivebough Wetland, on average in at least two of every ten years.	At least 20,000 waterbirds occur at Fivebough Wetland on average once every ten years.
Supports 1% of the size of a waterbird population (Glossy Ibis).	Over a ten-year period, more than 1% of the Australian population of Glossy Ibis occurs at Fivebough Wetland on average in at least two years.	Over a ten-year period, occurrence of more than 10,000 Glossy Ibis at Fivebough Wetland in less than two years would be unacceptable.
Assimilation of post-treated domestic and industrial wastewaters from sewage treatment plants.	Fivebough Wetland continuously assimilates at least 2.5 Megalitres per day of treated sewage effluent water.	The permanent part of Fivebough Wetland can accept larger discharge (up to doubled) without compromising wildlife values. **Some conservation values (as at date of listing) may be reduced if there is substantially less discharge.
Provides opportunities for nature observation.	Cannot be quantified at present.	Cannot be quantified at present.

[6] DEC (Department of Environment and Conservation) (2011). Ecological Character of the Fivebough and Tuckerbil Swamps Private Ramsar Site. Final Report.

Ecosystem Services	Description	Limits of Acceptable Change
Provides opportunities for education and research on wetlands.		

** White, L., 2014. Ecological Character Description for Fivebough and Tuckerbil Wetlands. Report prepared for Australian Government Department of the Environment. WetlandCare Australia, Ballina, NSW.

3.4 Biodiversity Characteristics

A summary of the biodiversity profiles of Fivebough and Tuckerbil Wetlands can be found below. Detail on relevant physical characteristics of the wetlands can be found in Appendix D – Geophysical Characteristics. Further detailed information on the ecological and biodiversity characteristics of the wetlands can be found in Attachment A - Stage 1 Ecological Report to this report.

3.4.1 Fivebough Wetland

Historically, Fivebough Wetland likely supported the Plant Community Type (PCT) *Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains* (PCT 53) that graded into *Black box grassy open woodland wetland of rarely flooded depressions in southwestern NSW (Riverina Bioregion and Murray Darling Depression Bioregion)* (PCT 16). This type of sedgy wetland occurs on grey and brown clays, including gilgais on low lying flats or depressions on floodplains. Extended inundation from this site's use as an irrigation drainage basin led to the dieback of Black box woodland trees, and encouraged the colonisation of dense stands of Cumbungi (*Typha spp.)* and Water couch (*Paspalum distichum*). Subsequent fires in the 1960s reduced Cumbungi cover, leaving large areas of bare mud, and by 2000, approximately 50% of the wetland was bare substrate.

Today, the wetland supports a mosaic of tall marsh communities, grassland, shrubland, introduced pasture species, and weeds. Past flooding and drying events have prompted colonisation by Black roly-poly (*Sclerolaena muricata*) and regeneration of Black box grassy woodlands on the wetland periphery. The understory in these woodland areas consists of a range of native grasses with a sparse cover of chenopod shrubs, including Spiny saltbush (*Rhagodia spinescens*), Creeping saltbush (*Atriplex semibaccata*), and Black cotton bush (*Maireana decalvans*), as well as various native forbs.

In December 2024, five waterbird habitat types were identified at Fivebough Wetland: chenopod woodland, Couch grass grassland, Cumbungi wetland/ open water mosaic, chenopod shrublands, and sedge dominated wetland. These habitat types, while now naturalised, reflect responses to the site's significantly altered conditions compared to pre-European benchmarks. Changes in the vegetation community have been influenced by historical clearing, modified hydrology, and the spread of introduced flora species. This shift in habitat types underscores the interaction between ecological processes and human impacts, where historical disturbances and altered environmental conditions have shaped the vegetation into forms aligning with specific Plant Community Types (Figure 3). Plant Community Types reflective of the vegetation community within habitat types in this area can be found in Appendix E – Reflective Plant Community Types of the region.

Kangaroo at Fivebough Wetlands. Image Credit: Ben Gawne, Dec, 2024.

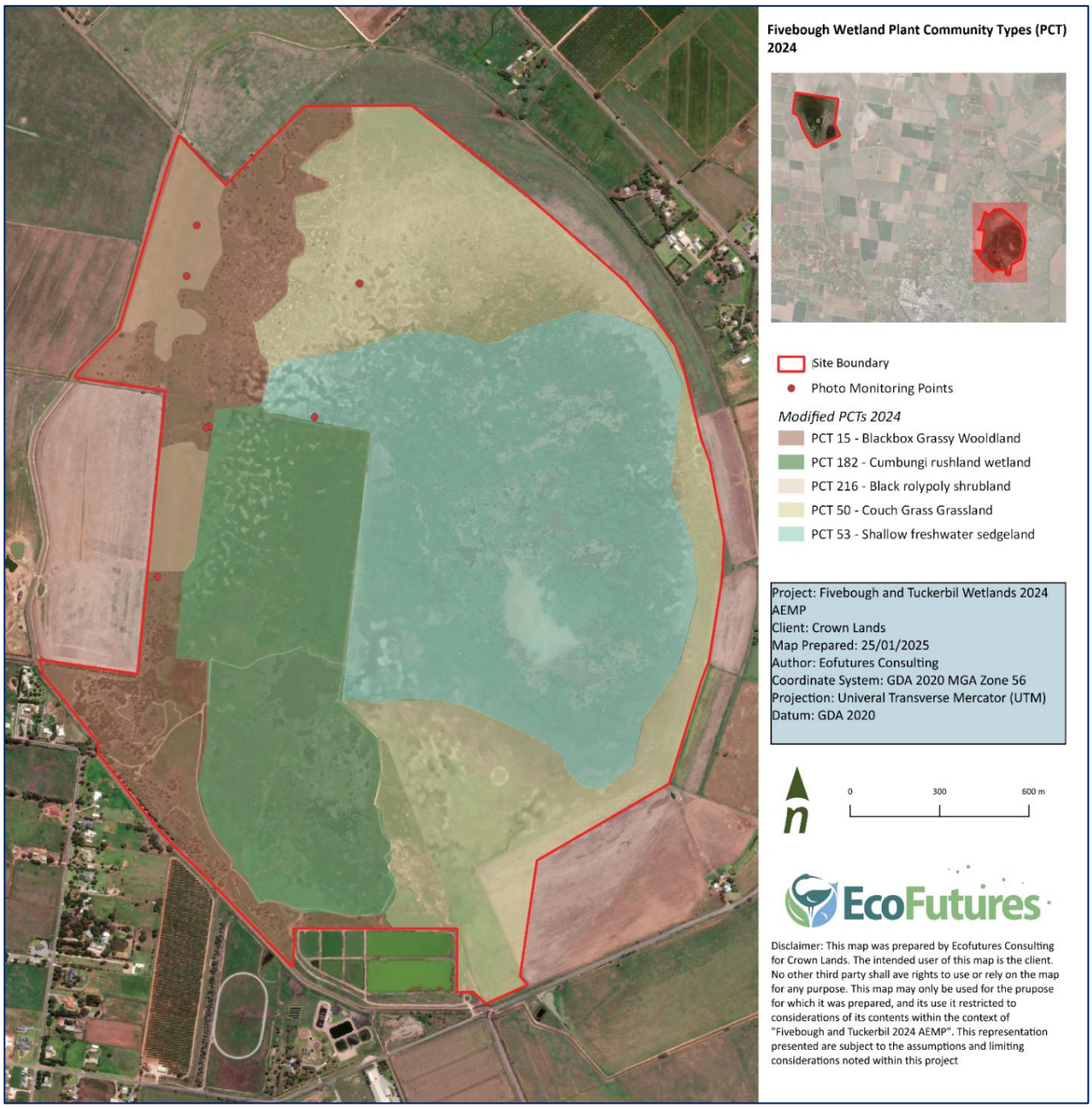


Figure 3 Fivebough Wetland Plant Community Types (PCT) extents December 2024

3.4.2 Tuckerbil Wetland

Tuckerbil Wetland is predominantly covered by swamp grassland, albeit in a modified state relative to its typology as *Swamp grassland wetland of the Riverine Plain* (PCT 47). This PCT typically occurs on grey cracking clays in swamps and depressions of the Riverine Plain within the Riverina Bioregion. Intact remnants of this community are characterised by grasslands and forb-dominated vegetation, including species such as Common blown grass (*Lachnagrostis filiformis*), Brown-back wallaby-grass (*Rytidosperma duttoniana*), and Billy buttons (*Pycnosorus globosus*). However, at Tuckerbil, the highly modified wetland community displays spatial variation in dominant species, reflecting altered conditions. Dominant species vary across the swamp grassland, ranging from graminoids like Pale spike-rush (*Eleocharis pallens*) and Marsh club-rush (*Bolboschoenus caldwelli*) to grass species such as Swamp cane grass (*Eragrostis australasica*).

Previous assessments documented Cumbungi (*Typha spp.*) as dominant in the central western areas and parts of the Stony Point Main Drain to the north, while Water Couch (*Paspalum distichum*) occurred in the wetter north-western sections[7], and Swamp cane grass has been recorded as dominating part of the Wetland's central area[8]. Additionally, recent flooding and drying cycles have facilitated the expansion of Black roly-poly (*Sclerolaena muricata*) and other chenopods, leading to the majority of Tuckerbil being mapped as Black Roly-poly shrubland in 2020[9]. The vegetation composition also transitions along the hydrology gradient, shifting from drier outer rims to areas with semi-permanent or permanent water (Figure 4). Historically, the fringing vegetation community was likely *Black box–Lignum woodland wetland of the inner floodplains* (PCT 13), though much of the overstory has been lost, transitioning into grassland or shrubland communities.

Despite these alterations,various waterbird habitat types were identified during the December 2024 assessment: tall sedgeland wetland, open water of varying depths, low spike-sedge wetland, modified woodland, grassy meadow/ chenopod shrubland complex, and Lignum (*Duma florulenta*) shrubland wetland. Plant Community Types reflective of the vegetation community within habitat types in this area can be found in Appendix E – Reflective Plant Community Types of the region.

[7] Determined by WetlandCare in 2014

[8] Determined by NGH in 2022

[9] In 2022, NGH conducted a biodiversity assessment of the site for a hydroworks development to coincide with NGH, 2020. "Fivebough & Tuckerbil Wetlands Adaptive Environmental Management Plan Five Year Review." NSW.

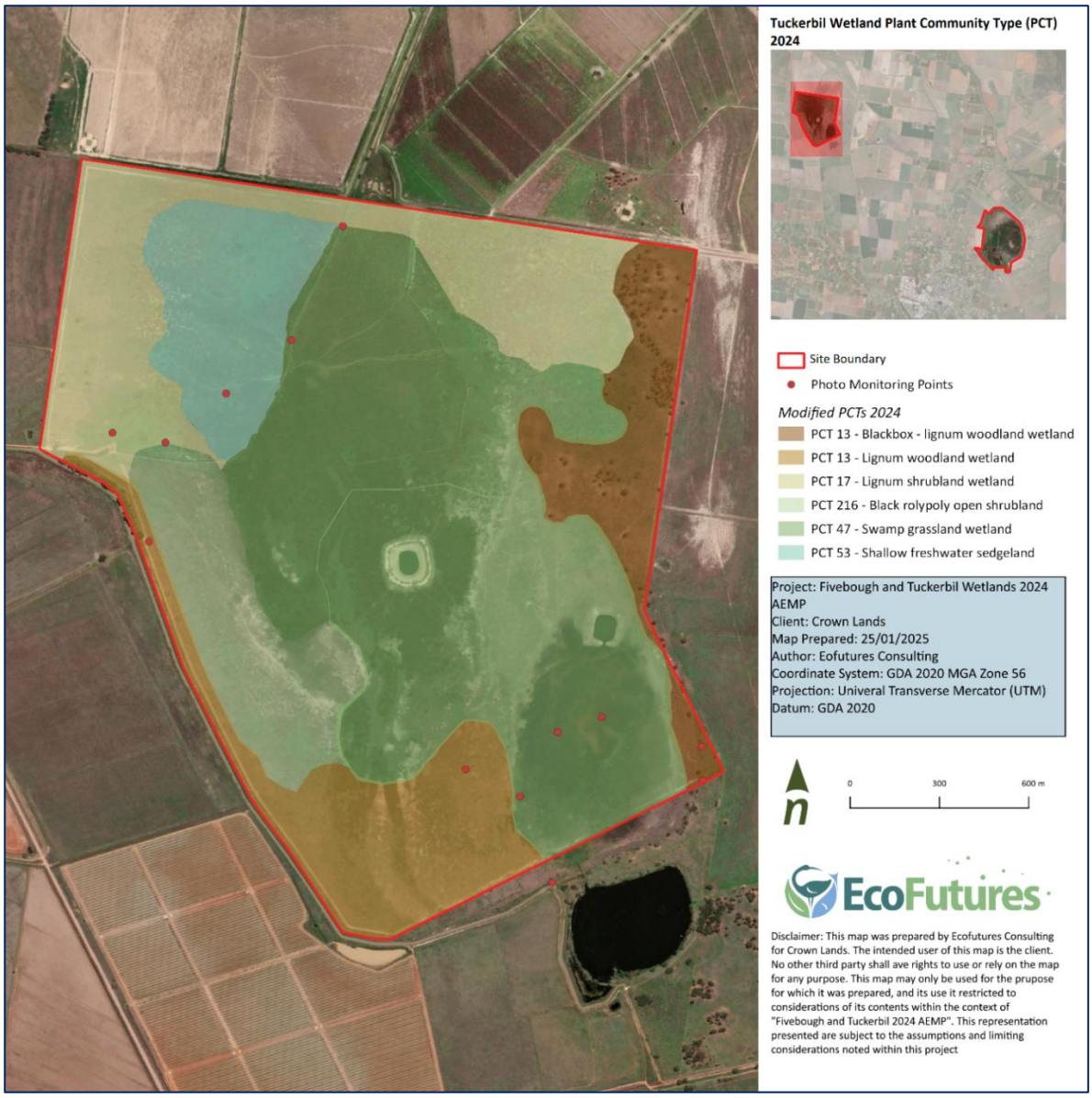


Figure 4 Tuckerbil Wetland Plant Community Types (PCT) extents December 2024

3.5 Cultural Values

Leeton is located in the country of the Wiradjuri Nation. The wetlands were historically used while travelling between the Murrumbidgee River and the nearby mountains, when eggs, nestlings, yabbies, mussels and plants would be gathered in spring. On the return journey in autumn, emu eggs and young could be added to this diet of wetland species. The wetlands and surrounding lands were traditional hunting and fishing places for the Wiradjuri people. Local cultural knowledge maintains that a bora ground, used for ceremonial purposes, was located between the Koonadan dune and Tuckerbil Wetland[10].

The Koonadan Historic Site is a lunette dune located adjacent to the Tuckerbil Wetland. It provided a significant source of food and served as a hunting and fishing ground. Evidence of domestic and spiritual life at the site is represented by the discovery of stone tools, ground ovens, and skeletal remains[11]. A Plan of Management, prepared in accordance with the National Parks and Wildlife Act 1974, exists to guide operations for Koonadan Historic Site with a focus on the protection of its cultural significance, and to provide opportunities for educational and suitable

[10] Koonadan Historic Site Plan of Management (NPWS) 1996

[11] "Koonadan Aboriginal Place". Leeton & District Local Aboriginal Land Council. Retrieved 1 May 2025.

recreational use. The wetlands also have a special significance in that they allowed the local Indigenous people to reconnect with their country upon their return from the missions earlier this century. During the late 1800s many of the traditional owners of the land were forcibly moved to nearby missions during which time much of their traditional knowledge was irrevocably lost. After the closure of the missions some people did return to the Koonadan area to continue their traditional ways as far as possible, including living off the land. Pastoral and quarrying activities later hindered this by clearing native vegetation and destroying wildlife habitat.

The cultural significance and the Traditional Owners' connection to the wetlands is communicated to the wider community by the Budyaan Baamirra Interpretive Centre, constructed by the Fivebough Tuckerbil Wetlands Trust in August 2001. Budyaan means birds and Baamirra swamp/wetland in the local Wiradjuri language, thus the name is Wiradjuri for 'birds at the swamp'.

The walking trail contains many points of interest illustrating the traditional uses of the area. The Wiradjuri gardens contain plants of spiritual and cultural significance such as Ruby Salt Bush, Old Man Salt Bush and Spiny Salt Bush. There is also a group of story poles along the trail, each representative of the different animal totems of the Clans within the Wiradjuri Nation such as turtles, snakes, ants and lizards.

The Leeton Local Aboriginal Land Council (LALC) is represented on the Fivebough and Tuckerbil Wetlands Advisory Committee.

Great Egret at Tuckebil Wetlands. Image Credit: Ben Gawne, December, 2024

4 Threats

4.1 Native Vegetation Loss and Change

The vegetation of these wetlands has changed over time, from woodland to a mixture of pasture species, introduced weeds, and macrophytes. Despite these changes, the site retains high habitat value for waterbirds and other fauna species. Maintaining the current suite of vegetative assemblages (a mosaic of densely vegetated areas and sparsely vegetated or bare areas) is critical for ensuring habitat persistence. The diverse needs of differing waterbird species create a unique set of problems when managing vegetation in these sites. Some species prefer extensive areas of medium-tall vegetation for their habitat, while others require open areas, mud flat, and low vegetation habitats. Further detail surrounding the specific needs of each species found in Fivebough and Tuckerbil Wetlands can be found in Attachment A – Stage 1 Ecological Report.

Hydrological management and water quality, primarily salinity levels, are key drivers in determining the extent, structure, and composition of vegetation communities within wetland systems. Grazing is currently being used as a vegetation management tool. The grazing extent, timing and stocking rates can directly influence vegetation dynamics and habitat heterogeneity.

While grazing can serve as a valuable and effective management tool in wetland systems, its implementation necessitates close monitoring and management to ensure that grazing regimes remain within ecologically sustainable limits and do not contribute to degradation. When appropriately implemented, grazing can be used to suppress proliferation of dominant species such as *Typha domingensis* (Cumbungi) and *Bolboshoenus fluviatilis* (Marsh Club-rush). These dense marcophyte stands can otherwise monopolise wetland areas, reducing availability of sparsely vegetated or open habitats critical for foraging wading birds. Controlled grazing can, therefore, enhance habitat diversity, maintain open areas and support a broader range of wetland-dependent species.

Conversely, inappropriate grazing regimes, including excessive stocking rates, prolonged grazing periods, or poorly timed grazing events can lead to significant ecological degradation. Inappropriate grazing can result in the loss of significant sheltering and nesting vegetation, increased soil compaction, trampling of wetland substrates and erosion, thereby altering hydrological function and ecosystem integrity. A loss of shelter vegetation including Cumbungi as a result of previous grazing regimes, hydrological changes and/or salinisation has reportedly resulted in a decline in numbers of some reliant bird species prior to 2002.

4.2 Altered Flow Regime

Water management is a key driver of the ecological character of the wetland. The hydrological regime plays a vital role in maintaining the mosaic of habitats required to support the range of waterbird habitats at the site. Substantial change occurs through this area due to changes in the management regime and climatic variation. The natural water regimes at Fivebough and Tuckerbil Wetlands have been highly modified over time.

The annual pattern of winter-spring inundation and drying out in summer-autumn driven by natural rainfall and evaporation has been altered through the diversion and regulation of flows for irrigation. Fivebough Wetland also now functions as a permanent but fluctuating fresh-brackish shallow wetland due to regular releases of treated effluent from the Leeton STP. Similarly, Tuckerbil Wetland, while still seasonal, receives environmental water order deliveries that have altered its natural hydrological regime. Climatic variation may also complicate hydrological modification factors. It is important that hydrological flows and depths are regularly monitored to ensure acceptable hydrological conditions are maintained.

Fivebough and Tuckerbil Wetlands are part of Planning Unit 14: Murrumbidgee Infrastructure Dependent Floodplain Wetlands of the Murrumbidgee Long Term Water Plan (LTWP). This planning unit is downstream of key regulating structures with the wetlands generally outside the reach of normal river flows and thus not affected by regulated water.

The LTWP includes environmental water requirements with water delivery from the Murrumbidgee Irrigation Area. Wetland connection flows in the Murrumbidgee are achieved through large fresh flows. These flows connect the river to anabranches and wetlands but remain below bankfull level. This Environmental Watering Requirement (EWR) is referred to as a 'wetland-connecting large fresh' flows[12]. The EWR has two timings specified in the EWR table in Part B of the LTWP.

4.3 Water quality

Leeton Shire Council releases treated effluent daily (approx. 2.5 ML) under an environmental protection licence issued by the Environmental Protection Authority – NSW (EPA). It monitors effluent discharge into Fivebough Wetland regularly to ensure that water quality levels comply with the EPA licence conditions. Appropriate assessment of water quality indicators (such as macroinverterbrates and salinity) should be determined by a measurement and monitoring program within the wetlands. Poor water quality would result in reduced macro invertebrate diversity and density, leading to a loss of waterbird habitat. These assessments should take into account the larger surrounding system (i.e. Murrumbidgee) and the needs of the vegetation in both the Fivebough and Tuckerbil sites.

4.4 Weeds

Weeds are a significant problem for wetland ecology as they can outcompete native aquatic, emergent and terrestrial species growing in the wetland basin, reducing habitat availability and food resources for native fauna. Weeds also impact on the recreational values of the site by reducing access and visual amenity.

While native vegetation has begun to regenerate in response to strategic grazing management, the presence of introduced vegetation, particularly priority weeds, has also flourished at the wetlands following the removal of grazing in some areas. As such, a combination of integrated weed control measures is an important component of the management of the site. Numerous introduced weed species were identified at Fivebough Wetland in December of 2024. These include African Boxthorn, Fleabane, Horehound, Indian fig, Prickly pears – Opuntias, Khaki Weed, Caltrop, and Silver-leaf Nightshade. Management actions relating to weed management are currenly in place under the *Biosecurity Act 2015*.

4.5 Pests

Pest management is dependent on the observed presence of pest species. Pest species identified previously included foxes, domestic cats and dogs, feral cats, the Oriental weatherloach (*Misgumus anguillicaudatus*), the European carp (*Cyprinus carpio*), and hares. These pest species can have a significant impact on waterbird breeding activities through the predation of nesting shorebirds and their eggs and young or on the food-chain by the predation of frogs, lizards, and removal of vegetation. Pests can also negatively affect the habitat itself with contribution to soil erosion, removal of vegetation, disturbance of waterbird species, and suppression of habitat regeneration.

[12] DCCEEW NSW long-term water plans environmental water requirement assessment code description 2024.

4.6 Climate Variation

It is widely accepted that Australia's climate will undergo change over the coming decades. Climate Change Australia (CCA)[13] states of annual average warming by 2030 (above 1986-2005 temperatures) is around 0.6–1.3 ºC., Drying is more likely in the southern areas of Australia due to a contraction in the rainfall belt[14].

There is high confidence that climate change will result in a harsher fire-weather climate in the future, as witnessed in the summer of 2019/20. Potential evapotranspiration is projected to increase in all seasons as warming progresses (high confidence) (CCA).

Intense rainfall events in most locations will become more extreme, driven by a warmer, wetter atmosphere. The combination of drying and increased evaporation means soil moisture is likely to decline over much of southern Australia. Despite potential increases in intense rainfall events, climate change predictions point toward an overall reduction in annual rainfall over the Murray-Darling Basin region[15]. For the Murray Darling Basin as a whole, reduced rainfall could lower saline water tables, however reduced flow is also likely to result in increased salinity, turbidity and eutrophication due to reduced flushing[16].

The factors discussed above have implications for the Fivebough and Tuckerbil Wetlands. Hydrology is a key driver of the ecological character of the wetlands. Decreased rainfall with increased temperature and evaporation will alter the existing hydrology and require additional management response.

While predicted higher future temperatures place wetlands at risk from increased evaporation[16], appropriate environmental water releases can be designed to accommodate these changing conditions. Associated climate stressors, such as prolonged periods of drought, increasing salinisation and increased heat stress to aquatic and terrestrial organisms, may be able to be addressed with appropriate adaptive hydrological management.

4.7 Fire

Fire frequency is expected to increase with climate change[17], creating a potential management concern for the wetlands. There is also a threat to neighbouring properties from fire that occurs within the wetlands. The Fire Management Strategy should consider mitigating this risk particularly at Fivebough Wetland, including the possible construction of firebreaks around the wetland perimeter.

The NSW Guidelines for Ecologically Sustainable Fire Management suggest acceptable fire intervals to be between 6 to 35 years for freshwater wetlands, which are classified as 'swamp heaths, bogs, and floodplain shrublands. These may be either periodically or permanently inundated with fresh water'. Certain wetland species occurring at the site, such as cumbungi, water couch and sedges, reshoot quickly from rootstocks and rhizomes and germinate after fire and rainfall. Herbaceous species, however, may gain a competitive advantage as a result of fire if intervals are too low, thus causing changes to the optimal vegetative assemblages at the site[18].

[13] CCA, 2015. *Chapter 207*, https://www.climatechangeinaustralia.gov.au/media/ccia/2.2/cms_page_media/168/CCIA_2015_NRM_TR_Chapter%207.pdf

[14] NGH, 2020. "Fivebough & Tuckerbil Wetlands Adaptive Environmental Management Plan Five Year Review." NSW.

[15] MDBA, 2024 *Climate Challenges,* https://www.mdba.gov.au/climate-and-river-health/climate/climate-challenges

[16] Pittock, J and Finlayson, C. M. 2011 Australia's Murray Darling Basin: freshwater ecosystem conservation options in an era of climate change Marine and Freshwater Research, 62, 232–243

[17] CSIRO,2011. Climate Change: Science and Solutions for Australia. Editors: Helen Cleugh, Mark Stafford Smith, Michael Battaglia, and Paul Graham. Climate Change: Science and Solutions for Australia. CSIRO Publishing, 168 pp.

[18] National Parks and Wildlife Service (NPWS) (2004), Guidelines for Ecologically Sustainable Fire Management, New South Wales Government.

Given the significant potential for fire impacts on the wetlands, management strategies will require careful attention to impacts resulting from changed climatic conditions. Small, controlled trials could be undertaken after an appropriate watering regime is established.

Dragonfly at Tuckerbil Wetlands. Image Credit: Ben Gawne, December, 2024

5 Site management strategies

5.1 Approach

5.1.1 Management

The strategies for managing Fivebough and Tuckerbil Wetlands are focused on:

A. Water management

B. Weed, pest, and fire mitigation

C. Promoting cultural and social connection

D. Learning and improvement

Management strategies A-C are designed to achieve the objectives:

1. To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, including threatened species, migratory waders, and those species found at the site in numbers greater than 1% of their population estimate
2. To respect and celebrate the cultural significance of the wetlands to the local Indigenous people.
3. To support use of the wetlands for social and recreational values

These strategies (A-C) are described in the form of program logics which outline:

- **The management lever** – the primary tool for making change
- **Foundational inputs** – key planning tools that provide detailed guidance around management activities
- **Management actions** – on-ground actions
- **Intermediate outcomes** – initial changes expected following implementation of actions
- **Long-term outcomes** – longer-term changes expected following implementation of actions
- **Objectives** – management objectives that are aligned with the strategy

For each of these strategies an implementation plan is also provided which details the timing and who is responsible for establishing foundational inputs of implementing management actions. Implementation of management actions must consider legislative obligations (see Appendix A – Legislation and Policy)

Management strategy D Learning and improvement is designed in the form of a monitoring and evaluation plan which aims to test the program logics established for management actions A-C. Following on from the 2025 review of the management plan, this Plan has a heavy focus on robust monitoring to enable ongoing adaptation of management as well as robust review in 2030.

Management activities (Table 5, Table 6, and Table 7) have been assigned a 2025-2030 management activity ID to help with ease of reporting.

Management actions listed as foundational inputs should be prioritised in the first year of implementation of this AEMP. Other actions require ongoing implementation, however, may be prioritised based on advice from the Advisory Committee or any sub-committees established (see below).

5.1.2 Governance

An effective governance structure is an essential part of achieving the objective:

4. To create lasting partnerships that contribute meaningfully to the long-term management of the wetlands.

Whilst the Advisory Committee has been successful in building partnerships to date, there is an opportunity to further strengthen partnerships and the management of the wetlands through establishing subcommittees that align with the management strategies.

Establishing sub-committees provides an opportunity to enhance focus, expertise, and efficiency. By creating sub-committees, each group can concentrate on specific management strategies, allowing for more specialised knowledge, targeted decision-making and prioritisation of actions within each management stream.

Whilst sub-committees would provide value to the management of the wetlands, it is important that the Advisory Group acts to:

Ensure that sub-committees to do not become silo' d and that there are no conflicting or duplicative activities occurring.

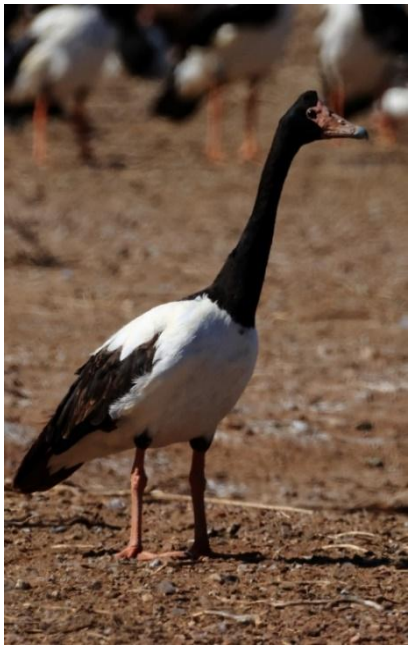
- Support clear and regular communication of management activities.
- Ensure sub-committees are acting in alignment with this AEMP.
- Provides oversight of learning and improvement activities.

Each sub-committee would need to be established under a clear Terms of Reference that includes objectives, roles, deliverables and timelines.

5.2 Water management

Water management is foundational to protecting the ecological characteristics of Fivebough and Tuckerbil Wetland. The logic of how water management can contribute to outcomes and objectives for the wetlands is shown in Table 4. The implementation plan for foundational inputs and management actions is shown in Table 5.

Dragonfly at Tuckerbil Wetlands.
Image Credit: Ben Gawne, December, 2024



Magpie Goose at Fivebough Wetlands.
Image Credit: Ben Gawne, December, 2024

Table 4 Logic of water management at Fivebough and Tuckerbil Wetlands

Management lever	Foundational input	Management action/s	Intermediate outcomes	Long-term outcomes	Objective
Environmental water	A clear and transparent decision-making framework that includes seasonal objectives Annual watering plan	Strategic delivery of environmental water in line with annual watering plan	Environmental water extends the availability of waterbird breeding habitats Environmental water extends the availability of waterbird foraging habitats Wetting and drying regime supports the maintenance of key wetland vegetation types	A range of habitat types, including woodland and shrubland; Cumbungi beds; Tall Sedgeland; Grassy meadows; bare open areas are maintained. Waterbirds use the wetlands as refuge during drought conditions.	To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, including threatened species, migratory waders, and those species found at the site in numbers greater than 1% of their population estimate.
	Infrastructure	Improvement and maintenance of infrastructure	Infrastructure is available for efficiently and effectively moving water		
Leeton STP (volume)	EPA licence Annual watering plan		Small areas of the wetland are permanently inundated		
Leeton STP (quality)	EPA licence	Water quality is maintained within the license requirements	Water quality supports the maintenance of key vegetation types		

Table 5 Implementation plan for water management foundational inputs and management activities.

2025-2030 management activity ID	Management activity requirement	Responsibility	Timing
1	**Environmental water decision framework (foundational input)** Develop a clear and transparent decision-making framework to support the delivery of environmental water that includes seasonal objectives. The decision framework must take into account the water requirements for key flora and waterbird species (see Appendix F – Waterbird and vegetation water requirements). It should establish management objectives and priorities under extreme dry, dry, median, and wet scenarios. This decision framework should be available to all stakeholders to ensure transparency around environmental watering decisions.	Crown Lands (in collaboration with Commonwealth and NSW environmental water managers)	To be completed December 2025
2	**Annual water planning (foundational input)** An annual water planning process that uses the decision-making framework (activity 1) should be implemented. Annual planning should consider the forecast climatic conditions and the annual environmental water priorities established under the Basin Plan/Long-Term Watering Plan processes. Outcomes of the annual planning process should be brought to the management committee for information and transparency purposes.	Crown Lands (in collaboration with Commonwealth and NSW environmental water managers)	Start of each water year
3	**Infrastructure improvement** (**management action**) Infrastructure should be improved to ensure effective and automated water delivery channels.	Crown Lands MI	To be completed by April 2027
4	**Infrastructure maintenance (management action)** Maintenance of water delivery infrastructure to remove blockages and ensure gates are working effectively.	Crown Lands MI	Ongoing: start of each water year

5.3 Weed, pest and fire mitigation.

Mitigating threats from weeds, pests and fire are important for maximising ecological outcomes at the wetlands. Brief backgrounds on these threats can be found in Section 4 of this Plan. The logic for weed, pest, and fire mitigation is shown in Table 6. The implementation plan for foundational inputs and management actions is shown in Table 7.

Table 6 Logic for protecting weed, pest and fire mitigation at Fivebough and Tuckerbil Wetlands

Management lever	Fundamental input	Management action/s	Intermediate outcomes	Long-term outcome	Objective
On-ground pest management	Weed and pest management regime (See Appendix G – Weed and Pest Management Regime)	Targeted pest animal control	Pest animals are less prevalent in the wetlands	Waterbirds are not impacted by predators at the wetlands	To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, including threatened species, migratory waders, and those species found at the site in numbers greater than 1% of their population estimate
On-ground weed management		Weed control	Weeds are less prevalent in the wetlands No new weed species establish in the wetlands	A range of habitat types, including woodland and shrubland; Cumbungi beds; Tall Sedgeland; Grassy meadows; bare open areas are maintained.	
	Grazing guidelines (See Appendix H Vegetation Management Guidelines)	Sustainable grazing regime implemented	Pest animals are less prevalent in the wetlands		
Hazard reduction	-	Maintain fire breaks (where suitable)	Vegetation density is sustainably managed Fire risk is minimised		
	-	Trial cool burns at boundary sites			

Table 7 Implementation plan for weed, pest and fire management foundational inputs and management activities.

2025-2030 management activity ID	Management activity requirement	Responsibility	Timing
5	**Weed control (management action)** As per the weed and pest management regime.	Crown lands Grazing Licence Holder	Annual and as threats are identified per the weed and pest management regime (Appendix G – Weed and Pest Management Regime)
6	**Pest animal control (management action)** As per the weed and pest management regime.	Crown lands	As threats are identified per the weed and pest management plan (Appendix G – Weed and Pest Management Regime)
7	**Implementation of sustainable grazing regime (management action)** As per the grazing guidelines in Appendix H – Vegetation Management Guidelines. Noting the need for monitoring to assess the guidelines and modify as required.	Crown Lands in conjunction with \Grazing Licence Holder	As per the grazing guidelines – Appendix H
8	**Maintenance of fire breaks (management action)** Fire breaks should be maintained at both sites to reduce fire risk to the wetlands and neighbouring properties. Maintenance of fire breaks should include removing vegetation, fallen trees and any other flammable materials	Crown Lands	Annually, prior to fire season.

2025-2030 management activity ID	Management activity requirement	Responsibility	Timing
9	**Trial cool burn (management action)** If the vegetation density is unable to be maintained at the wetlands a trial cool burn could be undertaken, noting that it must adhere to the *Rural Fires Act 1997* and other legislative requirements. Given the sensitivity of wetlands to fire, a trial cool burn should only occur on the boundaries of the wetland sites and only if considered essential.	Crown Lands	As a trial if hazard reduction cannot be achieved through other measures.

Cow grazing at Fivebough Wetlands. Image Credit: Ben Gawne, December 2024

5.4 Promoting cultural and social connection

Promoting cultural and social connection to the wetlands are aligned with the principle of balanced wise use and key objectives for Fivebough and Tuckerbil Wetlands. The logic for promoting cultural and social connection is shown in Table 8. The implementation plan for foundational inputs and management actions is shown in Table 9.

Table 8 Logic for foundational inputs and management activities relating to promoting cultural and social connection.

Management lever	Fundamental input	Management action/s	Intermediate outcomes	Long-term outcome	Objective
Engagement from local Aboriginal community	Cultural management plan	Actions identified in Cultural Management Plan are implemented	Cultural values and history are documented in a way that meets the needs of the Aboriginal community	The wetlands' cultural values are protected The Aboriginal community maintains their deep connection with the wetlands The wetlands are valued for their cultural significance	To respect and celebrate the cultural significance of the wetlands to the local Indigenous people.
Cultural water access licence		Cultural access licence is used to manage cultural values at the wetlands	The cultural values of the wetlands are supported by the use of cultural water		
Maintenance of facilities	Infrastructure and maintenance schedule (See Appendix I – Infrastructure Maintenance Schedule)	Facilities at the wetlands are maintained and improved	Facilities meet the needs of visitors to the wetlands Facilities are maintained and improved in ways that are sympathetic to the ecological and cultural values of the wetlands	Increased engagement in the wetlands from locals Increased recreational use and sustainable tourism in the wetlands	To support use of the wetlands for social and recreational values
Promotion	Updated visitation strategy	Promotion of the wetlands to locals Promotion of the wetlands to visitors	Awareness of the wetlands increases		

Table 9 Implementation plan for foundational inputs and management activities relating to promoting cultural and social connection.

2025-2030 management activity ID	Management activity requirement	Responsibility	Timing
10	**Cultural Management Plan (foundational input)** A cultural management plan must be established to document the cultural values of the wetlands and identify how the local Aboriginal community would like these values to be documented and managed. The cultural management plan should identify opportunities to use the Murrumbidgee Cultural Access Licence to protect or improve cultural values as appropriate.	Local Aboriginal Lands Council	To be completed June 2026
11	**Actions identified in Cultural Management Plan are implemented (management activity)** As per the Cultural Management Plan (activity 12).	Local Aboriginal Lands Council	As identified in the Cultural Management Plan
12	**Use of Cultural Water Access Licence (management activity)** As per the Cultural Management Plan (activity 12).	BCD and Local Aboriginal Lands Council	As identified in the Cultural Management Plan
13	**Facilities at the wetlands are maintained and improved (management action)** As per Appendix I – Infrastructure Maintenance Schedule	Crown Lands	As per the infrastructure and maintenance schedule
14	**Updated visitation strategy (foundational input)** The majority of actions listed in the previous visitation strategy (2014) were implemented or partially implemented. A refresh of this strategy is required with a focus of promotion of the wetlands both locally and for tourism purposes. The strategy should identify key messages, approaches and timeframes for promoting the wetlands.	Leeton Council	To be completed June 2026

2025-2030 management activity ID	Management activity requirement	Responsibility	Timing
15	**Promotion of the wetlands (management action)** As per updated visitation strategy (activity 16)	Leeton Council	As identified in the updated visitation strategy

5.5 Learning and improvement

Limitations in monitoring and information have vastly limited the opportunity to identify improved management actions at the 2025 review point. As such, learning and improvement is established as a key standalone management strategy. This strategy aims to test the program logics established for the other three management strategies. It incorporates questions that track implementation as well as questions that test the effectiveness of management activities in achieving outcomes. It introduces quarterly reporting aimed at tracking implementation and sharing data and information in a timely manner, as well monitoring that will allow an effective 5 yearly review and assessment against limits of acceptable change in 2030. This strategy is outlined in the form of an evaluation and monitoring plan which is shown in Table 10.

Table 10 Evaluation and monitoring plan aimed to test management strategies for the Fivebough and Tuckerbil Wetland and support reporting on

Evaluation question	Sub question	Indicators	Data source	Frequency of data collection	Frequency of reporting	Responsibility
To what extent have foundational inputs been developed as required?	Has a clear and transparent decision-making framework that includes seasonal objectives for environmental watering been established?	Progress on implementation	Reporting from agency/individual responsible for implementation	Quarterly	Quarterly	Crown Lands
	Are watering plans being developed each year?					Crown Lands
	Has a cultural management plan been established?					LALC

Evaluation question	Sub question	Indicators	Data source	Frequency of data collection	Frequency of reporting	Responsibility
	Has an updated visitation strategy been produced?					Leeton shire council
To what extent have management actions been implemented as intended?	Has environmental water been delivered in alignment with annual priorities? If not, why?	Progress on implementation	Reporting from agency/individual responsible for implementation	Quarterly	Quarterly	Crown Lands and Commonwealth environmental water managers.
	Has infrastructure been improved and maintained? If not, why?					Crown Lands
	Has weed control been implemented as intended? If not, why					Crown Lands
	Has pest animal control been implemented as intended? If not, why					Crown Lands
	Has a grazing regime been implemented that aligns with the grazing guidelines? If not, why?					Licensee
	Have fire breaks been maintained?					Crown Lands
	Have activities identified in the cultural access plan been implemented?					LALC

Evaluation question	Sub question	Indicators	Data source	Frequency of data collection	Frequency of reporting	Responsibility
	Has the cultural access licence been used?					Commonwealth and NSW environmental water managers
	Have facilities at the wetlands been maintained and improved as per the maintenance plan?					Crown Lands
	Have the wetlands been promoted to the local community?					Leeton Shire Council
	Have the wetlands been promoted for tourism purposes?					Leeton Shire Council
How effective are foundational inputs/management actions at achieving intermediate outcomes?	Has the delivery of environmental water as per annual planning benefited waterbird habitat availability and/or provided water requirements for maintenance of wetland vegetation types?	Water levels Vegetation and waterbird response	Data loggers Photo point monitoring (see Appendix J) Vegetation assessments (see Appendix J) Waterbird assessments (see Appendix J)	In response to environmental water delivery	In each quarterly report where an environmental watering action has occurred within the quarter.	DCCEEW (data loggers) Crown lands (photo point and assessments)

Evaluation question	Sub question	Indicators	Data source	Frequency of data collection	Frequency of reporting	Responsibility
	Has the water quality in the wetlands been maintained at appropriate levels?	Water quality parameters (pH. DO, salinity, temperature)	Data loggers	Real time gauging	Quarterly	Crown Lands DCCEEW
	Are weeds being effectively managed in the wetlands?	Weed distribution, abundance and species present	Vegetation assessments (see Appendix J) Biosecurity assessment Intel from graziers and other visitors	Quarterly (veg assessments) Every 2 years (biosecurity assessment) Ad hoc	Quarterly	Crown Lands
	Are pest species being effectively managed in the wetlands?	Pest distribution, abundance and species present	Vegetation assessment (see Appendix J) Bird assessments (see Appendix J) Intel from graziers and other visitors	Quarterly (vegetation assessments and bird assessments) Ad hoc	Quarterly	Crown Lands

Evaluation question	Sub question	Indicators	Data source	Frequency of data collection	Frequency of reporting	Responsibility
	Is the grazing regime supporting management of weeds and vegetation density?	Weed and vegetation density	Vegetation assessments (see Appendix J) Small plot experiments (see Appendix K)	Quarterly (vegetation assessment) Per season 2026-2029 (small plot experiment)	Quarterly	Crown Lands
	Are the grazing guidelines effective for ensuring there is no negative impacts of grazing on the ecological value of the wetlands?	Per cent bare ground cover Relative dominance ground cover Soil compaction Pugging density	Vegetation assessments Small plot experiments (see Appendix K)	Quarterly (vegetation assessment) Per season 2026-2029 (small plot experiment)	Quarterly	Crown Lands
	Are cultural values and history are documented in a way that meets the needs of the Aboriginal community?	Aboriginal community member sentiment	Interviews with community members	2029	At 5-year review point	LALC
	Are the cultural values of the wetlands are supported by the use of cultural water?	Aboriginal community member sentiment	Case study when cultural access licence is used	When cultural access licence is used	In quarterly report that aligns with when cultural water access licence is used	LALC

Evaluation question	Sub question	Indicators	Data source	Frequency of data collection	Frequency of reporting	Responsibility
	Are key vegetation types and other habitat types being maintained within the limits of acceptable change? Vegetation (regularly - minimum once a year (once per year boundaries of veg extent – and then additional drone support to confirm extent))	Area of key vegetation/habitat types	Vegetation assessments Data loggers Photo point monitoring	Quarterly	Data trends reported quarterly Key Evaluation Questions (KEQ) assessed at 5-year review point	Crown Lands
	Are waterbird populations at the wetlands being maintained within the limits of acceptable change?	Abundance of key species	Waterbird assessments Citizen science	Quarterly (waterbird assessments) Ad hoc (citizen science)	Data trends reported quarterly KEQ assessed at 5-year review point	Crown lands

Appendix A – Legislation and Policy

Ramsar Management Principles

This plan has been developed within the context of the Ramsar Convention and Australian Ramsar management principles. A brief summary of the principles is as follows:

1. Describes the key ecological character (ecosystem components, processes, benefits and services) of the wetland.
2. Demonstrates actions to be taken to maintain the ecological character of the wetland.
3. Promotes and describes actions to conserve the wetland.
4. Promotes and describes actions for the wise and sustainable use of the wetland.
5. Includes a public consultation process.
6. Includes the involvement of people with a particular interest in the wetland.
7. Provides for continuing community and technical input.
8. Describes the characteristics that make the site a wetland of international importance (Ramsar site).
9. Describes actions to deal with impacts that endanger the wetland's ecological character.
10. Identifies actions for restoration and rehabilitation, where required.
11. Considers ongoing monitoring and reporting on the ecological character of the wetland.
12. Is based on an integrated catchment management approach.
13. Allows for review within a seven-year period.
14. Includes assessment process for any actions anticipated to impact the ecological character of the wetland.

EPBC Act – Wetlands of international importance

Significant impact criteria

- An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:
- areas of the wetland being destroyed or substantially modified.
- a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected
- a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

NSW legislation and policy requiring consideration in the management of the Site.

Table 11 NSW legislation and policy requiring consideration in the management of the Site

Legislation Title	Function
Crown Land Management Act 2016	Provides for management of Crown land including environmental protection and administration, preservation of natural resources, public and multiple uses. It outlines the following management principles: • That environmental protection principles be observed in relation to the management and administration of Crown land. • That the natural resources of Crown land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible. • That public use and enjoyment of appropriate Crown land be encouraged. • That, where appropriate, multiple use of Crown land be encouraged. • That, where appropriate, Crown land should be used and managed in such a way that both the land and its resources are sustained in perpetuity; and • That Crown land be occupied, used, sold, leased, licensed or otherwise dealt with in the best interests of the State consistent with the above principles.
Biodiversity Conservation Act 2016 (BC Act)	provides for the conservation of threatened species, populations and ecological communities of plants and animals. It sets out processes of identification, classification and management through the preparation of recovery plans and abatement of key threatening processes.
Water Sharing Plan for the Murrumbidgee Unregulated River Water Sources 2012	The wetlands are within the Murrumbidgee Western Water Source.
Murrumbidgee Long Term Water Plan 2020 (LTWP)	A component of the Basin Plan, LTWPs identify environmental assets that are dependent on water, and match that need to the water available to be managed for or delivered to them. The LTWP sets objectives, targets and watering requirements for key plants, waterbirds, fish and ecosystem functions. Fivebough and Tuckerbil Wetlands are part of Planning Unit (PU) 14: Murrumbidgee Infrastructure Dependent Floodplain Wetlands. This PU is downstream of key regulating structures with the wetlands generally outside the reach of normal river flows and thus not affected by regulated water. The LTWP includes environmental water requirements with water delivery from the Murrumbidgee Irrigation Area.
Local Land Services Act 2013	Works in conjunction with the BC Act to ensure a balanced approach to biodiversity conservation. Part 5A and Part 5B of the Act guide land

	management in NSW, setting the standards for native vegetation management.
Environmental Planning and Assessment Act 1979	Ensures the conservation and protection of natural areas through ecologically sustainable planning and development. One of its key objectives is protecting threatened species and habitats.
Biosecurity Act 2015	Provides a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matters including pests, diseases, contaminants and other biosecurity matters.
Rural Fires Act 1997	Defines the functions of the NSW Rural Fire Service and define its functions; makes provision for the prevention, mitigation and suppression of rural fires.
Water Management Act 2000	Provides for the protection, conservation and ecologically sustainable development of the water sources of the State, and for other purposes.
Fisheries Management Act 1994	Provides conservation for fish and fish habitats and outlines approval processes for the activities that may impact on threatened species and habitats.
Protection of the Environment Administration Act 1991	Outlines the principles of Ecologically Sustainable Development (section 6(2)).
Protection of the Environment Operations Act 1997	Section 120 prohibits the pollution of waters. This includes causing or permitting any waters to be polluted.
Policy	
NSW Wetlands Policy 2010	Promotes sustainable conservation, management and wise use of wetlands in NSW by providing a set of guiding principles that government agencies should adopt, and stakeholders can refer to, when making decisions on wetland management and conservation.

Appendix B– Fivebough and Tuckerbil met Criterion Descriptions

Criterion 2

Fivebough Wetland provides suitable habitat for the Australasian Bittern (*Botaurus poiciloptilus*), which is listed as 'Endangered' under the EPBC Act. The species occurs regularly at both Fivebough and Tuckerbil Wetlands. The Wetlands also support Australian Painted Snipe (*Rostratula australis*), which is listed as 'Endangered' under the EPBC Act. Sharp-tailed Sandpiper, which is listed as 'Vulnerable' under the EPBC Act is also supported at Fivebough and Tuckerbil Wetlands. Remnants of Black box (*Eucalyptus largiflorens*), the original vegetation community, may be found in the margins of the Site.

Criterion 3

A total of 83 species of waterbirds have been identified at Fivebough and 69 species at Tuckerbil. The Site is important for maintaining a high diversity of species of waterbirds within the Riverina bioregion and Murray-Darling Basin drainage division.

Criterion 4

Tuckerbil is a post-breeding roost site for Brolga (*Grus rubicunda*). During spring-summer, Glossy Ibis (*Plegadis falcinellus*) gather at Fivebough to roost and feed. This also applies to a lesser extent to Whiskered Tern (*Childonias hybrida*). Fivebough provides important feeding habitat for three species of egret during their breeding season: Little Egret (Egretta garzetta), Intermediate Egret (*Ardea intermedia*) and Cattle Egret (*Ardea ibis*). The Site is important for migratory waterbirds with 37 species recorded over the Site listed under the Japan-Australia and/or China-Australia Migratory Bird Agreements (JAMBA and CAMBA). The wetlands support 17 species of waterbirds listed under the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Criterion 6

The recorded species of waterbirds at the Site which meet the 1% thresholds are the Sharp-tailed Sandpiper and Australasian Bittern.

An assessment of the achievement of this criterion was conducted as a part of this review. A summary of these findings can be found in Table 12 below, and further details can be found in Attachment A – Stage 1 Ecological Report to this report.

Table 12 Ramsar Criterion for Fivebough and Tuckerbil Wetlands Summary of Assessment

Ramsar Criterion	Justification at Time of Designation	2020 AEMP	2024 Status	Trend	Data Confidence	Data Source
Criterion 2: Supports vulnerable, endangered, or critically endangered species	Supports Australasian Bittern (*Botaurus poiciloptilus*), listed as 'Endangered' globally (IUCN 2000) and Painted Snipe (*Rostratula australis)*.	**Met**	**Met**	↘	★ ☆ ☆	DCCEEW, 2024
Criterion 3: Supports populations important for biodiversity	Important for maintaining high waterbird diversity in the Riverina bioregion. Highest number of waterbird species recorded in Murray-Darling Waterbird Project Fivebough Wetland: 83 species Tuckerbil Wetland: 69 species	**Met**	**Not** Met**	↘	★ ☆ ☆	(DCCEEW, 2024; Bionet, 2025) **Data gap between 2020-2024 significantly degrades this assessment

Ramsar Criterion	Justification at Time of Designation	2020 AEMP	2024 Status	Trend	Data Confidence	Data Source
Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions	• Breeding site for numerous waterbird species • Important habitat for Brolgas and Egrets • Supports migratory waterbirds listed under JAMBA/CAMB	**Likely Met**	**Not** Met**	↘	★ ☆ ☆	(DCCEEW, 2024; Bionet, 2025) ** Data gap between 2020-2024 significantly degrades this assessment.
Criterion 6: "A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird."	Glossy ibis, Sharp-tailed sandpiper, Whiskered tern, Australasian bittern and Brolga have all been recorded at the wetlands in numbers estimated to be greater than 1% of their populations.	**Likely Met**	**Not** Met**	↘	★ ☆ ☆	(DCCEEW, 2024; Bionet, 2025) **Data gap between 2020-2024 significantly degrades this assessment

Key for interpreting Ramsar criteria summary tables	
Symbol	**Meaning**
Met	Criterion is met
Likely met	Criterion is likely met
Not met	Criterion is not met
↗	Increasing trend
→	Stable trend
↘	Declining trend
★ ☆ ☆	Data confidence is low
★ ★ ☆	Data confidence is moderate
★ ★ ★	Data confidence is high

Appendix C - Summary of the waterbird habitat types occurring within Fivebough and Tuckerbil Wetlands

Table 13 Summary of the waterbird habitat types occurring within Fivebough and Tuckerbil Wetlands

Habitat Type	2020 Area (ha)		2024 Area (ha)		Explanatory Notes
	Fivebough	Tuckerbil	Fivebough	Tuckerbil	
Woodland Black Box woodland occurs on the outer edges of Fivebough and Tuckerbil Wetlands. The majority of this woodland is highly modified or has regenerated since past clearing. Sparsely scattered canopy trees (alive and standing dead) occur in mosaic with grassy, chenopod shrubland ground layer. These areas provide habitat for roosting birds such as Glossy Ibis and nesting habitat for a variety of wetland and woodland birds.	32	22	63	58	In 2024 mapping, woodland areas of Fivebough included areas that can be characterised as low chenopod shrubland but are more likely modified Black Box woodland with no canopy trees. At Tuckerbil, areas mapped as woodland in 2024 were previously mapped as *Black Rolypoly shrubland* (NGH 2020). These are areas where cut Black Box stumps are evidence of where woodland once was. Some standing dead stags also remain with few scattered live Black box trees.
Cumbungi beds/ Tall sedgeland wetland in mosaic with open water of variable depths Cumbungi beds (*Typha sp.*) and/ or tall sedgeland wetland occurs in mosaic with open water of variable depth – from deep water to shallow. These areas provide habitat for the Australasian Bittern (and other cryptic birds), which nests in densely vegetated water under deep cover, adjacent to deep water.	39	3.5	69	71	In 2024, *Cumbungi bed wetland mosaic* of Fivebough included areas that were likely previously mapped as S*hallow open water of variable depths.* The *Tall sedgeland wetland* at Tuckerbil was previously mapped as *Black Rolypoly shrubland* and S*hallow open water of variable depths* in 2020.
Shallow open water of variable depth These areas surround permanent deep water and are frequently wet from inflows. These area support habitat for wetland birds such as the Whiskered Tern, Australian Painted Snipe, Sharp Tailed Sandpipers, Brolga and Glossy Ibis.	42	36	-	-	Unable to be mapped at time of assessment in 2024. Inundation data, including water depth, was not available for mapping.

Habitat Type	2020 Area (ha)		2024 Area (ha)		Explanatory Notes
	Fivebough	Tuckerbil	Fivebough	Tuckerbil	
Shallowly inundated or muddy wetland mosaic with patchy vegetation cover. These areas are frequently wet but often dry out. These area support habitat for wetland birds such as the Australian Painted Snipe and Sharp tailed Sandpiper	130	-	114	80	The *Shallowly inundated or muddy wetland mosaic* at Tuckerbil was previously mapped as Black Rolypoly shrubland (NGH 2020)
Grassy meadows/ Chenopod shrubland complex Grassy meadows are only infrequently inundated and often dry out over summer. These areas of grassy meadows are intermixed with areas of scattered low chenopod shrubs. When wet, these areas are habitat for Brolgas and other large waders and migratory shorebirds. When dry, the areas provide habitat for grazing birds such as Glossy Ibis, Australian Wood Duck and others.	150	234	97	26	For Fivebough, the area of *Grassy meadow/ chenopod shrubland complex* remained the same between 2020 and 2024. The discrepancy in areas is likely due to a mapping error in 2020, resulting in the 50-ha difference. At Tuckerbil, this area was mapped as chenopod shrubland (*Black Rolypoly shrubland*) in 2020, (NGH 2020). In 2024, this area was mapped as a broader range of waterbird habitats.
Lignum shrubland wetland An open, tall shrubland dominated by the dense Tangled Lignum (*Duma florulenta*). These areas support habitat for waterbird species that rely on dense, flood-dependent vegetation, such as providing nesting platforms for Glossy Ibis and other waterbirds as well as providing cover for small birds (e.g., Fairywren species). When wet, these areas are habitat for migratory waders such as Sharp-tailed Sandpiper, which forage in the mudflats and shallow water within this open shrubland.	NA	-	NA	49	*Lignum shrubland wetland* was previously mapped as *Black Rolypoly shrubland* As a tall shrubland, *Lignum shrubland wetland* (up to two metres tall) provides a different waterbird habitat type to *Black Rolypoly shrubland*, that is a low chenopod shrubland.

Appendix D – Geophysical Characteristics

Geology and Soils

The wetlands lie within the northeastern edge of the Murray Basin, a sedimentary basin formed during the Cenozoic Era (Maunsell 1996). The Murray Basin is mainly filled with a sequence of sediments deposited during the Tertiary period (Ollier 1995). Depositional types in the Basin formed from limestones, shelf muds, marine, beach and alluvial sands, estuarine clays, and Aeolian dunes[19].

Fivebough and Tuckerbil Wetlands are located in shallow, circular depressions on the eastern margin of the Riverine Plain of NSW in the Murrumbidgee subregion of the Riverina bioregion. They once were semi- permanent wetlands, part of a series of wetlands and lagoons associated with a natural watercourse that flowed westerly across heavy clay soils onto the Murrumbidgee floodplain 15 km north of the river.

The clays are overlain to the east of the wetlands by red earth soils grading up to an extensive sand hill with low elevation forming the Koonadan Historic Site (specific to Tuckerbil Wetlands). A lens of sandy soils intersects beneath the clay and extends to a depth of 11.6m20. The subsoils are generally more saline than those of the surrounding region[21].

Climate

The wetlands are located in Australia's semi-arid zone. Climate is characterised by hot summers and cool winters, with temperatures generally exceeding 30° Celsius in the summer months. Frosts can occur between May and September within this region. The marked seasonal pattern strongly influences evaporation rates and consequently the hydrology of the wetlands.

Total rainfall is relatively evenly distributed throughout the year, however there are extreme differences in evaporation rates between the summer and winter months. Evaporative losses generally exceed rainfall for most of the year and this is particularly pronounced in the summer months, where evaporative losses are significantly higher. This comparison is unavailable post 2000, as evaporation data at the nearby Yanco Agricultural station ceased being recorded at the close of that year. These findings were not assessed with current climate data due to data constraints.

Hydrology

Fivebough and Tuckerbil Wetlands were originally ephemeral wetlands in separate natural depressions, and the water regime was determined by the balance between rainfall and evaporation. Although the original hydrological regime was variable, generally the wetlands would fill over autumn and winter due to precipitation exceeding evaporative losses, then dry out over the summer months when evaporative losses exceeded inputs from precipitation. The wetlands rarely filled completely, and only after exceptionally heavy and prolonged rainfall was water likely to flow out of the wetlands. The natural drainage line was originally from Fivebough Wetland through Tuckerbil Wetland flowing westerly into Mirrool Creek.

The hydrology has since been highly modified, affecting both the volume of water which would have naturally entered the wetlands, and its seasonality. There is a system of drains around the wetlands, including a ring drain around Fivebough constructed in 1939, which effectively intercept runoff from the catchment. Water that would normally naturally enter the wetlands now must be allocated as an environmental flow from the state or commonwealth water

[19] Munday, T.J, Hill, A.J, Wilson, T, Hopkins, B, Telfer, A.L, White, G. J and Green A.A. 2004. Combining Geology and Geophysics to Develop a Hydrogeologic Framework for Salt Interception in the Loxton Sands Aquifer, Central Murray Basin, Australia. Australian Water Environments CRC LEME Open File Report.

[20] Glazebrook, H. and Taylor I,R. 1998. Fivebough and Tuckerbil Swamps. A review of their history, conservation values and future management options. The Johnstone Centre, Report No. 105, Charles Sturt University, Albury.

[21] Halliwell, S., Page, K. & Ballantyne, R. 1986. Fivebough Bicentennial Lake, Environmental Impact Statement. Riverina Murray Institute of Higher Education, Wagga Wagga.

holders. The water will be delivered from the holdings of the NSW of Climate Change, Energy, Environment & Water (DCCEEW) or the Commonwealth Environmental Water Holder (CEWH) annual environmental water budget.

Tuckerbil Wetland is still ephemeral, usually drying out completely during late spring/early summer, while Fivebough Wetland receives water from treated sewage effluent discharges and as a result an area of the wetland are now permanently inundated.

Fivebough Wetland has a holding capacity of approximately 2000 ML and an average depth of around 45 cm. A volume of 500 ML is required to inundate approximately 60% of the wetland[22].

Tuckerbil has an average depth of 30 cm and overflows at 40 cm. A volume of approximately 500 ML is required to fill Tuckerbil Wetland.

Inflows

Water inputs into Fivebough and Tuckerbil Wetlands now consist primarily of naturally occurring rainfall runoff when it exceeds drainage system capacity, treated effluent releases from the Leeton Sewage Treatment Plant (Fivebough only) and environmental water allocations.

There exists the opportunity to release variable volumes into both sites depending on antecedent conditions and available water allocations. Currently both sites have an ongoing listing in the Commonwealth and NSW environmental water managers Annual Environmental Watering Plans as potential recipients of environmental flows under a variety of scenarios.

Currently water levels at the wetlands are assessed visually, in conjunction with quarterly bird surveying (funded by NSW DCCEEW), and a recommendation is then made by the Advisory Committee as to whether an environmental water allocation request is made to NSW DCCEEW.

Collectively, the Tuckerbil and Fivebough Wetlands have received six environmental waterings in the last ten years (Table 5 and 6). Previously, large releases (up to 1000 ML as a single amount delivered only to Fivebough) have been made which have resulted in flooding of the wetlands when combined with prevailing rainfall conditions at the time (e.g. 1000ML environmental flow in 2011 following by 1 in 100-year flood in 2012). In November 2013, 265 ML of environmental water was allocated to Tuckerbil Wetland which maintained shallow coverage of water in the wetland well into December.

Effluent released into Fivebough Wetland is treated via a combination of trickling filters, an Extended Aeration Tank with a total biological capacity of 27,000 EP (equivalent persons), and a chemical dosing facility installed in 2005 to provide for phosphorus/nutrient removal. Effluent sources are domestic sewage, local industry and industrial waste.

Current treated effluent release volumes into Fivebough Wetland are variable, however yearly averages are estimated to be in the order of 1000 ML. The effluent discharge from the Leeton sewage works has provided a permanent wetland area at Fivebough Wetland. Treated effluent is discharged via two outflow drains around the southwestern side of the wetland.

Waterlogging following wet periods is common at Fivebough Wetland, and water levels gradually recede, exposing mudflats and providing shallow water habitat. Land in the eastern and southern parts of the wetland is covered by shallow water at various times of the year and forms extensive mudflats as the water evaporates. Land to the north and the far west is higher and tends to flood only after very high rainfall. Water levels in Fivebough Wetland fluctuate considerably from season to season. It is important to remember that the wetting and drying cycle of the wetlands is highly variable and the proportion of wet and dry areas of the wetlands is constantly changing. The approximate coverage of Fivebough Wetland by a range of permanent and ephemeral water conditions has been mapped (Figure 11). After heavy rainfall, water levels can rise rapidly. The average flooding interval for the wetlands is every 10 - 15 years.

[22] Sinclair Knight Merz (2011). Environmental Water Delivery: Murrumbidgee Valley. Prepared for Commonwealth Environmental Water, Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Comprehensive systematic data on water depth (and quality) are not available for Fivebough or Tuckerbil Wetlands. Monitoring of these parameters is recommended in Section 5.

Water Quality

Leeton Council monitors its sewage treatment plant effluent outflows regularly to comply with EPA licence conditions. Water inflows from the STP are typical of flows from municipal STP's. The flows provide additional microbial activity, nutrients and salts over and above the source water. The capacity of the wetland to absorb the nutrients and salts associated with the STP are not known. Murrumbidgee Irrigation was previously required to monitor water quality parameters, including pesticides and metals, at key points in drainage structures as a requirement of water legislation, however this was not required once the organisation was privatised. Water monitoring bores in Fivebough and Tuckerbil measure pH, Temperature and Conductivity.

Acid Sulfate Soils

Inland acid sulfate soils in the Murray Darling Basin are an emerging issue. In 2010 the Murray Darling Basin Authority commissioned a study at the Fivebough and Tuckerbil Wetlands to determine the nature, severity and the specific risks associated with acid sulfate soil materials. The study found that numerous water quality parameters exceeded that of the Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines.

The report[23] found that there is a low risk of monosulfide formation, however the potential exists for monosulfides to form under suitable geochemical conditions (i.e. near neutral pH or prolonged inundation) if not managed appropriately. The acid sulfate soil materials identified in Tuckerbil Wetland have the potential to present a medium risk to the environmental values of both the wetland and adjacent waters. There is a medium risk of contaminant mobilization from the soil, and many of the contaminants examined exceeded the ANZECC water quality guidelines. Of note, levels of aluminium, chromium and iron exceeded the guidelines by more than 100 times.

Salinity

Tuckerbil is the shallower of the two wetlands, although both are subject to seasonal drying. The wetland can hold a maximum depth of approximately 30-40 cm of water and, as it dries out, pan evaporation results in an increase in salt concentration[20]. Salinisation has occurred where pressure levels have developed close to the surface in the relatively shallow sand strata and may have risen over time in line with other shallow groundwater rises in the Murrumbidgee Irrigation Area. Some areas show evidence of being salt affected through a change toward a salt tolerant vegetative assemblage.

EC readings fall into the 3000-4000 µS/cm zone for the wetland area based on data taken from piezometers deployed by Murrumbidgee Irrigation at locations near to the wetlands, indicating saline conditions in this region. Issues of salinity management for the sites form, at the regional scale, part of the Murrumbidgee Irrigation Area and Districts Land and Water Management Plan administered by Murrumbidgee Irrigation.

Patches of bare ground exist within Fivebough Wetland and the presence of salt tolerant species such as Seablite (*Suaeda baccifera*) and Sea Barley Grass (*Hordeum marinum*) indicates that these areas may be salt affected. Samphire (*Sclerostegia tenuis*) has also regenerated on some gilgai puffs. It is not clear what this means. Without knowing the timeframe over which Samphire had been absent it is not possible to know whether the salinity at the site had decreased over an extended period of time but has recently become saline again. The other option is that a short-term disturbance (flooding) disturbed the Samphire and with the return of more normal conditions, the Samphire is now regenerating. It is thought that the latter is more likely, however, monitoring of the distribution of Samphire will identify whether the area of saline soils is increasing. Issues of salinity management are administered by Murrumbidgee Irrigation under their Land and Water Management Plan; however, these operate at a regional rather than local scale.

[23] Ward N.J, Bush R. T, Sullivan L.A, Coughran, J, and Fyfe D.M. 2010. Assessment of Acid Sulfate Soil Materials (Phase 2): Fivebough and Tuckerbil Swamps, Final Report. Southern Cross Geoscience. Prepared for the Murray Darling Basin Commission.

Appendix E – Reflective Plant Community Types of the region

While these Plant Community Types are likely the best fit categories for the extant vegetation communities at the time of 2024 site assessment, their composition can only be considered to be in moderate condition relative to Plant Community Type benchmarks. This moderate condition is due to the absence of many native characteristic flora species and altered species compositions relative to the formal descriptions of these PCTs. Further information can be found in Attachment A– Stage 1 Ecological Report.

Tuckerbil Wetland

The extant vegetation communities of these habitat types exhibit characteristics that have close affinity to the following six Plant Community Types:

PCT 13 – Black box–Lignum woodland wetland of the inner floodplains

PCT 216 – Black Rolypoly low open shrubland of the Riverina Bioregion and Murray Darling Depression Bioregion

PCT 17 – Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

PCT 238 – Permanent and semi-permanent freshwater wetland of the inland slopes and plains (this PCT occurred in mosaic with PCT 47 – Swamp grassland wetland of the Riverine Plain)

PCT 53 – Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains

PCT 47 – Swamp grassland wetland of the Riverine Plain

Fivebough Wetland

The extant vegetation communities of these habitat types exhibit characteristics most closely associated with the following six Plant Community Types:

PCT 15 – Black Box Open Woodland wetland with Chenopod understory mainly on the outer floodplains in South-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)

PCT 216 – Black Rolypoly low open shrubland of the Riverina Bioregion and Murray Darling Depression Bioregion

PCT 50 – Couch grass grassland wetland on riverbanks and floodplains of inland river systems

PCT 182 – Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses in mosaic with PCT 238 – Permanent and semi-permanent freshwater wetland of the inland slopes and plains

PCT 53 – Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains

Appendix F – Waterbird and vegetation water requirements

Table 14 Summary of water requirements for breeding of Murray-Darling Basin waterbird species

Species	Stimulus	Breeding Season (flood timing)	Maximum flood timing	Minimum Lag Time (months)	Ideal Lag Time (months)	Breeding duration (months)	Minimum flood duration (months)	Ideal Flood Duration (months)	Ideal Flood depth (m)	Rate of fall	Longevity (years)	Large flood frequency (years)	Small Flood frequency (years)	Inter-Flood dry-period (months)
Glossy Ibis	Flood	Oct-Feb		3	6-12	2	5	8-12	Deep	Moderate-slow	26.8 (captive), 14.3 (Wild), 8-10 (typical)	4-5	1-2	1.3
Australian White Ibis	Flood	Sept-Apr		1-3	6-9	2-3	3-6	6-12	0.5-1	Slow	33.2 (captive), 8-10 (typical)	4-5	1-2	1-3
Straw-necked Ibis	Flood, Season	Sept-Feb	Anytime	3	6-9	3	6	9-12	0.5-1	Slow	39.4 (captive), 8-10 (typical)	4-5	1-2	1-3
Royal Spoonbill	Flood, Season	Nov-May	Oct-May	1-2	>2	2-3	3-5	>5	0.5-1	Moderate-Slow	8-10	4-5	1-2	1-3
Yellow-billed spoonbill	Flood, Season	Sept-Apr	Any time	2	2-6	2-3	4-5	4-9	Deep	Moderate-slow	28.6 (captive)	7	1-2	1-3
Brolga	Flood	July-Nov	May-Mar	1-2	2	3-4	4	6	0.24-0.72	Moderate-slow	41 (captive)	5		
Purple Swamphen	Flood, season	Aug-Dec	Any time	1	2-3	3	4	5-6	0.3-0.90	Moderate-slow	5.5 (wild)	2	1-2	1-3
Black-tailed native-hen	Rainfall	Aug-Dec	Any time	2	3	1-2	3-4	4-5	Shallow	Moderate	Unknown	1-2	1-2	1-3
Black-winged Stilt	Flood	Aug-Dec	Any time	2	3	2-3	4	6	Unknown	Moderate	3.11 (wild)	2	1-2	1-3
Red-necked Avocet	Flood	July-Feb	May-Feb	1	2	2	3	4	Unknown	Moderate	7.3 (wild)	3	1-2	1-3
Red-Capped Plover	Flood, rainfall	July-Jan	Any time	3	3	2.5	5	6	Unknown	Moderate	20.11 (wild)	5	1-2	1-3
Black-fronted Dotterel	Flood. season	Aug-Feb	Any time	3	3	2-3	5	6	Unknown	Moderate	6.11 (wild)	3	1-2	1-3
Red-Kneed dotterel	Flood, season	Aug-Jan	Any time	3	3	3	6	6	Unknown	Moderate-slow	Unknown	Unknown	1-2	1-3

Species	Stimulus	Breeding Season (flood timing)	Maximum flood timing	Minimum Lag Time (months)	Ideal Lag Time (months)	Breeding duration (months)	Minimum flood duration (months)	Ideal Flood Duration (months)	Ideal Flood depth (m)	Rate of fall	Longevity (years)	Large flood frequency (years)	Small Flood frequency (years)	Inter-Flood dry-period (months)
Banded Lapwing	Rainfall	July-Nov	Any time	<1	<1	3	<4	<4	Unknown	Moderate-fast	3.6 (wild)	2	1-2	1-3
Masked lapwing	Flood, rainfall, Season	July-Nov (NSW)	Any time	1	1	3	4	>4	Unknown	Moderate-fast	13.1 (wild)	6	1-2	1-3
Gull-billed Tern	Flood, Rainfall, Season	Sept-Jan		Nil	Nil	4	4	4	Unknown	Unknown	16 (wild)	5	1-2	Unknown
Caspian Tern	Flood, season	Sept-Feb		Unknown	Unknown	2	Unknown	Unknown	Unknown	Unknown	23 (wild)	Unknown	Unknown	unknown
Silver Gull	Flood, Season	Aug-Feb		2	3	2-3	4-6	>6	Shallow	Moderate-slow	28.8 (wild)	n/a	n/a	n/a
Whiskered Tern	Flood, Season	Oct-Jan		Nil	Nil	1-2	1-2	2	<0.6-1.8	Fast	10 (wild)	5	1-2	>1
Plumed whistling Duck	Flood, rainfall	Sept-Jan		2	3	3-5	5	8	±0.60	Moderate	3-4 (typical)	1-2	1-2	1-3
Blue-billed Duck	Flood, Season	Sept-Feb	Any time	2	2-3	3-5	5	5-8	Deep(>2)	Moderate-slow	3-4 (typical)	1-2	1-2	1-3
Musk Duck	Flood, season	Sept-Oct	June-Dec	2	3	4-5	6	6-8	Deep (>2)	Slow	6.2 (wild)	1-2	1-2	1-3
Freckled Duck	Flood	June-Dec	Any time	2	3	3	5	6	Unknown	Moderate-slow	3-4 (typical)	1-2	1-2	1-3
Black Swan	Flood, season	Apr-Oct		<1	1	7-8	7-9	9	0.3-0.6 (<2)	slow	24.8 (wild)	5	1-2	Unknown
Australian Shelduck	Flood, season	July-Nov		<1	1	3-4	3	5	0.60	Moderate	13.1 (wild). 3-4 (typical)	1-2	1-2	1-3
Pacific Black Duck	Flood, season	July-Sept	June-Dec	1	2-3	3-4	4-5	5-7	Unknown	Moderate	15.5 (wild), 3-4 (typical)	1-2	1-2	1-3
Grey Teal	Flood	June-Feb	Any time	1	2-5	3-4	4-5	5-9	Unknown	Moderate	>31 (wild), 3-4 (typical)	1-2	1-2	1-3
Chestnut Teal	Flood,	Aug-Oct	July-Mar	1	2	3-4	4-5	6	Unknown	Moderate-slow	6.5	3	1-2	Unknown
Pink-eared Duck	Flood	Aug-Feb	Any time	1-2	2-3	2-3	3-4	4-6	0.2-1.63	Moderate	1.3 (wild), 3-4 (typical)	1-2	1-2	1-3
Hardhead	Flood, season	Aug-Dec	Any time	2	2-3	3-5	5	5-8	Deep (>2)	Moderate-slow	3-4 (typical)	1-2	1-2	1-3

Species	Stimulus	Breeding Season (flood timing)	Maximum flood timing	Minimum Lag Time (months)	Ideal Lag Time (months)	Breeding duration (months)	Minimum flood duration (months)	Ideal Flood Duration (months)	Ideal Flood depth (m)	Rate of fall	Longevity (years)	Large flood frequency (years)	Small Flood frequency (years)	Inter-Flood dry-period (months)
Great crested grebe	Flood, season	Nov-Feb	Aug-Mar	1	1-3	1-2	2	2-5	1-2	Moderate-fast	19.2 (wild)	n/a	1-2	n/a
Hoary-headed grebe	Flood, season	Oct-Jan	Aug-Mar	2	5-6	1-2	3-4	6-8	Deep	Slow	unknown	n/a	1-2	n/a
Australasian grebe	Flood, season	Nov	Aug-Apr	3	5-7	3	6	8-10	Deep	Slow	Unknown	n/a	1-2	n/a
Darter	Flood	Nov-Apr		2	2-3	3	5	5-6	Deep (0.3-3.5)	Moderate	16 (Captivity)	4	1-2	1-3
Little Pied cormorant	Flood, season	Sept-Mar		3	9	3-4	6	12	shallow	Slow	11.7 (wild)	4	1-2	1-3
Little Black Cormorant	Flood, season	Sept-May	Anytime	3	9	3-4	6	12	1-2	slow	10 (wild)	4	1-2	1-3
Pied Cormorant	Flood, season	Sept-May	Any time	Unknown	Unknown	3-4	Unknown	Unknown	Unknown	Unknown	27.8 (wild)	Unknown	Unknown	Unknown
Great Cormorant	Flood, season	Sept-Jan Mar-Aug		3	9	4	7	12	Deep (up to 30)	slow	18 (wild)	5	1-2	1-3
Australian Pelican	Flood	Sept-Feb	Aug-Mar	2-3	3	4-5	7-8	8	n/a	slow	16.8 (wild)	5	1-2	n/a
White Faced Heron	Flood, Season	Aug-Oct	June-Mar	1-4	>4	3	4-7	>7	Deep	Moderate-slow	8-10 (wild)	4	1-2	1-3
Little Egret	Flood	Oct-Mar		<3	3	3-4	4-6	6	Deep	Moderate	8-10 (wild)	4	1-2	Unknown
Intermediate Egret	Flood, season	Nov-Apr		3	9	3-4	6-7	12	deep	slow	7 (wild)	3	1-2	1-6

Source: Modified to be Location Specific from Rogers, K and Ralph, T.J (2011) 'Chapter 2- Vegetation' in *Floodplain Wetland Biota in the Murray-Darling Basin Water and Habitat* NSW DECCW. CSIRO publishing

Table 15 Preferred waterbird foraging depths

	Water Depth (cm)										
	0	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20
Red-necked Avocet							**	**	**		
Black-winged Stilt				*	**	**	**	**	*		
Black-tailed Godwit				**	**	**	**				
Marsh Sandpiper			**	**	**						
Sharp-tailed Sandpiper		**	**	**							
Red-kneed Dotterel	**	**	**								
Red-capped Plover	**	**									
Masked Lapwing	**	**									

Source: Taylor and Richardson, 2000

Table 16 Table of water requirements for flora species at Fivebough and Tuckerbil Wetlands

Plant Group	Common Name	Scientific Name	Ideal flood frequency	Ideal flood duration	Maximum flood duration	Ideal flood timing	Maximum flood timing	Ideal flood depth	Maximum flood depth	Ideal inter-flood dry-period	Maximum inter-flood dry period
Trees	Black box	*Eucalyptus largiflorens*	1 in 2-5 years[3]	2-4 months	5 months	Any[4]	Any[4]	na	na	Variable[5]	Unknown[5]
	Weeping myall	*Acacia pendula*	Unknown[8]	Unknown[8]	Unknown[8]	Unknown[8]	Unknown[8]	na	na	Unknown[8]	Unknown[8]
Grasses	Water couch	*Paspalum distichum*	Annual[10]	1-2 months or 299-440 days/ 2 years	163-513 days/2 years	Summer	Spring to summer	<60 cm	200 cm	236 days	290 days
Sedges and rushes	Narrow-leaf cumbungi	*Typha domingensis*	Annual	9-12 months	12 months or permanent	Late winter to summer	Any	0-200 cm	200 cm	0-3 months	3-4 months[13]
	Billabong rush	*Juncus usitatus*	Annual	Unknown[15]	12 months or permanent	Late winter to summer	Any	Shallow	Unknown	0 months	Unknown
	Marsh club-rush	*Bolboschoenus caldwellii*	Annual and fluctuating[16]	1-3 months or 87-140 days/ 2 years	3 months or 22-163 days/ 2 years	Spring to summer	Any	±20 cm	60 cm	4-6 months or 290-313 days/ 2 years	6 months or 313 days/2 years
	Rice Sedge	*Cyperus diffomis*	Annual and fluctuating	Unknown	Unknown	Unknown	Any	Unknown	Unknown	Unknown	Unknown
	Flat spike-rush	*Eleocharis plana*	Annual and fluctuating	Unknown	Unknown	Unknown[17]	Any	Unknown	Unknown	Unknown	Unknown

[1]Frequency and duration reduced when watertable is shallow or trees have access to permanent water. Frequency and duration also reduced when setting is more characteristic of a woodland, compared to a forest. [2]Flood frequency and inter-flood dry period may be higher for woodlands, compared to forests, while duration may be reduced. [3]Minimum flood frequency of 1 in 8-10 years. [4]No evidence that timing influences growth. [5]Dependent on groundwater availability, depth and salinity. Observations in excess of 30 years. [6]Increased frequency may ensure survival at saline sites. [7]Death when waterlogged. [8]Unknown, regarded as drought- and flood-tolerant. [9]Unknown, regarded as drought- and flood-tolerant. Water regime requirements suspected to lie between those for river red gum and black box. [10]Rhizomes may survive longer frequencies. [11]Survives without flooding when there is access to other water, e.g. shallow groundwater. [12]Inferred from seasonal flood regime at Macquarie Marshes. [13]Rhizomes may remain viable with dry periods of 2-3 years. [14]Likely to exhibit some drought tolerance due to occurrence in ephemerally wet locations. [15]Regarded as drought- and salt-tolerant. Tolerance of fluctuating water levels unknown. [16]Tubers may survive 2 years without flooding; minimum flood frequency of 1-2 years. [17]Optimal flood timing likely to be late winter to summer to coincide with growing and flowering season. [18]Vallisneria species are collectively referred to as ribbonweed due to taxonomic ambiguity. Taxonomy of Vallisneria requires revision. [19]May grow according to annual growth habit where drying occurs in the winter months only. [20]Plants with dead appearance can rehydrate when water becomes available. Otherwise readily regenerates from spores lodged in deep cracks in soils. [21]May require some summer drying to promote seedling reproduction.

Appendix G – Weed and Pest Management Regime

Weeds

In addition to using grazing to support weed management, targeted management of weed species should also be used. Targeted management requires a flexible approach that responds to monitoring of weeds. The monitoring regime for weeds in the wetlands should include:

- Property inspection by a biosecurity officer from Leeton Shire Council every 2 years, with a focus on areas that are not grazed.
- Inclusion of weed monitoring as part of the vegetation monitoring program
- Ad hoc intel provided by grazing licence holders or other regular visitors to the wetlands.

In response to monitoring, the weed management regime should include:

- Annual implementation of weed management as recommended by the biosecurity officer
- Targeted weed spraying or removal in response to monitoring results or ad hoc intel that identify:
    - An increase in the abundance of weeds
    - An increase in the distribution of weeds
    - Incursion of a new weed species

Targeted weed management should be conducted in line with the Riverina Regional Strategic Weed Management Plan.

In the grazing areas, the herbicides used should be selective for certain species (including Bathurst Burr and Golden Dodder). In the visitor area, a more broad-spectrum herbicide should be used to combat the range of weeds in areas without the assistance of grazing pressure. Herbicide use in this area should also be those recommended for use near waterways.

Control should occur when weeds are in their early growth phase before seeding (this will vary between species, see Table 17. Spraying must be undertaken in favourable conditions, dry without expected rain and no wind.

Table 17 Recommended Timing of Weed Control

Weed	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
*Bathurst Burr												
*Noogoora Burr												
*Caltrop												
*Saffron Thistle												
*Star Thistle												
*Khaki weed											-	
*Silver leaf Nightshade												
*Lippia												

Pests

Pest management should be responsive to changing level of threat. Threat levels should be monitored by:

- Inclusion of pest monitoring as part of the vegetation monitoring program. This should be done through recording scat, disturbance, or evidence of predation on native animals.
- Recoding of pest sightings during bird monitoring
- Ad hoc intel provided by graziers or other regular visitors to the wetlands on pest animal sightings.
- Ad hoc reports from neighbouring landholders.

Targeted pest management in response to monitoring results or ad hoc intel should occur if it is identified that there:

- Is a re-occurring presence of carnivorous pests, including foxes or cats.
- Incursion of a new pest that are known to be damaging to wetland environments, such as pigs, deer or feral fish species.
- An increase in the presence of herbivorous pests, such as rabbits or hares

Targeted pest management should be tailored to the pest species that has been identified and must ensure:

- The safety of visitors to the wetlands is prioritised.
- Pest control methods and those applying them are sensitive to environmental values of the wetlands.
- Coordination with surrounding landholders

Appendix H – Vegetation Management Guidelines

NOTE: Monitoring the effectiveness of these vegetation management guidelines must be prioritised and is included as part of Strategy D – Learning and improving.

Introduction

Vegetation within Fivebough and Tuckerbil Wetlands is currently managed through two primary mechanisms: environmental water inflows and grazing. These management actions aim to maintain the ecological character of the wetlands by supporting diverse and structurally varied plant communities that provide critical habitat for waterbirds and other wetland-dependent species. The wetland's flow regime is now dependent on environmental flows with the natural climatic regime providing a guide for managing flows to supplement water during dry periods (Table 18), while grazing is employed to manage weed proliferation and promote native vegetation diversity across the wetland landscape.

Table 18 Historic climatic seasonality and Environmental water availability of Fivebough and Tuckerbil Wetland

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Drying	Driest	Wetting					Wettest		Drying		
Environmental water delivery					MIA closed for maintenance			Environmental water delivery			

Note: If seasonal rainfall patterns change then grazing will be adaptively managed to avoid grazing when soil conditions are wet. This is especially the case where soil degradation might occur.

Within the context of flow management, grazing is an important management tool to control wetland weeds in a broad-acre situation and to promote the variation of native wetland vegetation to maintain the diversity and abundance of wetland birds. This involves providing a diversity of vegetation structure, by allowing some areas to grow unimpeded into mature communities but intervening in other areas to arrest natural succession. Controlled grazing is a feasible option to achieve this, particularly at Fivebough Wetland, where broad acre spraying and fire, so close to the residential and sensitive ecological areas are undesirable forms of weed management. At Tuckerbil Wetland, a combination of grazing and fire may be the best option to control weeds and create a diversity of waterbird habitat.

To ensure the maintenance of ecological character of the wetlands, grazing is only considered a feasible management option where:

- Site soil and slope characteristics don't present a risk of high bank erosion or soil compaction
- There is opportunity to utilise a low stocking density and/or short-term grazing period
- There is opportunity to employ seasonal or extended spelling
- Protective fencing around stands of sensitive vegetation or bank areas can be established
- Monitoring of soil and vegetation condition is implemented.

Both Fivebough and Tuckerbil Wetlands display these characteristics, making them suitable for the use of grazing as a management tool.

The direct impact of stock on wetlands can include alterations to soil structure and nutrient levels, reduction in vegetation biomass, changes to vegetation assemblages and changes to water quality. No long-term studies have been conducted to quantify the effect of domestic livestock grazing on the ecology of Fivebough or Tuckerbil Wetlands. Equally, a lack of grazing has had equally negative impacts on the wetlands, allowing weeds to become established and out-compete native wetland grasses. A balanced grazing regime is necessary.

Grazing trials in wetlands have found that grazing was an effective management tool in wetlands that met the following criteria:

- flat low-lying floodplain and delta landforms (with limited erosion potential),
- widespread restriction of grazing land use from wetland and riparian habitats within agricultural areas is possible.
- extensive hydrological changes to stream and wetlands associated with year-round provision of:
    - regulated water flows via natural drainage systems for irrigation (and associated nutrient rich irrigation water inputs); and,
    - a seasonally dry climate[24].

Both Fivebough and Tuckerbil Wetlands display these characteristics, making them suitable for the use of grazing as a management tool. As a result, this Management Plan recommends an adaptive grazing regime that is guided by the inundation of the wetlands as well as pasture and weed growth.

It is recommended that the Advisory Management Committee, in coordination with Crown Lands and Grazing Licence Holders regularly monitor grazing impacts on native vegetation to determine occasional spelling as required. If alterations to grazing regimes are deemed necessary to achieve a particular environmental outcome, or to respond to unforeseen climatic events, Crown Lands will issue a written letter of instruction to the Grazing Licence Holders. Full destocking of the wetlands will require a minimum of three months' notice.

Adaptive Grazing Regime According to Water Levels

Wetland and riparian habitats are dynamic and can change relatively rapidly in response to grazing pressure, fires, climate variability and flood events. An adopted grazing regime that has produced good outcomes for several years may have emergent habitat impacts in the longer term or require adaptation in the face of unseasonal weather conditions. To deliver improved habitat condition land managers must recognise the primary cause of observed changes, including those driven by natural processes and those affected by management actions and be prepared to be flexible in changing management aspects they have control over.

Seasonal water level variation including periods of water recession and prolonged high flows interact with grazing and may be managed to maximise the control of weed biomass. In seasonal wetland systems, such as Fivebough and Tuckerbil Wetlands, stock gain access to the wetland as the dry season progresses and water levels recede. Timing must be adapted annually according to the overall water level of the wetland (dry/average or wet year) and/or environmental flow releases.

It is recommended that the grazing licence holders and Advisory Management Committee regularly monitor water levels and soil moisture to guide their decisions, confirmed by Crown Lands, about stock access across different sections of the wetlands. Flooding events should also trigger removal of cattle possibly followed by a higher stocking rate on drying to more intensively graze likely emergent weeds.

Spelling Wet Areas in Wet Times

Inundation of wetland basins is usually the best time to undertake spelling from stock grazing. However, where site conditions allow, the maintenance of continual low grazing pressure on the margins of wetland basins through the wet season helps prevent the rapid re-establishment of exotic weeds during their rapid growth periods. Habitat remnants in better condition, with little exotic pasture cover can be spelled during the wet season without as high a

[24] Tait. J. (2012) Guidelines for the Use of Grazing in the Management of Exotic Pasture Weeds in Wetland and Riparian Habitats. WetlandCare Australia, Ballina NSW.

risk of weed re-infestation. Matching grazing pressure to available pasture avoids the need to spell pasture, however spelling is warranted where:

- pasture resources are unable to support the stock that are present,
- overgrazing is impacting on remnant native wetland species,
- bird feeding, roosting or nesting sites are being impacted,
- slope or soil constraints present soil erosion risks,
- seasonal inundation / flooding presents risks to livestock,
- seasonal inundation / flooding presents germination and recruitment opportunities for native vegetation,
- it is intended to integrate spraying as part of the exotic pasture control program,
- or control treatments have progressed to an extent where spelling is desired to provide germination and recruitment opportunities for native vegetation.

Grazing Management

In managing grazing of the wetland, reserves managers are seeking to optimise environmental outcomes, which include promoting native vegetation and waterbirds, while minimising the risk of overgrazing or weed proliferation. However, the relationship between grazing and ecological responses (e.g. waterbird presence, vegetation condition) at Fivebough and Tuckerbil Wetlands is not well understood due to the absence of systematic monitoring.

As such, the recommendations provided in this section are intended as general guidance, informed by expert knowledge, stakeholder consultation and management practices from comparable wetland systems. This is an area where adaptive management can help improve the outcomes of environmental watering.

Consequently, there remains some uncertainty regarding:

- Optimal vegetation condition to sustain Ramsar character and provide suitable habitat and food resources for waterbirds.
- The grazing regime required to protect native species and minimise weeds in the current year and in future years given the risks to seeds and rhizomes.
- Grazing is primarily used strategically to achieve environmental outcomes (weeds, native plant and bird species habitat), with cattle productivity optimised within those environmental constraints.
- There are several elements of the grazing regime that are widely supported. These include:
    - Cattle should not have access to inundated areas of the wetland.
    - Cattle should be introduced once sediments have dried sufficiently to prevent pugging.
    - Ideally, grazing should be timed to enable plants to set seed thereby ensuring species diversity is sustained through time.

There are two broad approaches to controlling cattle access:

1. Permanent fencing. This approach has the benefit of being similar to existing fencing. It has two potential disbenefits;
    a. If the area inundated crosses the fence line then there would be inundated areas accessible to cattle.
    b. Fenced areas may need to exclude stock until the whole area is dry which may provide a window of opportunity for weeds.

2. Temporary fencing. It has been suggested that an electric fence be installed and moved according to the ‘wet edge’ allowing stock up to that edge. This approach would limit stock access to inundated areas and enable rapid access to dry areas to ensure weeds do not establish. This may make it possible for the grazier to keep stock on the site for longer, although as noted above, duration may not be the most appropriate target. There are two drawbacks, including:

    a. The wetlands do not dry in ways that would be easy to fence. In addition, over summer, pan evaporation rates can be around 8 cm per day which would require frequent fence adjustments.

    b. When moving the fence, the grazier would have to make a judgement on where sediments were sufficiently dry to support cattle. Given small scale variations in sediment conditions, this could be an onerous task.

Agreement would need to be reached on wetland vegetation conditions that would inform decisions on when cattle should be given access or removed. These would likely need to be adapted over time as our understanding of vegetation condition on waterbirds improves.

Fire Management

There has been discussion of using cultural burns to help manage vegetation at the wetlands. The strategy suggests maintaining fire breaks around the wetland perimeter to mitigate the risk of fire, particularly at Fivebough. According to the NSW Guidelines for Ecologically Sustainable Fire Management, acceptable fire intervals for freshwater wetlands are between 6 to 35 years. Certain wetland species, such as cumbungi, water couch, and sedges, reshoot quickly from rootstocks and rhizomes and germinate after fire and rainfall. However, herbaceous species may gain a competitive advantage if fire intervals are too low, potentially altering community composition.

Indigenous fire practices are based on cultural knowledge, with burns timed and placed to encourage native plant growth, manage fuel loads, and support habitat diversity. Low-intensity cultural burns have been shown to have less negative impact on native plants. While most published studies focus on forests and grasslands, the principles of cultural burning–such as low-intensity, patchy fires and respect for local hydrology–are applicable to wetland margins and riparian zones. Indigenous knowledge systems include careful use of fire around wetlands to maintain open water, control invasive species, and support habitat for birds and aquatic life. However, direct, peer-reviewed studies on cultural burning in NSW wetlands specifically are limited.

Burns are typically conducted between April and July, when vegetation begins to dry, fuel loads are low, and wind patterns are favourable for controlled, low-intensity fires. This period allows for "cool burns," which are less likely to damage wetland ecosystems and support regeneration. Cultural burns are initiated in response to environmental cues such as the flowering of certain trees, the curing of native grasses, and the moisture content of soils and vegetation. These cues indicate when a wetland is ready to benefit from fire without harming sensitive species or disrupting breeding. The aim is to enhance biodiversity, maintain open water, and support the health of the wetland ecosystem.

If cultural burns are introduced into the management regime, there will need to a comprehensive planning process to coordinate resources, ensure people are aware of their roles and responsibilities and the proposed time-frame.

One of the key issues is the extent to which environmental flow delivery can be coordinated with cultural burns that are dependent on environmental cues. This would need to be worked through before proceeding. Given the potential for fire impacts, small, controlled trials should be undertaken after establishing an appropriate watering regime. Table 18 provides a possible calendar for including grazing and cultural burns,

however, this timing would likely represent an exception rather than normal practice, given the NSW government recommendations on frequency of wetland fires.

Grazing access will need to consider both the amount of fuel and the timing of the burn as they will influence environmental outcomes. The amount of fuel will influence fire intensity and subsequent regeneration. Grazing may be an important tool in ensuring fuel loads are appropriate, leading to improved regeneration. Cultural burning achieves best results with cool burns, when soils are damp which helps protect roots. For this reason, cultural burns are usually undertaken in late winter. It is then important to exclude grazing to ensure native plants regenerate.

The areas to be burnt will also need to consider the plant species, particularly if fire sensitive threatened species occur in the area to be burnt. Some consideration will also need to be given to fauna that may be adversely affected by the fire, or loss of habitat or food in the aftermath.

While there are a number of issues that will need to considered in planning a cultural burn, there is likely to be ongoing uncertainty, particularly when using both fire and grazing to improve wetland condition. Table 19 provides a potential calendar, however, antecedent and seasonal conditions and environmental water availability may require significant amendments to this schedule.

Table 19 Alternate vegetation management regime including grazing and fire for Tuckerbil Wetland.

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Cattle stocking linked to wetland vegetation		Depending on vegetation biomass, crash graze while wetland is still dry, at end of growing season		Follow with controlled burn in line with FMS		Cattle Out to allow regeneration			Cattle in progressively as wetland dries. *Grazing License Holder should consider migratory bird arrivals and any breeding events		

Grazing Management of Fivebough Wetland

The key considerations for grazing management of Fivebough Wetland are the location of management zones (Figure 8), restricting cattle access to the wetter and sensitive habitat areas and creating a clear divide between the visitor area and the grazing area. The following provides adaptive guidance.

The flow regime at Fivebough Wetland is influenced by several inputs while losses are dictated by evaporation. Fivebough receives around 2.5 ML a day of treated effluent that plays an important role in sustaining permanent water in the wetland. The major input is environmental flows that are delivered via the irrigation network. This means that the wetting and drying cycle is heavily influenced by the availability of environmental water available for delivery from August to May. There may also be contributions from rainfall, irrigation runoff or local floodwaters that are diverted into the wetland. In the 2020 AEMP, grazing zones/paddocks at Fivebough Wetland are split into three main areas, Zones 1, 2 and 4. These zones are quite different in their characteristics, and all need separate grazing regimes for best management.

The drier Zones of 2 and 4 can be grazed all year and more heavily during the wetter months when grasses and weeds require the most control at high growth times. Although stocking rates should generally be kept low, these areas will be less sensitive to stocking rates than the wetter zones.

The wetter Zone 1 poses additional challenges as it is a large heterogeneous area, with areas of surface water persisting into early summer. With climate change increasing the likelihood of drought, Fivebough may become more important as a refuge for waterbirds, which may mean delivery of environmental flows later in the season to ensure there is sufficient habitat. The importance of this habitat may increase due to declines in open water habitat in surrounding agricultural areas.

It is important that grazing management is adaptive; There would need to be agreement on the conditions (sediment, vegetation) under which cattle would be given access and then removed. These would likely need to be adapted over time as understanding of outcomes improves. Decisions could then be based on monitoring of vegetation condition. Regular monitoring and recommendation of stocking rates and grazing management actions should be undertaken by the Advisory Committee in consultation with the license holder to fine-tune the management regime over time.

Both permanent and temporary fencing should be employed to manage grazing. Permanent fencing would be installed to divide Zone 1 into 3 areas that will enable greater control of grazing in areas as they are inundated and then dry (Figure 8, Appendix K). The middle zone of the current Zone 1 is the most frequently inundated.

Electric fencing would be used when:

- Cattle access poses a risk of trampling, soil compaction, or suppression of native grass growth essential for waterbird foraging or nesting. This would include when standing water is present in in mapped mudflat or native grass zones (as per Appendix K).
- Migratory waterbird species are observed or expected based on seasonal arrival data or recent monitoring.
- Alternative grazing areas within the wetland are available and require active management to prevent the proliferation of invasive or dominant weed species.

The current grazing licence holder monitors vegetation condition through visual inspection, though this is useful it is recommended that survey plots are used to inform management decisions. Regular monitoring and recommendation of stocking rates and grazing management actions should be undertaken by the Advisory Committee in consultation with the grazing license holder to fine-tune the management regimes below for adaptive management in response to prevailing seasonal and wetland conditions.

The combination of permanent and temporary fencing will provide greater flexibility in the management of grazing. For grazing Zones 2 & 4, there will be little change unless inundation is forecast. In Zone 1, the combination of permanent and temporary fencing will ensure protection of key habitats, areas at risk of sediment compaction and trampling while facilitating grazing access to dry areas of the wetland. The key will be to develop a regime that ensures protection of environmental values, minimizing the management of fencing and increasing the effectiveness of grazing as a tool to improve environmental outcomes.

There will remain some uncertainty around the areas likely to be inundated in the event of a flood or large environmental flow release. Planning for these events will help ensure that the license holder is given appropriate notice, that grazing does not affect the environmental response and that protective fencing is available to exclude cattle from key habitats. Early planning will also provide opportunities to install temporary fencing ahead of inundation. In all scenarios, grazing is a way of achieving environmental objectives and given inherent variability the timing, duration and stocking rate may all need to vary to ensure that environmental water managers objectives are met. Over time, as the relationship between vegetation condition, productivity and the waterbird community is understood it may be possible to develop vegetation indicators that would identify the times to allow access of remove cattle.

Grazing Management of Tuckerbil Wetland

The key consideration for grazing management of Tuckerbil Wetland is controlling weeds while ensuring a minimal impact on the wetter and sensitive habitat areas. The Tuckerbil Wetland is dry more often than Fivebough and has larger areas that dry down but are highly sensitive when wet.

This high level of variation and lack of supporting long term wetting and drying data means that Tuckerbil Wetland requires ongoing monitoring to ensure the grazing regime is effective. Unlike Fivebough Wetlands, the stock time on the site is limited.

Tuckerbil does not currently have identified grazing zones. There is local knowledge about where water goes when released into the wetland, water level sensors located in the south-east corner of the wetland and discussion of changes in infrastructure that would improve capacity to allocate water to different sections of the wetland. The following recommendations are made on the assumption that existing infrastructure remains.

The need for grazing management at Tuckerbil is reduced in comparison to Fivebough because it dries more rapidly than Fivebough and is dry for longer. In many years, it is likely that grazing access could be delayed until the wetland dries. When surface water persists, it tends to be in the south-east corner of Tuckerbil and we recommend a mix of permanent and temporary fencing to protect this area when there is a compelling case to provide early access to cattle (e.g. weeds). There is a ridge running roughly north-south about 400m in from the East shore. We suggest installing a permanent fence along this ridge that can then act as a foundation for temporary fencing to protect surface water habitat on either the Western side of the ridge or in the south-east corner of the wetland (Figure 9, Appendix K).

Grazing management at Tuckerbil will need to adapt to the area inundated and available capacity to protect inundated and drying areas using the proposed mix of permanent and temporary fencing. A guide to grazing is provided in Table 20.

Table 20 Grazing guidance considering capacity to exclude cattle from inundated areas and key habitats at Tuckerbil Wetland

Phase	Inundated areas can be protected	Inundated areas accessible to cattle
Dry	Grazing access to maintain vegetation within appropriate bounds	
Inundation	Stock access to dry areas	Stock excluded from key habitats and areas at risk
Drying down	Stock access to dry areas	Stock excluded from key habitats and areas at risk
Dried	Grazing access to maintain vegetation within appropriate bounds	

Appendix I – Infrastructure Maintenance Schedule

Table 21 Infrastructure Maintenance Schedule

Infrastructure	Action	Frequency	Responsibility	J	F	M	A	M	J	J	A	S	O	N	D
Walking Tracks - all	Spray edges	Twice/yr	Crown Lands			■					■				
	Repair edges, holes and wash outs	Annually	Crown Lands			■									
Signage - Entrance	Review & repair for fading or vandalism	Annually	Crown Lands							■					
Signage – Information Centre	Review & replace for fading, content relevance	Annually	Crown Lands							■					
Signage – Cultural Trail	Review & repair for fading, water damage, vandalism	Annually	LALC							■					
Signage – Interpretive along trails	Review and repair for damage, vandalism, fading, relevance	Annually	Crown Lands Local Community Groups							■					
Information Centre	Spray weeds	Twice/yr	Crown Lands			■					■				
	Review and repair shelter structure, including repaint	Bi-annually	Crown Lands							■					
	Review and repair tables	Annually	Crown Lands							■					
Toilets	Upkeep of toilets on site	Twice/yr	Leeton Council			■						■			
Cultural displays	Spray weeds within, whipper snip around	Twice/yr	LALC with support from Crown Lands			■					■				
Bird Hides	Spray weeds around and in front	Twice/yr	Crown Lands			■					■				
	Review and repair structures, including repaint	Bi-Annually	Crown Lands								■				
Fencing	Review and repair prior to cattle entering, timing may vary – see AEMP	Annually	Grazing Licence Holder												
Drains – internal	Clear with machine	Annually	Environmental water partners Crown Lands								■				
Drains – gates	Review and repair for flood damage, blockages, including boundary gates and regulators.	Annually	MI			■									
	Open or close for flow – see AEMP														

*Each item should also be undertaken as necessary

**High disturbance activities are timed prior to migratory bird arrival and spring breeding events, and when there are least visitors to the wetland

Appendix J – Monitoring Method

Summary of Monitoring Recommendations

A high-level summary of the recommended monitoring activities to support the effective and adaptive management of Fivebough and Tuckerbil Wetlands are outlined in Table 22. These recommendations have been developed to evaluate ecological condition, detect emerging threats, and inform evidence-based management responses, with considerations to the resource constraints faced by land managers. The monitoring framework prioritises cost-effective, scalable methods that can be integrated with routine management activities. Collectively, these monitoring efforts aim to support the maintenance of ecological character, assess the effectiveness of management interventions, and ensure the long-term conservation of wetland habitats, waterbird populations, and associated cultural values.

Table 22 High level summary of monitoring recommendations for Fivebough and Tuckerbil Wetlands

Monitoring Recommendation	Methodology	Frequency	Purpose / Indicators
Weed Monitoring	Opportunistic assessment during vegetation surveys; ad hoc reports from graziers/visitors	Quarterly (with vegetation/bird surveys); ad hoc	Detect weed presence, abundance, distribution, and incursions of new species; inform targeted control
Pest Monitoring	Opportunistic assessment during vegetation and bird surveys; ad hoc reports from graziers/visitors	Quarterly (with vegetation/bird surveys); ad hoc	Detect presence of pests (e.g., foxes, cats, rabbits); inform targeted pest control
Vegetation Surveys	Line transects, photo-point monitoring, drone imagery	Quarterly	Monitor floristic composition, vegetation structure, condition, and habitat quality
Waterbird Surveys	Quarterly point and transit counts; seasonal roost counts; incidental sightings	Quarterly + seasonal (Nov–Dec)	Track waterbird abundance, species diversity, presence of threatened/migratory species
Inundation Monitoring	Data loggers at inflow points. Real-time monitoring of water levels.	Continuous; reported quarterly Continuous to inform water delivery decisions.	Assess water inflows and Monitor depth in key habitats to ensure habitat maintenance and inform adaptive water management
Grazing Plot Surveys	Fenced plots vs grazed plots; measures of biomass, ground cover, soil compaction, pugging	Quarterly (2026–2029)	Quantify grazing impacts; inform refinement of grazing guidelines by 2030 review

Vegetation assessments

Line transects

Wetlands are a highly dynamic systems, that require regular and systematic monitoring to assess and reduce uncertainty. A shift in vegetation was observed between the 2020 AEMP and the 2024 assessment, with areas of the wetland transitioning from predominantly freshwater to more saline conditions. Due to the absence of consistent vegetation monitoring during this period, the drivers and ecological implications of this shift remain poorly understood.

To address this knowledge gap and support adaptive management, it is recommended that regular vegetation surveys be implemented. Changes in vegetation composition and structure should be assessed using line transect surveys, which allow for detection of changes in species richness, abundance, and spatial distribution over time.

Line transects should be surveyed at consistent intervals, ideally at the same time each year, to allow for temporal comparisons. The start and end of the line transects should be marked with a star picket (these can also serve as photo points depending on monitoring requirements). Transects should be at least 20m and up to 50m long. Take a compass bearing of the direction you are heading and run out the tape until the desired length is reached. If using a 20m line, record the species touching the tape at 50cm increments. A 50m length can also be used, with the species touching the tape recorded at either 50cm or 1m intervals depending on the level of resolution required. Further data on vegetative assemblages can be gathered by using 1m2 quadrats, which are deployed randomly five times and species within the quadrat recorded. Evidence of fauna occurrences can also be recorded if found within quadrats and along line transects.

Drone monitoring

Drone monitoring should be implemented to support ongoing assessment of vegetation distribution. Drones should be used quarterly when line transects are done to capture the distribution of key habitat types.

Photo-point monitoring

Photo-point monitoring is a simple and practical method for visually assessing the changes occurring to a particular site parameter over time. Mark the photo-point with a stake or a star picket. Spraying the tip of the stake with spray paint allows for easy identification of the stake in the field. Alternatively, a permanent fixture in the landscape such as a tree or pole can be used. Record the GPS location of the photo point. Refer to previously taken photos for landmarks to get the new photo as accurately positioned as possible. If possible, take the photos in the same season and at the same time of day to ensure that conditions are as similar as possible for comparative purposes.

Location coordinates for the photo-point locations for Fivebough Wetland and Tuckerbil Wetland used in assessing the condition of the wetlands for the development of this Plan can be found in Attachment A‑ Stage 1 Ecological Report.

Data loggers

Monitoring locations should occur at the points where water enters the wetland, and if possible, within the wetlands as well. Strategically placed data loggers should be installed to provide a consistent flow of real time data with which to analyse trends in water quality and assess drivers of change in order to inform management choices. The advantage of using data loggers is that the full suite of hydrological parameters can be assessed including flow velocities, depth and water quality however there is an initial cost for equipment and installation.

Waterbird assessments

Bird monitoring is undertaken by observing all birds utilising the site through high powered binoculars and recording counts of birds at key vantage points.

- Bird monitoring should consist of:
    - Quarterly point counts waterbirds
    - Quarterly transit counts waterbirds
    - November/ December roost counts for Glossy Ibis and Whiskered Terns
    - Incidental observations between regular counts for cryptic species, threatened species, rarities, vagrants and passage migrants

Point and transit counts

- Point count locations and transit routes are fixed, but duration of counts and transits vary with conditions, which have varied from severe flood to almost completely dry, calm and still to severe gales.
- Monitoring starts around 08.00h and revisit for 1 - 2 hours before sunset to cover roosting and crepuscular species.
- Count dates are as close as possible to the regular aerial counts (currently undertaken by Richard Kingsford).

Roost counts

Glossy Ibis and Whiskered Tern roost counts are point counts form NW corner of Fivebough Wetland. Virtually all birds can be counted with 8 x 32 binocs and 25 - 60 x 77mm scope, over a period of about an hour and a half from that point as they come in, in small groups and long lines of 10 to 500, occasionally up to a 1000 at a time, probably from as far away as Griffith area. It is easiest of count the groups as they arrive and add up those figures at the end of the count[25].

Equipment required

- Leica 8 x 32B binoculars.
- Leica 8 x 20B binoculars.
- Kowa Prominar 25 - 60 x 77mm telescope (or similar)

[25] NGH 2020, Fivebough and Tuckerbil Wetland Adaptive Environmental Management Plan Five Year Review. NSW

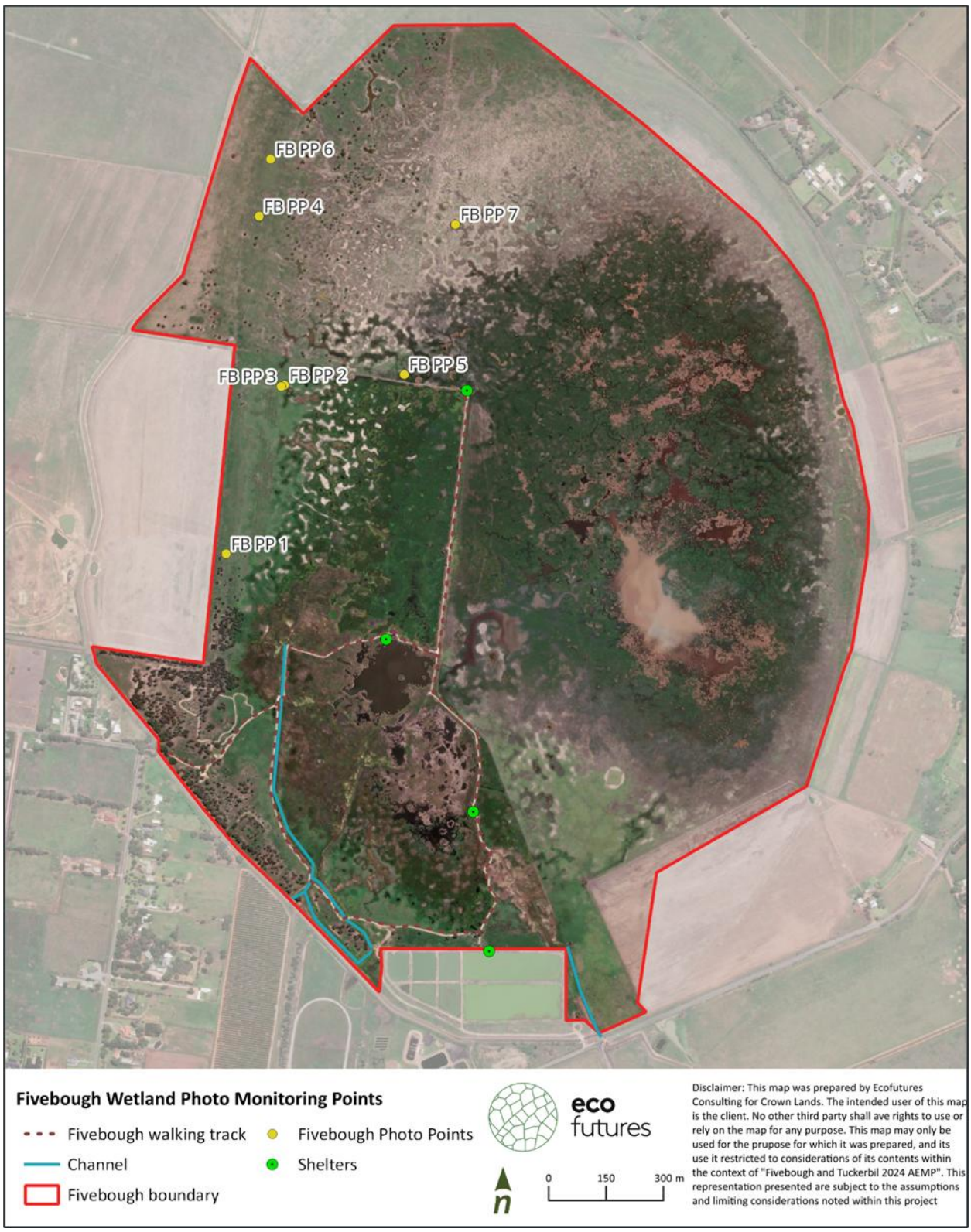


Figure 5 Fivebough Wetland photo monitoring points. (See Stage 1- Ecological Report for coordinates)

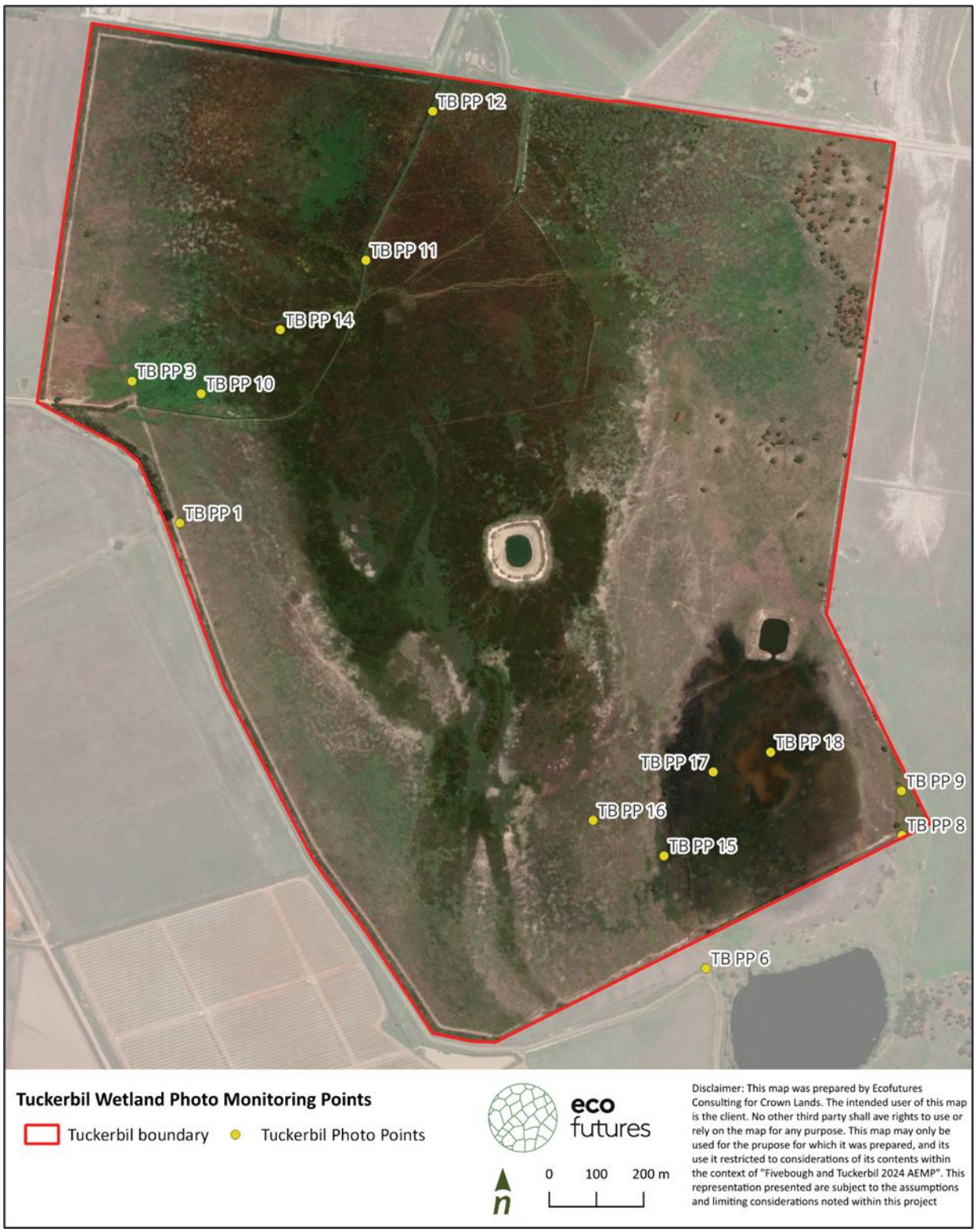


Figure 6 Tuckerbil Wetland photo monitoring points (See Stage 1 - Ecological Report for coordinates)

Appendix K – Small plot study to assess grazing guidelines

Robust assessment of the grazing regime is essential to ensure a sustainable grazing regime moving forward. Whilst assessment of the regime will be supported by reporting on regime implementation and vegetation assessments, a small plot study should be implemented to undertake targeted assessment of grazing benefits and impacts.

Exclusion plots are used in a variety of situations, with the main influences on their design being consideration of the animals to be excluded and site and vegetation being protected. Cost is also an important consideration with fencing of larger areas requiring more material, but also often needing additional maintenance. There have been examples of plots ranging in size from 0.5 to 15 Ha. Within wetlands, smaller plots are used to exclude both aquatic and terrestrial disturbance/consumption of plants (Figure 8).

The study should aim to improve our understanding of the effects of grazing on the main habitat or vegetation types present in the wetlands. Plots should be constructed from 3m farm gates[26]. If there are rabbits or other small grazers present, then the gates should have 2.5cm mesh attached to ensure all grazers are excluded. A minimum of 6 control plots is recommended for Fivebough and Tuckerbil. To capture all vegetation communities, the inclusion of 3 additional plots at Fivebough (N1,N2,N3, Figure 8) and Tuckerbil (S1,S2,S3, Figure 9) is recommended. Comparison plots of the same size and habitat type should be identified but not fenced off to allow comparison of grazed versus ungrazed areas.

Figure 7 A wetland vegetation plot made from 3m long farm gates at Mulcra Island once the wetland had dried. Photo credit: Parks Vic

Data for the indictors shown in Table 23 should be collected quarterly at a minimum and results compared between control and grazed plots. Identification of negative impacts should result in modifications to the grazing guideline sin a timely manner. Maintaining this study between 2026 and 2029 will allow changes to be tested over time and support a robust reset of the grazing guidelines at the 2030 review point.

[26] Does grazing exclusion in Australia's rangelands affect biomass and debris in carbon stocks? Forrester. D, Bray.S, England.J, Roxburgh.S, Rangeland Journal 47, RJ24028. Doi: 10.1071

Table 23 Process and Interpretation of small plot study indicators

Indicator	Process	Interpretation
Per cent bare ground cover	Estimating bare ground within replicated, sample areas. You can use photos of the ground at a marked location or thrown quadrats.	High values can indicate excessive grazing pressure or erosion risk. High values can be a positive indicator where bare ground is a natural feature within seasonal wetland basins of the dry tropics and where monospecific stands of exotic pasture are being targeted by heavy grazing pressure as part of an intensive transitional grazing regime.
Standing biomass	A measure of herbage / grass (dry) weight on a given area. Requires cutting, drying and weighing of standing plant material within defined sampling areas, though for the purposes of monitoring grazing regimes, estimates will usually suffice.	It is important for assessing stocking density, feed reserves and fire fuel loads. Varies naturally throughout the year so need to be recorded and compared at the same time each year.
Relative dominance ground cover	Describes the percentage makeup of the ground cover in terms of dominant species within a sampled area.	Botanical identification skills may be required to describe beyond the dominant species (NRM bodies or agencies can assist). For monitoring grazing control of exotic pastures, percentage of exotic pasture versus 'other ground cover' can suffice. As for biomass, it must be recorded and compared at the same time each year to account for seasonal vegetation changes.
Soil compaction	This measure monitors the impact of stock traffic on soil structure. It is most readily measured by penetration depth of a steel tent peg (or equivalent) into the topsoil. Multiple replicate samples within distance intervals along a transect established perpendicular to a wetland or watercourse provide good data.	Soil moisture affects compaction measurements, so seasonally stratified sampling (i.e. same time and moisture content (i.e. dry) each year) is required to allow comparisons. Increases in soil compaction can indicate negative habitat trends (e.g. reduced soil moisture holding capacity, reduced plant germination capacity) associated with excessive stock trampling and signal a need for site spelling.
Pugging density	Similar to percentage bare ground but specifically looks at the density of stock hoof prints in riparian and wetland areas within a defined quadrat (numeric count data and/or photo.	An indicator of impacts associated with excessive stock trampling and specifically assesses pressure on emergent wetland vegetation zones usually associated with water margin areas.

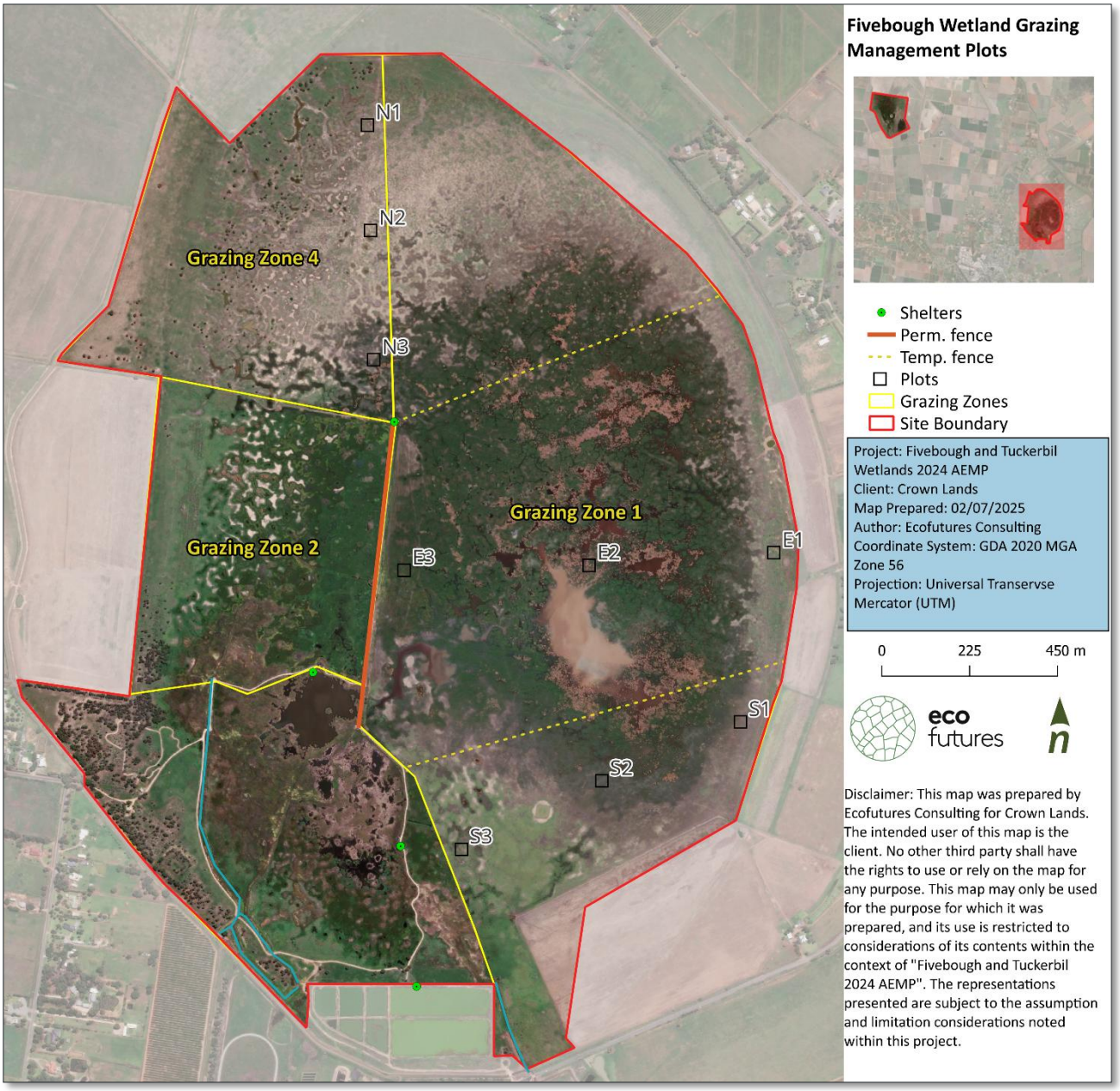


Figure 8 Suggested grazing impact monitoring plots for Fivebough Wetlands. Coordinates for permanent fence are provided in Table 25. The coordinate and line are based on the maps and will need to be confirmed through on-ground observations of elevation.

(Plot Naming Convention: N=North, E=East, S=South; 1=Dry, 2=Transition, 3=Wet) *Monitoring plot and temporary fence locations were informed by inundation extents at the time of reporting, plot and fence locations may require variations depending on environmental and management considerations.

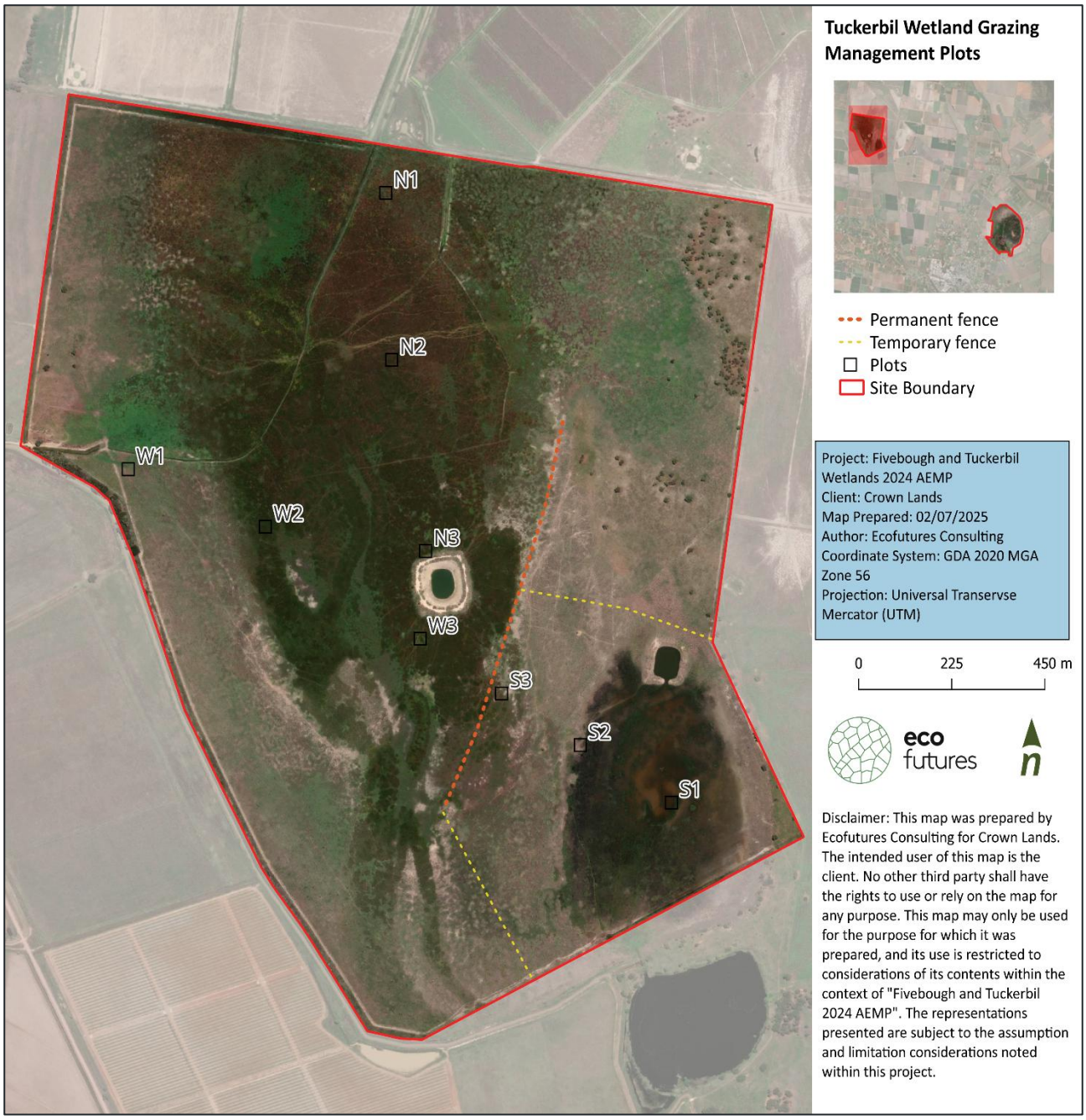


Figure 9 Suggested grazing impact monitoring plots for Tuckerbil Wetlands. Coordinates for permanent fence are provided in Table 25. The coordinate and line are based on the maps and will need to be confirmed through on-ground observations of elevation.

(Plot Naming Convention: N=North, E=East, S=South; 1=Dry, 2=Transition, 3=Wet) *Monitoring plot and temporary fence locations were informed by inundation extents at the time of reporting, plot and fence locations may require variations depending on environmental and management considerations.

Table 24 Fivebough and Tuckerbil Wetland grazing small study plots and fence points

Site	Name	Inundation	Lat	Long
Fivebough	N Perm. Fence Point	NA	-34.527447	146.429256
Fivebough	S Perm. Fence Point	NA	-34.534409	146.428171
Fivebough	N1	Dry	-34.5205	146.4286
Fivebough	N2	Transition	-34.523	146.4286
Fivebough	N3	Wet	-34.5259	146.4287
Fivebough	E1	Dry	-34.5304	146.4398
Fivebough	E2	Transition	-34.5307	146.4347
Fivebough	E3	Wet	-34.5308	146.4295
Fivebough	S1	Dry	-34.5343	146.4389
Fivebough	S2	Transition	-34.5357	146.435
Fivebough	S3	Wet	-34.5372	146.4311
Tuckerbil	N Perm. Fence Point	NA	-34.48326	146.353678
Tuckerbil	S Perm. Fence Point	NA	-34.491695	146.350823
Tuckerbil	N1	Dry	-34.4787	146.3493
Tuckerbil	N2	Transition	-34.4822	146.3495
Tuckerbil	N3	Wet	-34.4861	146.3503
Tuckerbil	W1	Dry	-34.4844	146.3425
Tuckerbil	W2	Transition	-34.4856	146.3461
Tuckerbil	W3	Wet	-34.4879	146.3502
Tuckerbil	S1	Dry	-34.4913	146.3568
Tuckerbil	S2	Transition	-34.4901	146.3544
Tuckerbil	S3	Wet	-34.4891	146.3523

**Current plot and temporary fence locations were informed by inundation extents at the wetland at time of reporting. These locations may need to be altered at time of deployment to best capture the wetland inundation areas.*

Fivebough and Tuckerbil Wetland AEMP Stage 1

ECOLOGICAL REPORT

5 March 2025

alluvium

Alluvium recognises and acknowledges the unique relationship and deep connection to Country shared by Aboriginal and Torres Strait Islander people, as First Peoples and Traditional Owners of Australia. We pay our respects to their Cultures, Country and Elders past and present.

Artwork by Melissa Barton. This piece was commissioned by Alluvium and tells our story of caring for Country, through different forms of waterbodies, from creeklines to coastlines. The artwork depicts people linked by journey lines, sharing stories, understanding and learning to care for country and the waterways within.

This report has been prepared by Alluvium Consulting Australia Pty Ltd for Crown Lands under the contract titled 'Fivebough and Tuckerbil Wetland 2024 AEMP'.

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Contents

Figures

Tables

1 Executive Summary

This report presents a review of the ecological data and key findings for Fivebough and Tuckerbil Wetlands, focusing on their Ramsar status, waterbird populations, vegetation dynamics and associated waterbird habitat extents. These wetlands are internationally significant due to their biodiversity values and role in supporting migratory and threatened waterbird species. The assessment evaluates existing reports and datasets, including the 2020 Adaptive Environmental Management Plan (AEMP), BioNet, Atlas of Living Australia (ALA), and Quarterly Waterbird Surveys conducted by field naturalists commissioned by the Department of Climate Change, Energy, the Environment and Water (DCCEEW, 2024). However, significant data gaps between 2020 and 2024 have impacted the comprehensiveness of this review, reducing confidence in trend assessment, reporting of waterbird presence and abundance counts, and influencing environmental variables and management decisions. The findings highlight the need to implement recommended ecological monitoring, data management, and strengthened collaboration among land managers and key stakeholders to maintain the site's role as a critical habitat for internationally significant and endangered waterbirds, while preserving the ecological character of these wetlands.

2 Key Findings and Recommendations

Incomplete and Fragmented Ecological Data

Significant data gaps from 2020 to 2024 hinder efforts to assess ecological trends. Essential datasets were unavailable, incomplete, or inconsistently collated, particularly for waterbird surveys, vegetation monitoring, and hydrological assessments. The absence of a clear methodology for assessing waterbird habitat and vegetation in the 2020 AEMP further limits comparative analysis of Plant Community Types (PCTs) and wetland habitat changes over time.

Recommendations:

- Establish an accessible data repository for collating and sharing ecological datasets.
- Implement systematic and standardised monitoring programs for vegetation and hydrology assessment.
- Require commercial operators to submit cleaned and collated field data within one month of surveys.
- Develop and formalise data-sharing agreements between land managers and key stakeholders to ensure data consistency and accessibility.

Declining Waterbird Diversity and Abundance

Currently, only one of the four Ramsar criteria is being maintained at the site. Of the 10 LACs used to assess waterbird condition at the wetlands, 3 are Met, 2 are Likely Met, 4 are Not Met and 1 does not have sufficient information to assess. Waterbird survey data suggests a declining trend in species diversity and abundance, but incomplete datasets from 2020 to 2024 reduce confidence in this assessment. The lack of concurrent vegetation and hydrological monitoring limits the ability to identify environmental and management drivers behind these trends.

Recommendations:

- Regularly collate and report quarterly waterbird survey data to assess against Limits of Acceptable Change and ensure accurate trend analysis.
- Supplement data gaps using external sources such as Atlas of Living Australia (ALA), with appropriate quality control measures.
- Implement regular vegetation and hydrological monitoring to align environmental water delivery with key waterbird breeding and migration periods.
- Investigate potential drivers of waterbird declines, including habitat degradation and hydrological shifts, using existing and recommended monitoring data.

Altered Hydrology and Vegetation Dynamics

Fivebough has transitioned from an ephemeral wetland to a permanently fluctuating fresh to brackish system, leading to Black Box (*Eucalyptus largiflorens*) dieback and the expansion of Cumbungi (*Typha spp.*) and Water Couch (*Paspalum distichum*). Tuckerbil remains a swamp grassland but has undergone significant modifications due to hydrological changes, altering vegetation composition and habitat structure. A December 2024 site inspection confirmed the presence of saline and sub-saline vegetation, suggesting shifts in soil and water chemistry. Prolonged inundation has further impacted key habitat types, reducing their suitability for waterbirds.

Recommendations:

- Implement hydrological management strategies that maintain wetting-drying cycles to support diverse waterbird habitats and identify and address issues occurring at the site i.e.. increases in salinity.
- Restore Black Box and Lignum (*Duma florulenta*) woodland to improve habitat complexity and connectivity.
- Use adaptive management to identify suitable water and grazing regimes to sustain specified plant communities.
- Monitor encroachment of Black Roly-poly (*Sclerolaena muricata*) into wetland areas to maintain habitat diversity.
- On the basis of outputs from a range of hydrological models, forecast the distribution of vegetation communities that align with management objectives.
- Utilise remote sensing (NDVI) and satellite imagery (NearMap) to measure and assess inundation extents and vegetation shifts.

Need for Improved Adaptive Management

Limited ecological data compromises the ability to compare current conditions with Ramsar Limits of Acceptable Change. The absence of a structured vegetation monitoring program restricts assessment of ecological shifts and their effects on waterbird populations. Stakeholder consultations highlighted a need for clearer governance around data collection, reporting, and long-term monitoring. Resourcing constraints have further hindered the ability to conduct systematic ecological assessments, impacting conservation planning and adaptive management.

Recommendations:

- Develop a comprehensive waterbird habitat and vegetation management plan incorporating adaptive management principles.
- As per the 2020 review, implement a water quality and water depth monitoring program to assess hydrological impacts on habitat conditions.
- Ensure monitoring aligns with Ramsar ecological character descriptions to support international conservation objectives.
- Strengthen collaboration between land managers, researchers, and government agencies to enhance data reliability and management.

The findings of this report underscore the importance of structured data collection, consistent monitoring, and adaptive management to maintain the ecological integrity of Fivebough and Tuckerbil Wetlands. While these wetlands continue to provide critical habitat for waterbirds, the lack of data from 2020–2024 and undocumented ecological shifts highlight the need for regular reporting at the wetlands. Addressing data limitations and improving ecological monitoring and reporting will be critical for maintaining the ecological character of these Ramsar-listed wetlands and ensuring their long term ecological function as critical habitat for waterbirds.

3 Ecological data review

A desktop review of ecological data was performed to identify datasets relevant to the assessment criteria for Ramsar listings and the Ecological Character Description for the Wetlands. The datasets included in this review are detailed in Table 1.

Table 1: Data sources reviewed for 2025 AEMP.

Source	Description	2020-2024 Data Quality	Data extraction date	Area	Limitation
NSW Department of Planning, Housing and Infrastructure Bionet Atlas	All validated fauna species data including birds, mammals, reptiles, fish from 1993-2023.	Low	05/01/2025	220m Buffer of Fivebough and Tuckerbil Ramsar boundary	The quarterly waterbird surveys are the primary data source for Bionet at this site. The paucity in data from the waterbird surveys are mirrored in the Bionet data.
National Research Infrastructure for Australia, CSIRO and GBIF, Atlas of Living Australia Spatial Portal	All validated fauna species data from 1982-2024. Input data sources include iNaturalist, Ebird, BioNet, government and non-government research organisation.	Medium	05/01/2025	220m Buffer of Fivebough and Tuckerbil Ramsar boundary	The dataset is prone to duplication, multiple authorships, no standard data collection methodology. Modifying the dataset to be sufficient for this review is beyond the project scope.
NSW DCCEEW Water and Wetlands Team, Science, Economics and Insights Division	Quarterly bird survey counts conducted by field naturalists 2011-2023 (limited data 2021, no 2022 or 2024 data).	Low	15/12/2024	Fivebough and Tuckerbil Ramsar site	High quality historic dataset conducted by field naturalists. Data from 2021-2024 had many data gaps significantly hindering the comprehensiveness of the 2024 AEMP.
NGH, 2020 AEMP Review-Waterbird Presence tables	Summary of waterbird presence data from report (source for this dataset was not specified in report. When cross referenced with public and private databases,	Not available	Not available	Fivebough and Tuckerbil Ramsar site	Raw data and methodology used in the 2020 AEMP not available.

Source	Description	2020-2024 Data Quality	Data extraction date	Area	Limitation
	data source was unable to be determined)				
NGH, 2020 AEMP Waterbird habitat methodology and happing	Waterbird habitat extent mapping, data and methodology used in the report was not available for this review.	Not available	Not available	Fivebough and Tuckerbil Ramsar site	Raw data and methodology used to inform 2020 AEMP not available.
EPBC Act Protect Matters Search Tool (PMST)	Matters of National Environmental Significance (MNES): Threatened flora and fauna, endangered populations and ecological communities and migratory species.	Medium	15/12/2024	Fivebough and Tuckerbil Ramsar Boundary	Supplementary information.
NSW Biodiversity Values Map and Threshold Spatial Data	All Biodiversity Values assigned to the mapped areas.	Medium	15/12/2024	Fivebough and Tuckerbil Ramsar Boundary	Supplementary information.
NGH, 2020 AEMP PCT Maps Figure X	Mapped Plant Community Types (PCTs) conducted by NGH. Vegetation classification and mapping methodology not stated.	Low	Not available	Fivebough and Tuckerbil Ramsar site	In absence of spatial datasets used in report, PCT extents were extracted from maps in 2020 AEMP.
DPIE Vegetation Information System, State Vegetation Mapping	Plant Community Type (PCT) Descriptions	Medium	12/12/2024	Fivebough and Tuckerbil Ramsar Boundary	Used as supplementary information
Crown lands	Inundation monitoring data	Not available	Not available	Fivebough and Tuckerbil Ramsar site	Depth and water extent data not available to inform habitat suitability considerations.

3.1 Waterbird data

A desktop review of the data and information underpinning the 2020 Adaptive Environmental Management Plan (AEMP) was conducted. This review included an assessment of reports, private datasets provided by Crown Lands, and online database searches, such as BioNet, Atlas of Living Australia (ALA) and Protected Matters Tool to understand the data landscape and context for the wetlands.

The review revealed some of the data used in the 2020 AEMP report was not accessible. Data was also not available post-2020 AEMP as it hadn't been collated or reported.

Waterbird Survey Methodology:
To assess waterbird trends and Limits of Acceptable Change for the wetlands, quarterly bird surveys were conducted in October, January, April, and July. Each survey session lasted between 20 and 60 minutes per site and is completed within a single day (Smith.N, personal communication, 2024).

The surveys cover multiple locations, including:

- STW (Sewage Treatment Works)
- Hooey Lookout
- Gibb Road
- The Middle Track (from the Interpretation Centre to the Steel Brolga)
- North from the Steel Brolga
- South from the Steel Brolga

During each survey, all observed birds are recorded, including species identification, individual counts, and any birds detected acoustically.

The quarterly waterbirds surveys (DCCEEW, 2024) and field naturalists provide historic data from 2011-2023, with gaps for parts of 2021 and all of 2022 and 2024. Because the primary source of waterbird data populating Bionet for the site is from the quarterly bird surveys (ie. DCCEEW dataset), Bionet reflected similar data deficiencies. Although waterbird surveys were conducted during these years, the data had not been collated and transcribed into Bionet or DCCEEW's private dataset in time for this review. Data from Atlas of Living Australia (ALA) was available for 2021,2022 and 2024, however, the opportunistic nature of its collection and uncertain data quality preclude its use for reliable assessments. After discussion with local stakeholders, it was discovered that community members maintain their own personal records of waterbirds at the site that could potentially fill data gaps. Collating and cleaning external data sources such as ALA or private datasets from stakeholders is beyond the scope of this review.

Following extensive consultations with Crown Lands and stakeholders, it was determined that the quarterly waterbird surveys 2011-2023 dataset provided by DCCEEW (DCCEWW, 2023) would serve as the primary data source. This dataset is derived from approximately four annual surveys conducted by field naturalists. Bionet data will be used to supplement the DCCEEW dataset to account for bird species presence at the site.

The limited annual site visits and paucity of survey data between 2020-2024 significantly reduce confidence in the assessment of LAC. In an attempt to reduce uncertainty, incidental observations from the DCCEEW dataset have been included in this assessment. Despite this additional data, the assessment should be interpreted within the context of known data limitations.

A key recommendation of this updated review will be to implement regular waterbird monitoring and to clean, collate and report on waterbird survey findings at regular intervals.

3.2 Vegetation data

The vegetation data used to inform the 2020 Adaptive Environmental Management Plan (AEMP) could not be recovered from either Crown Lands or NGH. Consequently, the occurrence and extent of Plant Community Types (PCTs) were inferred from tables and map images included in the report (Figure 8, Figure 9, 2020 AEMP). However, the methods used to map these PCTs were not clearly documented, and any comparative changes should be interpreted with this limitation in mind.

The vegetation monitoring recommendations outlined in Section 5.2 of the 2020 AEMP proposed regular monitoring of both the Fivebough and Tuckerbil Wetlands at specific intervals using a defined methodology (line transect and random quadrat surveys). It appears that formal vegetation monitoring via systematic surveys have not been conducted at the site. Instead, visual assessments of vegetation composition and structure (in addition to waterbird observations), performed by land managers, have informed water delivery and wetland

management decisions(Crown Lands, personal. comms, 2024). While this approach has been sufficient in assessing the habitat extents for waterbirds at the site, it does not allow for a comparative analysis or an understanding of causal shifts in wetland vegetation and the broader ecosystem due to the absence of a regular standardised survey methodology and consistent data. Additionally, after the site visit conducted in December 2024, it was observed that in some areas, vegetation composition in the wetland has shifted from a freshwater composition to a saline or sub-saline composition. Due to the lack of regular formalised monitoring, it cannot be readily ascertained when this shift happened, nor which environmental variables contributed to those shifts and the subsequent effects they have had on the waterbird populations of the site.

In 2022, NGH conducted a biodiversity assessment of the site for a hydroworks development. This report provides the most comprehensive recent assessment of site vegetation. This report was be used to provide supplemental vegetative context where appropriate.

A key recommendation of this updated review is to implement the vegetation monitoring strategies outlined in the 2020 AEMP and to identify and address the factors that have hindered the consistent collection of vegetation monitoring data.

4 Findings from site inspection and surveys

A site inspection was conducted by Ecofutures and Alluvium ecologists to understand the site context and collect vegetation information for Fivebough and Tuckerbil Wetlands. The site survey was conducted in December 2024, over the course of 3 days (2 days at Fivebough, 1 day Tuckerbil). A list of the activities undertaken is provided in Table 2. Prior to the site inspection, it was assumed that comprehensive waterbird data from 2011 to 2024 would be readily available for this review, negating the need for additional surveys. However, it was subsequently discovered that although quarterly waterbird surveys were conducted in 2022 and 2024, this data has not been collated and is therefore unavailable for inclusion in this review. Furthermore, the quarterly bird survey data for 2021 is incomplete, with only 2 out of the 4 surveys represented in the dataset. This unexpected data gap significantly impacts the comprehensiveness and continuity of the analysis presented in this review, and the results should be interpreted with this limitation in mind. Data from Bionet, extracted in 2025 will be used to supplement the data gaps, though due to the nature of Bionet data population does not provide substantial improvement to the dataset.

Table 2. List of tasks undertaken during the field assessment

Site Inspection Task	Method	Status
Photopoint monitoring	Replicate photopoint monitoring from 2020 AEMP	**Complete –** additional photo points were included to capture shifts in vegetation
PCT validation **Ecological context/condition**	Rapid assessment/ground truthing of the PCTs and vegetation condition based on maps and drone imagery.	**Complete** – due to the significant vegetation shifts, the PCT's were remapped rather than validated.
Weed Presence/Threats	Targeted assessment of weeds at the site. Target drainage and inflow areas.	**Partially Complete –** due to complexity of vegetation mapping, this assessment was altered to a rapid assessment conducted during random meander
Waterbird context with stakeholders	4 hour site visit with Stakeholders	**Complete**
Grazing context with stakeholder	2x 1-2 hour site visit with Stakeholders	**Complete**

Waterbird Habitat review	Have waterbird stakeholders (Nella) identify waterbird habitat areas on maps and inundation regimes Use PCT validation data to identify waterbird habitat post-fieldwork	Complete

5 Assessment

The assessment has been based on multiple lines of evidence that contributed to the designation of both Fivebough and Tuckerbil wetland as a Ramsar sites. Waterbird data between 2013-2023 sourced from the Quarterly Waterbird Surveys (DCCEEW, 2024) and data extracted from Bionet (Bionet, 2025), was assessed against the following factors that contributed to the sites listings for criteria relating to waterbirds.

- Threatened wetland species Australasian Bittern (*Botaurus poiciloptilus*) and Painted Snipe *(Rostratula australis*).
- A high diversity of waterbird species.
- Migratory species and waterbird roosting and breeding.
- Numbers of five species: Sharp-tailed Sandpiper (*Calidris acuminata*), Australasian Bittern (*Botaurus poiciloptilus*), Whiskered Tern (*Chlidonias hybrida)* and Glossy Ibis (*Plegadis falcinellus*) in excess of the 1% of the population.

Gaps in the available data introduce considerable uncertainty when comparing current condition to the Ramsar Limits of Acceptable Change. While these data limitations influence this report and future reporting on the condition of the wetlands, more importantly they compromise manager's capacity to undertake effective adaptive management. The Basin Plan operates within an adaptive management framework while the Ramsar treaty strongly recommends adaptive management.

5.1 Waterbirds

Objective 1 - To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, in particular, threatened species, migratory waders and those species found at the site in numbers greater than their 1% population estimate

Synthesis of findings: Fivebough and Tuckerbil Wetlands meets the following four of the nine criteria (2, 3, 4 and 6) for listing as a wetland of International Importance (White, 2014). Currently, one criteria (criteria 2) is being maintained, according to the 2013-2023 data landscape. Due to the lack of data between 2020-2024, the assessment against the criteria justifications is severely degraded and should be interpreted with this limitation in mind. There has been a noted declining trend amongst the waterbird species diversity and abundance across both sites. Due to the lack of comprehensive data from 2020 to 2024, it is not possible to confidently determine whether this trend accurately represents waterbird use at the wetlands or to assess the environmental variables influencing it.

Recommendations

The analysis for this assessment would be significantly improved with regular collation and reporting on waterbird surveys, as recommended in the 2020 AEMP. In addition, if resourcing is limited, utilising other data from other databases such as Atlas of Living Australia, or private datasets, by collating and cleaning outside data on regular basis to use as supplementary information to inform the adaptive management of the site.

Ramsar Criteria Status

The results of this assessment have been summarised and ranked against the Limited of Acceptable Change (LACs) as outlined in the Ecological Character Descriptions (White.L, 2014) (see Stage 1 Report, Section 2.3) and the current Ramsar criteria outlined in the RIS (White, 2014). The intention of this assessment is to provide context for wetland trends as documented in the available data. However, the limited data between 2020 and 2024 reduces the confidence in the findings, and interpretations should consider this limitation.

Though the scope of this report is not to assess and report on whether the wetlands meet the current justification criteria for the wetlands, measurements against the criteria provide an opportunity to assess potential condition and trends of condition and should be interpreted with this understanding. In the event that there is a significant adverse human-induced change in the ecological character of the wetland it would need to be reported to the Ramsar Convention Secretariat in accordance with the National Guidance on Notifying Change in Ecological Character of Australia's Ramsar Wetland (Article 3.2) (DEWHA, 2009).

Key for interpreting Ramsar criteria summary tables

Symbol	Meaning
Met	Criterion is met
Likely met	Criterion is likely met
Not met	Criterion is not met
↗	Increasing trend
→	Stable trend
↘	Declining trend
★ ☆ ☆	Data confidence is low
★ ★ ☆	Data confidence is moderate
★ ★ ★	Data confidence is high

Ramsar Criterion	Justification at Time of Designation	2020 AEMP	2024 Status	Trend	Data Confidence	Data Source
Criterion 2: Supports vulnerable, endangered, or critically endangered species	Supports Australasian Bittern (*Botaurus poiciloptilus*), listed as 'Endangered' globally (IUCN 2000) and Painted Snipe (*Rostratula australis)*.	**Met**	**Met**	↘	★ ☆ ☆	DCCEEW, 2024

Fivebough and Tuckerbil Wetlands support two nationally threatened waterbird species, the Australasian Bittern (*Botaurus poiciloptilus*) and the Australian Painted Snipe (*Rostratula australis*). Historically, the Australasian Bittern typically occurs at Fivebough Wetland annually and at Tuckerbil Wetland in at least four of the ten years surveyed. The Australasian Bittern favours wetlands, such as Fivebough Swamp, with large areas (>5ha) of tall, dense vegetation (e.g., *Typha* spp. and *Phragmites australis*) (DLWC 2002). The habitat

requirements of the Australian Painted Snipe are not well understood, but it primarily inhabits sparsely vegetated wetlands with shallow water, wet mud, and patchy low or tall vegetation.

The Australian Painted Snipe occurs at Fivebough intermittently but, on average, in three of every ten years. The RIS (Schultz et al. 2002) indicates that the species occurred at both Fivebough Wetland (counts of up to eight birds) and Tuckerbil Wetland at the time of listing. The species was also recorded in 2012 and 2013 (K. Hutton, pers.comm. 2014) (White 2014).

The Australasian Bittern was present at Fivebough seven of every ten years (2013-2018 and 2023). Data from the ALA (2025) suggests that this LAC was met with Australian Bitterns occurring nine out of the ten years. The highest count was 197 in 2015. There has been a notable decline in observations after 2017, the occurrences in the single digits. In the last ten years (2013-2023), the Painted Snipe was detected at Fivebough in 2013 (3) and 2014 (5). Suitable habitat for the Painted Snipe depends on maintaining open, shallowly inundated areas with sparse vegetation and access to invertebrate prey, which can be supported through appropriate hydrology and vegetation management, such as grazing. **It appears criterion2 is being met at the site**, **but the trend is in decline**. The limitation in data between 2020-2024 significantly impacts the confidence for this assessment.

Ramsar Criterion	Justification at Time of Designation	2020 AEMP	2024 Status	Trend	Data Confidence	Data Source
Criterion 3: Supports populations important for biodiversity	Important for maintaining high waterbird diversity in the Riverina bioregion. Highest number of waterbird species recorded in Murray-Darling Waterbird Project Fivebough Swamp: 83 species Tuckerbil Swamp: 69 species	Met	Not** Met		★ ☆ ☆	(DCCEEW, 2024; Bionet, 2025) **Data gap between 2020-2024 significantly degrades this assessment

Fivebough and Tuckerbil Wetlands are significant for supporting a high diversity of waterbirds in the Riverina bioregion, where non-riparian wetlands are scarce. Historically, these wetlands recorded some of the highest waterbird species richness in the Murray-Darling Basin, with Fivebough ranking second and Tuckerbil seventh in species diversity among 360 surveyed sites. Fivebough Wetland and Tuckerbil Wetland had the highest and the second highest number respectively of waterbird species recorded (65 and 64 species respectively) during the 1994 - 1997 Murray Darling Waterbird Project (Glazebrook & Taylor 1998) (Birdlife International 2024). At the time of listing, 83 waterbird species were recorded at Fivebough and 69 at Tuckerbil, though recent records (2013–2023) show a decline, with 72 species at Fivebough and 25 at Tuckerbil (Bionet, 2025). **Based on the data available criterion 3 is not met.** However, due to the absence of recent surveys, it is unclear whether this reflects an actual decline or a data gap.

Ramsar Criterion	Justification at Time of Designation	2020 AEMP	2024 Status	Trend	Data Confidence	Data Source

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions	• Breeding site for numerous waterbird species • Important habitat for Brolgas and Egrets • Supports migratory waterbirds listed under JAMBA/CAMB	Likely Met	Not** Met	 ★ ☆ ☆	(DCCEEW, 2024; Bionet, 2025) ** Data gap between 2020-2024 significantly degrades this assessment.

Fivebough and Tuckerbil Wetlands provide critical breeding, roosting, and feeding habitat for a diverse range of waterbirds. A total of 22 waterbird species have been recorded breeding at Fivebough and 11 at Tuckerbil, with at least 12 species known to breed regularly.

Tuckerbil Wetland serves as a post-breeding roost site for up to 130 Brolga (*Grus rubicunda*). During spring and summer, thousands of Glossy Ibis (*Plegadis falcinellus*) roost at Fivebough Wetland in the evenings, while many also forage extensively in the area. The Whiskered Tern (*Chlidonias hybridus*) exhibits similar behaviour, although to a lesser extent.

The wetlands are significant for migratory waterbirds, with 24 species recorded at Fivebough and 13 at Tuckerbil, many of which are listed under the Japan-Australia (JAMBA) and China-Australia (CAMBA) Migratory Bird Agreements. Among these, 19 at Fivebough and ten at Tuckerbil are shorebirds. Additionally, these wetlands support 17 waterbird species listed under the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Between 2013 and 2024, 16 migratory waterbird species were recorded at Fivebough (Bionet, 2025), 13 of which were migratory shorebirds. At Tuckerbil, three migratory waterbirds were recorded, one being a migratory shorebird (Black-winged Stilt (*Himantopus himantopus*) (Bionet, 2025)). At Fivebough, 13 migratory waterbird species were recorded, three of the migratory waterbird species recorded at Tuckerbil were listed under the Japan-Australia (JAMBA), China-Australia (CAMBA) Migratory Bird Agreements, or Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) Migratory Bird Agreements (DCCEEW, 2024). **Based on the data available criterion 4 is not met** The lack of data between 2020-2024 may significantly impact this assessment.

At Fivebough Wetland, a total of 19 waterbirds were observed breeding and four at Tuckerbil between 2013-2023 (DCCEEW, 2024). An Australian Bittern was observed breeding at Fivebough in 2015. Five waterbirds were observed breeding between 2020-2024 including: Black Swan (*Cygnus atratus*), Eurasian Coot (*Fulica atra*), Great Crested Grebe (*Podiceps cristatus*), Hoary-headed Grebe (*Poliocephalus policephalus*), and Purple Swamhen (*Porphyrio porphyrio)*. Four waterbird species were observed breeding at Tuckerbil between 2020-2024 including: Australasian Darter (*Anhinga novaehollandiae*), Black-fronted Dotterel (*Elseyonis melanops*), Grey Teal (*Ana gracilis*), Pacific Black Duck (*Anas superciliosa*).

Brolgas have been detected in five of the last 10 years at Tuckerbil wetland. Brolgas have been detected in nine out of the last ten years (not detected in 2022, no surveys were conducted) at Fivebough Wetland. Brolgas were detected in one of the last ten years (2019: 163) in significant numbers at Fivebough. Brolgas have not been recorded in significant numbers at Tuckerbil wetland in the last ten years. There was one suggestion in the data that Brolgas (2) formed a breeding pair in December 2013. There has been no other documentation reporting Brolga breeding behaviour. **Based on the data available criterion 4 is not met**. The lack of data between 2020-2024 impacts the confidence in this assessment.

Ramsar Criterion	Justification at Time of Designation	2020 AEMP	2024 Status	Trend	Data Confidence	Data Source

Criterion 6: "A wetland should be considered internationall y important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird."	Glossy ibis, Sharp-tailed sandpiper, Whiskered tern, Australasian bittern and Brolga have all been recorded at the wetlands in numbers estimated to be greater than 1% of their populations.	**Likely Met**	**Not Met?**		★ ☆ ☆	(DCCEEW, 2024; Bionet, 2025) **Data gap between 2020-2024 significantly degrades this assessment

The Ramsar Information Sheet (RIS) for the site at the time of listing (Schultz *et al*. 2002) reported five species of waterbird at numbers estimated to represent greater than 1% of their population:

- Sharp-tailed Sandpiper (*Calidris acuminata)* - 2,015 at Fivebough Wetland and 2,253 at Tuckerbil Wetland.
- Whiskered Tern - 20,000 at Fivebough Wetland and 900 at Tuckerbil Wetland.
- Brolga - 9 at Fivebough Wetland and up to 130 at Tuckerbil Wetland.
- Glossy Ibis - 20,000 recorded at Fivebough Wetland.
- Australasian Bittern - 17 at Fivebough Wetland and 6 at Tuckerbil Wetland.

In three of the last ten years (2013-2023) Sharp-tailed Sandpipers were detected (including incidental observations) at Fivebough in numbers over 1,550 (2013: 6,828 individuals; 2014: 1,365 individuals; and 2015: 5,447 individuals). Tuckerbil has not experienced more than 200 Sharp-tailed Sandpiper in the last 10 year (DCCEEW, 2024). Between 2003-2023, a total of of 15,150 Sharp-tailed Sandpipers have been recorded at Fivebough (Bionet, 2025). No Sharp-tailed Sandpipers have been recorded in Bionet between 2003-2023. **Based on the data available criterion 6 is met**. Data gaps are likely to affect this assessment.

Between 2013-2023 Whiskered Terns at Fivebough Wetland have met the 1% threshold of 10,000 (Wetlands International 2006) on at least 1 occasion (2014: 10,896). This was the only occurrence of Whiskered Terns meeting the 1% threshold since the time of the Ramsar listing in 2002. There is no evidence that this is a regular occurrence, with numbers recorded usually between several hundred to a few thousand (2013: 5,260 individuals; 2015: 5,166 individuals; and 2017: 5,461 individuals) (DCCEEW, 2024). **Based on the data available criterion 6 is met but degrading.**

Brolgas have not been detected at Tuckerbil wetland in significant numbers the last ten years (max: 40, 2018). Brolgas have been detected in nine out of the last ten years (absence: 2022) at Fivebough Wetland. There was one suggestion in the data that Brolgas (2) formed a breeding pair in December 2013 (DCCEEW, 2024). Otherwise, there have been no other suggestions of Brolgas using Fivebough or Tuckerbil as a post-breeding site in significant numbers. The lack of data between 2020-2024 impacts the confidence in this assessment**. Based on the data available criterion 6 is not met**. It is presently unclear whether the northern and southern population of the Brolga should be regarded as separate populations so this Criterion cannot be met with certainty (RIS, 2024).

Over the past decade, the highest number of Glossy Ibis (*Plegadis falcinellus*) recorded at Fivebough Wetland was 9,189 in 2017, including incidental observations. When excluding incidental records, the highest count was 2,362 in 2014. At Tuckerbil Wetland, the maximum recorded number of Glossy Ibis, including incidental observations, was 434 in 2020 (DCCEEW, 2024). These findings suggest a potential decline in Glossy Ibis numbers at the wetlands; however, the absence of data between 2020 and 2024 may influence this assessment. **Based on the data available criterion 6 is not met.**

A total of 19 Australasian Bitterns were recorded at Fivebough Wetland in 2014, the highest number individuals recorded in a single instance was five in October 2015. Australasian Bittern occurred at Fivebough Wetlands

seven of every ten years (2013-2018, 2023). Data from ALA (2025) suggests that this LAC was met with Australian Bitterns occurring nine of the ten years. No Australasian Bitterns were recorded at Tuckerbil wetland between 2013-2023 (DCCEEW, 2024). **Based on the data available criterion 6 is met**.

Waterbird diversity and abundance

Between 2020 and 2023, 52 waterbird species were recorded across Fivebough and Tuckerbill wetlands, totalling 17,251 individuals (Bionet, 2025). The peak year was 2023, with 10,446 waterbirds observed (BioNet, 2025). At least 12 of these species are known to breed regularly at the wetlands (RIS, 2024). At Fivebough, four migratory shorebird species were documented: Black-winged Stilt (*Himantopus Himantopus*), Double-banded Plover (*Charadrius bicinctus*), Sharp-tailed Sandpiper, and Wood Sandpiper (*Tringa glareola*) (Table 3). Black-winged Stilts were consistently present at Fivebough, with a notable count of 373 in 2023. No migratory shorebirds were recorded at Tuckerbil wetlands between 2020-2024. This absence is significant, as Tuckerbil historically supported 13 migratory species, including ten shorebirds. This change may indicate alterations in habitat conditions or other environmental factors affecting bird populations at Tuckerbil or is a result of the limited waterbird data across the site.

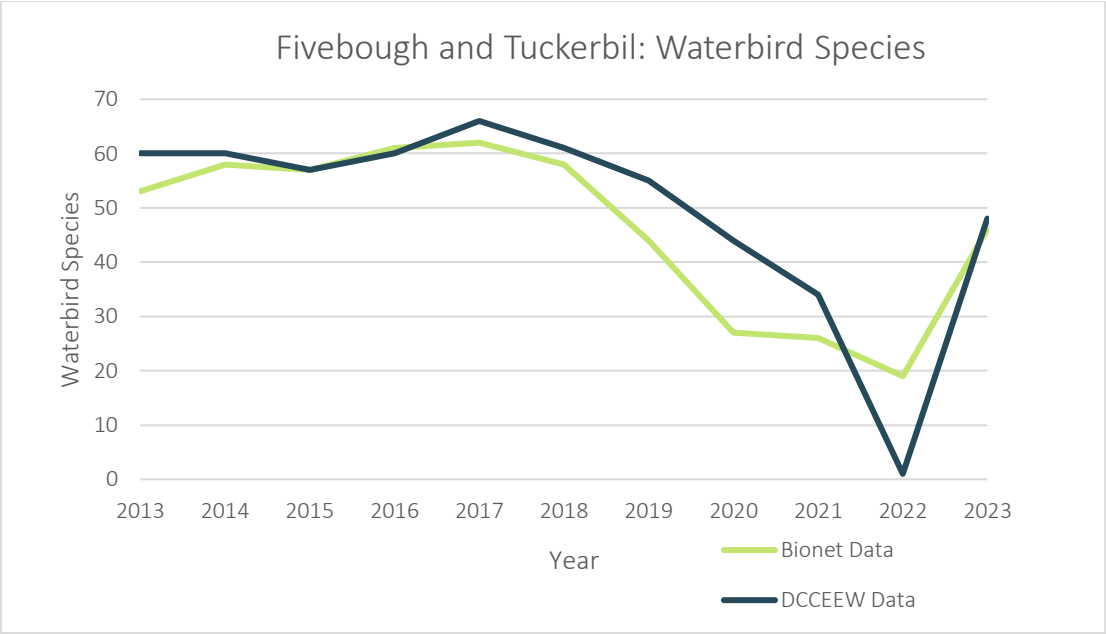

Figure 1: 2013-2023 Bird species diversity across Fivebough and Tuckerbil Wetlands (multiple data sources).

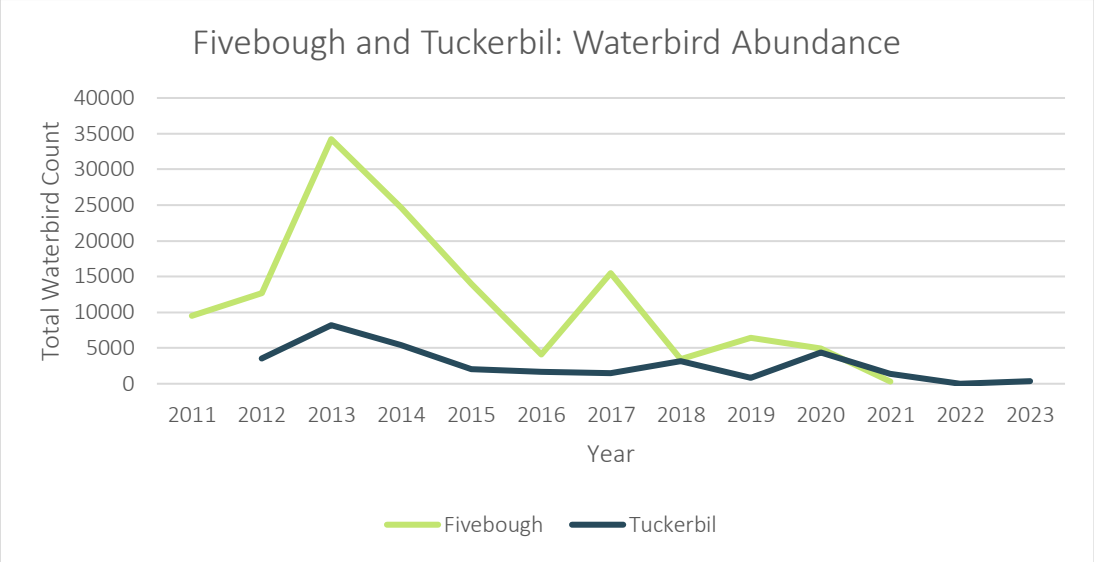

**Figure 2: 2011-2023 Annual waterbird counts for Fivebough and Tuckerbil Wetlands. *****Note waterbird survey data is not available for 2022-2024* (Source: DCCEEW, 2024).

Threatened Species:

Fivebough and Tuckerbil Wetlands are of national and international importance due to the presence, abundance and diversity of waterbird populations inhabiting the wetlands. These populations include both migratory and threatened species, including the EPBC listed endangered species: Australasian Bittern (*Botaurus poiciloptilus*) and Australian Painted Snipe. Tuckerbil and Fivebough Wetlands support more than 1% of the estimated south-eastern Australian population of the Australasian Bittern. The species was historically regularly recorded utilising Tuckerbil Wetland.

Historically, seven NSW Threatened Species have been regularly observed at Fivebough Wetlands. This includes the Magpie Goose (*Anseranas semipalmata*), Freckled Duck (*Stictonetta naevosa*), Blue-billed Duck (*Oxyura australis*), Brolga (*Grus rubicunda*), and Black-tailed Godwit (*Limosa limosa*) all of which are listed as vulnerable. Additionally, the Australasian Bittern (*Botaurus poiciloptilus*) and Australian Painted Snipe (*Rostratula australis*) (Bionet, 2025) are listed as endangered under the NSW Biodiversity Conservation Act 2016 and Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).

Between 2020-2023, four threatened species were recorded at Fivebough (Endangered (BC Act 2016): Australasian Bittern; Vulnerable (BC Act 2016): Blue-billed Duck, Brolga and Magpie Goose (see Appendix 2, Table 6). Meanwhile, six threatened species were recorded at Tuckerbil including (Endangered (BC Act 2016); Australian Bittern; Vulnerable (BC Act 216): Brolga, Little Egret, Magpie Goose and White-fronted Chat. The Painted Snipe has not been recorded at Fivebough or Tuckerbil since 2014 according to DCCEEW and Bionet datasets. Additionally, the Black-tailed Godwit and Freckled Duck, previously regularly observed at Fivebough, were not recorded between 2020-2024.

Significant Species:

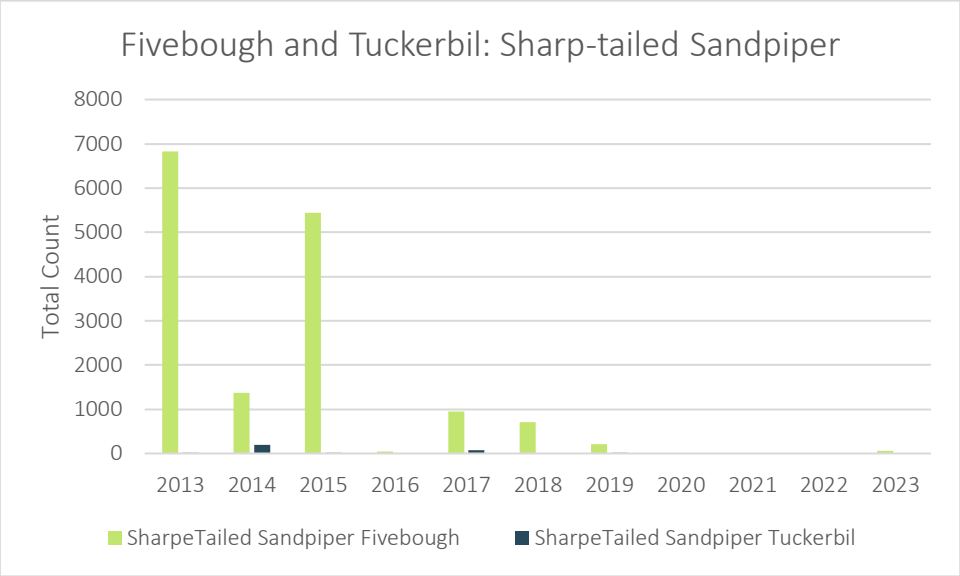

Figure 3: Sharp-Tailed Sandpiper presence and abundance at Fivebough and Tuckerbil wetlands (Data source: DCCEEW, 2024)

Sharp-tailed Sandpiper

Fivebough and Tuckerbil Wetlands have historically demonstrated significant importance for Sharp-tailed Sandpipers. At Fivebough, a maximum count of 3,000 birds was recorded in 2003/4, with several counts exceeding the 1% population threshold of 1,550 birds. Recent surveys show substantial occurrences in three of the last ten years, with counts of 6,828 in 2013, 1,365 in 2014, and 5,447 in 2015 (DCCEEW, 2024). These numbers surpass the current 1% threshold of significance, based on the latest population estimates of 60,000-120,000 birds globally. Tuckerbil wetland also previously supported up to 4,000 Sharp-tailed Sandpipers, with counts exceeding the 1% threshold in 1995 and 1997. However, recent data indicates a decline, with the most notable count in the past decade being only 200 birds in 2014 (Figure 3).

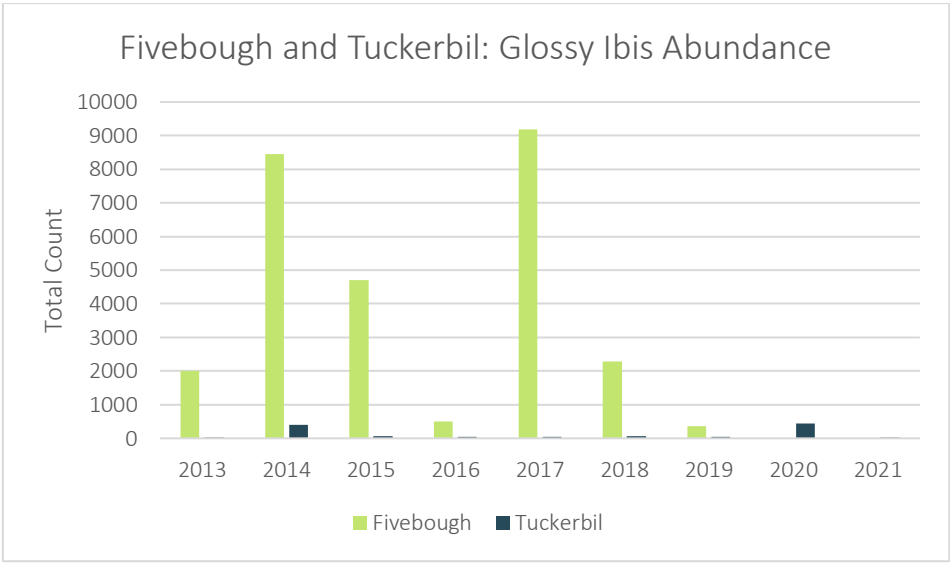

Figure 4: Glossy Ibis presence and abundance at Fivebough and Tuckerbil wetlands (Data source: Bionet, 2025)

Glossy Ibis

A maximum count of 20,000 Glossy Ibis at Fivebough Wetland was recorded in December 1995, with 15,000 counted in November 2004. These counts represent a regular occurrence exceeding the 1% population threshold of 10,000 for this species. However, Glossy Ibis have not been detected in significant numbers in

recent years. Between 2013-2023, The highest count was in 2017, with a total of 9,189 individuals recorded at Fivebough Wetland. Since 2019, Glossy Ibis have not been recorded in Fivebough wetland in significant numbers. Likewise, this species has not been recorded at Tuckerbil Wetland since 2021 with 23 species recorded (DCCEEW, 2024). Glossy Ibis primarily use the site during spring and summer. Historically, thousands of Glossy Ibis (*Plegadis falcinellus*) have been recorded to gather at Fivebough Wetland in the evenings to roost, although many also feed extensively in the wetland (RIS, 2024).

The absence of significant counts in recent years suggests that the site may no longer meet Ramsar criteria 6 for Glossy Ibis. However, due to data gaps from 2020-2024, it is difficult to determine if this represents a definitive declining trend.

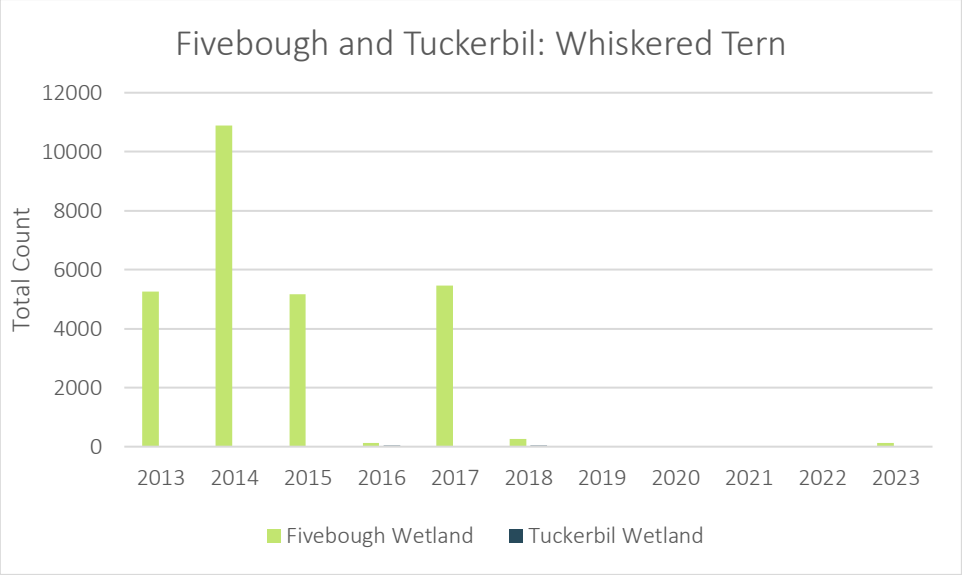

Figure 5: Whiskered Tern presence and abundance at Fivebough and Tuckerbil wetlands (Data source: DCCEEW, 2024)

Whiskered Tern

The population of Whiskered Terns at Fivebough and Tuckerbil Wetlands between 2013-2023 has been highly variable (min: 3 (2019), max: 10,918 (2014)). Subsequent years from 2013 to 2017 consistently showed counts exceeding 5,000 birds. However, a decline occurred from 2018 onwards, with bird numbers plummeting to five in 2019 and 119 in 2023. Whiskered Terns were not observed at either wetland between 2021-2022, however, this is likely attributed to the lack of surveys conducted during those years. Overall, Fivebough Wetland consistently hosted substantially larger numbers of Whiskered Terns compared to Tuckerbil, with Tuckerbil's highest count being only 37 birds in 2016. This decline is particularly significant given the site's historical importance, having previously recorded up to 20,000 Whiskered Terns—considered the highest count in Australia. The recent population trends potentially challenge the wetlands' Limits of Acceptable Change criteria, which stipulate that fewer than 1,000 Whiskered Terns in less than five years over a decade would be unacceptable.

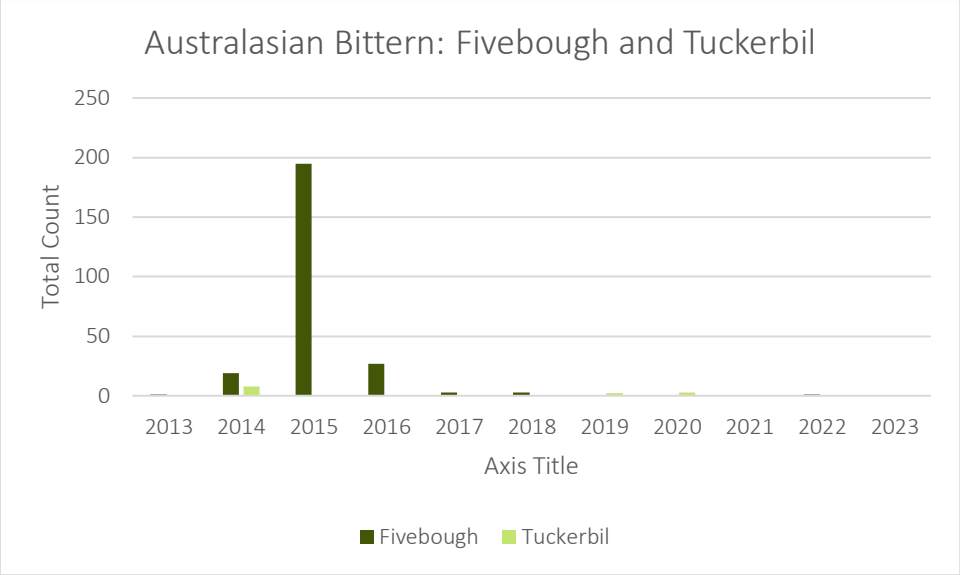

Figure 6: Australian Bittern presence and abundance at Fivebough and Tuckerbil wetlands (Data source: DCCEEW, 2024)

Australasian Bittern

The Australasian Bittern (*Botaurus poiciloptilus*) counts at Fivebough and Tuckerbil Wetlands from 2013 to 2023 show significant fluctuations. The peak year was 2015, with a count of 195 birds. Notable counts were also recorded in 2014 and 2016, with 27 birds each year, primarily at Fivebough (Bionet, 2025). However, a sharp decline was observed from 2017 onwards, with single-digit counts becoming the norm. Fivebough Wetland consistently hosted larger numbers than Tuckerbil, with Tuckerbil's highest count being 8 birds in 2014. Due to lack of surveys, no birds were recorded in 2021 and 2023 at either wetland. The most recent data from 2022 shows a slight increase with one bird observed at Fivebough.

The recent (within 7 years) decline is particularly significant given the Australasian Bittern's endangered status and the wetlands' historical importance for the species (RIS,2024). Much of the habitat needed to support Australasian Bittern in the Riverina bioregion has been lost (RIS, 2024; Mike Schultz pers. comm.) Fivebough Wetland provides suitable habitat for Australasian Bittern, which favours wetlands with large areas (>5 ha) of tall, dense vegetation dominated by Typha spp. and Phragmites australis (DLWC, 2002). Although the data meets the LACs for this metric, if the observed decline in numbers continues the site may no longer meet the criteria for supporting more than 1% of the estimated south-eastern Australian population of Australasian Bittern, which was a key factor in its Ramsar site designation. Lack of data between 2020-2024 significantly impacts the confidence of this assessment.

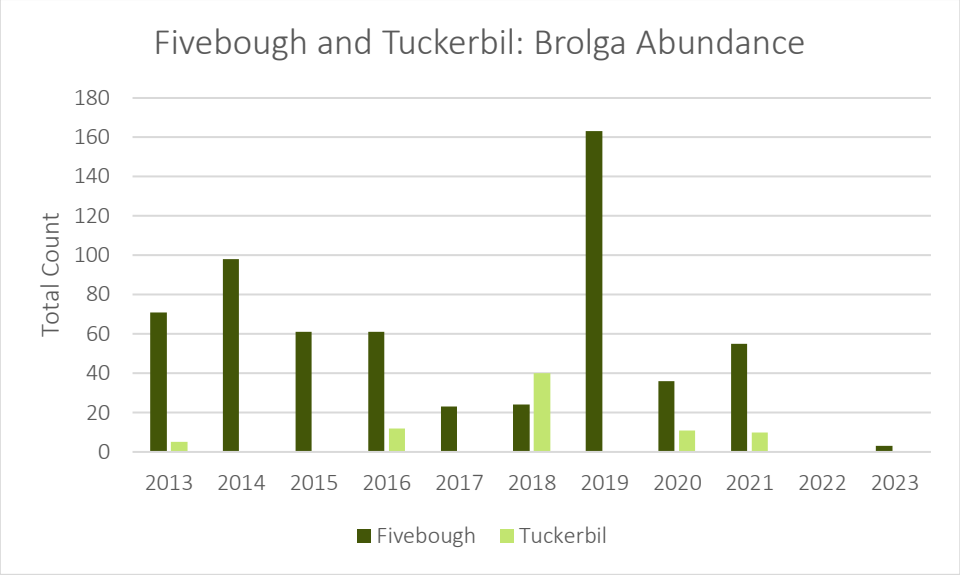

Figure 7: Brolga abundance and presence at Fivebough and Tuckerbil Wetland (Data source: DCCEEW, 2024)

Brolga

The Brolga population at Fivebough and Tuckerbil Wetlands has demonstrated significant variability from 2013 to 2023. Historically, Tuckerbil Wetland has served as a critical post-breeding roost site, accommodating up to 130 individuals (ECD, 2018), potentially representing more than 1% of the southern Australian population. Between 2013-2023, the peak year for Brolga observations was 2019, with 163 birds recorded exclusively at Fivebough Wetland, followed by 98 birds in 2014. Fivebough consistently hosted larger numbers compared to Tuckerbil, with the latter's highest count being 40 birds in 2018. The Ramsar site criteria specify that over a ten-year period, substantial Brolga roosting should occur in at least nine years, a threshold potentially not met by the current data. Brolgas historically roost in open areas at Tuckerbil Wetland, out of, but immediately adjacent to, inundated areas. Without inundation and regular ecological monitoring data is cannot be determined if environmental variables contribute to the decline in species sightings.

Internationally Protected Species:

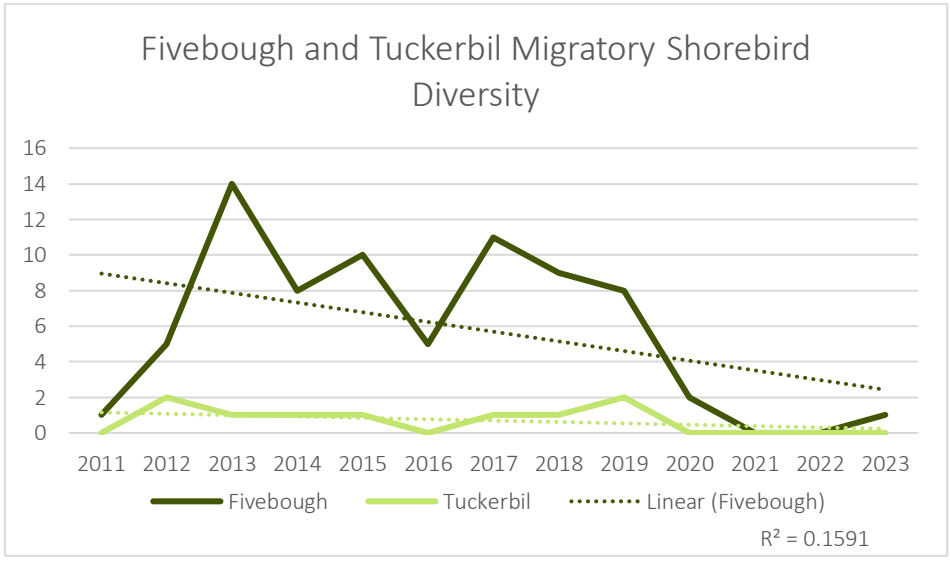

Figure 8: Threatened and migratory waterbird presence at Fivebough and Tuckerbil Wetland (Data source: DCCEEW, 2024)

At the time of listing, the wetlands were designated as important for migratory waterbirds as 24 species recorded at Fivebough Wetland and 13 species at Tuckerbil Wetland are listed under the Japan-Australia and/or the China-Australia Migratory Bird Agreements (JAMBA and CAMBA). The wetlands support seventeen species of waterbirds listed under the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Between 2013 and 2023, 16 migratory waterbird species were recorded at Fivebough Wetland (Bionet, 2025), 13 of which were migratory shorebirds (see Table 3). At Tuckerbil, three migratory waterbirds were recorded, including one migratory shorebird, the Black-winged Stilt (Bionet, 2025). Of the 13 migratory waterbird species recorded at Fivebough and the three recorded at Tuckerbil, all were listed under the Japan-Australia (JAMBA), China-Australia (CAMBA) Migratory Bird Agreements or Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) Migratory Bird Agreements (DCCEEW, 2024). This suggests a significant decline in migratory waterbird occurrences at both Fivebough and Tuckerbil Wetlands from historic norms. However, the lack of data between 2020-2024 may be significantly influencing this assessment.

Table 3 : Threatened and listed migratory species present at Fivebough and Tuckerbil Wetlands. (Data source: Bionet, 2025)

Common Name	Scientific Name	Comm Status	CAMBA	JAMBA	ROKAMBA
Australasian Bittern	*Botaurus poiciloptilus*	E			
Australian Painted Snipe	*Rostratula australis*	E			
Bar-tailed Godwit	*Limosa lapponica*		L	L	L
Black-tailed Godwit	*Limosa limosa*	E	L	L	L
Caspian Tern	*Hydroprogne caspia*			L	
Common Greenshank	*Tringa nebularia*		L	L	L
Curlew Sandpiper	*Calidris ferruginea*	CE	L	L	L
Latham's Snipe	*Gallinago hardwickii*	V		L	L
Marsh Sandpiper	*Tringa stagnatilis*		L	L	L
Pacific Golden Plover	*Pluvialis fulva*		L	L	L
Pectoral Sandpiper	*Calidris melanotos*		L	L	
Red-necked Stint	*Calidris ruficollis*		L	L	L
Sharp-tailed Sandpiper	*Calidris acuminata*		L	L	L
Wood Sandpiper	*Tringa glareola*		L	L	L
Gull-billed Tern	*Gelochelidon nilotica*		L		
Eastern Great Egret	*Ardea modesta*	M			
Eurasian Coot	*Fulica atra*				
Black-winged Stint	*Himantopus himantopus*	M			

1 *V-vulnerable, E- endangered, CE – critically endangered, M-migratory waterbird not listed, L- Listed. Species listing statuses were extracted from Bionet data (extraction date, January 2025). As listing statuses are subject to regular updates, changes may not be reflected in this dataset..

5.2 Vegetation and waterbird habitat assessment

The objective of the site assessment was to determine the presence/absence of Plant Community Types (PCTs) and water bird habitat types as described in the Fivebough and Tuckerbil Wetlands Ramsar Site Ecological Character Description (DEC 2006). The method employed to validate PCTs, was a random meander survey, a standard technique developed by Cropper (1993). In this approach, the surveyor walks in a non-predetermined pattern throughout the study area, recording dominant and key characteristic Plant Community Type flora species, threatened species and noxious weeds.

Objective 1 - To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, in particular, threatened species, migratory waders and those species found at the site in numbers greater than their 1% population estimate

Synthesis of findings:

The vegetation communities of Fivebough and Tuckerbil Wetlands have been significantly altered by hydrological modifications, land-use changes, and shifting soil and water chemistry. Historically, Fivebough supported a **Black Box (*Eucalyptus largiflorens*)** grassy woodland-fringed freshwater sedgeland, while Tuckerbil was dominated by swamp grassland with a **Black Box–Lignum (*Duma florulenta*)** woodland fringe. Clearing, grazing, fire, and hydrological change, including altered inundation regimes, have transformed these ecosystems, resulting in a mix of modified remnant vegetation communities, native regrowth, and the spread of introduced species.

Fivebough, once ephemeral, now functions as a permanent but fluctuating fresh-brackish wetland. Prolonged historical inundation led to **Black Box** dieback and the expansion of **Cumbungi (*Typha spp.*)** and **Water Couch (*Paspalum distichum*)**. Today, this wetland supports a mosaic of **tall marsh, grassland, shrubland, and woodland**, with **Black Roly-poly (*Sclerolaena muricata*)** colonisation and **Black Box** regeneration at the margins. Five waterbird habitat types were identified in 2024: **Chenopod woodland, Couch grass grassland, Cumbungi wetland/open water mosaic, chenopod shrublands, and sedge-dominated wetland**, corresponding to several **Plant Community Types (PCTs)**, albeit in moderate condition.

Tuckerbil remains a **swamp grassland wetland**, though highly modified. Its vegetation varies along hydrological gradients, with **Pale Spike-rush (*Eleocharis pallens*)**, **Marsh Club-rush (*Bolboschoenus caldwelli*)**, and **Swamp Canegrass (*Eragrostis australasica*)** dominating different zones. Historical **Black Box–Lignum** woodland has largely transitioned to shrubland and grassland. In 2024, five waterbird habitat types were identified: **tall sedgeland wetland, open water, low spike-sedge wetland, modified woodland, and grassy meadow/chenopod shrubland complex**, aligning with six **PCTs**. Both wetlands remain dynamic, responding to fluctuating hydrological regimes and a changing climate.

Objective 1 - To actively conserve and enhance the wetlands to provide a range of habitats for waterbirds, in particular, threatened species, migratory waders and those species found at the site in numbers greater than their 1% population estimate.

Recommendations:

Maintain and Restore Hydrological Regimes

- Implement **hydrological management** that maintains wetting and drying cycles to support diverse waterbird foraging and breeding habitats.
- Ensure **shallow water and exposed mudflats** persist during key migration periods for waders.
- Manage water levels to sustain **shallow foraging areas** for migratory waders while ensuring deeper water refuges for diving birds.
- Coordinate environmental water deliveries to align with key breeding and migration periods.
- Avoid prolonged inundation that could lead to habitat degradation, particularly in **Cumbungi wetlands** and **sedge-dominated areas**.

Enhance and Protect Key Vegetation Communities and Habitat Types

- Protect existing **Cumbungi (*Typha* spp.)** beds and **tall sedgeland wetland** to provide nesting habitat for Australasian Bittern and other waterbirds.
- Encourage **Lignum (*Duma florulenta*) regeneration** in shrubland wetlands to improve nesting and roosting sites for **Glossy Ibis** and other colonial breeders.
- Restore **Black Box woodland** along wetland margins to improve habitat complexity and connectivity
- Manage the encroachment of **Black Roly-poly (*Sclerolaena muricata*)** into sedgeland and marsh areas to maintain diverse habitat structure.

Monitor and Adapt Habitat Management

- Implement annual or biannual **vegetation community and habitat type condition and extent mapping and monitoring** to assess habitat condition and inform adaptive management strategies.
- Include an evaluation of **Ramsar ecological character descriptions** in a monitoring program to ensure the wetlands continue to meet international conservation objectives.
- Implement a water quality and water depth monitoring program.
- Develop a waterbird habitat/ vegetation management plan that includes weeds and over abundant native flora management.

Vegetation communities and habitat types

The vegetation communities of Fivebough and Tuckerbil Wetlands have changed dramatically since European settlement due to altered hydrology, land-use practices, and shifts in soil and water chemistry. These wetlands, historically brackish to freshwater and seasonally ephemeral, also rely partially on groundwater for their water source (DCCEEW, 2012). Fivebough likely supported a freshwater sedgeland wetland fringed by Black box (*Eucalyptus largiflorens*) grassy woodland, while Tuckerbil was dominated by swamp grassland with a fringe of Black box – Lignum (*Duma florulenta*) woodland.

Agricultural clearing, grazing, altered inundation regimes, and fire have significantly modified these vegetation communities. Today, the vegetation reflects a combination of native regrowth, changes to hydrology, and the establishment of introduced exotic species and opportunistic, colonising native species. These wetlands are in a state of transition, exhibiting characteristics of both their historical conditions and the impacts of human intervention. The highly modified nature of these wetlands is evident in their current hydrology. Fivebough

Swamp, once an ephemeral wetland, now functions as a permanent but fluctuating fresh-brackish shallow wetland due to regular releases of treated effluent from the Leeton sewage treatment plant. Similarly, Tuckerbil Swamp, while still seasonal, receives environmental water allocations that have altered its natural hydrological regime.

These wetland systems remain dynamic, with vegetation communities shifting seasonally and in response to climatic variations. The transition state is further complicated by the impacts of climate change, which introduces additional variability and challenges in maintaining ecological character. As a result, the vegetation recorded can differ widely across an annual cycle, reflecting the ongoing adaptation of these ecosystems to changing environmental conditions.The current state of these wetlands represents a complex interplay between their pre-European conditions and the significant modifications they have undergone. This transitional state presents both challenges and opportunities for management, as these ecosystems continue to evolve in response to environmental changes and conservation efforts.

Fivebough Wetland

Historically, Fivebough Wetland likely supported the Plant Community Type (PCT) *Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains* (PCT 53) that graded into *Black box grassy open woodland wetland of rarely flooded depressions in south western NSW (Riverina Bioregion and Murray Darling Depression Bioregion)* (PCT 16). This type of sedgy wetland occurs on grey and brown clays, including gilgais on low lying flats or depressions on floodplains. Extended inundation from this site's use as an irrigation drainage basin led to the dieback of Black box woodland trees, and encouraged the colonisation of dense stands of Cumbungi (*Typha* spp.) and Water couch (*Paspalum distichum*). Subsequent fires in the 1960s reduced Cumbungi cover, leaving large areas of bare mud, and by 2000, approximately 50 % of the wetland was bare substrate.

Today, the wetland supports a mosaic of tall marsh communities, grassland, shrubland, introduced pasture species, and weeds. Past flooding and drying events have prompted colonisation by Black roly-poly (*Sclerolaena muricata*) and regeneration of Black box grassy woodlands on the wetland periphery. The understory in these woodland areas consists of a range of native grasses with a sparse cover of chenopod shrubs, including Spiny saltbush (*Rhagodia spinescens*), Creeping saltbush (*Atriplex semibaccata*), and Black cotton bush (*Maireana decalvans*), as well as various native forbs.

In December 2024, five waterbird habitat types were identified at Fivebough Wetland: chenopod woodland, Couch grass grassland, Cumbungi wetland/ open water mosaic, chenopod shrublands, and sedge dominated wetland. These habitat types, while now naturalised, reflect responses to the site's significantly altered conditions compared to pre-European benchmarks. Changes in the vegetation community have been influenced by historical clearing, modified hydrology, and the spread of introduced flora species. This shift in habitat types underscores the interaction between ecological processes and human impacts, where historical disturbances and altered environmental conditions have shaped the vegetation into forms aligning with specific Plant Community Types. The extant vegetation communities of these habitat types exhibit characteristics most closely associated with the following six Plant Community Types (Figure 9):

PCT 15 – *Black Box Open Woodland wetland with Chenopod understory mainly on the outer floodplains ins South-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)* (Photo 1 and Photo 2)

PCT 216 – *Black Rolypoly low open shrubland of the Riverina Bioregion and Murray Darling Depression Bioregion* (Photo 3)

PCT 50 – *Couch grass grassland wetland on riverbanks and floodplains of inland river systems* (Photo 4)

PCT 182 – *Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses* in mosaic with PCT 238 – *Permanent and semi-permanent freshwater lakes wetland of the inland slopes and plains* (Photo 5)

PCT 53 – *Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains* (Photo 6)

While these Plant Community Types are likely the best fit categories for the extant vegetation communities at the time of 2024 site assessment, their compostion can only be considered to be in moderate condition relative to Plant Community Type benchmarks. This moderate condition is due to the absence of many native characteristic flora species and altered species compositions relatove to the formal descriptions of these PCTs.

Further, these PCTs fit into four Ramsar waterbird habitat types as summarised in the following table.

Table 4 Fivebough Wetland Ramsar ecological character descriptions for extant vegetation and waterbird habitat types

Ramsar Waterbird Habitat Type	Plant Community Type (PCT)	Plant Community Type sub-description
Open chenopod woodland	PCT 15 – *Black Box Open Woodland wetland with Chenopod understory mainly on the outer floodplains ins South-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)*	Chenopod woodland with sparsely scattered Black box and a chenopod ground layer variously composed of low-growing chenopod shrubs interspersed with scattered exotic and native grasses and forbs.
	PCT 216 – *Black Rolypoly low open shrubland of the Riverina Bioregion and Murray Darling Depression Bioregion*	Low, open chenopod shrubland/ Couch grass (*Cynodon dactylon*) grassland complex with a heavy presence of exotic grasses.
Cumbungi beds/ Tall sedgeland wetland/ open water mosaic	PCT 182 – *Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses*	Dense stands of Cumbungi (*Typha* spp.) fringing areas of open water of various depths. Patches of sedgeland wetland dominated by Marsh Club-rush (*Bolboschoenus caldwelli*) were also present.
Shallowly inundated or muddy wetland mosaic with patchy vegetation cover	PCT 53 – *Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains*	Sedgeland wetland variously dominated by dense stands of Marsh Club-rush (*Bolboschoenus caldwelli*) and the exotic grass Annual Beardgrass (*Polypogon monspeliensis**). Scattered areas of open bare ground also present and occasional stands of Cumbungi (*Typha* spp.)
Grassy meadow/ Open shrublands mosaic	PCT 50 – *Couch grass grassland wetland on riverbanks and floodplains of inland river systems*	Highly modified Couch grass wetland variously dominated by Couch grass (*Cynodon dactylon*), Water couch (*Paspalum distichum*) and a range of exotic and introduced pasture grass species.

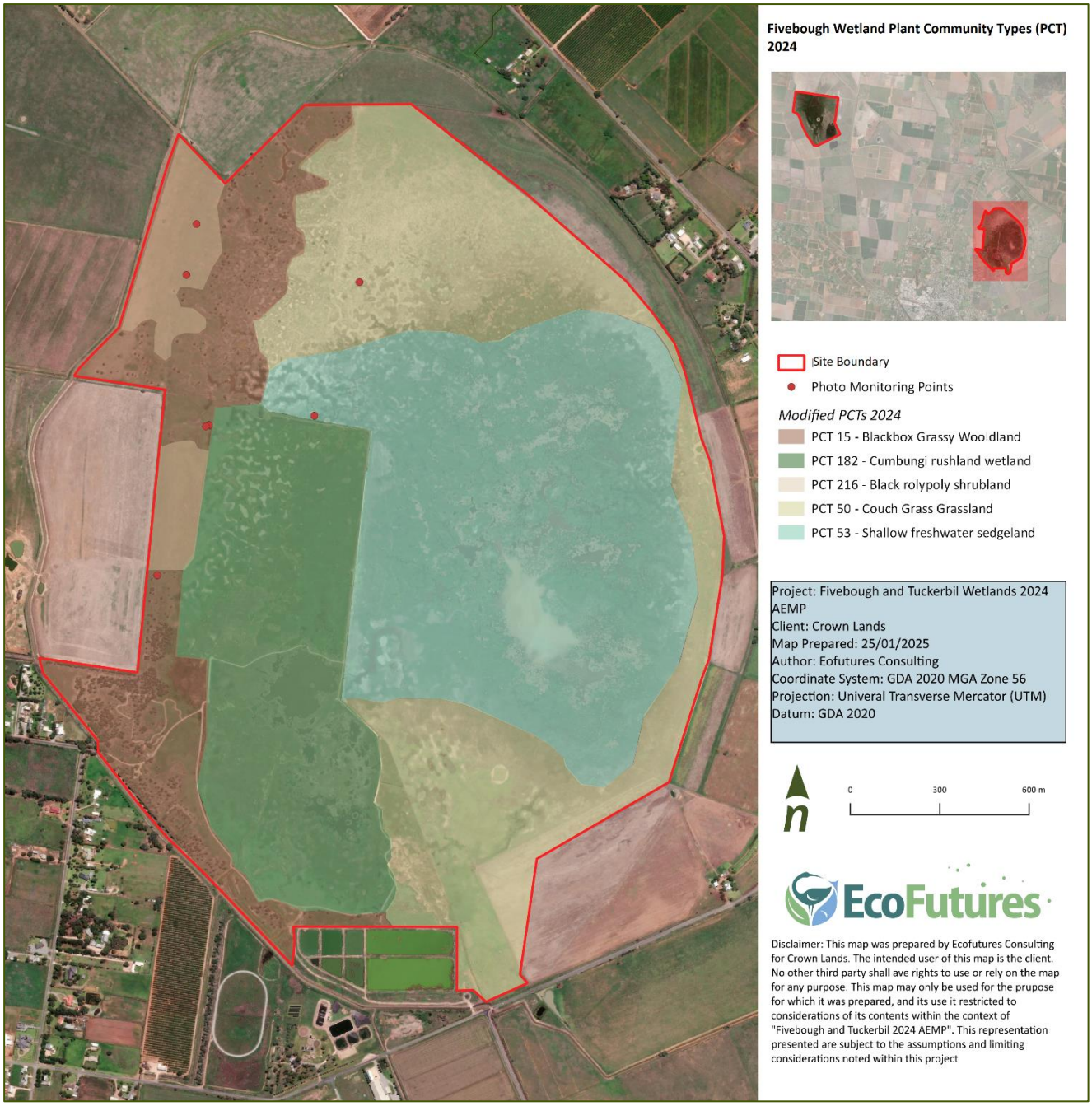

Figure 9: Fivebough Wetland Plant Community Types (PCT) extents 2024

Photo 1 Fivebough Wetland *Black Box Open Woodland wetland with Chenopod understory mainly on the outer floodplains ins South-western NSW* (PCT 15), December 2024

Photo 2 Fivebough Wetland Revegetated area of *Black Box Open Woodland wetland with Chenopod understory*, December 2024

Photo 3 Fivebough Wetland *Black Rolypoly low open shrubland of the Riverina Bioregion and Murray Darling Depression Bioregion* (PCT 216)

Photo 4 Fivebough Wetland *Couch grass grassland wetland on riverbanks and floodplains of inland river systems* (PCT 50), December 2024

Photo 5 Fivebough Wetland *Cumbungi rushland wetland of shallow semi-permanent water bodies and inland watercourses* (PCT 182) and *Permanent and semi-permanent freshwater lakes wetland of the inland slopes and plains* (PCT 238), December 2024

Photo 6 Fivebough Wetland *Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains* (PCT 53), December 2024

Tuckerbil Wetland

Tuckerbil Wetland is predominantly covered by swamp grassland, albeit in a modified state relative to its typology as *Swamp grassland wetland of the Riverine Plain* (PCT 47). This PCT typically occurs on grey cracking clays in swamps and depressions of the Riverine Plain within the Riverina Bioregion. Intact remnants of this community are characterised by grasslands and forb-dominated vegetation, including species such as Common blown grass (*Lachnagrostis filiformis*), Brown-back wallaby-grass (*Rytidosperma duttoniana*), and Billy buttons (*Pycnosorus globosus*). However, at Tuckerbil, the highly modified wetland community displays spatial variation in dominant species, reflecting altered conditions. Dominant species vary across the swamp grassland, ranging from graminoids like Pale spike-rush (*Eleocharis pallens*) and Marsh club-rush (*Bolboschoenus caldwelli*) to grass species such as Swamp cane grass (*Eragrostis australasica*).

Previous assessments documented Cumbungi (*Typha spp.*) as dominant in the central western areas and parts of the Stony Point Main Drain to the north, while Water Couch (*Paspalum distichum*) occurred in the wetter north-western sections (Wetland Care 2014), and Swamp cane grass has been recorded as dominating part of the Wetland's central area (NGH 2024). Additionally, recent flooding and drying cycles have facilitated the expansion of Black roly-poly (*Sclerolaena muricata*) and other chenopods, leading to the majority of Tuckerbil being mapped as Black Roly-poly shrubland in 2020 (NGH 2020). The vegetation composition also transitions along the hydrology gradient, shifting from drier outer rims to areas with semi-permanent or permanent water. Historically, the fringing vegetation community was likely *Black box–Lignum woodland wetland of the inner floodplains* (PCT 13), though much of the overstory has been lost, transitioning into grassland or shrubland communities.

Despite these alterations,various waterbird habitat types were identified during the December 2024 assessment: tall sedgeland wetland, open water of varying depths, low spike-sedge wetland, modified woodland, grassy meadow/ chenopod shrubland complex, and Lignum (*Duma florulenta*) shrubland wetland. The extant vegetation communities of these habitat types exhibit characteristics that have close affinity to the following six Plant Community Types (Figure 10):

PCT 13 – *Black box–Lignum woodland wetland of the inner floodplains*

PCT 216 – *Black Rolypoly low open shrubland of the Riverina Bioregion and Murray Darling Depression Bioregion*

PCT 17 – *Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)*

PCT 238 – *Permanent and semi-permanent freshwater lakes wetland of the inland slopes and plains* (this PCT occured in mosaic with PCT 47 – *Swamp grassland wetland of the Riverine Plain*)

PCT 53 – *Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains*

PCT 47 – *Swamp grassland wetland of the Riverine Plain*

While these Plant Community Types are likely the best fit categories for the extant vegetation communities at the time of 2024 site assessment, their compostion can only be considered to be in moderate condition relative to Plant Community Type benchmarks. This moderate condition is due to the absence of many native characteristic flora species and altered species compositions relatove to the formal descriptions of these PCTs.

Further, these PCTs fit into five Ramsar waterbird habitat types as summarised in the following table (Table 4).

Table 5 Tuckerbil Wetland Ramsar ecological character descriptions for extant vegetation and waterbird habitat types

Ramsar Waterbird Habitat Type	Plant Community Type (PCT)	Plant Community Type sub-description
Grassy meadow/ Open chenopod shrublands mosaic	PCT 216 – *Black Rolypoly low open shrubland of the Riverina Bioregion and Murray Darling Depression Bioregion*	Chenopod shrubland/ Couch grass (*Cynodon dactylon*) grassland complex
Cumbungi beds/ Tall sedgeland wetland/ open water mosaic	PCT 47 – *Swamp grassland wetland of the Riverine Plain*	Brackish sedgeland wetland dominated by Marsh Club-rush (*Bolboschoenus caldwelli*) intermixed with brackish aquatic herbland including Red Water-milfoil (*Myriophyllum verrucosum*), Stoneworts (*Characeae* spp.) and Pondweed (*Potamogeton* spp.), and dwarf floating aquatic herbland with areas of open water.
Shallow inundated or muddy wetland mosaic	PCT 53 – *Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains*	Spike-sedge wetland variously dominated by Pale spike rush (*Eleocharis pallens*) and Common spike rush (*Eleocharis acuta*). Other common species included Marsh Club-rush (*Bolboschoenus caldwelli*), Common nardoo (*Marsilea drummondii*), and tall rushes (*Juncus* spp).
Woodland	PCT 15 – *Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)*	Open Black box woodland with characterised by scattered Lignum (*Duma florulenta*), Nitre Goosefoot (*Chenopodium nitrariaceum*) and a ground layer composed of low chenopod shrubs and predominantly exotic grasses.
Lignum shrubland wetland	PCT 17– *Lignum (Duma florulenta) shrubland wetland of semi-arid (warm plains) Riverina Bioregion*	Open shrubland commonly up to 2 m, canopy species dominated by Lignum (*Duma florulenta*) often with Nitre Goosefoot (*Chenopodium nitrariaceum*) and a low cover of Canegrass (*Eragrostis australasica*).

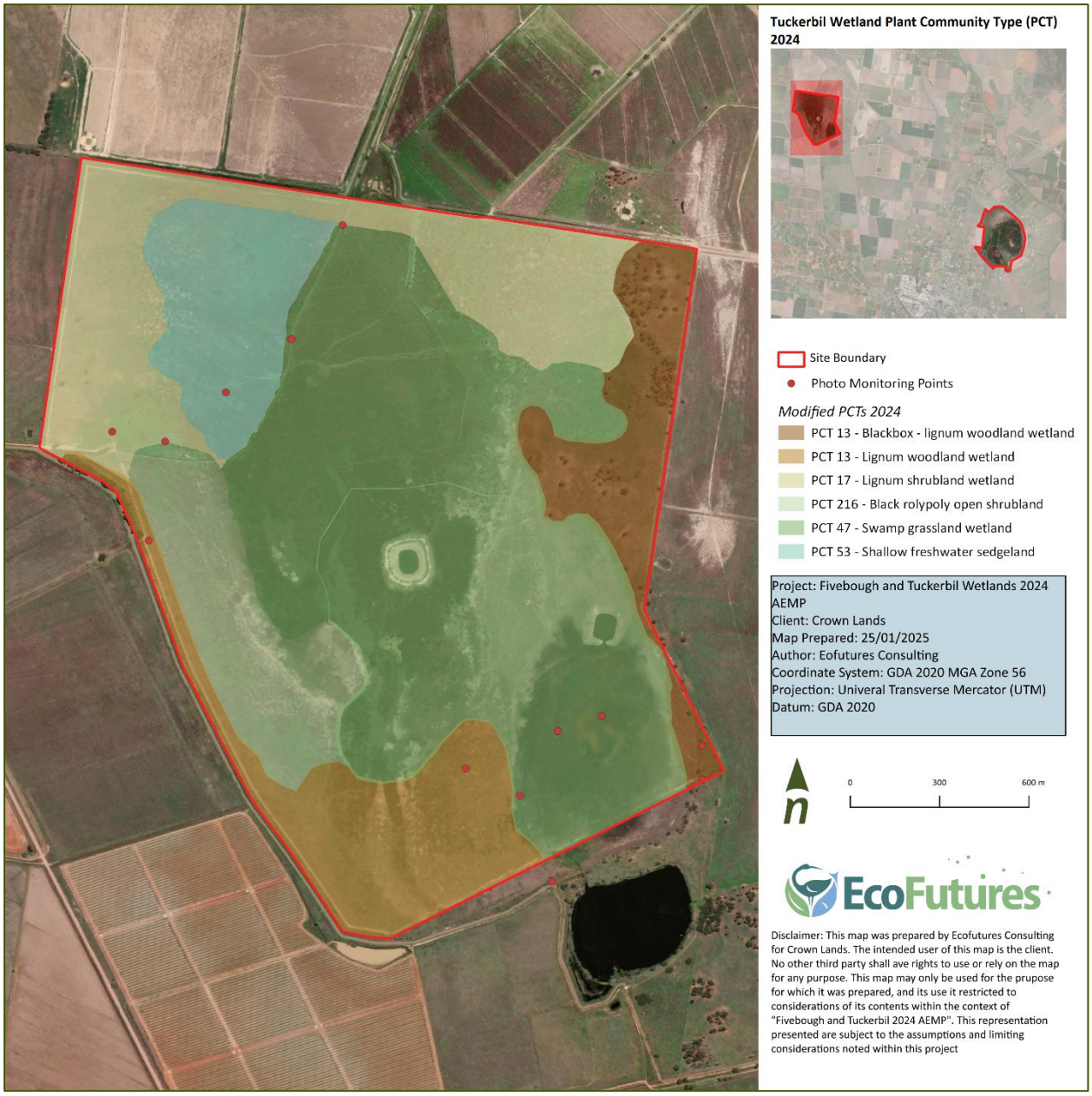

Figure 10: Tuckerbil wetland Plant Community Types (PCT) extents December 2024

Photo 7 Tuckerbil Wetland *Black box–Lignum woodland wetland of the inner floodplains* PCT 13, December 2024

Photo 8 Tuckerbil Wetland *Black Rolypoly low open shrubland of the Riverina Bioregion and Murray Darling Depression Bioregion* (PCT 216), December 2024

Photo 9 Tuckerbil Wetland *Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)* (PCT 17), December 2024

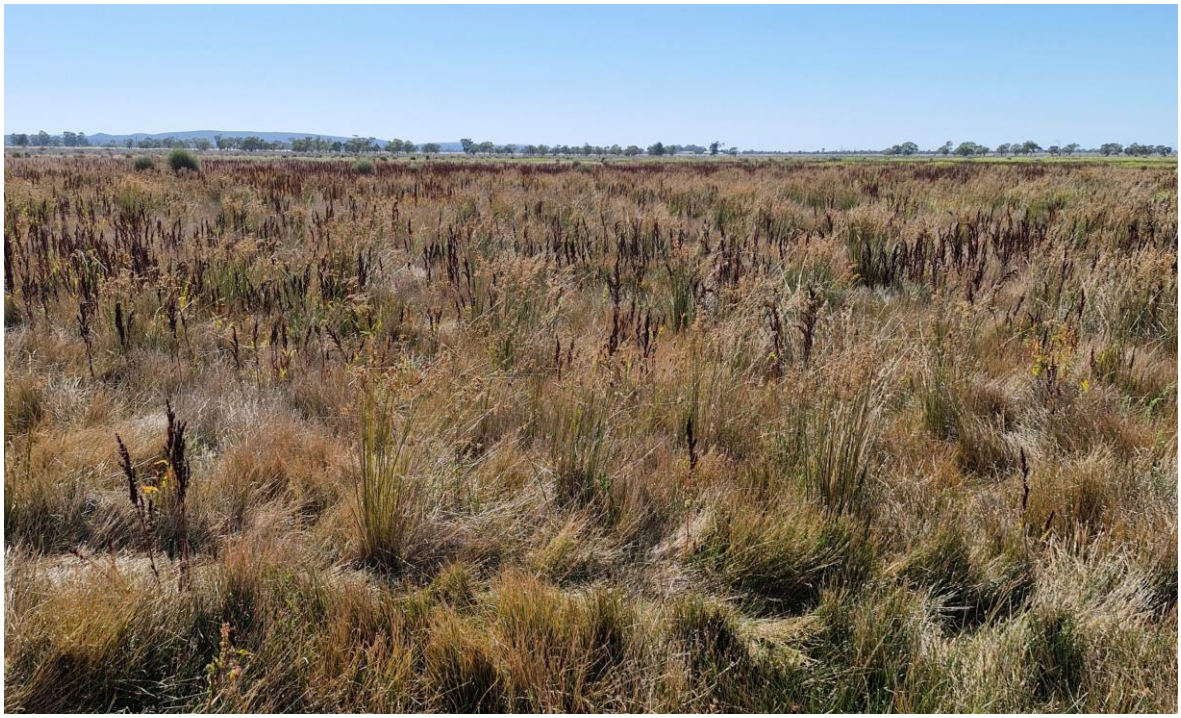

Photo 10 Tuckerbil Wetland *Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains* (PCT 53), December 2024

Photo 11 Tuckerbil Wetland *Swamp grassland wetland of the Riverine Plain* (PCT 47) in mosaic with *Permanent and semi-permanent freshwater lakes wetland of the inland slopes and plains* (PCT 238), December 2024

Waterbird Habitat

The ecological character of Fivebough and Tuckerbil Wetlands has undergone significant transformation due to hydrological modifications, land-use changes, and shifts in soil and water chemistry. Historically, Fivebough supported a Black Box (*Eucalyptus largiflorens*) grassy woodland-fringed freshwater sedgeland, while Tuckerbil was characterised by swamp grassland with a Black Box–Lignum (*Duma florulenta*) woodland fringe. These wetlands were shaped by natural cycles of inundation and drying, which maintained a dynamic mosaic of vegetation types and supported a diverse array of waterbird species.

The numbers and diversity of waterbirds at Fivebough and Tuckerbil Wetlands are a function of the hydrology and vegetation of the site. Areas of dense wetland vegetation such as Cumbungi (*Typha* spp.) and Marsh Club-rush (*Bolboschoenus caldwelli*) provide shelter for some species, while the extent of bare areas and sparse vegetation cover, which are shallowly inundated or drying, are important for wader bird habitat.

However, extensive clearing, grazing, fire, and altered hydrological regimes have reshaped these ecosystems. Fivebough, once an ephemeral wetland, has been converted into a permanent yet fluctuating fresh-brackish system, while Tuckerbil, historically a shallower and more transient wetland, has experienced substantial vegetation shifts due to prolonged modifications to its natural water regimes. The altered hydrology has led to Black Box dieback in Fivebough and the expansion of Cumbungi (*Typha spp.*) and Water Couch (*Paspalum distichum*), resulting in a highly modified yet still ecologically valuable landscape.

Today, Fivebough Wetland functions as a fluctuating but permanent wetland, providing habitat for a succession of waterbird species throughout its annual wetting-drying cycle. Different species use the wetland at various stages as water levels recede, each responding to preferred foraging depths. Areas of dense wetland vegetation, such as Cumbungi and Marsh Club-rush (*Bolboschoenus caldwelli*), offer shelter for some species, while shallowly inundated or drying bare areas provide critical habitat for waders.

Fivebough now supports a mosaic of tall marsh, grassland, shrubland, and woodland. Black Roly-poly (*Sclerolaena muricata*) has begun colonising, and some Black Box regeneration is occurring at the margins. In 2024, five distinct waterbird habitat types were identified (see Table 5), corresponding to several Plant Community Types (PCTs) in moderate condition.

Tuckerbil Wetland remains a swamp grassland, though its vegetation is now strongly structured by hydrological gradients. Pale Spike-rush (*Eleocharis pallens*), Marsh Club-rush, and Swamp Canegrass (*Eragrostis australasica*) dominate different zones, while the historical Black Box–Lignum woodland has largely transitioned to shrubland and grassland. Tuckerbil generally dries out before Fivebough, providing shallow water and exposed mudflats that are crucial for smaller wader species when water levels in Fivebough remain too high.

In 2024, five waterbird habitat types were identified at Tuckerbil, aligning with six PCTs. Both wetlands continue to respond dynamically to fluctuating hydrological regimes and an increasingly variable climate. Their future ecological character will depend on ongoing water management and conservation efforts to maintain the balance between vegetation structure, habitat availability, and waterbird diversity.

The range and extent of waterbird habitat types are illustrated in Figure 11 and Figure 12, and further described in Table 6.

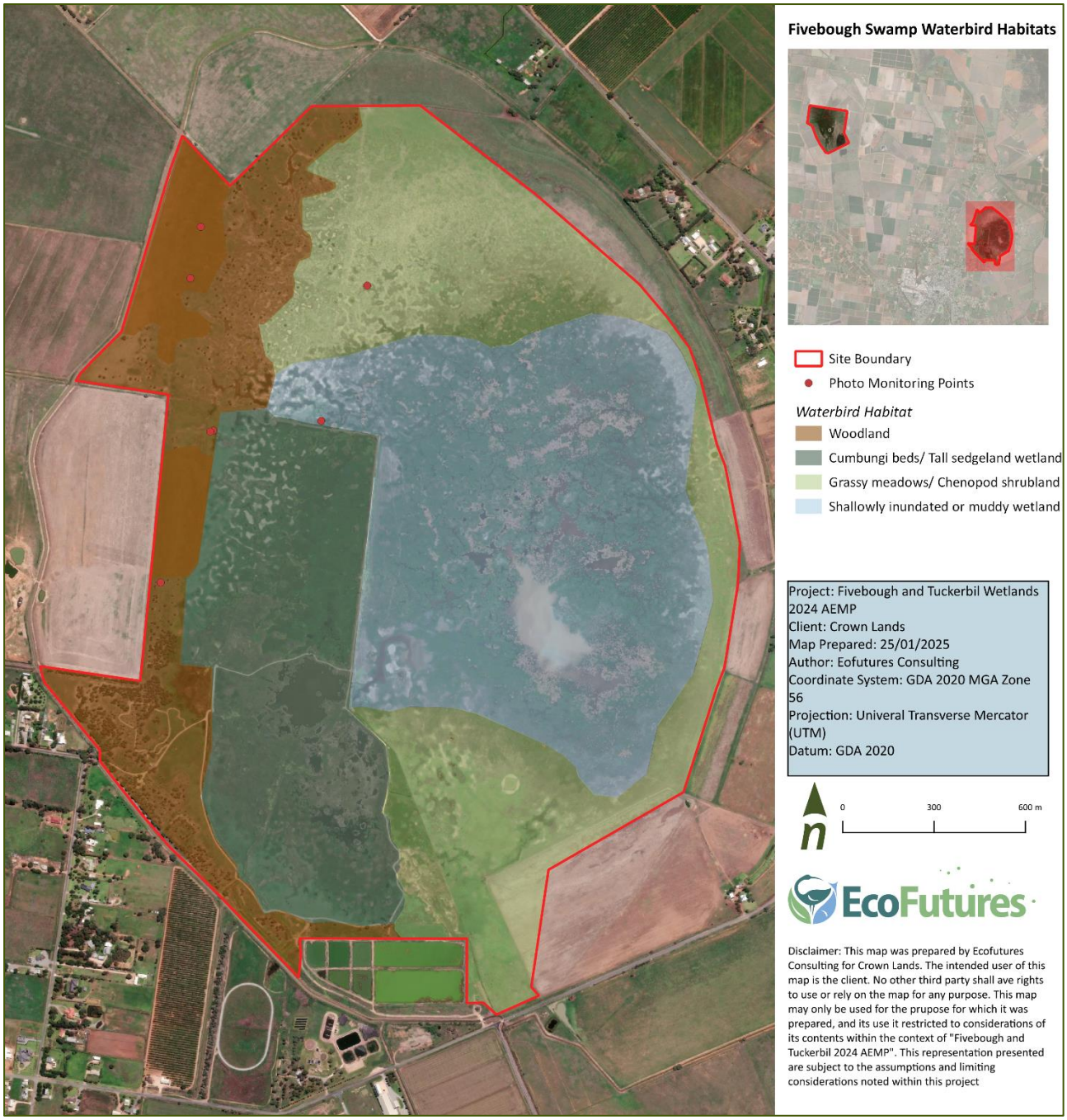

Figure 11: Fivebough Wetland waterbird habitats 2024.

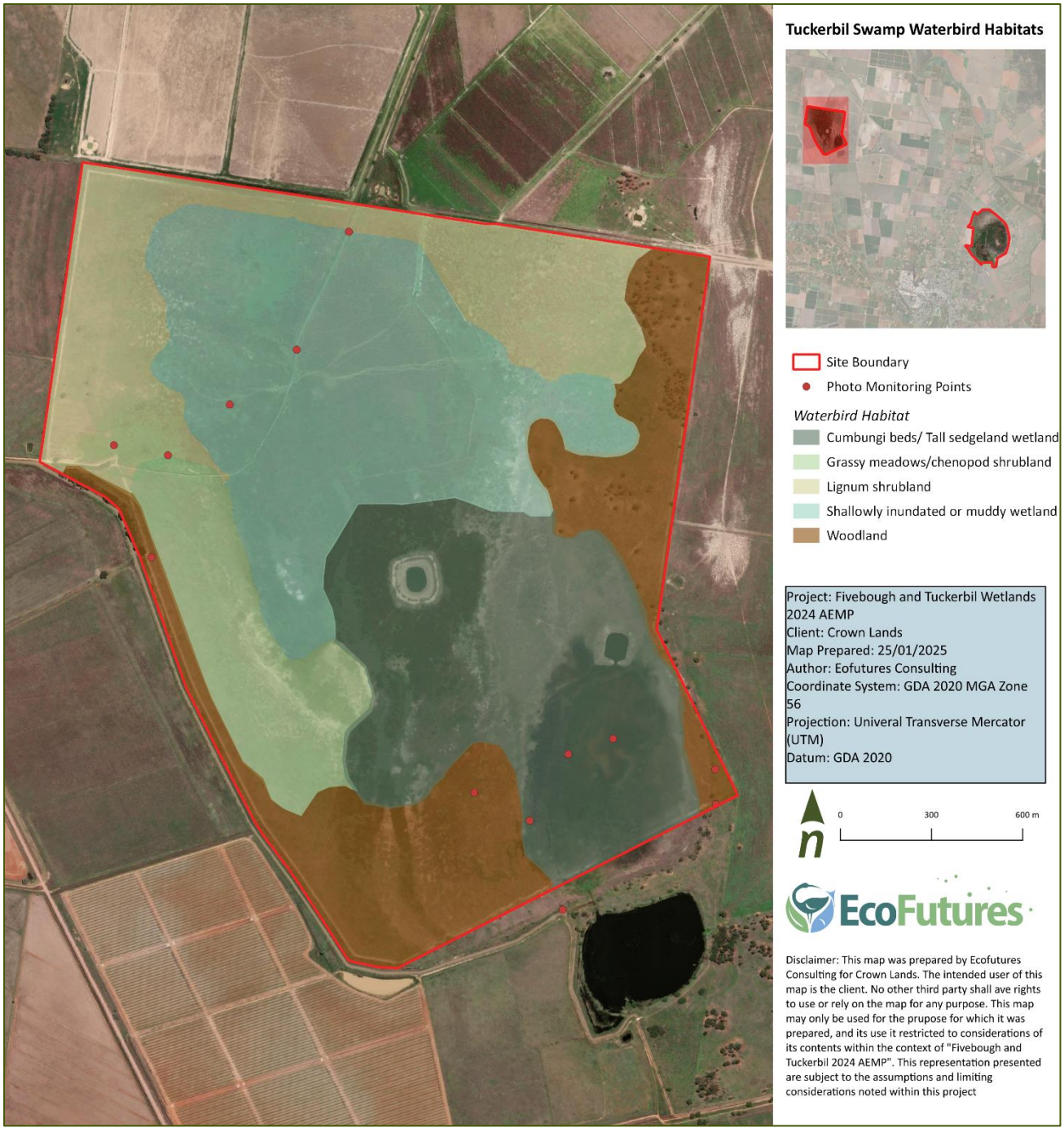

Figure 12: Tuckerbil wetland waterbird habitats 2024

Table 6: Summary of the waterbird habitat types occurring within Fivebough and Tuckerbil Wetlands

Habitat Type	2020 Area (ha)		2024 Area (ha)		Explanatory Notes
	Fivebough	Tuckerbil	Fivebough	Tuckerbil	
Woodland Black Box woodland occurs on the outer edges of Fivebough and Tuckerbil Wetlands. The majority of this woodland is highly modified or has regenerated since past clearing. Sparsely scattered canopy trees (alive and standing dead) occur in mosaic with grassy, chenopod shrubland ground layer. These areas provide habitat for roosting birds such as Glossy Ibis and nesting habitat for a variety of wetland and woodland birds.	32	22	63	58	In 2024 mapping, woodland areas of Fivebough included areas that can be characterised as low chenopod shrubland but are more likely modified Black Box woodland with no canopy trees. At Tuckerbil, areas mapped as woodland in 2024 were previously mapped as *Black Rolypoly shrubland* (NGH 2020). These are areas where cut Black Box stumps are evidence of where woodland once was. Some standing dead stags also remain with few scattered live Black box trees.
Cumbungi beds/ Tall sedgeland wetland in mosaic with open water of variable depths Cumbungi beds (*Typha sp.*) and/ or tall sedgeland wetland occurs in mosaic with open water of variable depth – from deep water to shallow. These areas provide habitat for the Australasian Bittern (and other cryptic birds), which nests in densely vegetated water under deep cover, adjacent to deep water.	39	3.5	69	71	In 2024, *Cumbungi bed wetland mosaic* of Fivebough included areas that were likely previously mapped as S*hallow open water of variable depths.* The *Tall sedgeland wetland* at Tuckerbil was previously mapped as *Black Rolypoly shrubland* and S*hallow open water of variable depths* in 2020.
Shallow open water of variable depth These areas surround permanent deep water and are frequently wet from inflows. These area support habitat for wetland birds such as the Whiskered Tern, Australian Painted Snipe, Sharp Tailed Sandpipers, Brolga and Glossy Ibis.	42	36	-	-	Unable to be mapped at time of assessment in 2024. Inundation data, including water depth, was not available for mapping.

Habitat Type	2020 Area (ha)		2024 Area (ha)		Explanatory Notes
	Fivebough	Tuckerbil	Fivebough	Tuckerbil	
Shallowly inundated or muddy wetland mosaic with patchy vegetation cover. These areas are frequently wet but often dry out. These area support habitat for wetland birds such as the Australian Painted Snipe and Sharp tailed Sandpiper	130	-	114	80	The *Shallowly inundated or muddy wetland mosaic* at Tuckerbil was previously mapped as Black Rolypoly shrubland (NGH 2020)
Grassy meadows/ Chenopod shrubland complex Grassy meadows are only infrequently inundated and often dry out over summer. These areas of grassy meadows are intermixed with areas of scattered low chenopod shrubs. When wet, these areas are habitat for Brolgas and other large waders and migratory shorebirds. When dry, the areas provide habitat for grazing birds such as Glossy Ibis, Australian Wood Duck and others.	150	234	97	26	For Fivebough, the area of *Grassy meadow/ chenopod shrubland complex* remained the same between 2020 and 2024. The discrepancy in areas is likely due to a mapping error in 2020, resulting in the 50 ha difference. At Tuckerbil, this area was mapped as chenopod shrubland (*Black Rolypoly shrubland*) in 2020, (NGH 2020). In 2024, this area was mapped as a broader range of waterbird habitats.
Lignum shrubland wetland An open, tall shrubland dominated by the dense Tangled Lignum (*Duma florulenta*). These areas support habitat for waterbird species that rely on dense, flood-dependent vegetation, such as providing nesting platforms for Glossy Ibis and other waterbirds as well as providing cover for small birds (e.g., Fairywren species). When wet, these areas are habitat for migratory waders such as Sharp-tailed Sandpiper, which forage in the mudflats and shallow water within this open shrubland.	NA		NA	49	*Lignum shrubland wetland* was previously mapped as *Black Rolypoly shrubland* As a tall shrubland, *Lignum shrubland wetland* (up to two metres tall) provides a different waterbird habitat type to *Black Rolypoly shrubland*, that is a low chenopod shrubland.

Photo monitoring points

Photo monitoring points were replicated from the 2020 AEMP. Due to significant vegetation community shifts observed between the 2020 AEMP and the current review, additional photo monitoring points were established to comprehensively document the diverse vegetation communities and waterbird habitat types present at the wetlands. These new points enhance the spatial coverage and representativeness of the monitoring program, allowing for more accurate assessment of ecological changes over time. The complete set of photo monitoring points and their corresponding images are presented in Appendix 2, Table 16.

Figure 13: Fivebough Wetland photo monitoring points surveyed in December 2024. See Appendix 2, Table 16.

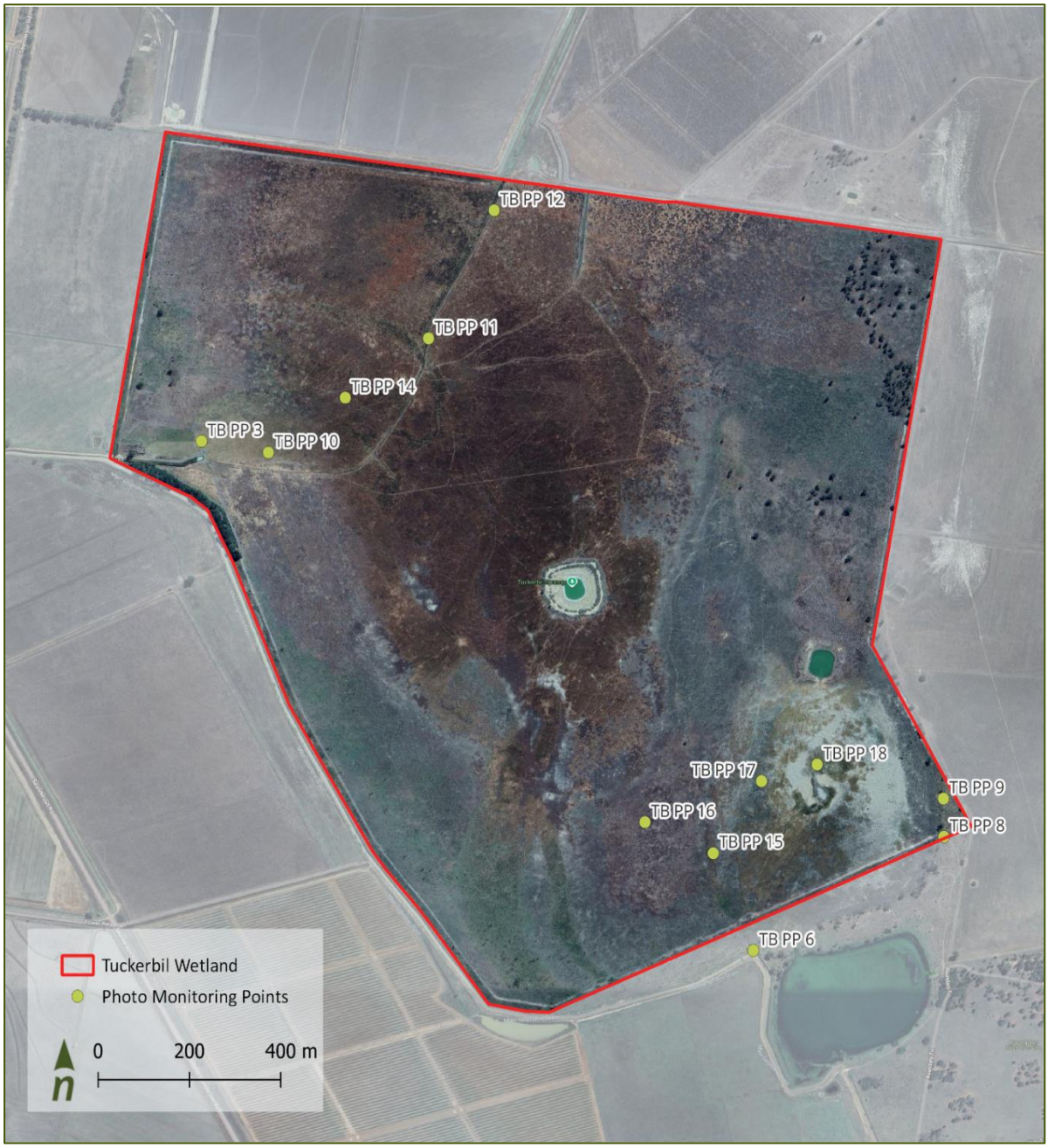

Figure 14: Tuckerbil wetland photo monitoring points surveyed in December 2024. See Appendix 2, Table 16.

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Attachment 1. Waterbird Data

Bird species occurrence at Fivebough and Tuckerbil 2020-2023

Table 7:2020-2023 Bird species occurrence at Fivebough and Tuckerbil Wetlands (DCCEEW, Bionet Atlas, 2024).

Kingdom	Class	Family	Scientific Name	Common Name
Fauna	Aves	Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill
Fauna	Aves	Acanthizidae	*Smicrornis brevirostris*	Weebill
Fauna	Aves	Accipitridae	*Aquila audax*	Wedge-tailed Eagle
Fauna	Aves	Accipitridae	*Circus approximans*	Swamp Harrier
Fauna	Aves	Accipitridae	*Elanus axillaris*	Black-shouldered Kite
Fauna	Aves	Accipitridae	*Haliastur sphenurus*	Whistling Kite
Fauna	Aves	Accipitridae	*Milvus migrans*	Black Kite
Fauna	Aves	Acrocephalidae	*Acrocephalus australis*	Australian Reed-Warbler
Fauna	Aves	Anatidae	*Anas castanea*	Chestnut Teal
Fauna	Aves	Anatidae	*Anas gracilis*	Grey Teal
Fauna	Aves	Anatidae	*Anas rhynchotis*	Australasian Shoveler
Fauna	Aves	Anatidae	*Anas superciliosa*	Pacific Black Duck
Fauna	Aves	Anatidae	*Aythya australis*	Hardhead
Fauna	Aves	Anatidae	*Chenonetta jubata*	Australian Wood Duck
Fauna	Aves	Anatidae	*Cygnus atratus*	Black Swan
Fauna	Aves	Anatidae	*Dendrocygna eytoni*	Plumed Whistling-Duck
Fauna	Aves	Anatidae	*Malacorhynchus membranaceus*	Pink-eared Duck
Fauna	Aves	Anatidae	*Oxyura australis*	Blue-billed Duck
Fauna	Aves	Anatidae	*Tadorna tadornoides*	Australian Shelduck
Fauna	Aves	Anhingidae	*Anhinga novaehollandiae*	Australasian Darter
Fauna	Aves	Anseranatidae	*Anseranas semipalmata*	Magpie Goose
Fauna	Aves	Ardeidae	*Ardea intermedia*	Intermediate Egret
Fauna	Aves	Ardeidae	*Ardea pacifica*	White-necked Heron
Fauna	Aves	Ardeidae	*Ardea/Egretta sp.*	Unidentified Egret
Fauna	Aves	Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern
Fauna	Aves	Ardeidae	*Bubulcus ibis*	Cattle Egret
Fauna	Aves	Ardeidae	*Casmerodius modesta*	Eastern Great Egret
Fauna	Aves	Ardeidae	*Egretta novaehollandiae*	White-faced Heron
Fauna	Aves	Ardeidae	*Nycticorax caledonicus*	Nankeen Night Heron
Fauna	Aves	Artamidae	*Gymnorhina tibicen*	Australian Magpie
Fauna	Aves	Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo
Fauna	Aves	Cacatuidae	*Eolophus roseicapilla*	Galah
Fauna	Aves	Charadriidae	*Charadrius bicinctus*	Double-banded Plover
Fauna	Aves	Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel
Fauna	Aves	Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel

Fauna	Aves	Charadriidae	*Vanellus miles*	Masked Lapwing
Fauna	Aves	Columbidae	*Ocyphaps lophotes*	Crested Pigeon
Fauna	Aves	Corvidae	*Corvus mellori*	Little Raven
Fauna	Aves	Estrildidae	*Taeniopygia guttata*	Zebra Finch
Fauna	Aves	Falconidae	*Falco cenchroides cenchroides*	Nankeen Kestrel
Fauna	Aves	Falconidae	*Falco peregrinus*	Peregrine Falcon
Fauna	Aves	Gruidae	*Grus rubicunda*	Brolga
Fauna	Aves	Hirundinidae	*Hirundo neoxena*	Welcome Swallow
Fauna	Aves	Laridae	*Chlidonias hybrida*	Whiskered Tern
Fauna	Aves	Laridae	*Chroicocephalus novaehollandiae*	Silver Gull
Fauna	Aves	Locustellidae	*Poodytes gramineus*	Little Grassbird
Fauna	Aves	Maluridae	*Malurus cyaneus*	Superb Fairy-wren
Fauna	Aves	Maluridae	*Malurus lamberti*	Variegated Fairy-wren
Fauna	Aves	Maluridae	*Malurus leucopterus*	White-winged Fairy-wren
Fauna	Aves	Meliphagidae	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater
Fauna	Aves	Meliphagidae	*Manorina flavigula*	Yellow-throated Miner
Fauna	Aves	Meliphagidae	*Manorina melanocephala*	Noisy Miner
Fauna	Aves	Meliphagidae	*Philemon corniculatus*	Noisy Friarbird
Fauna	Aves	Meliphagidae	*Plectorhyncha lanceolata*	Striped Honeyeater
Fauna	Aves	Monarchidae	*Grallina cyanoleuca*	Magpie-lark
Fauna	Aves	Passeridae	*Passer domesticus*	House Sparrow
Fauna	Aves	Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican
Fauna	Aves	Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant
Fauna	Aves	Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant
Fauna	Aves	Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant
Fauna	Aves	Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant
Fauna	Aves	Podargidae	*Podargus strigoides*	Tawny Frogmouth
Fauna	Aves	Podicipedidae	*Podiceps cristatus*	Great Crested Grebe
Fauna	Aves	Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe
Fauna	Aves	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe
Fauna	Aves	Psittacidae	*Psephotus haematonotus*	Red-rumped Parrot
Fauna	Aves	Rallidae	*Fulica atra*	Eurasian Coot
Fauna	Aves	Rallidae	*Gallinula tenebrosa*	Dusky Moorhen
Fauna	Aves	Rallidae	*Hypotaenidia philippensis*	Buff-banded Rail
Fauna	Aves	Rallidae	*Porphyrio porphyrio*	Purple Swamphen
Fauna	Aves	Rallidae	*Porzana fluminea*	Australian Spotted Crake
Fauna	Aves	Rallidae	*Porzana tabuensis*	Spotless Crake
Fauna	Aves	Rallidae	*Tribonyx ventralis*	Black-tailed Native-hen
Fauna	Aves	Recurvirostridae	*Cladorhynchus leucocephalus*	Banded Stilt
Fauna	Aves	Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt

Fauna	Aves	Recurvirostridae	*Recurvirostra novaehollandiae*	Red-necked Avocet
Fauna	Aves	Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail
Fauna	Aves	Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper
Fauna	Aves	Scolopacidae	*Tringa glareola*	Wood Sandpiper
Fauna	Aves	Sturnidae	*Sturnus vulgaris*	Common Starling
Fauna	Aves	Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill
Fauna	Aves	Threskiornithidae	*Platalea regia*	Royal Spoonbill
Fauna	Aves	Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis
Fauna	Aves	Threskiornithidae	*Threskiornis moluccus*	Australian White Ibis
Fauna	Aves	Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis

Authors Note 1: Data from the BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°C; ^^ rounded to 0.01°C. Copyright the State of NSW through the Department of Planning, Industry and Environment. Data was clipped to Ramsar boundary with a 220m buffer to include external bird counts of the site (ie. Hooney Rd. Lookout)

Bird survey results for Fivebough Wetland from 2013-2023

Table 8: Quarterly Bird counts at Fivebough Wetlands 2013-2017

Fivebough species	2013				2014						2015				2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Australasian Bittern (*Botaurus poiciloptilus*)						1		2		4				5				1					13
Australasian Darter (*Anhinga novaehollandiae*)	16	1			1	1	1		2	2			1			1			7	4	4	1	42
Australasian Grebe (*Tachybaptus novaehollandiae*)	3	3			3	2		2		4	5			2	1	8	8	4	2	10	4	6	67
Australasian Shoveler (*Anas rhynchotis*)	22	51	84	5	15	30	140	1	3	15	7		44		2	24	22	11	9	2	34	6	527
Australian Gull-billed Tern (*Gelochelidon macrotarsa*)																			28				28
Australian Hobby (*Falco longipennis*)		1	2	1		4	2	2			1	2	3	1	2	2				2			25
Australian Little Bittern (*Ixobrychus dubius*)										9	2				1								12
Australian Pelican (*Pelecanus conspicillatus*)	537	52	67	13	11	60	6	5	4	14	6	1	27	5	6	8	10	2	5	938	16	5	1798
Australian Reed-Warbler (*Acrocephalus australis*)	8	1		11	51	4	4	41	52	59	15	3		50	21		13	20	20	2		45	420
Australian Shelduck (*Tadorna tadornoides*)		33	2	132		65	9	219	1	4	5	34		136	3	11				40		67	761
Australian Spotted Crake (*Porzana fluminea*)	1	5	1		1	4	5	4	3	2	1	6		7	2	3			1	1	2	2	51

Fivebough species	2013				2014						2015				2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Australian White Ibis (*Threskiornis molucca*)	9	3	6	2	12	14	2	11	6	16	7	15	1	4	12	21	38	38	7	6		1	231
Australian Wood Duck (*Chenonetta jubata*)	3	51	12		12	2	4	7		7	8	20	3		4		1	14	2	72	52		274
Baillon's Crake (*Porzana pusilla*)								2	2	2	1			1									8
Banded Lapwing (*Vanellus tricolor*)														1									1
Black Falcon (*Falco subniger*)		2	1									1				2							6
Black Kite (*Milvus migrans*)	3	16		2	11		2	1		1	1	1			11	1			1	1			52
Black Swan (*Cygnus atratus*)	2	64	270	6		218	364	13			4	65	406	30	8	40	370	82	61	39	153	30	2225
Black-fronted Dotterel (*Elseyornis melanops*)	16	5	25		1	62	93	95		5	11	15	15			8	8	1	13	78	16	2	469
Black-shouldered Kite (*Elanus axillaris*)	1	2	1	1	1	3		3		3		2	5		2	2		1	1	1		1	30
Black-tailed Godwit (*Limosa limosa*)	1																						1
Black-tailed Native-hen (*Tribonyx ventralis*)	273	177		3	8				4	13				11						1	9	25	524
Black-winged Stilt (*Himantopus leucocephalus*)	303	372	147	1059	4	240	279	3189	161	108	27	240	450	2500	18	62	190	34	137	77	69	1100	10766
Blue-billed Duck (*Oxyura australis*)																	1	28	3			1	33
Brolga (*Grus rubicunda*)		4	5			16						18			4					6			53
Brown Falcon (*Falco berigora*)	1	3	1		1	1		1							1	1					1		11
Brown Goshawk (*Accipiter fasciatus*)		1																			1		2

Fivebough species	2013				2014						2015				2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Buff-banded Rail (*Gallirallus philippensis*)										1				1									2
Cattle Egret (*Bubulcus ibis*)	4		4	1	4	1		6	3	17	118	4		3	122			28	19			11	345
Chestnut Teal (*Anas castanea*)	50	85	55	63	20	25	32	20	24	25	22	12	6		10	25		5	4	9	32	14	538
Collared Sparrowhawk (*Accipiter cirrocephalus*)			1			1					1				4			1					8
Common Greenshank (*Tringa nebularia*)														7								1	8
Double-banded Plover (*Charadrius bicinctus*)			3				2														3		8
Dusky Moorhen (*Gallinula tenebrosa*)	4	7		2			2	4		9	3	1	3		2	12	4	5	16	21	4	34	133
Eastern Great Egret (*Ardea alba modesta*)	136		7	1	1	1		4	4	19	15	1		3	12	3		6	34	69	5	2	323
Eurasian Coot (*Fulica atra*)	299	111	64	10	2	35	44	216	16	37	67		2		44	29	366	47	221	50	28	79	1767
Freckled Duck (*Stictonetta naevosa*)	250	33	35		9	15	2			4	2				8			5	43	1			407
Glossy Ibis (*Plegadis falcinellus*)	239			89	60		5	2144	1	152	18	5	9	2060	245	2			73			692	5794
Golden-headed Cisticola (*Cisticola exilis*)	2	2	11	5	25	1	8	9	7	10	3	29	7	8	6	4	19	4	11		1	2	174
Great Cormorant (*Phalacrocorax carbo*)	80	8	21	2	12	26	1	6	4	3	1	2	1						216	355	9	6	753
Great Crested Grebe (*Podiceps cristatus*)																		88	5				93
Grey Teal (*Anas gracilis*)	4519	2860	5000	2593	402	455	1058	3206	725	761	292	160	405	1095	176	500	6	75	666	950	816	1600	28320
Hardhead (*Aythya australis*)	84	12	51	70	15	15	4	20	27	39	13	1	5	4			10	23	26	22	10	86	537

Fivebough species	2013				2014						2015				2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Hoary-headed Grebe (*Poliocephalus poliocephalus*)	161	16	125	29	28	9	10	32	18	12						18	51	17	11	3	36	15	591
Intermediate Egret (*Ardea intermedia*)									2	12	5				15			1	2	1			38
Little Black Cormorant (*Phalacrocorax sulcirostris*)	20				22		1	9	13	15	1								17		1		99
Little Curlew (*Numenius minutus*)				1																			1
Little Eagle (*Hieraaetus morphnoides*)												1			1					1			3
Little Egret (*Egretta garzetta*)								1	1	8	3				1				5	1			20
Little Grassbird (*Megalurus gramineus*)	1		11	5	10	2	10	11	9	12	2	16	3	5	17	1	18	2	2	2	12	12	163
Little Pied Cormorant (*Microcarbo melanoleucos*)	10	4	2		2	1	3	1	2	11	2	1	4	1	4	4		1	21	10	33	1	118
Magpie Goose (*Anseranas semipalmata*)															4			3	198				205
Marsh Sandpiper (*Tringa stagnatilis*)	11							9	5	54	10			27	12				2				130
Masked Lapwing (*Vanellus miles*)	33	36	17	38	46	50	32	67	4	11	39	31	13	32	29	86	14	11	39	34	53	40	755
Musk Duck (*Biziura lobata*)	2																1	3	8				14
Nankeen Kestrel (*Falco cenchroides*)		2		4	1		4	2		6	1	2	4	1	3	3		1	1	1	1	5	42
Nankeen Night-Heron (*Nycticorax caledonicus*)																		1	14				15

Fivebough species	2013				2014						2015				2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Pacific Black Duck (*Anas superciliosa*)	158	29	272	58	52	16	98	69	25	79	28	30	85	36	45	52	38	114	29	57	43	45	1458
Pectoral Sandpiper (*Calidris melanotos*)										1				1									2
Peregrine Falcon (*Falco peregrinus*)	1					1																	2
Pied Cormorant (*Phalacrocorax varius*)	2																						2
Pink-eared Duck (*Malacorhynchus membranaceus*)	454	433	2500		224	210	450		8	173	30				30			36	126	710	41	6	5431
Plumed Whistling-Duck (*Dendrocygna eytoni*)								2										7	21				30
Purple Swamphen (*Porphyrio porphyrio*)	9	352	230	40	2	13	54	99	28	28	21	52	98		2	82	59	10	5	22	78	44	1328
Red-capped Plover (*Charadrius ruficapillus*)	13	27	11	8	1		31	5	37	12				5	2				8	32	27	60	279
Red-kneed Dotterel (*Erythrogonys cinctus*)	322	221	1		2	1	3	24	59	35		11	2	18					57	81	62	17	916
Red-necked Avocet (*Recurvirostra novaehollandiae*)	20	285	90	275			70	246	11	161		27	74	135	2		10	2		51	167	290	1916
Red-necked Stint (*Calidris ruficollis*)			1																				1
Royal Spoonbill (*Platalea regia*)	25	20	1			1		7	2	11	12	3		7	22	4			5	76	1	1	198
Sharp-tailed Sandpiper (*Calidris acuminata*)	202	4		2800	16			750		223				2300	43				117			85	6540
Silver Gull (*Chroicocephalus novaehollandiae*)	233	250	83	21		33	40	18	1	1			4			1	8	5	155	374	42	6	1275
Spotless Crake (Porzana tabuensis)					1	1	3	4	1		3	1		1	3	2	2					1	23

Fivebough species	2013				2014						2015				2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Spotted Harrier (Circus assimilis)		1	1												1								3
Straw-necked Ibis (Threskiornis spinicollis)	35	32	131	1486	1	25	1	89	33	119	29	38	110	22	130	71		7	1	60	14		2434
Swamp Harrier (Circus approximans)	4	1	6	6	1	4	4	7	3	5	10		4	44	8	4		4	4	4	4	4	131
Wandering Whistling-Duck (*Dendrocygna arcuata*)										4													4
Wedge-tailed Eagle (*Aquila audax*)						1												1					2
Whiskered Tern (*Chlidonias hybrida*)	542			1230				2506	200	2030				2040				10	164			2300	11022
Whistling Kite (*Haliastur sphenurus*)	17	7	3	5		1	3	1		1	1	1	4		1	7		1	4	10	1	4	72
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1	4	2				6								2		1			4	2		22
White-faced Heron (*Egretta novaehollandiae*)	5	4	2	3	7	35	4	25	9	34	5	30	11	9	6	20	3	15	11	6	2	3	249
White-necked Heron (*Ardea pacifica*)	4	1	3			2	4	12	1	2	1	4	2	9	1		1		3	2	1		53
Wood Sandpiper (*Tringa glareola*)	1		1			2			1	4				1	3								13
Yellow-billed Spoonbill (*Platalea flavipes*)	16	75	5	7	14	19	12	56	12	19	5	10	2	45	15	4	1	1	5	49	5	9	386

1 Data source is from DCCEEW private database (2024). Data is collected on a quarterly basis by field naturalists. The data in the above table is collated and input into Bionet. Data was filtered for incidental observations, unknown or not confirmed sightings (to the species level), species counts were based on total individual counts per survey (as recorded). It is possible that individual species had duplicate counts per survey as data management methodology was unavailable at the time of this report.

Table 9:Quarterly Bird counts at Fivebough Wetlands 2018-2021

Fivebough species	2018			2019			2020			Total (2018-2020)
	Jan	Jul	Oct	Jan	Apr	Jul	Apr	Jun	Jul	
Australasian Darter (*Anhinga novaehollandiae*)	1	2	2	2		1				8
Australasian Grebe (*Tachybaptus novaehollandiae*)	2	3	4	2	4	3		6	4	28
Australasian Shoveler (*Anas rhynchotis*)	1	79	1	3	54	74	17	12	36	277
Australian Hobby (*Falco longipennis*)			1							1
Australian Magpie (*Cracticus tibicen*)							5		2	7
Australian Pelican (*Pelecanus conspicillatus*)	2	5	2	8	6	9	2	1	1	36
Australian Reed-Warbler (*Acrocephalus australis*)	13		45	4	3	1		1		67
Australian Shelduck (*Tadorna tadornoides*)		50	66	11	85	15	40		3	270
Australian Spotted Crake (*Porzana fluminea*)	2	1	1	3	1					8
Australian White Ibis (*Threskiornis molucca*)	2	1	27	36	60	82	75	64		347
Australian Wood Duck (*Chenonetta jubata*)	5			2		2	38	1	2	50
Baillon's Crake (*Porzana pusilla*)			1	1						2
Black Falcon (*Falco subniger*)		2		1						3
Black Kite (*Milvus migrans*)		5		1						6
Black Swan (*Cygnus atratus*)		99	2	11	138	478	300	252	423	1703
Black-fronted Dotterel (*Elseyornis melanops*)	4	4			8	21				37

Fivebough species	2018			2019			2020			Total (2018-2020)
	Jan	Jul	Oct	Jan	Apr	Jul	Apr	Jun	Jul	
Black-shouldered Kite (*Elanus axillaris*)		2	1							3
Black-tailed Godwit (*Limosa limosa*)	1									1
Black-tailed Native-hen (*Tribonyx ventralis*)	15		5	1						21
Black-winged Stilt (*Himantopus leucocephalus*)	57	122	70	5	113	415		270	314	1366
Blue-billed Duck (*Oxyura australis*)				1		2				3
Brolga (*Grus rubicunda*)		4			38		14	7		63
Cattle Egret (*Bubulcus ibis*)	7		1	7	7					22
Chestnut Teal (*Anas castanea*)	29		12	8	44	40		10	4	147
Collared Sparrowhawk (*Accipiter cirrocephalus*)	2			2						4
Common Starling (*Sturnus vulgaris*)							20		300	320
Crested Pigeon (*Ocyphaps lophotes*)							12	4	8	24
Dusky Moorhen (*Gallinula tenebrosa*)	8	2	11	7	15	15				58
Eastern Great Egret (*Ardea alba modesta*)	3		4	4						11
Eurasian Coot (*Fulica atra*)	18	30	30	10	11	36	2	3	15	155
Freckled Duck (*Stictonetta naevosa*)	7					1				8
Glossy Ibis (*Plegadis falcinellus*)	34	1	164	43	43					285
Golden-headed Cisticola (*Cisticola exilis*)	5	5		1	1	3				15

Fivebough species	2018			2019			2020			Total (2018-2020)
	Jan	Jul	Oct	Jan	Apr	Jul	Apr	Jun	Jul	
Great Cormorant (*Phalacrocorax carbo*)	1	3	2	4	1	3				14
Grey Teal (*Anas gracilis*)	291	60	410	222	330	1570	52	350	1351	4636
Hardhead (*Aythya australis*)	44	7	85	30	6	25		4	5	206
Hoary-headed Grebe (*Poliocephalus poliocephalus*)	52	37	5	13	18	16			15	156
House Sparrow (*Passer domesticus*)								2	2	4
Intermediate Egret (*Ardea intermedia*)	4			1			2			7
Little Black Cormorant (*Phalacrocorax sulcirostris*)	7	1	3	6						17
Little Eagle (*Hieraaetus morphnoides*)		1								1
Little Egret (*Egretta garzetta*)	1									1
Little Grassbird (*Megalurus gramineus*)	4		12	1	3	5		1	2	28
Little Pied Cormorant (*Microcarbo melanoleucos*)	3	2	3	10	4	1		1		24
Little Raven (*Corvus mellori*)							28	7	27	62
Magpie Goose (*Anseranas semipalmata*)									1	1
Magpie-lark (*Grallina cyanoleuca*)							11	12	19	42
Marsh Sandpiper (*Tringa stagnatilis*)	10		1							11
Masked Lapwing (*Vanellus miles*)	36	17	22	16	31	8	6	16	23	175
Nankeen Kestrel (*Falco cenchroides*)	2	5	4	1			1		1	14

Fivebough species	2018			2019			2020			Total (2018-2020)
	Jan	Jul	Oct	Jan	Apr	Jul	Apr	Jun	Jul	
Noisy Miner (*Manorina melanocephala*)									2	2
Northern Shoveler (*Anas clypeata*)						1				1
Pacific Black Duck (*Anas superciliosa*)		45	86	73	130	73	195	180	74	856
Peregrine Falcon (*Falco peregrinus*)			1							1
Pied Cormorant (*Phalacrocorax varius*)							10	1		11
Pink-eared Duck (*Malacorhynchus membranaceus*)	56	35		125	410	14				640
Purple Swamphen (*Porphyrio porphyrio*)	10	250	116	4	85	91	17	100	126	799
Red-capped Plover (*Charadrius ruficapillus*)	1	35			18	10				64
Red-kneed Dotterel (*Erythrogonys cinctus*)	116			6						122
Red-necked Avocet (*Recurvirostra novaehollandiae*)	1	16				27				44
Red-rumped Parrot (*Psephotus haematonotus*)								2		2
Royal Spoonbill (*Platalea regia*)	2		1	5	1	1				10
Sharp-tailed Sandpiper (*Calidris acuminata*)	43									43
Silver Gull (*Chroicocephalus novaehollandiae*)	3		301		559	257	60	200		1380
Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*)								1		1
Spotless Crake (*Porzana tabuensis*)									2	2
Straw-necked Ibis (*Threskiornis spinicollis*)	1	148	1	24	52	70	50	130	38	514

Fivebough species	2018			2019			2020			Total (2018-2020)
	Jan	Jul	Oct	Jan	Apr	Jul	Apr	Jun	Jul	
Striped Honeyeater (*Plectorhyncha lanceolata*)							1			1
Sulphur-crested Cockatoo (*Cacatua galerita*)									1	1
Superb Fairy-wren (*Malurus cyaneus*)							7	4	4	15
Swamp Harrier (*Circus approximans*)	3	3	1	2	2	2				13
Variegated Fairy-wren (*Malurus lamberti*)								2	4	6
Wedge-tailed Eagle (*Aquila audax*)		1		1						2
Weebill (*Smicrornis brevirostris*)								2	1	3
Welcome Swallow (*Hirundo neoxena*)							2	15	20	37
Whiskered Tern (*Chlidonias hybrida*)			38							38
Whistling Kite (*Haliastur sphenurus*)	1	2	1	1			1	1		7
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)		2		1						3
White-faced Heron (*Egretta novaehollandiae*)	5	7	9	7	29	4	4	4		69
White-necked Heron (*Ardea pacifica*)			5	1	1	1		1		9
Willie Wagtail (*Rhipidura leucophrys*)							5		2	7
Wood Sandpiper (*Tringa glareola*)	2				1					3
Yellow-billed Spoonbill (*Platalea flavipes*)	4		8	8	13	1	8			42
Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*)								5	5	10

Fivebough species	2018			2019			2020			Total (2018-2020)
	Jan	Jul	Oct	Jan	Apr	Jul	Apr	Jun	Jul	
Zebra Finch (*Taeniopygia guttata*)							5			**5**

2 Data source is from DCCEEW private database (2024). Data is collected on a quarterly basis by field naturalists. The data in the above table is collated and input into Bionet. Data was filtered for incidental observations, unknown or not confirmed sightings (to the species level), species counts were based on total individual counts per survey (as recorded). It is possible that individual species had duplicate counts per survey as data management methodology was unavailable at the time of this report.

**Survey data for 2022 and 2024 not available, and quarterly bird count surveys reduced from 4 surveys a year to 2 per year in 2021.*

Table 10:Quarterly Bird counts at Fivebough Wetlands 2021-2023

Fivebough species	2021		2023		Total (2021-2023)
	Apr	May	Jan	Mar	
Australasian Bittern (*Botaurus poiciloptilus*)			1		1
Australasian Grebe (*Tachybaptus novaehollandiae*)		3	5	8	16
Australian Magpie (*Cracticus tibicen*)	5				5
Australian Pelican (*Pelecanus conspicillatus*)	2	4	1		7
Australian Reed-Warbler (*Acrocephalus australis*)			6		6
Australian Shelduck (*Tadorna tadornoides*)	11	24			35
Australian Spotted Crake (*Porzana fluminea*)			1	2	3
Australian White Ibis (*Threskiornis molucca*)	6		5	23	34
Black Swan (*Cygnus atratus*)	40	29	186	113	368
Black-fronted Dotterel (*Elseyornis melanops*)				1	1

Fivebough species	2021		2023		Total (2021-2023)
	Apr	May	Jan	Mar	
Black-shouldered Kite (*Elanus axillaris*)				1	1
Black-winged Stilt (*Himantopus leucocephalus*)	20		50	40	110
Blue-billed Duck (*Oxyura australis*)			3		3
Brolga (*Grus rubicunda*)	18	31			49
Buff-banded Rail (*Gallirallus philippensis*)			2		2
Cattle Egret (*Bubulcus ibis*)	1				1
Chestnut Teal (*Anas castanea*)		3			3
Common Starling (*Sturnus vulgaris*)			150		150
Crested Pigeon (*Ocyphaps lophotes*)			5	6	11
Eastern Great Egret (*Ardea alba modesta*)			5	38	43
Eurasian Coot (*Fulica atra*)	1	7	362	65	435
Galah (*Eolophus roseicapillus*)			10		10
Great Cormorant (*Phalacrocorax carbo*)			1		1
Great Crested Grebe (*Podiceps cristatus*)			2		2
Grey Teal (*Anas gracilis*)	6	20	340	365	731
Hardhead (*Aythya australis*)			13	1	14
Hoary-headed Grebe (*Poliocephalus poliocephalus*)			21		21

Fivebough species	2021		2023		Total (2021-2023)
	Apr	May	Jan	Mar	
House Sparrow (*Passer domesticus*)				5	5
Intermediate Egret (*Ardea intermedia*)			100	2	102
Little Black Cormorant (*Phalacrocorax sulcirostris*)		4		1	5
Little Grassbird (*Megalurus gramineus*)			1	1	2
Little Pied Cormorant (*Microcarbo melanoleucos*)	1	3	3		7
Magpie Goose (*Anseranas semipalmata*)		9	1	96	106
Magpie-lark (*Grallina cyanoleuca*)			7	4	11
Masked Lapwing (*Vanellus miles*)	4	1	13	15	33
Nankeen Night-Heron (*Nycticorax caledonicus*)			8	7	15
Noisy Friarbird (*Philemon corniculatus*)			1		1
Pacific Black Duck (*Anas superciliosa*)	9		218	75	302
Peregrine Falcon (*Falco peregrinus*)			1		1
Pied Cormorant (*Phalacrocorax varius*)			7		7
Pink-eared Duck (*Malacorhynchus membranaceus*)		16			16
Purple Swamphen (*Porphyrio porphyrio*)	4	1	27	38	70
Royal Spoonbill (*Platalea regia*)	2	7		13	22
Sharp-tailed Sandpiper (*Calidris acuminata*)				3	3

Fivebough species	2021		2023		Total (2021-2023)
	Apr	May	Jan	Mar	
Silver Gull (*Chroicocephalus novaehollandiae*)			100	221	321
Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*)	2				2
Spotless Crake (*Porzana tabuensis*)				2	2
Straw-necked Ibis (*Threskiornis spinicollis*)	13		10	20	43
Swamp Harrier (*Circus approximans*)			1		1
Welcome Swallow (*Hirundo neoxena*)			100		100
Whiskered Tern (*Chlidonias hybrida*)			40	28	68
Whistling Kite (*Haliastur sphenurus*)		1	1		2
White-faced Heron (*Egretta novaehollandiae*)			6	31	37
White-necked Heron (*Ardea pacifica*)				10	10
White-winged Fairy-wren (*Malurus leucopterus*)			1		1
Yellow-billed Spoonbill (*Platalea flavipes*)	5		2	6	13
Yellow-throated Miner (*Manorina flavigula*)			3		3
Zebra Finch (*Taeniopygia guttata*)				6	6

3:Data source is from DCCEEW private database (2024). Data is collected on a quarterly basis by field naturalists. The data in the above table is collated and input into Bionet. Data was filtered for incidental observations, unknown or not confirmed sightings (to the species level), species counts were based on total individual counts per survey (as recorded). It is possible that individual species had duplicate counts per survey as data management methodology was unavailable at the time of this report.

Bird survey results for Tuckerbil Wetland from 2013-2023

Table 11: Quarterly Bird counts at Tuckerbil Wetlands 2013-2017

Tuckerbil species	2013				2014						2015			2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Australasian Bittern (*Botaurus poiciloptilus*)								7	1													8
Australasian Darter (*Anhinga novaehollandiae*)									3								1	1	2			7
Australasian Grebe (*Tachybaptus novaehollandiae*)	6			3					1	6	2			2	3			1	4			28
Australasian Shoveler (*Anas rhynchotis*)			5							27	12	3	2	6		12	1		1			69
Australian Hobby (*Falco longipennis*)		2		1	1						1	1			1		1	1			1	10
Australian Little Bittern (*Ixobrychus dubius*)									2													2
Australian Pelican (*Pelecanus conspicillatus*)	6	33	13	6	2	5	8	12	13	21	30	4	8	15	28	4	11			3	3	225
Australian Reed-Warbler (*Acrocephalus australis*)				10	4			8	13	8	5	2	2	2			7	6			17	84
Australian Shelduck (*Tadorna tadornoides*)			2								5											7

Tuckerbil species	2013				2014						2015			2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Australian Spotted Crake (*Porzana fluminea*)				2																		2
Australian White Ibis (*Threskiornis molucca*)	3	7				3		3		6	2	1		5	7		2	5	4		1	49
Australian Wood Duck (*Chenonetta jubata*)		15	2	2			2	2	4	8		13	2	35	29	6		2	10	7	4	143
Banded Lapwing (*Vanellus tricolor*)								2			2										1	5
Black Kite (*Milvus migrans*)		29		5	2						3	2	1	1	1		1					45
Black Swan (*Cygnus atratus*)			32								2	2				3	5		2			46
Black-fronted Dotterel (*Elseyornis melanops*)	4		1	1								8										14
Black-shouldered Kite (*Elanus axillaris*)	1	7	4	5	5	13	13	3		1	1	3		1	1			1		3	2	64
Black-tailed Native-hen (*Tribonyx ventralis*)	13			7	19				2													41
Black-winged Stilt (*Himantopus leucocephalus*)	8		208		30			300	50	500	60	4		3		190	30	33		2	2	1420
Brolga (*Grus rubicunda*)			5												8	4						17
Brown Falcon (*Falco berigora*)	3	1	6	1	1	3		2		1			1	1	2		1	1	2	4	1	31

Tuckerbil species	2013				2014						2015			2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Brown Goshawk (*Accipiter fasciatus*)				1		1									1				1			4
Buff-banded Rail (*Gallirallus philippensis*)																		2				2
Cattle Egret (*Bubulcus ibis*)								1	9		28							1				39
Chestnut Teal (*Anas castanea*)										2									1			3
Collared Sparrowhawk (*Accipiter cirrocephalus*)														2	1							3
Dusky Moorhen (*Gallinula tenebrosa*)																		4				4
Eastern Great Egret (*Ardea alba modesta*)	6	1			2			5	2	5	6		1	39	2		2	7				78
Eurasian Coot (*Fulica atra*)	3		8	4	1			10	7	95	46		2	4	2	15	6	32	2			237
Freckled Duck (*Stictonetta naevosa*)										1	9	1	1						1			13
Glossy Ibis (*Plegadis falcinellus*)	30							60	277	56	55		8	50				35				571
Golden-headed Cisticola (*Cisticola exilis*)		1	2				8				1			4			1	7			2	26

Tuckerbil species	2013				2014						2015			2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Great Cormorant (*Phalacrocorax carbo*)	20	9	2	3	7	2		7	1	5	7	1	3	1	2	3	9	5	8		2	97
Grey Teal (*Anas gracilis*)	1502	3	5500	2	262		70	870	306	540	850	263	250	90	380	6	30	75	70	20	49	11138
Hardhead (*Aythya australis*)			4		41			25	1	13			1			2	3	2	1			93
Hoary-headed Grebe (*Poliocephalus poliocephalus*)			2		6				1	9										2		20
Intermediate Egret (*Ardea intermedia*)								1	1	1	3						2	2				10
Little Black Cormorant (*Phalacrocorax sulcirostris*)					2			17	10	8	1		3	2		1		1				45
Little Eagle (*Hieraaetus morphnoides*)												1										1
Little Egret (*Egretta garzetta*)								2	1													3
Little Grassbird (*Megalurus gramineus*)	1		2	2		1	1	2	1					1			2				2	15
Little Pied Cormorant (*Microcarbo melanoleucos*)	4	2	1		1			47	5	3	7	1	3	8	1		11	22	2	1	2	121
Magpie Goose (*Anseranas semipalmata*)													3									3

Tuckerbil species	2013				2014						2015			2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Masked Lapwing (*Vanellus miles*)	4		6		2	2		6			2	9			1		10			2		44
Musk Duck (*Biziura lobata*)																1						1
Nankeen Kestrel (*Falco cenchroides*)		9	6	4	2	5		3		2	6	6	1	5	2		8	4	3	8	12	86
Nankeen Night-Heron (*Nycticorax caledonicus*)																		32				32
Pacific Black Duck (*Anas superciliosa*)	4	12	332	162	181	28	59	724	71	42	27	49	125	130	152	11	65	62	153	347	214	2950
Pink-eared Duck (*Malacorhynchus membranaceus*)	2										2	4	1	10	8		2	9	20	2		60
Plumed Whistling-Duck (*Dendrocygna eytoni*)					16																	16
Purple Swamphen (*Porphyrio porphyrio*)			1	3	1			4	2	2	1	10	2	2	4	2	4		38		1	77
Red-kneed Dotterel (*Erythrogonys cinctus*)	73			20	13				15	1		5						5			25	157
Red-necked Avocet (*Recurvirostra novaehollandiae*)																	2					2
Royal Spoonbill (*Platalea regia*)	4	7			3	2			1	8	1			9								35
Sharp-tailed Sandpiper (*Calidris acuminata*)	6									200	10							70				286

Tuckerbil species	2013				2014						2015			2016				2017				Total (2013-2017)
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Nov	Dec	Jan	Apr	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	
Silver Gull (*Chroicocephalus novaehollandiae*)													1			2	3					6
Spotted Harrier (*Circus assimilis*)	1	1			1	2																5
Straw-necked Ibis (*Threskiornis spinicollis*)		10	21		2	10		2		59	1	3				10	46	22	9	1		196
Swamp Harrier (*Circus approximans*)	1		4	6	2	3		5	2	2	1	4		2	2		4		4	2		44
Wandering Whistling-Duck (*Dendrocygna arcuata*)										2												2
Wedge-tailed Eagle (*Aquila audax*)		1	1	1		1	1	2				1	1				1					10
Whiskered Tern (*Chlidonias hybrida*)								10		12	14						37	22				95
Whistling Kite (*Haliastur sphenurus*)	1	5	3	1	2	2				1	2	2	1		12		2		4		1	39
White-faced Heron (*Egretta novaehollandiae*)	2	5	2	5	4	5	7	11	5	17	9	5	4	3	3		12	20	3	3	2	127
White-necked Heron (*Ardea pacifica*)	3	6	7	2	1	1		24		4				1		4		14	1	1		69
Yellow-billed Spoonbill (*Platalea flavipes*)	4	4	2	2	7	9	6	12	6	8	1	1		4	4			6	5			81

4:Data source is from DCCEEW private database (2024). Data is collected on a quarterly basis by field naturalists. The data in the above table is collated and input into Bionet. Data was filtered for incidental observations, unknown or not confirmed sighting (to the species level), species counts were based on total individual counts per survey (as recorded). It is possible that individual species had duplicate counts per survey as data management methodology was unavailable at the time of this report.

Table 12: Quarterly Bird counts at Tuckerbil Wetlands 2018-2020

Tuckerbil species	2018				2019					2020							Total (2018-2020)
	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Nov	Dec	Jan	Apr	May	Jul	Oct	Nov	Dec	
Australasian Bittern (*Botaurus poiciloptilus*)									2	3							5
Australasian Darter (*Anhinga novaehollandiae*)		2		1	1			2							4	10	20
Australasian Grebe (*Tachybaptus novaehollandiae*)		8	6				1			10							25
Australasian Pipit (*Anthus novaeseelandiae*)								1									1
Australasian Shoveler (*Anas rhynchotis*)		2	6							2				10	4	10	34
Australian Hobby (*Falco longipennis*)	1							1									2
Australian Little Bittern (*Ixobrychus dubius*)									1	1					1		3
Australian Magpie (*Cracticus tibicen*)											2	2	2			1	7
Australian Pelican (*Pelecanus conspicillatus*)	2	10		19	9		4	12	8	11	10	5		1	14	65	170
Australian Raven (*Corvus coronoides*)											4						4
Australian Reed-Warbler (*Acrocephalus australis*)	8			10	2		1	1	1	2				2	2	2	31
Australian Shelduck (*Tadorna tadornoides*)			10							5							15
Australian White Ibis (*Threskiornis molucca*)	1	22	7	2	4	2	3	2			8				2	1	54

Tuckerbil species	2018				2019					2020							Total (2018-2020)
	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Nov	Dec	Jan	Apr	May	Jul	Oct	Nov	Dec	
Australian Wood Duck (*Chenonetta jubata*)	2		38	2	17		6	19			1	3			1	7	96
Black Falcon (*Falco subniger*)			1														1
Black Kite (*Milvus migrans*)		4														20	24
Black Swan (*Cygnus atratus*)		9	2	14				1	1		4	30		1		2	64
Black-faced Cuckoo-shrike (*Coracina novaehollandiae*)									1								1
Black-fronted Dotterel (*Elseyornis melanops*)					3	3				11					8	2	27
Black-shouldered Kite (*Elanus axillaris*)	1	1	3	1													6
Black-tailed Native-hen (*Tribonyx ventralis*)	12						10	6		2						37	67
Black-winged Stilt (*Himantopus leucocephalus*)			70	520	8			2		14					21	9	644
Blue-faced Honeyeater (*Entomyzon cyanotis*)											1	1					2
Brolga (*Grus rubicunda*)		10	12	8							3	8					41
Brown Falcon (*Falco berigora*)	1	1	2	1	2											1	8
Brown Goshawk (*Accipiter fasciatus*)															1		1
Brown Songlark (*Cincloramphus cruralis*)													3				3
Cattle Egret (*Bubulcus ibis*)	15			27													42
Chestnut Teal (*Anas castanea*)		2	8								10				2		22
Cockatiel (*Nymphicus hollandicus*)		2					2	1	4	2					5	6	22

Tuckerbil species	2018				2019					2020							Total (2018-2020)
	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Nov	Dec	Jan	Apr	May	Jul	Oct	Nov	Dec	
Common Starling (*Sturnus vulgaris*)		50					70	20	50	810	25	5000	20		130	160	6335
Crested Pigeon (*Ocyphaps lophotes*)		2						4	4	6	1		6	3	4	12	42
Dusky Moorhen (*Gallinula tenebrosa*)		1								2				1	2	4	10
Eastern Great Egret (*Ardea alba modesta*)	4			5	3			3		4				3	10	19	51
Eastern Rosella (*Platycercus eximius*)								2	3	4				1			10
Eurasian Coot (*Fulica atra*)			4					1	10					1	9	12	37
Fairy Martin (*Petrochelidon ariel*)								60									60
Glossy Ibis (*Plegadis falcinellus*)	50			11	16	16		12		24				10		400	539
Great Cormorant (*Phalacrocorax carbo*)	1	1	1				2	1	3	8	1			6			24
Grey Teal (*Anas gracilis*)	48	300	412	965	19	3	42	200	50	271	200			38	412	838	3798
Hardhead (*Aythya australis*)	3	6	4					17	20	43				19	123	330	565
Hoary-headed Grebe (*Poliocephalus poliocephalus*)			10					1									11
House Sparrow (*Passer domesticus*)													6			5	11
Intermediate Egret (*Ardea intermedia*)				5	1		2	2		2					2		14
Latham's Snipe (*Gallinago hardwickii*)				1													1
Little Black Cormorant (*Phalacrocorax sulcirostris*)				1			4	7	3	16					33	11	75
Little Eagle (*Hieraaetus morphnoides*)											1						1

Tuckerbil species	2018				2019					2020							Total (2018-2020)
	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Nov	Dec	Jan	Apr	May	Jul	Oct	Nov	Dec	
Little Egret (*Egretta garzetta*)	1				1												2
Little Grassbird (*Megalurus gramineus*)		2	1	2				1	1	2				1	2	3	15
Little Pied Cormorant (*Microcarbo melanoleucos*)	5	3		2	4	1	3	11	1	17	4	1			6	9	67
Little Raven (*Corvus mellori*)							2				100	3	14		2		121
Magpie Goose (*Anseranas semipalmata*)															2	17	19
Magpie-lark (*Grallina cyanoleuca*)		1					2	2	3	15	3	2	11	3	2	7	51
Marsh Sandpiper (*Tringa stagnatilis*)					6												6
Masked Lapwing (*Vanellus miles*)		2		2	2		1	1	3		2	1			3	3	20
Nankeen Kestrel (*Falco cenchroides*)	6	2	3	3	2		1	5		3	3	2	2			1	33
Nankeen Night-Heron (*Nycticorax caledonicus*)	2														1	18	21
Noisy Miner (*Manorina melanocephala*)										4				4			8
Pacific Black Duck (*Anas superciliosa*)	11	100	80	79	5	5	79	48	30	158	300	31	63	20	89	120	1218
Peregrine Falcon (*Falco peregrinus*)			1								1		1				3
Pied Butcherbird (*Cracticus nigrogularis*)									7		1	1	1				10
Pied Cormorant (*Phalacrocorax varius*)											1	2					3
Pink-eared Duck (*Malacorhynchus membranaceus*)			54							1					2	1	58
Plumed Whistling-Duck (*Dendrocygna eytoni*)															6	12	18

Tuckerbil species	2018				2019					2020							Total (2018-2020)
	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Nov	Dec	Jan	Apr	May	Jul	Oct	Nov	Dec	
Purple Swamphen (*Porphyrio porphyrio*)	2	13	2	1	9	1	1	2	1	8		5		4	6	8	63
Red-kneed Dotterel (*Erythrogonys cinctus*)					3	3		1									7
Red-necked Avocet (*Recurvirostra novaehollandiae*)			50														50
Red-rumped Parrot (*Psephotus haematonotus*)		4					5	12	2	27	20	1	8	10	2	27	118
Royal Spoonbill (*Platalea regia*)	2	2	1	5	3	1		5		4	4			1	2	13	43
Sacred Kingfisher (*Todiramphus sanctus*)										1							1
Sharp-tailed Sandpiper (*Calidris acuminata*)					9												9
Silver Gull (*Chroicocephalus novaehollandiae*)															2		2
Spotted Harrier (*Circus assimilis*)			1														1
Straw-necked Ibis (*Threskiornis spinicollis*)	7	20	19		28						12			2	6	157	251
Superb Fairy-wren (*Malurus cyaneus*)								1				4	4		21	12	42
Swamp Harrier (*Circus approximans*)		2	2	2					1	3	1				5	2	18
Tree Martin (*Petrochelidon nigricans*)							15							30			45
Unidentified Fairy-wren ()							1		1								2
Variegated Fairy-wren (*Malurus lamberti*)										4	2			3			9
Weebill (*Smicrornis brevirostris*)										2						2	4

Tuckerbil species	2018				2019					2020							Total (2018-2020)
	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Nov	Dec	Jan	Apr	May	Jul	Oct	Nov	Dec	
Welcome Swallow (*Hirundo neoxena*)							20	11		22	10	5					68
Whiskered Tern (*Chlidonias hybrida*)				25				2		4							31
Whistling Kite (*Haliastur sphenurus*)	1	5			1						3	1				33	44
White-faced Heron (*Egretta novaehollandiae*)	12	1	3	3	3	5	3	2			1	5				1	39
White-fronted Chat (*Epthianura albifrons*)								1			5				10		16
White-necked Heron (*Ardea pacifica*)			1	1												1	3
White-plumed Honeyeater (*Lichenostomus penicillatus*)															1	2	3
White-winged Fairy-wren (*Malurus leucopterus*)											2		2				4
Willie Wagtail (*Rhipidura leucophrys*)								1	1	1	7	5	2	2	1	7	27
Yellow-billed Spoonbill (*Platalea flavipes*)	1		4	1	3	5		1		6	7						28
Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*)															5		5
Yellow-throated Miner (*Manorina flavigula*)									2								2
Zebra Finch (*Taeniopygia guttata*)											23	2			5	7	37

Table 13: Quarterly bird counts at Tuckerbil Wetlands 2021-2023

Tuckerbil species	2021				2022	2023		Total (2021-2023)
	Jan	Feb	Mar	Apr	Jul	Jan	May	
Australasian Darter (*Anhinga novaehollandiae*)	2	1						3
Australasian Grebe (*Tachybaptus novaehollandiae*)			2					2
Australasian Pipit (*Anthus novaeseelandiae*)	1							1
Australian Magpie (*Cracticus tibicen*)					1	2	6	9
Australian Pelican (*Pelecanus conspicillatus*)	40	6	3	11				60
Australian Raven (*Corvus coronoides*)		1	1					2
Australian Reed-Warbler (*Acrocephalus australis*)	2							2
Australian White Ibis (*Threskiornis molucca*)	1	24				100		125
Australian Wood Duck (*Chenonetta jubata*)		4	2	50				56
Black Kite (*Milvus migrans*)							1	1
Black Swan (*Cygnus atratus*)	12			1				13
Black-faced Cuckoo-shrike (*Coracina novaehollandiae*)		1			1	2		4
Black-fronted Dotterel (*Elseyornis melanops*)	6	6						12
Black-shouldered Kite (*Elanus axillaris*)					2	1	1	4
Black-tailed Native-hen (*Tribonyx ventralis*)	13							13
Black-winged Stilt (*Himantopus leucocephalus*)			1			5		6
Brolga (*Grus rubicunda*)				10				10
Brown Falcon (*Falco berigora*)	1		5					6
Brown Quail (*Synoicus ypsilophorus australis*)		2						2
Cattle Egret (*Bubulcus ibis*)		16	7					23
Chestnut Teal (*Anas castanea*)				2				2
Common Starling (*Sturnus vulgaris*)		100	22		8	10	200	340
Crested Pigeon (*Ocyphaps lophotes*)	1	1	8		5	4		19
Dusky Moorhen (*Gallinula tenebrosa*)	1							1
Eastern Great Egret (*Ardea alba modesta*)	1	2				1		4
Eastern Rosella (*Platycercus eximius*)						1		1

Tuckerbil species	2021				2022	2023		Total (2021-2023)
	Jan	Feb	Mar	Apr	Jul	Jan	May	
Eurasian Coot (*Fulica atra*)	2		2					4
European Goldfinch (*Carduelis carduelis*)						2		2
Galah (*Eolophus roseicapillus*)	8	20	20					48
Glossy Ibis (*Plegadis falcinellus*)		23						23
Golden-headed Cisticola (*Cisticola exilis*)						2		2
Great Cormorant (*Phalacrocorax carbo*)	2	4	2	4				12
Grey Fantail (*Rhipidura fuliginosa*)					1		4	5
Grey Teal (*Anas gracilis*)	120	22	52	20		12		226
Hardhead (*Aythya australis*)	178		50					228
House Sparrow (*Passer domesticus*)		50	10			5		65
Intermediate Egret (*Ardea intermedia*)		6						6
Laughing Kookaburra (*Dacelo novaeguineae*)		2						2
Little Black Cormorant (*Phalacrocorax sulcirostris*)	1	5	6					12
Little Grassbird (*Megalurus gramineus*)	1	1	1				1	4
Little Pied Cormorant (*Microcarbo melanoleucos*)		8		5				13
Little Raven (*Corvus mellori*)	1		2		1	4	7	15
Magpie Goose (*Anseranas semipalmata*)	7	11	3					21
Magpie-lark (*Grallina cyanoleuca*)	1	3	4			2		10
Masked Lapwing (*Vanellus miles*)							2	2
Nankeen Kestrel (*Falco cenchroides*)			2			1	1	4
Nankeen Night-Heron (*Nycticorax caledonicus*)	4	4	5			4		17
Noisy Miner (*Manorina melanocephala*)					2	4	2	8
Pacific Black Duck (*Anas superciliosa*)	26	70	140			5	10	251
Peregrine Falcon (*Falco peregrinus*)			1				2	3
Pied Butcherbird (*Cracticus nigrogularis*)	2				1		1	4
Pink-eared Duck (*Malacorhynchus membranaceus*)	2							2
Plumed Whistling-Duck (*Dendrocygna eytoni*)	9		2	2				13

Tuckerbil species	2021				2022	2023		Total (2021-2023)
	Jan	Feb	Mar	Apr	Jul	Jan	May	
Purple Swamphen (*Porphyrio porphyrio*)	5	2	3	13		12		35
Red-capped Robin (*Petroica goodenovii*)							1	1
Red-rumped Parrot (*Psephotus haematonotus*)	3	14	8		6	12	6	49
Royal Spoonbill (*Platalea regia*)	3							3
Rufous Whistler (*Pachycephala rufiventris*)					1			1
Singing Honeyeater (*Lichenostomus virescens*)					1		1	2
Straw-necked Ibis (*Threskiornis spinicollis*)		300				10	3	313
Striated Pardalote (*Pardalotus striatus*)					1			1
Striped Honeyeater (*Plectorhyncha lanceolata*)		1						1
Superb Fairy-wren (*Malurus cyaneus*)	2		4				12	18
Swamp Harrier (*Circus approximans*)	5		1					6
Tree Martin (*Petrochelidon nigricans*)					2			2
Variegated Fairy-wren (*Malurus lamberti*)	3	3				7		13
Weebill (*Smicrornis brevirostris*)						1		1
Welcome Swallow (*Hirundo neoxena*)					4		5	9
Whistling Kite (*Haliastur sphenurus*)		2	1					3
White-faced Heron (*Egretta novaehollandiae*)					1	8	9	18
White-fronted Chat (*Epthianura albifrons*)					8			8
White-necked Heron (*Ardea pacifica*)						1		1
White-winged Fairy-wren (*Malurus leucopterus*)						1		1
Willie Wagtail (*Rhipidura leucophrys*)	1	2	4		2	1	11	21
Yellow Thornbill (*Acanthiza nana*)							5	5
Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*)							8	8

Incidental observations at Fivebough and Tuckerbil 2013-2023

Table14: Incidental observations of threatened or migratory bird species at Fivebough Wetlands 2012-2023 (Source: DCCEEW, 2024)

Date	Site	Name	Total Count
8/09/2013	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
6/07/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
12/07/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
11/09/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	2
2/10/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
9/10/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	2
15/12/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
20/12/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
25/12/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
26/12/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
30/12/2014	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
9/01/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
16/01/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
16/01/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	2
30/08/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
5/09/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
22/10/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	2
28/10/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	5
3/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	4
6/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	3
8/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	6
9/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	8
14/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	22
15/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	18

Date	Site	Name	Total Count
16/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	32
20/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	34
21/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	17
23/11/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	32
25/12/2015	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
10/01/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
18/01/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
9/04/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
22/05/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
6/08/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
28/08/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
9/09/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
9/10/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
25/10/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	4
17/11/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	4
17/11/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
23/11/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
1/12/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	4
5/12/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
10/12/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
15/12/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
16/12/2016	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
9/01/2017	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
2/09/2017	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
7/09/2017	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
15/11/2018	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1

Date	Site	Name	Total Count
22/11/2018	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	3
3/12/2018	Incidental - Fivebough	Australasian Bittern (*Botaurus poiciloptilus*)	1
10/01/2013	Incidental - Fivebough	Australian Painted-snipe (*Rostratula australis*)	1
8/09/2013	Incidental - Fivebough	Australian Painted-snipe (*Rostratula australis*)	3
11/05/2014	Incidental - Fivebough	Australian Painted-snipe (*Rostratula australis*)	2
18/05/2014	Incidental - Fivebough	Australian Painted-snipe (*Rostratula australis*)	2
22/06/2014	Incidental - Fivebough	Australian Painted-snipe (*Rostratula australis*)	1
10/11/2013	Incidental - Fivebough	Bar-tailed Godwit (*Limosa lapponica*)	1
18/11/2013	Incidental - Fivebough	Bar-tailed Godwit (*Limosa lapponica*)	1
3/10/2017	Incidental - Fivebough	Bar-tailed Godwit (*Limosa lapponica*)	1
12/07/2014	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
20/07/2014	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
18/10/2014	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
15/08/2015	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
2/03/2016	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
24/03/2016	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
22/05/2016	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
20/08/2017	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
26/09/2017	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
12/09/2018	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
19/09/2018	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
30/09/2018	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
16/12/2018	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
9/06/2019	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
28/07/2019	Incidental - Fivebough	Black Falcon (*Falco subniger*)	1
21/05/2013	Incidental - Fivebough	Black-tailed Godwit (*Limosa limosa*)	1

Date	Site	Name	Total Count
10/01/2016	Incidental - Fivebough	Black-tailed Godwit (*Limosa limosa*)	1
24/01/2018	Incidental - Fivebough	Black-tailed Godwit (*Limosa limosa*)	1
26/01/2018	Incidental - Fivebough	Black-tailed Godwit (*Limosa limosa*)	1
17/02/2019	Incidental - Fivebough	Black-tailed Godwit (*Limosa limosa*)	1
4/03/2019	Incidental - Fivebough	Black-tailed Godwit (*Limosa limosa*)	1
20/04/2014	Incidental - Fivebough	Blue-billed Duck (*Oxyura australis*)	2
3/07/2016	Incidental - Fivebough	Blue-billed Duck (*Oxyura australis*)	3
6/08/2016	Incidental - Fivebough	Blue-billed Duck (*Oxyura australis*)	1
7/10/2016	Incidental - Fivebough	Blue-billed Duck (*Oxyura australis*)	1
9/11/2016	Incidental - Fivebough	Blue-billed Duck (*Oxyura australis*)	1
12/06/2017	Incidental - Fivebough	Blue-billed Duck (*Oxyura australis*)	1
14/09/2017	Incidental - Fivebough	Blue-billed Duck (*Oxyura australis*)	2
7/09/2018	Incidental - Fivebough	Blue-billed Duck (*Oxyura australis*)	3
18/03/2013	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
17/04/2013	Incidental - Fivebough	Brolga (*Grus rubicunda*)	5
27/04/2013	Incidental - Fivebough	Brolga (*Grus rubicunda*)	23
9/05/2013	Incidental - Fivebough	Brolga (*Grus rubicunda*)	30
8/12/2013	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
23/03/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
12/04/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	9
20/04/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	10
26/04/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	16
18/05/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	11
22/06/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	9
6/07/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	4
18/09/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	8

Date	Site	Name	Total Count
21/09/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	4
2/10/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	4
27/10/2014	Incidental - Fivebough	Brolga (*Grus rubicunda*)	5
29/04/2015	Incidental - Fivebough	Brolga (*Grus rubicunda*)	14
29/04/2015	Incidental - Fivebough	Brolga (*Grus rubicunda*)	14
29/04/2015	Incidental - Fivebough	Brolga (*Grus rubicunda*)	5
26/06/2015	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
28/06/2015	Incidental - Fivebough	Brolga (*Grus rubicunda*)	4
23/08/2015	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
31/08/2015	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
10/01/2016	Incidental - Fivebough	Brolga (*Grus rubicunda*)	1
18/01/2016	Incidental - Fivebough	Brolga (*Grus rubicunda*)	4
9/04/2016	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
17/04/2016	Incidental - Fivebough	Brolga (*Grus rubicunda*)	19
25/04/2016	Incidental - Fivebough	Brolga (*Grus rubicunda*)	28
29/05/2016	Incidental - Fivebough	Brolga (*Grus rubicunda*)	3
22/03/2017	Incidental - Fivebough	Brolga (*Grus rubicunda*)	1
2/09/2017	Incidental - Fivebough	Brolga (*Grus rubicunda*)	5
7/09/2017	Incidental - Fivebough	Brolga (*Grus rubicunda*)	5
24/09/2017	Incidental - Fivebough	Brolga (*Grus rubicunda*)	6
7/09/2018	Incidental - Fivebough	Brolga (*Grus rubicunda*)	1
26/09/2018	Incidental - Fivebough	Brolga (*Grus rubicunda*)	6
30/09/2018	Incidental - Fivebough	Brolga (*Grus rubicunda*)	8
7/10/2018	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
15/11/2018	Incidental - Fivebough	Brolga (*Grus rubicunda*)	3
8/01/2019	Incidental - Fivebough	Brolga (*Grus rubicunda*)	11

Date	Site	Name	Total Count
17/02/2019	Incidental - Fivebough	Brolga (*Grus rubicunda*)	18
4/03/2019	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
25/03/2019	Incidental - Fivebough	Brolga (*Grus rubicunda*)	18
30/03/2019	Incidental - Fivebough	Brolga (*Grus rubicunda*)	18
20/04/2019	Incidental - Fivebough	Brolga (*Grus rubicunda*)	34
23/06/2019	Incidental - Fivebough	Brolga (*Grus rubicunda*)	20
28/07/2019	Incidental - Fivebough	Brolga (*Grus rubicunda*)	4
2/04/2020	Incidental - Fivebough	Brolga (*Grus rubicunda*)	15
6/03/2021	Incidental - Fivebough	Brolga (*Grus rubicunda*)	4
6/03/2021	Incidental - Fivebough	Brolga (*Grus rubicunda*)	2
26/04/2023	Incidental - Fivebough	Brolga (*Grus rubicunda*)	3
15/12/2016	Incidental - Fivebough	Caspian Tern (*Hydroprogne caspia*)	1
1/01/2017	Incidental - Fivebough	Caspian Tern (*Hydroprogne caspia*)	7
10/08/2017	Incidental - Fivebough	Caspian Tern (*Hydroprogne caspia*)	2
24/09/2017	Incidental - Fivebough	Caspian Tern (*Hydroprogne caspia*)	2
3/10/2017	Incidental - Fivebough	Caspian Tern (*Hydroprogne caspia*)	1
9/10/2017	Incidental - Fivebough	Caspian Tern (*Hydroprogne caspia*)	2
5/05/2013	Incidental - Fivebough	Common Greenshank (*Tringa nebularia*)	1
15/10/2013	Incidental - Fivebough	Common Greenshank (*Tringa nebularia*)	3
28/10/2015	Incidental - Fivebough	Common Greenshank (*Tringa nebularia*)	4
3/09/2017	Incidental - Fivebough	Common Greenshank (*Tringa nebularia*)	1
5/05/2013	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	2
24/08/2013	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	1
15/10/2013	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	2
18/11/2013	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	1
23/09/2015	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	2

Date	Site	Name	Total Count
14/09/2017	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	1
14/09/2017	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	3
26/09/2017	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	1
6/10/2017	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	1
9/10/2017	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	4
7/09/2018	Incidental - Fivebough	Curlew Sandpiper (*Calidris ferruginea*)	1
11/08/2013	Incidental - Fivebough	Freckled Duck (*Stictonetta naevosa*)	40
20/04/2014	Incidental - Fivebough	Freckled Duck (*Stictonetta naevosa*)	2
30/12/2014	Incidental - Fivebough	Freckled Duck (*Stictonetta naevosa*)	2
7/10/2016	Incidental - Fivebough	Freckled Duck (*Stictonetta naevosa*)	2
16/02/2017	Incidental - Fivebough	Freckled Duck (*Stictonetta naevosa*)	8
15/09/2018	Incidental - Fivebough	Freckled Duck (*Stictonetta naevosa*)	6
20/10/2018	Incidental - Fivebough	Freckled Duck (*Stictonetta naevosa*)	1
28/07/2019	Incidental - Fivebough	Freckled Duck (*Stictonetta naevosa*)	1
11/08/2013	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	5
15/10/2013	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	165
13/11/2013	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	600
18/11/2013	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	100
3/12/2013	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	800
22/02/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	60
23/03/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	4
12/04/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	1
12/07/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	1
20/07/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	6
6/09/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	9
18/09/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	30

Date	Site	Name	Total Count
18/10/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	1000
27/10/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	600
25/12/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	2500
26/12/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	1816
30/12/2014	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	67
29/04/2015	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	11
29/04/2015	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	35
9/08/2015	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	12
15/08/2015	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	15
5/09/2015	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	30
8/10/2015	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	500
28/10/2015	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	2000
22/05/2016	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	1
6/08/2016	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	3
23/11/2016	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	7
16/12/2016	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	250
16/02/2017	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	15
18/02/2017	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	100
26/09/2017	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	29
3/10/2017	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	130
11/11/2017	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	1000
17/11/2017	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	2150
27/11/2017	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	2000
24/12/2017	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	3000
3/01/2018	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	1500
2/09/2018	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	16

Date	Site	Name	Total Count
7/09/2018	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	18
19/09/2018	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	39
4/10/2018	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	147
30/10/2018	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	164
3/12/2018	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	45
16/12/2018	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	150
8/01/2019	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	250
12/11/2019	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	12
12/11/2019	Incidental - Fivebough	Glossy Ibis (*Plegadis falcinellus*)	4
1/09/2013	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
8/09/2013	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
18/11/2013	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
22/02/2014	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
18/10/2014	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	2
5/09/2015	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
1/10/2015	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
9/11/2016	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
23/11/2016	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	2
10/12/2016	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
16/02/2017	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
26/09/2017	Incidental - Fivebough	Latham's Snipe (*Gallinago hardwickii*)	1
15/10/2013	Incidental - Fivebough	Little Curlew (*Numenius minutus*)	1
14/11/2013	Incidental - Fivebough	Little Curlew (*Numenius minutus*)	1
22/05/2016	Incidental - Fivebough	Little Eagle (*Hieraaetus morphnoides*)	1
24/09/2017	Incidental - Fivebough	Little Eagle (*Hieraaetus morphnoides*)	1
2/09/2018	Incidental - Fivebough	Little Eagle (*Hieraaetus morphnoides*)	1

Date	Site	Name	Total Count
8/11/2012	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	2
9/11/2015	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	5
10/11/2015	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	15
10/01/2016	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	2
7/10/2016	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	4
9/11/2016	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	4
23/11/2016	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	9
5/12/2016	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	30
15/12/2016	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	17
1/01/2017	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	122
16/02/2017	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	100
18/02/2017	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	87
20/03/2017	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	230
1/01/2018	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	7
6/03/2021	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	3
26/03/2023	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	200
24/04/2023	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	150
26/04/2023	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	150
20/05/2023	Incidental - Fivebough	Magpie Goose (*Anseranas semipalmata*)	400
22/09/2013	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	4
29/09/2013	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	10
3/10/2013	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	10
15/10/2013	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	7
8/12/2013	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	8
11/09/2014	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	1
9/10/2014	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	2

Date	Site	Name	Total Count
18/10/2014	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	10
15/12/2014	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	10
30/12/2014	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	13
5/09/2015	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	1
22/10/2015	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	10
28/10/2015	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	27
14/11/2015	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	13
28/03/2016	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	1
16/08/2016	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	1
24/09/2017	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	3
26/09/2017	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	4
6/10/2017	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	6
13/11/2017	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	6
26/01/2018	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	1
2/09/2018	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	1
4/10/2018	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	3
11/10/2018	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	4
16/12/2018	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	30
8/01/2019	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	13
12/11/2019	Incidental - Fivebough	Marsh Sandpiper (*Tringa stagnatilis*)	3
4/09/2013	Incidental - Fivebough	Pacific Golden Plover (*Pluvialis fulva*)	1
9/10/2017	Incidental - Fivebough	Pacific Golden Plover (*Pluvialis fulva*)	1
28/09/2018	Incidental - Fivebough	Pacific Golden Plover (*Pluvialis fulva*)	1
30/09/2018	Incidental - Fivebough	Painted Honeyeater (*Grantiella picta*)	1
7/10/2018	Incidental - Fivebough	Painted Honeyeater (*Grantiella picta*)	1
5/05/2013	Incidental - Fivebough	Pectoral Sandpiper (*Calidris melanotos*)	1

Date	Site	Name	Total Count
25/08/2013	Incidental - Fivebough	Pectoral Sandpiper (*Calidris melanotos*)	1
15/10/2013	Incidental - Fivebough	Pectoral Sandpiper (*Calidris melanotos*)	1
13/11/2013	Incidental - Fivebough	Pectoral Sandpiper (*Calidris melanotos*)	3
15/12/2014	Incidental - Fivebough	Pectoral Sandpiper (*Calidris melanotos*)	1
20/12/2014	Incidental - Fivebough	Pectoral Sandpiper (*Calidris melanotos*)	1
29/04/2015	Incidental - Fivebough	Pectoral Sandpiper (*Calidris melanotos*)	8
11/10/2018	Incidental - Fivebough	Pectoral Sandpiper (*Calidris melanotos*)	1
18/05/2013	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	2
7/07/2013	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	1
24/08/2013	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	3
22/09/2013	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	3
13/11/2013	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	5
5/09/2015	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	2
19/08/2017	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	1
7/09/2017	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	2
14/09/2017	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	3
9/10/2017	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	4
12/11/2019	Incidental - Fivebough	Red-necked Stint (*Calidris ruficollis*)	2
5/05/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	1
11/05/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	6
18/05/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	1
11/08/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	1
18/08/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	28
7/09/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	35
18/09/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	100
29/09/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	500

Date	Site	Name	Total Count
15/10/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	1000
20/10/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	1500
18/11/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	200
3/12/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	250
8/12/2013	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	200
22/02/2014	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	2
20/04/2014	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	2
26/04/2014	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	40
11/09/2014	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	23
9/10/2014	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	7
18/10/2014	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	300
15/12/2014	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	2
29/04/2015	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	30
5/09/2015	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	4
23/09/2015	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	53
26/09/2015	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	110
1/10/2015	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	250
28/10/2015	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	2200
14/11/2015	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	500
9/01/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	27
16/02/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	10
30/03/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	3
16/04/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	20
7/09/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	52
14/09/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	76
26/09/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	103

Date	Site	Name	Total Count
6/10/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	100
9/10/2017	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	350
24/01/2018	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	12
26/01/2018	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	50
7/09/2018	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	77
4/10/2018	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	22
11/10/2018	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	63
22/11/2018	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	144
16/12/2018	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	300
8/01/2019	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	60
30/03/2019	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	43
22/04/2019	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	50
12/11/2019	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	64
24/04/2023	Incidental - Fivebough	Sharp-tailed Sandpiper (*Calidris acuminata*)	60
26/04/2014	Incidental - Fivebough	Spotted Harrier (*Circus assimilis*)	1
15/12/2014	Incidental - Fivebough	Spotted Harrier (*Circus assimilis*)	1
19/01/2018	Incidental - Fivebough	Spotted Harrier (*Circus assimilis*)	1
17/04/2013	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	2
18/05/2013	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
10/06/2013	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	2
1/09/2013	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	4
15/09/2014	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	2
9/08/2015	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
5/09/2015	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
26/09/2015	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
10/11/2015	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1

Date	Site	Name	Total Count
28/06/2016	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
3/07/2016	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	2
18/07/2016	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
19/07/2016	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
4/08/2016	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
5/09/2016	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
22/03/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
16/04/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
12/06/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
1/07/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
23/07/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
27/07/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
13/08/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
2/09/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
7/09/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
26/09/2017	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
7/09/2018	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
28/07/2019	Incidental - Fivebough	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	1
12/11/2019	Incidental - Fivebough	White-fronted Chat (*Epthianura albifrons*)	4
18/11/2012	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
24/02/2013	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	3
5/05/2013	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
11/08/2013	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
18/08/2013	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
24/08/2013	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
18/11/2013	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1

Date	Site	Name	Total Count
8/12/2013	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
22/02/2014	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
23/03/2014	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	4
12/04/2014	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
20/04/2014	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
26/04/2014	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
19/09/2014	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
24/10/2014	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
30/12/2014	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	4
5/09/2015	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
20/09/2015	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
14/12/2015	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	6
18/01/2016	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
7/02/2016	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	3
24/03/2016	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	4
28/03/2016	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
22/04/2017	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1
26/01/2018	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
4/03/2019	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	9
30/03/2019	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	11
20/04/2019	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	7
12/11/2019	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	2
2/04/2020	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	3
2/04/2020	Incidental - Fivebough	Wood Sandpiper (*Tringa glareola*)	1

Table 15: Incidental observations of threatened or migratory bird species at Tuckerbil wetland 2012-2023 (Source: DCCEEW, 2024)

Date	Site	Name	Total Count
1/12/2013	Incidental - Tuckerbil	Australasian Bittern (*Botaurus poiciloptilus*)	1
12/04/2018	Incidental - Tuckerbil	Black Falcon (*Falco subniger*)	1
17/04/2018	Incidental - Tuckerbil	Black Falcon (*Falco subniger*)	1
9/05/2018	Incidental - Tuckerbil	Black Falcon (*Falco subniger*)	2
9/05/2018	Incidental - Tuckerbil	Brolga (*Grus rubicunda*)	10
12/04/2018	Incidental - Tuckerbil	Freckled Duck (*Stictonetta naevosa*)	2
9/05/2018	Incidental - Tuckerbil	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	2

Annual waterbird counts at Fivebough and Tuckerbil Wetlands 2011-2023

Table 16: Annual bird counts at Fivebough and Tuckerbil Wetlands 2011-2023 (Source: DCCEEW, 2024)

Site	Sighting Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Fivebough	Survey	9,526	12,792	34,398	25,000	14,246	4,306	15,676	3,580	6,439	5,499	313		3,067	134,842
Fivebough	Incidental Observation		117	11,664	20,175	11,948	2,288	33,190	5,610	4,153	449	138		4,582	94,314
Tuckerbil	Survey		3,551	8,330	5,574	2,051	1,693	1,615	3,326	1,188	11,157	1,679	49	749	40,962
Tuckerbil	Incidental Observation			51					4136						4,187
Total		9,526	16,460	54,443	50,749	28,245	8,287	50,481	16,652	11,780	17,105	2,130	49	8,398	274,305

Waterbird water requirements for breeding of Murray Darling-Basin waterbird species

Species	Stimulus	Breeding Season (flood timing)	Maximum flood timing	Minimum Lag Time (months)	Ideal Lag Time)months)	Breeding duration (months)	Minimum flood duration (months)	Ideal Flood Duration (months)	Ideal Flood depth (m)	Rate of fall	Longevity (years)	Large flood frequency (years)	Small Flood frequency (years)	Inter-Flood dry-period (months)
Glossy Ibis	Flood	Oct-Feb		3	6-12	2	5	8-12	Deep	Moderate- slow	26.8(captive),14.3(Wild),8-10 (typical)	4-5	1-2	**1.3**
Australian White Ibis	Flood	Sept-Apr		1-3	6-9	2-3	3-6	6-12	0.5-1	Slow	33.2 (captive), 8-10 (typical)	4-5	1-2	**1-3**
Straw-necked Ibis	Flood, Season	Sept-Feb	Anytime	3	6-9	3	6	9-12	0.5-1	Slow	39.4 (captive), 8-10 (typical)	4-5	1-2	**1-3**
Royal Spoonbill	Flood, Season	Nov-May	Oct-May	1-2	>2	2-3	3-5	>5	0.5-1	Moderate- Slow	8-10	4-5	1-2	**1-3**
Yellow-billed spoonbill	Flood, Season	Sept-Apr	Any time	2	2-6	2-3	4-5	4-9	Deep	Moderate- slow	28.6 (captive)	7	1-2	**1-3**
Brolga	Flood	Dec-Feb (northern), July-Nov (Southern)	Aug-June (northern), May-Mar (southern)	1-2	2	3-4	4	6	0.24-0.72	Moderate- slow	41 (captive)	5		
Purple Swamphen	Flood, season	Aug-Dec (southern), Jan- Nov (northern)	Any time	1	2-3	3	4	5-6	0.3-0.90	Moderate- slow	5.5 (wild)	2	1-2	**1-3**

Black-tailed native-hen	Rainfall	Aug-Dec	Any time	2	3	1-2	3-4	4-5	Shallow	Moderate	Unknown	1-2	1-2	**1-3**
Black-winged Stilt	Flood	Aug-Dec	Any time	2	3	2-3	4	6	Unknown	Moderate	3.11 (wild)	2	1-2	**1-3**
Red-necked Avocet	Flood	July-Feb	May-Feb	1	2	2	3	4	Unknown	Moderate	7.3 (wild)	3	1-2	**1-3**
Red-Capped Plover	Flood, rainfall	July-Jan	Any time	3	3	2.5	5	6	Unknown	Moderate	20.11 (wild)	5	1-2	**1-3**
Black-fronted Dotterel	Flood. season	Aug-Feb	Any time	3	3	2-3	5	6	Unknown	Moderate	6.11 (wild)	3	1-2	**1-3**
Red-Kneed dotterel	Flood, season	Aug-Jan	Any time	3	3	3	6	6	Unknown	Moderate- slow	Unknown	Unknown	1-2	**1-3**
Banded Lapwing	Rainfall	July-Nov	Any time	<1	<1	3	<4	<4	Unknown	Moderate- fast	3.6 (wild)	2	1-2	**1-3**
Masked lapwing	Flood, rainfall, Season	July-Nov (NSW) July-Dec (Vic, northern MBD)	Any time	1	1	3	4	>4	Unknown	Moderate- fast	13.1 (wild)	6	1-2	**1-3**
Gull-billed Tern	Flood, Rainfall, Season	Sept-Jan		Nil	Nil	4	4	4	Unknown	Unknown	16 (wild)	5	1-2	**Unknown**
Caspian Tern	Flood, season	Any time (northern), sept-Feb (southern)		Unknown	Unknown	2	Unknown	Unknown	Unknown	Unknown	23 (wild)	Unknown	Unknown	**unknown**
Silver Gull	Flood, Season	Aug-Feb		2	3	2-3	4-6	>6	Shallow	Moderate- slow	28.8 (wild)	n/a	n/a	**n/a**
Whiskered Tern	Flood, Season	Oct-Jan		Nil	Nil	1-2	1-2	2	<0.6-1.8	Fast	10 (wild)	5	1-2	**>1**
Plumed whistling Duck	Flood, rainfall	Sept-Jan	Sept-May (northern)	2	3	3-5	5	8	±0.60	Moderate	3-4 (typical)	1-2	1-2	**1-3**

Blue-billed Duck	Flood, Season	Sept-Feb	Any time	2	2-3	3-5	5	5-8	Deep(>2)	Moderate- slow	3-4 (typical)	1-2	1-2	**1-3**
Musk Duck	Flood, season	Sept-Oct	June-Dec	2	3	4-5	6	6-8	Deep (>2)	Slow	6.2 (wild)	1-2	1-2	**1-3**
Freckled Duck	Flood	June-Dec	Any time	2	3	3	5	6	Unknown	Moderate- slow	3-4 (typical)	1-2	1-2	**1-3**
Black Swan	Flood, season	Apr-Oct		<1	1	7-8	7-9	9	0.3-0.6 (<2)	slow	24.8 (wild)	5	1-2	**Unknown**
Australian Shelduck	Flood, season	July-Nov		<1	1	3-4	3	5	0.60	Moderate	13.1 (wild). 3-4 (typical)	1-2	1-2	**1-3**
Pacific Black Duck	Flood, season	July-Sept	June-Dec	1	2-3	3-4	4-5	5-7	Unknown	Moderate	15.5 (wild), 3-4 (typical)	1-2	1-2	**1-3**
Grey Teal	Flood	June-Feb	Any time	1	2-5	3-4	4-5	5-9	Unknown	Moderate	>31 (wild), 3-4 (typical)	1-2	1-2	**1-3**
Chestnut Teal	Flood,	Aug-Oct	July-Mar	1	2	3-4	4-5	6	Unknown	Moderate- slow	6.5	3	1-2	**Unknown**
Pink-eared Duck	Flood	Mar-May (northern), Aug-Feb (southern)	Any time	1-2	2-3	2-3	3-4	4-6	0.2-1.63	Moderate	1.3 (wild), 3-4 (typical)	1-2	1-2	**1-3**
Hardhead	Flood, season	Aug-Dec	Any time	2	2-3	3-5	5	5-8	Deep (>2)	Moderate- slow	3-4 (typical)	1-2	1-2	**1-3**
Great crested grebe	Flood, season	Nov-Feb	Aug-Mar	1	1-3	1-2	2	2-5	1-2	Moderate- fast	19.2 (wild)	n/a	1-2	**n/a**
Hoary-headed grebe	Flood, season	Oct-Jan	Aug-Mar	2	5-6	1-2	3-4	6-8	Deep	Slow	unknown	n/a	1-2	**n/a**
Australasian grebe	Flood, season	Nov	Aug-Apr	3	5-7	3	6	8-10	Deep	Slow	Unknown	n/a	1-2	**n/a**

Darter	Flood	Nov-Apr		2	2-3	3	5	5-6	Deep (0.3-3.5)	Moderate	16 (Captivity)	4	1-2	**1-3**
Little Pied cormorant	Flood, season	Sept-Mar		3	9	3-4	6	12	shallow	Slow	11.7 (wild)	4	1-2	**1-3**
Little Black Cormorant	Flood, season	Dec-May (northern), Sept-May (southern)	Anytime	3	9	3-4	6	12	1-2	slow	10 (wild)	4	1-2	**1-3**
Pied Cormorant	Flood, season	Sept-May	Any time	Unknown	Unknown	3-4	Unknown	Unknown	Unknown	Unknown	27.8 (wild)	Unknown	Unknown	**Unknown**
Great Cormorant	Flood, season	Sept-Jan Mar-Aug		3	9	4	7	12	Deep (up to 30)	slow	18 (wild)	5	1-2	**1-3**
Australian Pelican	Flood	Sept-Feb	Aug-Mar	2-3	3	4-5	7-8	8	n/a	slow	16.8 (wild)	5	1-2	**n/a**
White Faced Heron	Flood, Season	Aug-Oct	June-Mar	1-4	>4	3	4-7	>7	Deep	Moderate- slow	8-10 (wild)	4	1-2	**1-3**
Little Egret	Flood	Oct-Mar		<3	3	3-4	4-6	6	Deep	Moderate	8-10 (wild)	4	1-2	**Unknown**
Intermediate Egret	**Flood, season**	**Dec-Ma(northern), Nov-Apr (southern)**		**3**	**9**	**3-4**	**6-7**	**12**	**deep**	**slow**	**7 (wild)**	**3**	**1-2**	**1-6**

5:Source: 2020 AEMP, Appendix 5 pg. 108; Rogers, K and Ralph, T.J (2011) 'Chapter 2- Vegetation' in Floodplain Wetland Biota in the Murray-Darling Basin Water and Habitat NSW DECCW. CSIRO publishing

Preferred waterbird foraging depths

	Water Depth (cm)										
	0	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20
Red-necked Avocet							**	**	**		
Black-winged Stilt				*	**	**	**	**	*		
Black-tailed Godwit				**	**	**	**				
Marsh Sandpiper			**	**	**						
Sharp-tailed Sandpiper		**	**	**							
Red-kneed Dotterel	**	**	**								
Red-capped Plover	**	**									
Masked Lapwing	**	**									

6 2020 AEMP Appendix 8; Appendices 7 and 8: Taylor and Richardson, 2000.

Attachment 2. Vegetation Data

Table 17: Photo Monitoring Points for Fivebough and Tuckerbil wetland (*collected December 2024*)

Site	Waypoint ID	Lat.	Long.	elevation (m)	Photo Direction	Creation Date Time	Description
Fivebough	FB PP 1	-34.53114904	146.422438	137.985107	170 deg	2024-12-17T05:19:23Z	Black box woodland revegetation area
Fivebough	FB PP 2	-34.52723804	146.424104	139.074554	120 deg	2024-12-17T00:13:05Z	Black Rolypoly Chenopod shrubland
Fivebough	FB PP 3	-34.52726897	146.424011	137.953552	180 deg	2024-12-17T00:06:04Z	Black Rolypoly chenopod shrubland
Fivebough	FB PP 4	-34.52331003	146.423421	139.827713	40 deg	2024-12-17T01:10:55Z	Black box grassy, chenopod woodland
Fivebough	FB PP 5	-34.52700703	146.427465	135.679092	40 deg	2024-12-16T23:39:33Z	Couch grass grassland wetland
Fivebough	FB PP 6	-34.52198602	146.423751	139.430161	200 deg	2024-12-17T01:40:58Z	Black Rolypoly chenopod shrubland
Fivebough	FB PP 7	-34.52352603	146.428924	139.757034	20 deg	2024-12-17T02:11:44Z	Couch grass grassland wetland
Tuckerbil	TB PP 1	-34.49252301	146.368152	134.181824	12 deg	2024-12-18T21:16:13Z	Black box woodland revegetation area
Tuckerbil	TB PP 2	Could not relocate	NA	NA	NA	NA	NA
Tuckerbil	TB PP 3	-34.48350797	146.341843	134.181824	240 deg	2024-12-18T21:16:13Z	NA
Tuckerbil	TB PP 6	-34.49479999	146.355007	136.977509	110 deg	2024-12-19T05:28:54Z	Irrigation channel / water delivery channel
Tuckerbil	TB PP 8	-34.49227796	146.359554	139.254623	270 deg	2024-12-19T02:23:12Z	Lignum shrubland wetland
Tuckerbil	TB PP 9	-34.49143197	146.359542	138.181274	330 deg	2024-12-19T02:11:50Z	Black box woodland
Tuckerbil	TB PP 10	-34.48375801	146.343437	131.633896	15 deg	2024-12-18T21:33:17Z	Couch grass grassland (grassy meadow/ chenopod shrubland complex), original not found, new Photo Point 10 established
Tuckerbil	TB PP 11	-34.48122801	146.34726	134.602676	94 deg	2024-12-18T22:33:08Z	Overlooking tall sedgeland wetland
Tuckerbil	TB PP 12	-34.47838898	146.348824	135.223404	55 deg	2024-12-18T23:10:05Z	Overlooking deep marsh sedgy area
Tuckerbil	TB PP 12	-34.47838898	146.348824	135.223404	125 deg		Lignum shrubland wetland
Tuckerbil	TB PP 13	Not resurveyed	NA	NA	NA	NA	Determined to be an extraneous Photo Point (another drain/channel) and not easily accessible. Substitutes/ replacement photo points established in the inundated areas.
Tuckerbil	TB PP 14	-34.48254397	146.345273	131.277023	150 deg	2024-12-18T21:59:56Z	Spike sedge wetland/ shallow freshwater sedgeland
Tuckerbil	TB PP 15	-34.492644	146.354052	136.070007	60 deg	2024-12-19T03:25:50Z	Middle of wet, tall sedgeland wetland

Site	Waypoint ID	Lat.	Long.	elevation (m)	Photo Direction	Creation Date Time	Description
Tuckerbil	TB PP 16	-34.49195601	146.352421	136.095749	60 deg	2024-12-19T03:41:34Z	Dry island in the middle of inundated tall sedgeland wetland, likely historically Black box woodland wetland
Tuckerbil	TB PP 17	-34.49104498	146.355202	135.014404	30 deg	2024-12-19T04:19:48Z	Wet, tall sedgeland wetland
Tuckerbil	TB PP 18	-34.49067601	146.35653	137.191086	0 deg	2024-12-19T04:32:00Z	Wet, tall sedgeland wetland

5.3 Fivebough Wetland Photo Points

Photo Point 1. Black box woodland revegetation area (-34.53114904, 146.422438).

Photo Point 2. Black Rolypoly Chenopod shrubland (-34.52723804, 146.424104).

Photo Point 3. Black Rolypoly Chenopod shrubland -34.52726897, 146.424011).

Photo Point 4. Black box grassy/ chenopod woodland (-34.52331003, 146.423421).

Photo Point 5. Couch grass grassland wetland Photo 1 (-34.52700703, 146.427465).

Photo Point 5. Couch grass grassland wetland Photo 2 (-34.52700703, 146.427465).

Photo Point 6. Black Rolypoly chenopod shrubland (-34.52198602, 146.423751).

Photo Point 7. Couch grass grassland wetland (-34.52352603, 146.428924).

5.4 Tuckerbill Wetland Photo Points

PhotoPoint 1. Revegetated area and second photo of chenopod shrubland (-34.49252301, 146.368152).

Photo Point 2. Could not relocate

Photo Point 3. Could not relocate (--34.48350797 146.341843).

Photo Point 4. No previous record.

Photo Point 5. No previous record.

Photo Point 6. Irrigation channel / water delivery channel. Photo also taken in opposite direction of view over the wetland (-34.49479999 146.355007)

Photo Point 7. No record.

Photo Point 8. Black box – Lignum woodland (34.49227796, 146.359554)

Photo Point 9. View over Tuckerbil wetland (-34.49143197, 146.359542)

Photo Point 10. Couch grass grassland (grassy meadow/ chenopod shrubland complex), original not found, new Photo Point 10 established (-34.48375801, 146.343437).

Photo Point 11. Overlooking tall sedgeland wetland (146.34726, 134.602676).

Photo Point 12. Overlooking tall dry, sedgland wetland area (-34.48122801, 146.34726).

Photo Point 12 – Photo 2. Lignum shrubland wetland in Northern corner of Tuckerbil swamp

Photo Point 12 – Photo 3. Lignum shrubland wetland in Northern corner of Tuckerbil swamp

Photo Point 13. Not surveyed

Photo Point 14. Spike sedge wetland/ shallow freshwater sedgeland (-146.345273, 131.277023).

Photo Point 15. Middle of wet, tall sedgeland wetland (-34.492644, 146.354052).

Photo Point 16. Dry island in the middle of inundated tall sedgeland wetland, likely historically Black box woodland wetland (-34.49195601, 146.352421).

Photo Point 17. Wet, tall sedgeland wetland (-34.49104498, 146.355202).

Photo Point 18. Wet, tall sedgeland wetland (-34.49067601, 146.35653).