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Fauna Habitat Assessment and Species Utilisation Tarro Recreation Area Lake

February 2023

Fauna Habitat Assessment and Species Utilisation Survey – Tarro Recreation Area Lake

8 February 2023

Prepared for:
Nation Partners Pty Ltd
Suite 306, 30 Holt Street
Surry Hills NSW 2010

Prepared by:
DPM Envirosciences Pty Ltd
ABN: 54 602 226 460
PO Box 1298
Mooloolaba QLD 4557

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Fauna Habitat Assessment and Species Utilisation Survey – Tarro Recreation Area Lake

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By

DPM Enviros ciences Pty Ltd
ABN: 54 602 226 460
PO Box 1298 Mooloolaba QLD 4557

David Moore
Principal Environmental Scientist

Technical review:

Deanna Bayliss
Senior Ecologist & GIS Analyst, EcoGIS

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1 INTRODUCTION

DPM Enviroscienses Pty Ltd (DPM Enviroscienses) was commissioned by Nation Partners Pty Ltd (Nation Partners) to undertake a site visit to complete a fauna habitat assessment and capture data on species utilising the lake at the Tarro Recreation Area (Figure 1).

Nation Partners is investigating the ecological significance of potential contamination associated with per- and polyfluoroalkyl substances (PFAS) from historical use in the lake's catchment, including an area that was formerly used for fire training by Fire and Rescue NSW and has subsequently become part of Our Lady of Lourdes Primary School. Nation Partners required a site visit by an experienced ecologist to capture ecological data for the lake to further inform existing ecological risk assessments.

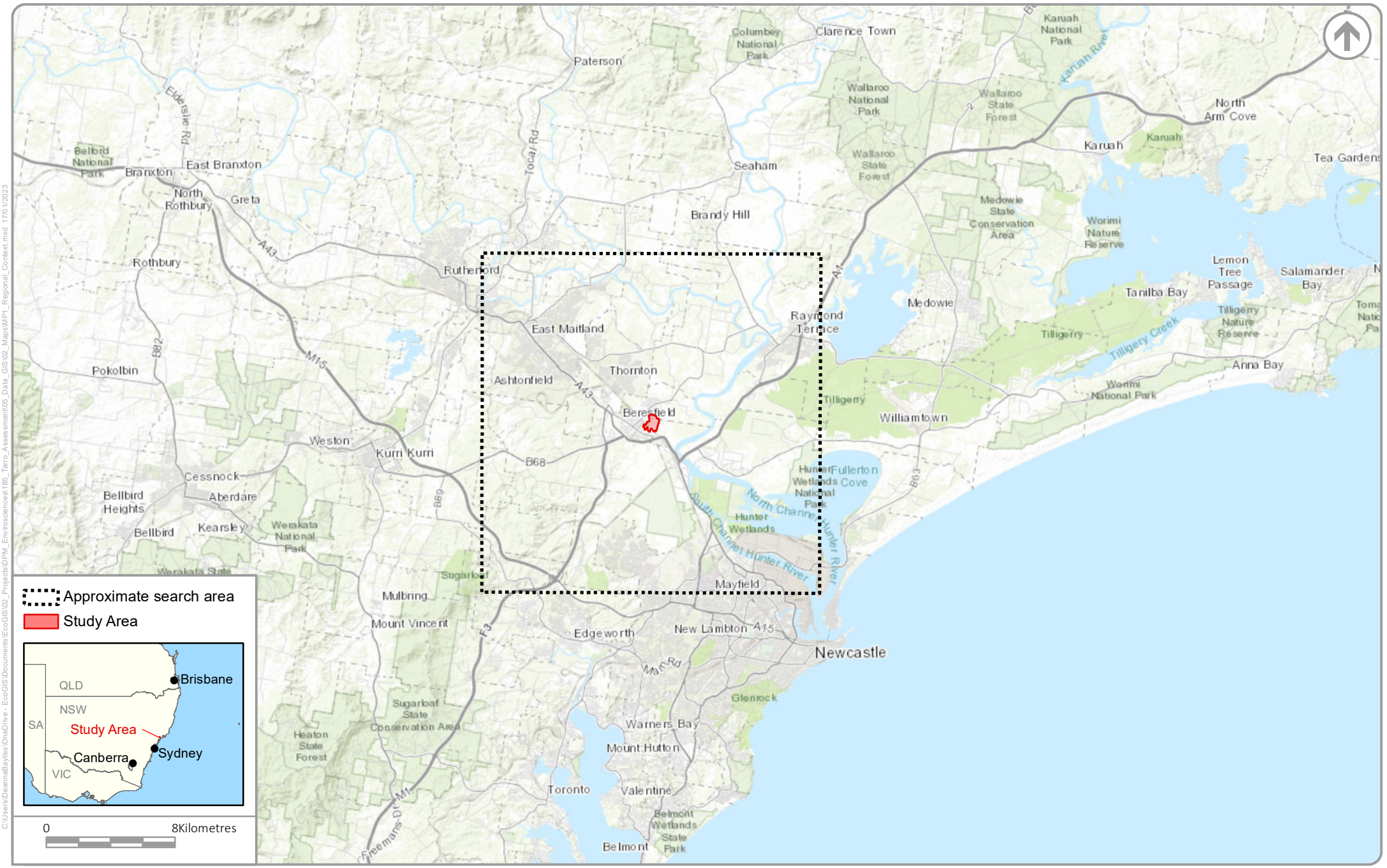
As PFAS are water soluble and mobile, their main transport mechanisms are interpreted to be surface watercourses, infiltration to the subsurface and subsequent transport with groundwater. Surface waters draining from the Tarro Fire Station, and potential surface expressions of groundwater, provide potential pathways for PFAS consumption by fauna. The site visit aimed to capture data on aquatic and terrestrial fauna species that are likely to access the lake for direct consumption (drinking) or to forage for other aquatic organisms.

The assessment provides a list of fauna species considered likely to reside within or make use of the lake on occasion. The findings discussed in this report are based on a desktop assessment of readily available data sources, supplemented by field survey undertaken 6-7 December 2022.

1.1 Scope

The scope of work for this fauna habitat assessment and species utilisation survey consisted of the following tasks:

- conduct a desktop review of readily available data sources for a Search Area encompassing the Tarro Recreation Area Lake and adjoining wetland to the north-east of the railway, plus a 10 km buffer, to establish a comprehensive list of fauna which 'may occur', are 'likely to occur', or that are 'known to occur' in the Search Area;
- conduct a site visit to capture habitat attribute data to assist in refining the fauna species list; and
- prepare a fauna habitat assessment and species utilisation report that provides a refined list of fauna species considered likely to occur in the Tarro Recreation Area Lake and adjoining wetland, for use in subsequent ecological risk assessments.



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REGIONAL CONTEXT

Fauna Habitat Assessment and Species Utilisation Survey – Tarro Recreation Area Lake

FIGURE 1

2 METHODS

2.1 Study Area

The area formerly used for fire training by Fire and Rescue NSW contains stormwater pits and a subsurface infiltration system (Nation Partners 2020). Overflow from this system enters the local stormwater system on Anderson Drive and is expected to discharge to the north towards Tarro Reserve and waterbodies north of the reserve (Nation Partners 2020). This area discharges to the Hunter River (approximately 2 km south-east of the lake) via Purgatory Creek (Figure 1).

The Study Area for the desktop assessment considers the Tarro Recreation Area Lake and the adjoining wetland to the north-east. The desktop Search Area extends approximately 10 km from the Study Area in each cardinal direction and is defined by the GDA 2020 coordinates:

- -32.71°; 151.55°;
- -32.71°; 151.78°;
- -32.90°; 151.78°; and
- -32.90°; 151.55°.

Fauna habitat assessments and survey effort conducted 6-7 December 2022 were confined to the Survey Area, being the publicly accessible lake and its periphery (Figure 2).

2.2 Desktop assessment

The desktop assessment involved searches of readily accessible databases. This assessment was used to document known records for the Study Area, identify the potential presence of conservation-significant fauna species, and assist in targeting survey effort. The desktop assessment compiled data from the following sources:

- Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool, to identify ecological Matters of National Environmental Significance (MNES) within approximately 10 km of the Study Area (DCCEEW 2022);
- NSW Department of Planning and Environment (DPE) BioNet Atlas database (DPE 2022a), to identify fauna records within approximately 10 km of the Study Area; and
- DPE State Vegetation Type Map: Plant Community Type, Version C1.1.M1.1 (December 2022) (DPE 2022b).

The following fauna reference texts were also reviewed: Allen, Midgley and Allen (2002), Cayley (2011), Churchill (2008), Cogger (2014), Morcombe (2003) and Strahan (1995).

2.3 Site visit

The site visit 6-7 December 2022 aimed to capture data on general fauna usage of the Study Area to improve our understanding of what species and faunal groups are utilising these areas or are likely to utilise these areas on occasion. The collected data allowed DPM Enviroscienses to refine a list of threatened or migratory vertebrate fauna species identified for the broader desktop Search Area to those which are likely to utilise habitat resources of the Study Area.

2.3.1 Terrestrial fauna habitat assessment

Terrestrial fauna habitat assessments were undertaken at two representative locations on the lake periphery (Figure 2) to inform potential fauna usage and assess potential for threatened and migratory fauna species likely to utilise the Study Area. At each site an approximate 1 ha

area was assessed for a range of features including overall condition, type and extent of erosion, presence and type of disturbance, presence and accessibility of standing water, and abundance of large hollows (>20 cm), small hollows (<20cm), large logs (>50 cm diameter), small logs (<50cm diameter), cliffs and rocky outcrops, large rocks (>30 cm), small rocks (<30 cm), decorticating bark, leaf litter, dense grass/shrub shelter, arboreal and terrestrial termite mounds, seeding grass cover, fruiting plants and nectar and pollen producing plants.

Photos were obtained and site profiles were compiled for each site (Appendix A).

2.3.2 Aquatic fauna habitat assessment

Aquatic fauna habitat assessment was undertaken at two representative locations on the lake to establish a general description of the waterbody and aquatic habitat features available. The data collected included water level, depth, velocity, physico-chemical water quality, width, canopy cover, substrate types, habitat attributes, local catchment erosion, sediment deposits, water colour, presence of algae, water odour, substrate odour, presence of snags and large woody debris, riparian zone width and cover, and general signs of disturbance.

Photos were obtained and site profiles were compiled for each site (Appendix A).

2.3.3 Terrestrial fauna survey

Terrestrial fauna was surveyed across the lake and lake periphery, contributing to a list of species known to utilise the waterbody.

The survey effort included:

- bird dawn chorus survey (two mornings) and dusk chorus survey (two evenings) – to obtain data on waterfowl, wader birds and woodland birds;
- Anabat echo-location bat call detector (two nights) – to obtain data on microbat species;
- diurnal reptiles and amphibian searches;
- searches for mammal tracks, scats and other traces; and
- recording of incidental observations.

Comprehensive fauna survey (spotlighting, Elliot trapping, cage trapping, pitfall trapping, camera trapping, harp trapping etc.) was not undertaken.

Bird surveys at dawn (vicinity of site TAQ2)

Anabat bat detector deployed overnight (vicinity of site TAQ2)

Plates 1-2 Terrestrial fauna survey effort within the Study Area 6-7 December 2022

2.3.4 Fish survey

DPM Enviros ciences used a combination of active survey techniques (backpack electrofishing) and passive survey techniques (fyke nets and box traps deployed for 8 hours, checked 4-hourly) to capture data on fish species and size range within the lake.

Fish surveys were conducted in accordance with DPM Enviros ciences' NSW Animal Research Authority and NSW Scientific Collection Permit. Native fishes were identified, measured and enumerated in the field, then returned to the water. Pest species were euthanized and disposed of appropriately as per our NSW Animal Research Authority.

Backpack electrofishing (vicinity of site TAQ1)

Two fyke nets and five box traps deployed at site TAQ1

Plates 3-4 Fish survey effort within the Study Area 7 December 2022

2.3.5 Turtle survey

Baited fyke nets were deployed for 8 hours (checked 4-hourly) to capture data on turtle species, sex, size and life history stage (juvenile, intermediate and adult) within the lake.

2.3.6 Aquatic macroinvertebrate survey

Two representative macroinvertebrate samples were collected from the lake in the vicinity of the aquatic habitat assessment locations. Freshwater macroinvertebrates were collected by a NSW Australian River Assessment System (AusRivAS) accredited ecologist. AusRivAS protocols are modified for lacustrine and palustrine wetland sites by combining the bed and edge habitat sampling to provide overall indices of diversity and taxonomic composition.

A standard sized dip net with 250 µm mesh was used to sample macroinvertebrates. The collected material was transferred to plastic sorting trays, where the contents were sorted and live-picked for up to one hour. Picked specimens were placed into specimen jars with 70% ethanol.

Samples were identified to AusRivAS taxonomic level (primarily Family level) under stereomicroscope.

Standard data analyses were applied, including:

- taxonomic richness;
- total number of PET (Plecoptera, Ephemeroptera and Trichoptera) families and percentage of PET – as a measure of disturbance-sensitive taxa;
- SIGNAL2 (Revised Stream Invertebrate Grade Number – Average Level) indices – as an indicator of habitat quality and environmental stressors; and

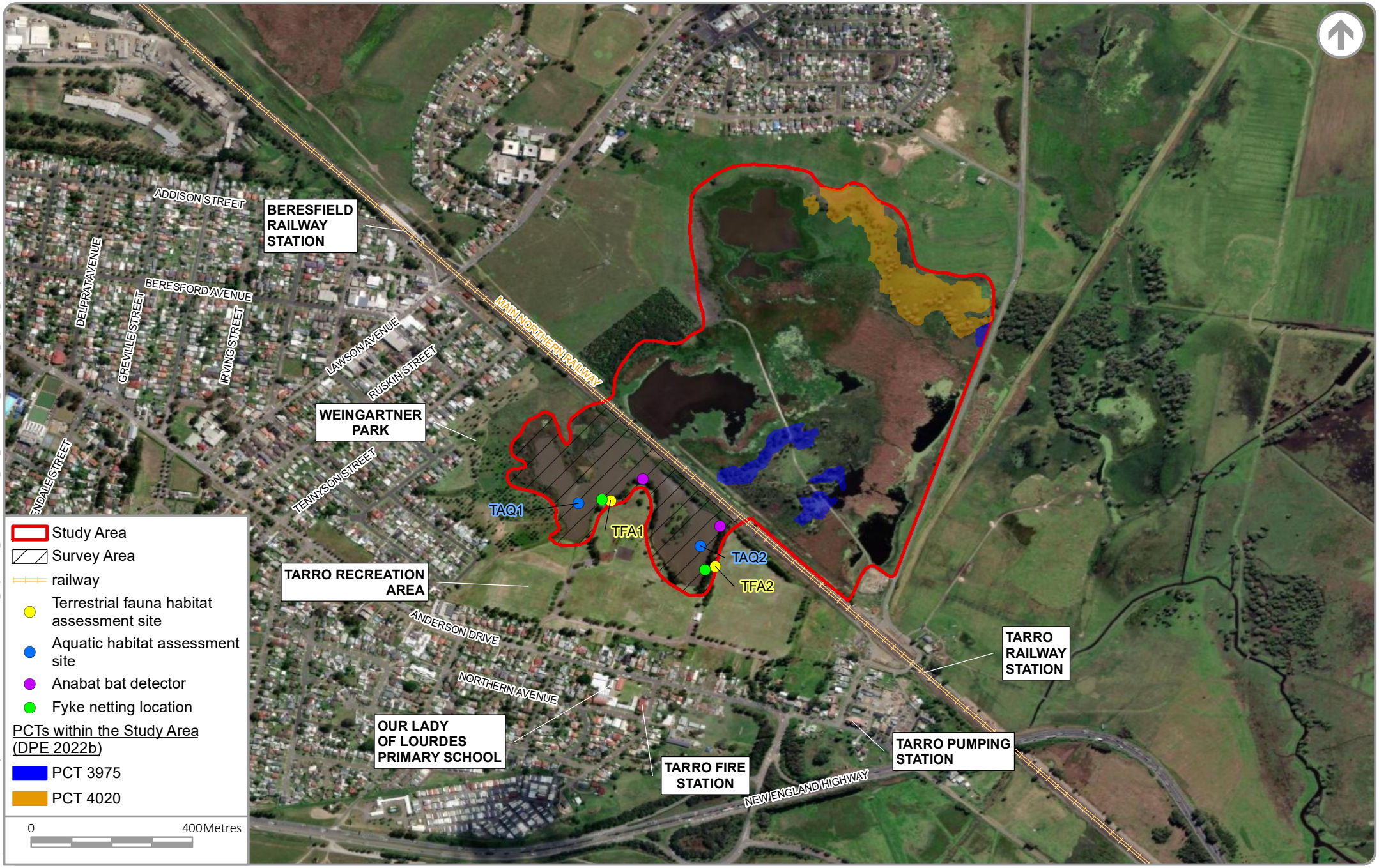
- tolerant taxa – those taxa with a SIGNAL2 sensitivity score of 3 or less (Marshall et al. 2001) – an absence of more sensitive taxa suggests environmental conditions may be too harsh for these taxa (i.e. those with SIGNAL2 score of 4 or above).

2.3.7 Aquatic flora survey

Aquatic plants (macrophytes) were surveyed across the lake and lake periphery. This involved a survey of the wetted perimeter using a kayak and an estimation of relative abundance applying the categories: Little (1-10%), Some (10-50%), Moderate (50-75%) and Extensive (>75%). Aquatic plant specimens were identified to species using available literature and keys. Algae (apart from branching algae, which are macrophytes) were not identified during this assessment. It is noted, however, that no noteworthy algal (or cyanobacterial) blooms were encountered.

2.4 Taxonomic nomenclature

Scientific names of fauna used in this report follow the CSIRO List of Australian Vertebrates (Clayton et al. 2006). Scientific names of flora used in this report follow the Australian Plant Census (CHAH 2021).



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FAUNA HABITAT ASSESSMENT AND SURVEY SITES

Fauna Habitat Assessment and Species Utilisation Survey – Tarro Recreation Area Lake

FIGURE 2

3 RESULTS

3.1 Fauna habitats

The vegetation of the Tarro Recreation Area Lake is void of any State-mapped or field-verified Plant Community Types (PCTs). The vegetation and fauna habitats comprise:

- open water;
- fringing macrophytes;
- fringing native regrowth trees and shrubs;
- planted trees and shrubs; and
- sporting fields.

Fringing macrophytes and trees (site TFA1)

Fringing trees (site TFA2)

Fringing macrophytes (alligator weed and narrow-leaved cumbungi) in the vicinity of site TAQ1

Open water in the vicinity of site TAQ2

Planted trees and shrubs, fringing regrowth trees and shrubs, and fringing macrophytes near site TAQ1

Sporting fields, open water, fringing native regrowth, plantings and fringing macrophytes

Plates 5-10 Fauna habitats encountered within the Study Area 6-7 December 2022

The adjoining wetland north-east of the rail line could not be accessed during the site visit but appears to provide areas of open water as well as extensive shallow areas suited to wader birds. This area also appears to contain emergent and fringing macrophytes, pasture, fringing trees, as well as some areas of State-mapped Coastal Floodplain Wetland PCT4020 – 'Coastal Creekflat Layered Grass-Sedge Swamp Forest' and Coastal Freshwater Lagoon PCT 3975 – 'Southern Lower Floodplain Freshwater Wetland' (Figure 2), both of which are potential Threatened Ecological Communities under the NSW *Biodiversity Conservation Act 2016*.

The Study Area, including the Tarro Recreation Area Lake and the adjoining wetland to the north-east, provides potential foraging and breeding habitat for threatened frogs, waterbirds, wader birds, woodland birds and microbats identified in Table 1. The Study Area also provides potential foraging (and some breeding) habitat for Migratory birds identified in Table 2, as well as habitat resources for a diversity of common fish, frogs, reptiles, waterbirds, wader birds, woodland birds, and mammals, including many of those identified in Appendix B.

3.2 Aquatic habitat attributes

The aquatic habitat attributes for sites TAQ1 and TAQ2 at the Tarro Recreation Area Lake are provided as site profiles in Appendix A.

At the time of assessment the lake was wadable in most areas (average depth of about 1 m), deepening to about 2 m at constrictions. The lake appears to have been constructed or modified with a heavy clay base. Minor silt deposition was detected in deeper areas. Substrate complexity is poor, with a predominantly firm, gently sloping clay base. No sand, gravel, pebble, cobble or boulders were detected, apart from minor occurrence of sand in the edge habitat. Fringing macrophytes in the edge habitats provided better habitat complexity for fish, turtles and aquatic macroinvertebrates than the bed habitats. Open water areas provided potential habitat for mullets, although none were detected during the fish survey (Section 3.4.1).

3.3 Physico-chemical water quality

Surface (0-0.15 cm depth) measurements were undertaken at two locations (TAQ1 and TAQ2) within the Tarro Recreation Area Lake on 6 December 2022 (Figure 2).

At the time of measurement, water temperatures were 24.6°C (at 8:15 Eastern Standard Time [EST]) at TAQ2 and 25.4°C (at 9:30 EST) TAQ1 (Appendix A).

In-situ pH levels were neutral (7.3 pH units) at TAQ2 to mildly alkaline (7.6 pH units) at TAQ1.

Specific conductivity levels were marginal (i.e. >800 µS/cm, but <1,600 µS/cm) at both TAQ1 (824 µS/cm) and TAQ2 (816 µS/cm).

Dissolved oxygen (DO) levels were typical of an open waterbody with relatively low levels of algae, submerged macrophytes and detritus. DO levels were 73.2% saturation and 7.3 mg/L at 8:15 EST (at TAQ2) and 88.7% and 7.6 mg/L at 9:30 EST (at TAQ1). DO levels are likely to rise to a diurnal peak of around 100% by midday.

Turbidity levels were moderate (moderate clarity), with 36 NTU recorded at both TAQ1 and TAQ2.

3.4 Fauna species

A review of readily available fauna databases, combined with observations during the field assessment, identified many vertebrate fauna species that have been recorded from, or that may potentially utilise habitat within, the broader Search Area. A total of 521 vertebrate fauna species were identified from the desktop searches, comprising 14 fish, 32 amphibians, 50 reptiles, 351 birds and 74 mammals (Table B1 in Appendix B). Species detected during the field visit included 63 vertebrate fauna species within the Study Area, comprising eight fish, three reptiles, 40 birds and 12 mammals (Table B1 in Appendix B).

3.4.1 Fish

Eight species were identified from 951 fishes identified from the lake 7 December 2022, comprising six common native species and two pest species (Table 1).

Table 1 Fish detected within the Tarro Recreation Area Lake, 7 December 2022

Common name	Species name	No. captured / observed+	Size range (mm)^
Short-finned Eel	*Anguilla australis*	4	200-450
Longfin Eel	*Anguilla reinhardtii*	10	200-700
Carp*	*Cyprinus carpio**	4	250-400
Gambusia*	*Gambusia holbrooki**	79	20-45
Striped Gudgeon	*Gobiomorphus australis*	24	30-120
Empire Gudgeon	*Hypseleotris compressa*	612	30-100
Firetail Gudgeon	*Hypseleotris galii*	190	30-50
Flathead Gudgeon	*Philypnodon grandiceps*	28	30-70

Notes:

* Introduced species. All introduced species euthanised and disposed of in accordance with our NSW Animal Research Authority.

^ Snout to fork length.

3.4.2 Turtles

One species was identified from two turtles captured in fyke nets deployed 7 December 2022. This comprised the common native species eastern snake-necked turtle (*Chelodina longicollis*), comprising two sub-adults, each 14 cm in length.

3.4.3 Mammals

Targeted survey effort was undertaken for Microchiropteran bats (microbats), with searches for other mammal species limited to searches for tracks, scats and other traces (Section 2.3.3) and opportunistic sightings. Apart from microbats, mammal detections were limited to the sightings of one Feral Cat (*Felis catus*)*, numerous domestic Dogs (*Canis familiaris*)* (with their owners), and both cat and dog scats.

Microbats were positively identified by bat specialist Greg Ford (Balance! Environmental) using the recorded echolocation call spectrograms and derived metrics and comparing them with regionally relevant reference calls and published call descriptions. Positively identified calls were allocated to eight distinct species and two undifferentiated species pairs (Table 2).

Given the apparent absence of suitable natural roosting sites for the Eastern Cave Bat (*Vespadelus troughtoni*) near the Study Area, it is most likely the *Vespadelus* species pair represents Little Forest Bat (*V. vulturnus*); however, the presence of two *Miniopterus* species

suggests that suitable roost sites for *V. troughtoni* (which includes sandstone overhang caves, boulder piles, mines, buildings and abandoned fairy martin nests under bridges and in culverts [Churchill 2008]) potentially exist nearby (Balance! Environmental 2023).

The Southern Myotis (*Myotis macropus*) is a species that forages over streams and pools catching insects and small fish by raking their disproportionately large feet across the water surface, and was detected by 361 calls in the eastern corner of the Survey Area (Figure 2 and Plate 2).

Table 2 Bats detected within the Tarro Recreation Area Lake, 6-7 December 2022

Common name	Species name	Positively identified calls
Gould's Wattled Bat	*Chalinolobus gouldii*	10
Chocolate Wattled Bat	*Chalinolobus morio*	23
Southern Myotis[V]	*Myotis macropus*[V]	361
Lesser Long-eared Bat / Gould's Long-eared Bat	*Nyctophilus geoffroyi / N. gouldi*	8
Greater Broad-nosed Bat[V]	*Scoteanax rueppellii*[V]	20
Eastern Cave Bat[V] / Little Forest Bat	*Vespadelus troughtoni*[V] */ V. vulturnus*	4
Little Bent-winged Bat[V]	*Miniopterus australis*[V]	83
Large Bent-winged Bat[V]	*Miniopterus orianae oceanensis*[V]	9
Eastern Coastal Free-tailed Bat[V]	*Micronomus norfolkensis*[V]	50
Eastern Free-tailed Bat	*Ozimops ridei*	80

Notes:

[V] Denotes Vulnerable species listed under the NSW *Biodiversity Conservation Act 2016.*

3.4.4 Aquatic macroinvertebrates

A total of 14 taxa were identified from 209 aquatic macroinvertebrates collected from the Tarro Recreation Area Lake (two composite bed/edge samples) on 7 December 2022. The sample was dominated by tolerant taxa (those taxa with a SIGNAL2 sensitivity score of 3 or less), including Atyidae (freshwater shrimp), Coleoptera (beetles), Diptera (true flies), Ephemeroptera (mayflies), Hemiptera (true bugs), Trichoptera (Ecnomid caddis flies) and Zygoptera (damselflies); as well as Copepoda (copepods) with no SIGNAL2 score. Sensitive taxa (those with a SIGNAL2 sensitivity score >4) included Trichoptera (Leptocerid caddis flies) (Table 3).

Three PET taxa were recorded, comprising one Ephemeroptera (mayfly) taxon: Caenidae; and two Trichoptera (caddis fly) taxa: Ecnomidae and Leptoceridae (Table 3). No Plecoptera (stoneflies) were detected, nor were they expected to occur due to lack of suitable habitat.

The taxonomic composition of aquatic macroinvertebrates within the lake is similar to other well-established constructed/modified lakes sampled by DPM Enviroscienses in the region. A higher number of taxa would be expected in waterbodies with greater habitat complexity, such as natural and varying substrates and shallow edges grading into deeper habitats. The constructed clay base, paucity of large woody debris, and relatively abrupt drop from the shore into deep habitat along most edges, limits habitat complexity and consequently limits the aquatic macroinvertebrate community composition. The dominance of pollution-tolerant taxa suggests that the lake may exhibit harsh environmental conditions through unfavourable habitat or reduced water quality.

Table 3 Aquatic macroinvertebrates sampled from the Tarro Recreation Area Lake, 7 December 2022

Major taxon	Family/Sub-Family (s.f.)	SIGNAL2 score	Number of individuals	
			TAQ1	TAQ2
Copepoda	-	-		1
Decapoda	*Atyidae*	3	49	34
Coleoptera	*Chrysomelidae*	2		8
	Curculionidae	2		1
	Hydrophilidae	2	1	1
Diptera	*s.f. Chironominae*	3	16	38
Ephemeroptera	*Caenidae*	4	1	
Hemiptera	*Mesoveliidae*	2	2	1
	Micronectidae	2	2	
	Naucoridae	2		1
	Pleidae	2	1	2
Zygoptera	*Coenagrionidae*	2	12	13
Trichoptera	*Ecnomidae*	4	3	1
	Leptoceridae	6	7	14
Number of individuals (taxa richness; excluding microcrustacea [copepods])			94	114
Number of taxa (taxa richness; excluding microcrustacea [copepods])			10	11
SIGNAL2 average			3.00	2.73
PET taxa			3	2
Plecoptera			0	0
Ephemeroptera			1	0
Trichoptera			2	2
Taxa with SIGNAL2 scores			10	11
Tolerant taxa (SIGNAL2 ≤3)			7	9
% tolerant taxa			70	82

3.4.5 Threatened fauna species

Listed threatened fauna species are those taxa listed in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the NSW *Biodiversity Conservation Act 2016* (BC Act), or the NSW *Fisheries Management Act 1994* (FM Act) as Critically Endangered (CE), Endangered (E) or Vulnerable (V).

The database searches identified 104 threatened fauna species that 'may' occur, are 'likely' to occur or that are 'known' to occur from the broader Search Area. This includes three fish, five amphibians, six reptiles, 69 birds and 21 mammals. Of these species, 56 are listed under the EPBC Act, 84 are listed under the BC Act and three are listed under the FM Act. Table C1 in Appendix C lists these threatened fauna species, together with their preferred habitat and an indication as to whether their preferred habitat potentially occurs within the Study Area. Based on a desktop review of habitat preferences, 17 of the 104 threatened species have a greater potential to utilise habitats within the Study Area. Six of these species (all microbats) were detected within the Study Area (Table 4). One of these species – the Southern Myotis (*Myotis macropus*) forages over streams and pools catching insects and small fish by raking their disproportionately large feet across the water surface.

Of the threatened species that have a greater potential to utilise habitats of the Study Area but that were not detected during the survey (i.e. the remaining 11 species), it is possible that they may have been present within the larger portion of wetland habitat of the Study Area that was not accessible in the 6-7 December survey. These species may also utilise habitats of the broader Study Area in other times of the year, or simply may not have been detected by the limited/opportunistic survey effort undertaken 6-7 December 2022. Finally, other threatened fauna species may utilise the Study Area on occasion despite the habitats not being preferred habitat.

All 104 threatened fauna species recorded from the broader Search Area are detailed in Table C1 in Appendix C. The 17 species that have the greatest potential to utilise habitats of the Study Area are presented in Table 4.

Table 4 Threatened vertebrate fauna species with the greatest potential to utilise habitats of the Study Area

Common name	Scientific name	Status		Preferred habitat (and notes)
		BC Act[1]	EPBC Act[2]	
Amphibians				
Wallum Froglet	*Crinia tinnula*	V		Acid swamps on coastal sand plains; sedgelands and wet heathlands. Potentially available within the wetland to the north-east that was not accessible.
Green and Golden Bell Frog	*Litoria aurea*	E	V	Marshes, dams and stream-sides; unshaded and free of mosquitofish (*Gambusia holbrooki*). Potentially available within the wetland to the north-east that was not accessible.
Birds				
Magpie Goose	*Anseranas semipalmata*	V		Shallow wetlands with dense growth of rushes or sedges. Potentially available within the wetland to the north-east that was not accessible.
Blue-billed Duck	*Oxyura australis*	V		Deep water in large permanent wetlands and swamps with dense vegetation.
Freckled Duck	*Stictonetta naevosa*	V		Permanent freshwater swamps and creeks with heavy growth of cumbungi, lignum or tea-tree.
White-throated Needletail	*Hirandapus caudacutus*	V		High open airspaces above almost any habitat, including oceans.
Black-necked Stork	*Ephippiorhynchus asiaticus*	E		Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers.
Australasian Bittern	*Botaurus poiciloptilus*	E	E	Dense beds of reeds and rushes.
Black Bittern	*Ixobrychus flavicollis*	V		Terrestrial and estuarine wetlands with permanent water and dense vegetation.
Australian Painted Snipe	*Rostratula australis (benghalensis)*	E	E	Fringes of wadable swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber. Potentially available within the wetland to the north-east that was not accessible.
Little Lorikeet	*Glossopsitta pusilla*	V		Forests and woodland, favouring open country - trees along watercourses and open paddock trees.

Common name	Scientific name	Status		Preferred habitat (and notes)
		BC Act[1]	EPBC Act[2]	
Mammals				
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V		Forages above almost all habitats, with or without trees; roosts in tree hollows, buildings and mammal burrows.
Southern Myotis	*Myotis macropus*	V		Forage over streams and pools; roosting nearby in caves, mine shafts, tree hollows, structures and dense foliage. **Detected in Survey Area.**
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V		Variety of habitats including rainforest, open woodland, *Melaleuca* swamp woodland, wet and dry sclerophyll forests, cleared paddocks with remnant trees and tree-lined creeks in open areas; roosting tree hollows, cracks, fissures, bark, and roofs of old buildings. **Detected in Survey Area.**
Little Bent-winged Bat	*Miniopterus australis*	V		Moist forest, rainforest, vine thicket, sclerophyll forests, *Melaleuca* swamps, dense coastal forests, banksia scrub; roosting in caves. **Detected in Survey Area.**
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V		Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, *Melaleuca* forests and open grasslands; roosting in caves but also man-made structures including road culverts. **Detected in Survey Area.**
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V		Open spaces in woodland or forest, being more active in the upper slopes of forest areas, but forages over larger waterways; roosts in tree hollows. **Detected in Survey Area.**
Eastern Cave Bat	*Vespadelus troughtoni*	V		Tropical and mixed woodland and wet sclerophyll forests (when on the coast); roosting in sandstone overhang caves, boulder piles, mines, buildings and abandoned fairy martin nests under bridges and in culverts. **Potentially detected (one of two possible species) in Survey Area** (Section 3.4.3)

Notes:

CE = Critically Endangered; E = Endangered; V = Vulnerable.

1. EPBC Act = status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
2. BC Act = conservation status under the NSW *Biodiversity Conservation Act 2016*.

3.4.6 Migratory fauna species

An additional 49 fauna species (three marine fish, and 46 birds) listed under the EPBC Act as Migratory protected species have previously been recorded from the Search Area or have geographic ranges that overlap the Search Area (not including threatened fauna also listed as Migratory). These include species listed under the Japan Australian Migratory Bird Agreement (JAMBA), China Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention on the Conservation of Migratory Species. Whilst these are not threatened species, they are EPBC Act protected species that may utilise local habitats on a seasonal basis, or are species that may overfly or otherwise utilise the broader area. Based on a desktop review of habitat preferences (Table D1 in Appendix D), 16 of these species have a greater potential to utilise habitats within

the Study Area (Table 5). None of these species were detected in the Survey Area 6-7 December 2022, but may still utilise the Survey Area on occasion throughout the year. Importantly, the larger portion of wetland habitat of the Study Area that was not accessible in the 6-7 December survey appears to provide greater habitat complexity, including shallow areas better suited to migratory wader birds. Consequently, there remains potential that some of these migratory bird species may have been accessing the broader Study Area at the time of the survey but could not be detected.

Table 5 Migratory fauna species with the greatest potential to utilise habitats of the Study Area (excluding threatened fauna also listed as Migratory)

Common name	Scientific name	Preferred habitat
Birds		
Garganey	*Anas querquedula*	Freshwater wetlands, swamps, shallow lakes, flooded grasslands and floodplains.
Fork-tailed Swift	*Apus pacificus*	Airspace over varied habitat, rainforest to semi-desert.
Double-banded Plover	*Charadrius bicinctus*	Tidal mudflats, beaches, exposed reefs, salt marshes, freshwater wetlands, inland salt lakes, short grass of golf courses and airfields.
Grey Plover	*Pluvialis squatarola*	Marine shores of estuaries or lagoons on broad, open mudflats, sandy bars or beaches, rock platforms and reef flats of rocky coasts; also margins of salt lakes and swamps.
Sharp-tailed Sandpiper	*Calidris acuminata*	Fresh or salt wetlands and the muddy edges of lagoons, swamps, lakes, dams, soaks, sewage farms and temporary floodwaters.
Pectoral Sandpiper	*Calidris melanotos*	Coastal wetland, both fresh and saline, also inland on permanent and temporary wetlands, preferring mudflats, fringing vegetation, and swamps with heavy overgrowth of vegetation.
Swinhoe's Snipe	*Gallinago megala*	Billabongs, swamps, flooded grassland, sewage ponds and claypans.
Pin-tailed Snipe	*Gallinago stenura*	Coastal freshwater wetlands – swamps, river pools, sewage ponds, usually with grass.
Little Curlew	*Numenius minutus*	Dry grassland of clay and blacksoil plains, river floodplains, woodlands with grassy understorey and around billabongs and freshwater swamps.
Ruff	*Philomachus pugnax*	Mud flats and sedges around fresh or saline lakes, estuaries, tidal pools.
Wood Sandpiper	*Tringa glareola*	Shallows of wooded lakes or swamps with trees, including freshwater swamps, lakes and flooded pasture.
Marsh Sandpiper	*Tringa stagnatilis*	Salt or freshwater wetlands. Estuarine and mangrove mudflats, beaches, shallows or swamps, lakes, billabongs, temporary floodwaters, sewage farms and saltworks ponds.
White-winged Black Tern	*Chlidonias leucopterus*	Marine and freshwater coastal wetland, including river pools, billabongs and inundated floodplains.
Gull-billed Tern	*Gelochelidon nilotica*	Inland fresh or salt waters during breeding. Lagoons and saltmarshes near the coast all other times.
Barn Swallow	*Hirundo rustica*	Open sites, often near water; summer migrant to Australia.
Yellow Wagtail	*Motacilla flava*	Open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground.

Notes:

1. EPBC Act = status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

3.4.7 Common native fauna species

The desktop searches, combined with observations during the field assessment, indicated that the Study Area may be utilised by many common fauna species. A total of 386 common native vertebrate fauna species were identified as potentially present (including Migratory species, but excluding threatened species). This includes nine species of fish, 27 amphibians, 43 reptiles, 270 birds and 37 mammals. The complete list of common species identified as potentially present is included in Table B1 of Appendix B.

Fish records are depauperate in the database searches used and likely underestimate the number of fish species utilising the Study Area. Field survey of the less-disturbed adjoining wetland to the north-east (that was not accessed) may have also detected additional fish and freshwater turtle species.

3.4.8 Introduced fauna species

A total of 31 introduced fauna species have been recorded from the Search Area, including two species of fish, one reptile (a snake), 12 birds and 16 mammals. These species are included in Table A1 of Appendix A, where they are denoted as introduced species by an asterisk (*). Introduced fauna species detected during the site visit 6-7 December 2022 included:

- Fish:
  - Carp (*Cyprinus carpio*);
  - Gambusia (*Gambusia holbrooki*);
- Mammals
  - Feral Cat (*Felis catus*)*;
  - Dog (*Canis familiaris*)*; and
- Birds
  - Common myna (*Acridotheres tristis*).

3.5 Aquatic flora

Fourteen species of macrophytes (aquatic plants) were detected within or along the periphery of the lake at the time of assessment 6-7 December 2022 (Table 6). The majority of these are common native species. Others are introduced environmental weeds. Emergent and fringing native macrophytes included narrow-leaved cumbungi (*Typha domingensis*), bulrush (*T. orientalis*), water couch (*Paspalum distichum*), bunchy sedge (*Cyperus polystachyos*), common rush (*Juncus usitatus*), water smartweed (*Persicaria attenuata*), slender knotweed (*P. decipiens*), common reed (*Phragmites australis*), buttercup (*Ranunculus* sp.) and river clubrush (*Schoenoplectus validus*). Floating macrophytes included Pacific azolla (*Azolla filiculoides*). No submerged macrophytes were detected.

Introduced macrophytes detected in the Tarro Recreation Area Lake included alligator weed (*Alternanthera philoxeroides*)*, sharp rush (*Juncus acutus* subsp. *acutus*)* and umbrella sedge (*Cyperus eragrostis*)*. Alligator weed exhibits vigorous growth, competes with and displaces native flora, and reproduces readily from stem fragments. It is scheduled under the NSW *Biosecurity Regulation 2017* and has a 'State Priority Weed Objective' of 'containment' identified in the Hunter Regional Strategic Weed Management Plan 2017-2022 (Hunter Local Land Services 2017). Sharp rush is not yet identified in the *Biosecurity Regulation 2017*, nor the Hunter Regional Strategic Weed Management Plan 2017-2022, but is a serious environmental weed that also presents a serious safety risk in public spaces as it forms dense hemispherical tussocks with very pointed tips at about eye height (0-1.2 m) for children. Umbrella sedge is an environmental weed that is unlikely to be of any ecological significance in this setting.

Table 6 Aquatic flora detected within the Tarro Recreation Area Lake, 6-7 December 2022

Common name	Scientific name	Site	
		TAQ1	TAQ2
Alligator Weed*	*Alternanthera philoxeroides**	M	M
Pacific Azolla	*Azolla filiculoides*	L	L
Umbrella Sedge*	*Cyperus eragrostis**	L	L
Bunchy Sedge	*Cyperus polystachyos*	L	L
Sharp Rush*	*Juncus acutus* subsp. *acutus**	L	S
Common Rush	*Juncus usitatus*	L	L
Water Couch	*Paspalum distichum*	M	M
Water Smartweed	*Persicaria attenuata*	L	L
Slender Knotweed	*Persicaria decipiens*	L	L
Common Reed	*Phragmites australis*	L	L
Buttercup	*Ranunculus* sp.	L	L
River Clubrush	*Schoenoplectus validus*	L	L
Narrow-leaved Cumbungi	*Typha domingensis*	E	E
Bulrush	*Typha orientalis*	L	L

Notes:

* Denotes introduced species.

L = 1-10% (little); S = 10-50% (some); M = 50-75% (moderate); E = >75% (extensive).

4 DISCUSSION

The following section provides a brief discussion on the findings of the fauna habitat assessment and species utilisation survey.

The Study Area is positioned on a floodplain of the Hunter River and approximately 15 km from the Newcastle coastline. The combination of nearby populous areas, coastline, the Hunter River and conservation reserves such as the Hunter Wetlands National Park, contribute to a relatively comprehensive list of fauna species database records for the broader Search Area.

The majority of the Study Area was inaccessible at the time of the site visit. Consequently, the site visit focussed on a Survey Area comprising the publicly accessible Tarro Recreation Area Lake and immediate surrounds. The site visit improved the understanding of fauna habitats and potentially occurring fauna species of the Survey Area and presented an opportunity to detect some of the species utilising the Study Area. More detailed surveys within the Survey Area would likely detect many more species; as would surveys across the broader Study Area, as well as surveys during other seasons of the year. Notwithstanding, the limited survey effort contributed valuable data to improve the understanding of fauna utilisation of the Study Area. Six Vulnerable (BC Act) microbat species were detected during the site visit, including the Southern Myotis (*Myotis macropus*) which forages over streams and pools catching insects and small fish by raking their feet across the water surface. This demonstrates one of several potential linkages between aquatic and terrestrial fauna species, including threatened fauna species, within the Study Area.The Tarro Recreation Area Lake appears to have been constructed or at least modified with a heavy clay base, with minor silt deposition in deeper areas, and a lack of sand, gravel, pebble, cobble or boulder substrates. Habitat complexity is poor, with fringing macrophytes in the edge habitats providing better cover and foraging habitat for fish, turtles and aquatic macroinvertebrates.

Physico-chemical water quality was neutral to mildly alkaline, of marginal salinity, well oxygenated, and of moderate clarity. The water surface appeared normal, with no foams, hydrocarbon slicks, organic sheens or algal scums observed at the time of assessment.

The majority (70-82%) of macroinvertebrate taxa detected in samples collected from the lake are attributed a SIGNAL2 score of 4 or less, suggesting that the macroinvertebrate community is dominated by taxa tolerant of a range of environmental conditions, including habitat degradation, poor habitat complexity and/or pollution. The relative absence of more sensitive taxa groups suggests that the lake may exhibit harsh environmental conditions through unfavourable habitat and/or reduced water quality.

A narrow strip of relatively young native tree and shrub species border the lake periphery, providing foraging and nesting opportunities for common native woodland birds. Planted native trees and shrubs immediately south-west of the lake provide good foraging and nesting opportunities for woodland birds. Young trees on the lake islands are utilised by cormorants, darters, ducks, ibis and similar waterbirds and wader bird species for roosting.

Native aquatic plants, including fringing, emergent and to a lesser extent floating macrophytes, provide a food source and refuge for aquatic macroinvertebrates, which in turn provide a food source for higher trophic organisms, including fish, turtles, water birds and mammals (including microbats). Varying size ranges and life stages of aquatic fauna, combined with a diversity of waterbirds observed roosting and foraging within the site, suggest that the lake is supporting higher trophic organisms through an established ecosystem.

The waterbirds observed roosting or foraging within the lake at the time of the site visit are not confined to the lake, but likely also forage in the Hunter River and in more complex (with varying depth and habitat attributes) wetlands in the vicinity. It is also likely that many of the piscivorous waterbirds observed, such as the cormorants and darters, spend a higher proportion of their

time foraging within more productive waters in the vicinity, but utilise the relatively safe refuge of the lake islands for roosting.

Pest species of aquatic plants, including alligator weed (*Alternanthera philoxeroides*)* and sharp rush (*Juncus acutus* subsp. *acutus*)*, detract from the ecological health and amenity of the lake and are likely to proliferate rapidly without early intervention by the responsible party.

The Study Area, including the Tarro Recreation Area Lake and the adjoining wetland to the north-east, provides potential foraging and breeding habitat for threatened frogs, birds and mammals identified in Table 4, potential foraging (and some breeding) habitat for Migratory birds identified in Table 5, as well as habitat resources for a diversity of common fish, frogs, reptiles, birds and mammals, including many of those identified in Appendix B.

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Appendix A: Habitat Assessment Site Profiles

Site code: TAQ1	**Location:** Tarro Recreation Area Lake
Date: 6/12/2022	**Season:** Summer
Assessor: DM	**Coordinates:** -32.8052; 151.6619 (GDA 2020)
Water level: moderate (= watermark)	**Likely flow nature:** permanent or semi-permanent
Topography: floodplain	
Water quality	
Time (EST): 9:30	**Water temperature:** 25.4˚C
Sp. Conductivity: 824 µS/cm	**pH:** 7.6
Dissolved oxygen: 88.7%	**Dissolved oxygen:** 7.26 mg/L
Turbidity: 36 NTU	
Observations within 2 m of sampling point	
Shading: 0%	**Water colour:** clear
Water odour: none detected	**Water surface:** normal
Algae on substrate: L	**Algae in water column:** N
Emergent macrophytes: M	**Submerged macrophytes:** N
Floating macrophytes: L	
Reach observations (100 m reach, or 10 x modal width)	
Mean wetted width: 50 m	**Bankfull width:** 80 m
Maximum depth: 1.2 m	**Bankfull height:** 1.7 m
Mean depth: 1 m	**Maximum wetted width:** 100 m
Habitat types: 0% riffle, 0% run, 100% sandy pool, 0% rocky pool 0% dry	
Variety of habitat: shallow (<0.5 m), deep (>0.5 m), pool, large woody debris, macrophytes	
Habitat attributes: detritus (L), sticks (L), branches (L), logs (N), periphyton (M), moss (N), filamentous algae (S), macrophytes (M), bank overhang (S), trailing bank vegetation (E), blanketing silt (S), substrate anoxia (E)	
Upstream landuse: urban/semi-urban, industrial	
Adjacent landuse (right bank): recreation/sporting fields	
Adjacent landuse (left bank): recreation/sporting fields	
Bed, edge and bank characteristics	
Bed substrates: 100% silt/clay (<0.05 mm), 0% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock	
Edge substrates: 95% silt/clay (<0.05 mm), 5% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock	
Bank soils: loamy clay	**Bank stability:** stable
Bed stability: moderate deposition	**Bank shape:** stepped
Channel shape: U shaped	**Recent deposits:** Silt (N), sand (N)
Local catchment erosion: gully (N), rill (N),tunnel (N), sheet (N), bank slumping (N), cattle pugging (N)	

Upstream

Left bank

Downstream

Right bank

Notes:
Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%).

Riparian vegetation	
Cover	
Width of riparian zone on left bank: 10 m	**Width of riparian zone on right bank:** 10 m
Bare ground: N	**Grasses/forbs:** E
Shrubs: L	**Trees <10 m:** L
Trees >10m: S	**Exotic riparian species:** E
Composition and health	
State-mapped PCT: not classified	
Verified PCT: not classified	
Vegetation status: regrowth	**Dominant stratum:** wetland
Health: average	**Dieback:** not detected
EDL height: 10 m	**EDL cover:** 10%
Canopy species: *Casuarina cunninghamiana subsp. cunninghamiana* (River Oak) (D)	
Sub-canopy species: *Melaleuca linariifolia* (Flax-leaved Paperbark) (O), *Melaleuca styphelioides* (Prickly-leaved Tea Tree) (O)	
Shrub species: *Typha domingensis* (Narrow-leaved Cumbungi) (D), *Baccharis halimifolia** (Groundsel Bush) (O), *Lantana camara** (Lantana) (O), *Nicotiana glauca** (Tree Tobacco), *Cestrum parqui** (Green Cestrum) (R), *Cinnamomum camphora** (Camphor Laurel) (O)	
Ground species: *Paspalum distichum* (Water Couch) (D), *Cyperus eragrostis** (Umbrella Sedge) (F), *Cyperus polystachyos* (O), *Juncus usitatus* (Common Rush) (O), *Bromus* sp. (O), *Azolla pinnata* (water fern), *Alternanthera philoxeroides** (Alligator Weed) (O), *Ambrosia artemisiifolia** (Annual Ragweed) (O), *Arundinella nepalensis* (Reedgrass) (O), *Bolboschoenus medianus* (O)	
Macrophytes	
Submerged macrophytes:	
Floating macrophytes: *Azolla filiculoides (Pacific Azolla) (L)*	
Emergent macrophytes: *Typha domingensis* (Narrow-leaved Cumbungi) (E), *Paspalum distichum* (Water Couch) (M), *Alternanthera philoxeroides** (Alligator Weed) (M), *Juncus acutus* subsp. *acutus** (Sharp Rush) (L), *Juncus usitatus* (Common Rush) (L), *Persicaria attenuata* (Water Smartweed) (L), *Phragmites australis* (Common Reed) (L), *Persicaria decipiens* (Slender Knotweed) (L), *Typha orientalis* (Broad-leaved Cumbungi) (L), *Ranunculus* sp. (L), *Cyperus eragrostis** (Umbrella Sedge) (L), *Cyperus polystachyos* (Bunchy Sedge) (L), *Schoenoplectus validus* (River Clubrush) (L)	

Aquatic biota
Aquatic macroinvertebrate sampling undertaken: yes
Habitat for platypus: unlikely habitat
Habitat for threatened fish species: unlikely
Fish sampling undertaken: yes
Suitable habitat for threatened turtle species: unlikely
Turtle sampling undertaken: yes
Aquatic vertebrates encountered: longfin eel (*Anguilla reinhardtii*), Short-finned Eel (*Anguilla australis*), Carp (*Cyprinus carpio**), Mosquito Fish (*Gambusia holbrooki**), Striped Gudgeon (*Gobiomorphus australis*), Empire Gudgeon (*Hypseleotris compressa*), Firetail Gudgeon (*Hypseleotris galii*), Flathead gudgeon (*Philypnodon grandiceps*), Eastern Snake-necked Turtle (*Chelodina longicollis*)

Visual assessment of human disturbance	
1. Water quality	1 (Little disturbance) – disruption of the natural hydrology
2. Instream	2 (Moderate disturbance) – pipes,rubbish,filamentous algae,alien fish species,invasion by exotic aquatic plants
3. Riparian zone	2 (Moderate disturbance) – devegetation,point sources
4. Catchment assessment	3 (High disturbance) – urban development
Overall score	**8/16 (Moderate disturbance)**

Aerial photograph from 120 m above ground level, oriented north up

Notes:
Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%).
Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).

Site code: TFA1	**Location:** Tarro Recreation Area Lake
Date: 6/12/2022	**Survey type:** Fauna habitat
Coordinates: -32.8052°, 151.6626° (GDA 2020)	
Fauna habitat within 1 ha	
Hollows	not detected
No. of hollows	large (>20 cm): not detected medium (11-20 cm): not detected small (<11 cm): not detected
No. of logs	large (>50 cm): not detected small (<50 cm): not detected
No. termite mounds	arboreal: not detected ground: not detected
Burrows	not detected
Rock crevices	not detected
Basking areas	not detected
Exfoliating bark	not detected
Cliffs/outcrops	not detected
Grassy tussocks	not detected
Cracking clays	not detected
Fine leaf litter (<2 cm diameter)	ocassional (11-50 %)
Coarse litter (2-10 cm diameter)	rare (1-10 %)
Stones (20-60 cm)	not detected
Boulders (61 cm-2 m)	not detected
Large boulders (>2 m)	not detected
Seeding native grass cover	occasional (11-25 %)
Fleshy fruiting plants	rare (1-10 %)
Shrub density (cover)	occasional (11-25 %)
Nectar abundance	occasional (11-25 %)
Proximity to water	1 m

North

East

South

West

Site code: TAQ2	**Location:** Tarro Recreation Area Lake
Date: 6/12/2022	**Season:** Summer
Assessor: DM	**Coordinates:** -32.8062; 151.6646 (GDA 2020)
Water level: moderate (= watermark)	**Likely flow nature:** permanent or semi-permanent
Topography: floodplain	
Water quality	
Time (EST): 08:15	**Water temperature:** 24.6˚C
Sp. Conductivity: 816 µS/cm	**pH:** 7.3
Dissolved oxygen: 73.2%	**Dissolved oxygen:** 6.08 mg/L
Turbidity: 36 NTU	
Observations within 2 m of sampling point	
Shading: 0%	**Water colour:** clear
Water odour: none detected	**Water surface:** normal
Algae on substrate: N	**Algae in water column:** N
Emergent macrophytes: S	**Submerged macrophytes:** N
Floating macrophytes: L	
Reach observations (100 m reach, or 10 x modal width)	
Mean wetted width: 50 m	**Bankfull width:** 80 m
Maximum depth: 1.2 m	**Bankfull height:** 2 m
Mean depth: 1 m	**Maximum wetted width:** 150 m
Habitat types: 0% riffle, 0% run, 100% sandy pool, 0% rocky pool 0% dry	
Variety of habitat: shallow (<0.5 m), deep (>0.5 m), pool, large woody debris, macrophytes	
Habitat attributes: detritus (L), sticks (L), branches (L), logs (N), periphyton (M), moss (N), filamentous algae (M), macrophytes (S), bank overhang (S), trailing bank vegetation (S), blanketing silt (S), substrate anoxia (E)	
Upstream landuse: urban/semi-urban, industrial	
Adjacent landuse (right bank): recreation/sporting fields	
Adjacent landuse (left bank): recreation/sporting fields	
Bed, edge and bank characteristics	
Bed substrates: 100% silt/clay (<0.05 mm), 0% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock	
Edge substrates: 90% silt/clay (<0.05 mm), 10% sand (0.05-2 mm), 0% gravel (2-4 mm), 0% pebble (4-64 mm), 0% cobble (64-256 mm), 0% boulder (>256 mm), 0% bedrock	
Bank soils: loamy clay	**Bank stability:** stable
Bed stability: moderate deposition	**Bank shape:** stepped
Channel shape: U shaped	**Recent deposits:** Silt (N), sand (N)
Local catchment erosion: gully (N), rill (N), tunnel (N), sheet (N), bank slumping (N), cattle pugging (N)	

Upstream

Left bank

Downstream

Right bank

Notes:
Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%).

Riparian vegetation	
Cover	
Width of riparian zone on left bank: 10 m	**Width of riparian zone on right bank:** 10 m
Bare ground: N	**Grasses/forbs:** E
Shrubs: L	**Trees <10 m:** S
Trees >10m: S	**Exotic riparian species:** M
Composition and health	
State-mapped PCT: not classified	
Verified PCT: not classified	
Vegetation status: regrowth	**Dominant stratum:** tree
Health: average	**Dieback:** not detected
EDL height: 10 m	**EDL cover:** 20%
Canopy species: *Casuarina cunninghamiana subsp. cunninghamiana* (River Oak) (D), *Eucalyptus amplifolia* (Cabbage Gum) (R), *Eucalyptus tereticornis* (Forest Red Gum) (R)	
Sub-canopy species: *Melaleuca linariifolia* (Flax-leaved Paperbark) (O)	
Shrub species: *Ochna serrulata** (Mickey Mouse Plant) (O), *Typha domingensis* (Narrow-leaved Cumbungi) (A), *Lantana camara** (Lantana) (O), *Sida rhombifolia** (Paddy's Lucerne) (O), *Baccharis halimifolia** (Groundsel Bush) (R), *Verbena bonariensis** (Purpletop) (O), *Phragmites australis* (Common Reed) (O), *Araujia sericifera** (Moth Vine) (R), *Foeniculum vulgare** (Fennel) (R), *Cinnamomum camphora** (Camphor Laurel) (O)	
Ground species: *Paspalum distichum* (Water Couch) (D), *Ambrosia artemisiifolia** (Annual Ragweed) (F), *Bromus sp.* (F), *Hydrocotyle bonariensis** (F), *Cirsium vulgare** (Spear Thistle) (R), *Plantago* sp. (Plantain), *Juncus usitatus* (F), *Juncus acutus subsp. acutus** (Sharp Rush) (F), *Rumex conglomeratus** (Clustered Dock), *Lolium perenne** (Perennial Ryegrass) (R), *Persicaria decipiens* (Slender Knotweed), *Trifolium* sp.* (R)	

Macrophytes
Submerged macrophytes:
Floating macrophytes: *Azolla filiculoides* (Pacific Azolla) (L)
Emergent macrophytes: *Typha domingensis* (Narrow-leaved Cumbungi) (E), *Paspalum distichum* (Water Couch) (M), *Juncus acutus* subsp. *acutus** (Sharp Rush) (L), *Juncus usitatus* (L), *Persicaria attenuata* (L), *Phragmites australis* (Common Reed) (L), *Persicaria decipiens* (Slender Knotweed) (L), *Typha orientalis* (Broad-leaved Cumbungi) (L), *Ranunculus* sp. (L), *Cyperus eragrostis** (Umbrella Sedge) (L), *Cyperus polystachyos* (L), *Schoenoplectus validus* (L), *Alternanthera philoxeroides** (Alligator Weed) (M)

Aquatic biota
Aquatic macroinvertebrate sampling undertaken: yes
Habitat for platypus: unlikely; nor burrows detected
Habitat for threatened fish species: unlikely
Fish sampling undertaken: yes
Suitable habitat for threatened turtle species: unlikely
Turtle sampling undertaken: yes
Aquatic vertebrates encountered: longfin eel *(Anguilla reinhardtii)*, Mosquito Fish *(Gambusia holbrooki*)*, Striped Gudgeon (*Gobiomorphus australis*), Empire Gudgeon (*Hypseleotris compressa*), Firetail Gudgeon (*Hypseleotris galii*), Flathead gudgeon (*Philypnodon grandiceps*)

Visual assessment of human disturbance	
1. Water quality	1 (Little disturbance) – disruption of the natural hydrology
2. Instream	2 (Moderate disturbance) – filamentous algae, alien fish species, invasion by exotic aquatic plants
3. Riparian zone	2 (Moderate disturbance) – devegetation, exotic plant invasion
4. Catchment assessment	3 (High disturbance) – urban development
Overall score	**8/16 (Moderate disturbance)**

Aerial photograph from 120 m above ground level, oriented north up

Notes:
Aquatic cover categories: None detected (N), Little (L; 1-10%), Some (S; 10-50%), Moderate (M; 50-75%), Extensive (E; >75%).
Terrestrial cover categories: Dominant (D), Abundant (A), Frequent (F), Occasional (O), Rare (R).

Site: TFA2	**Location:** Tarro Recreation Area Lake
Date: 6/12/2022	**Survey type:** fauna habitat
Coordinates: -32.8066°, 151.6649° (GDA 2020)	
Fauna habitat within 1 ha	
Hollows	not detected
No. of hollows	large (>20 cm): not detected medium (11-20 cm): not detected small (<11 cm): not detected
No. of logs	large (>50 cm): not detected small (<50 cm): not detected
No. termite mounds	arboreal: not detected ground: not detected
Burrows	not detected
Rock crevices	not detected
Basking areas	not detected
Exfoliating bark	rare (1-10 %)
Cliffs/outcrops	not detected
Grassy tussocks	not detected
Cracking clays	not detected
Fine leaf litter (<2 cm diameter)	ocassional (11-50 %)
Coarse litter (2-10 cm diameter)	rare (1-10 %)
Stones (20-60 cm)	not detected
Boulders (61 cm-2 m)	not detected
Large boulders (>2 m)	not detected
Seeding native grass cover	occasional (11-25 %)
Fleshy fruiting plants	rare (1-10 %)
Shrub density (cover)	rare (1-10 %)
Nectar abundance	occasional (11-25 %)
Proximity to water	1 m

North

East

South

West

Appendix B: Vertebrate Fauna Species Identified from Database Searches and the Site Visit

Table B1 Vertebrate fauna species previously recorded from the Search Area, or with geographic ranges that overlap the Search Area

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Fish						
Short-finned eel	*Anguilla australis*	-	-			✓
longfin eel	*Anguilla reinhardtii*	-	-		✓	✓
Carp*	*Cyprinus carpio**	-	-		✓	✓
Striped Gudgeon	*Gobiomorphus australis*	-	-		✓	✓
Empire Gudgeon	*Hypseleotris compressa*	-	-			✓
Firetail Gudgeon	*Hypseleotris galii*	-	-		✓	✓
Flathead gudgeon	*Philypnodon grandiceps*	-	-		✓	✓
Mosquito Fish*	*Gambusia holbrooki**	-	-		✓	✓
Black Rockcod	*Epinephelus daemelii*	V[2]	V	Likely		
Mackerel shark	*Lamna nasus*	-	Mi	May		
Scalloped hammerhead	*Sphyrna lewini*	E[2]	CD	Likely		
Reef Manta Ray	*Mobula alfredi*	-	Mi	May		
Giant Manta Ray	*Mobula birostris*	-	Mi	May		
Southern Bluefin Tuna	*Thunnus maccoyii*	E	CD	Likely		
Amphibians						
Eastern Sign-bearing Froglet	*Crinia parinsignifera*	P			✓	
Common Eastern Froglet	*Crinia signifera*	P			✓	
Wallum Froglet	*Crinia tinnula*	V,P			✓	
Haswell's Froglet	*Paracrinia haswelli*	P			✓	
Bibron's Toadlet	*Pseudophryne bibronii*	P			✓	
Red-backed Toadlet	*Pseudophryne coriacea*	P			✓	
Dusky Toadlet	*Uperoleia fusca*	P			✓	
Smooth Toadlet	*Uperoleia laevigata*	P			✓	
Mahony's Toadlet	*Uperoleia mahonyi*	E,P	E	✓	✓	
Tyler's Toadlet	*Uperoleia tyleri*	P			✓	
Tusked Frog	*Adelotus brevis*	P			✓	
Eastern Banjo Frog	*Limnodynastes dumerilii*	P			✓	
Brown-striped Frog	*Limnodynastes peronii*	P			✓	
Spotted Grass Frog	*Limnodynastes tasmaniensis*	P			✓	
Ornate Burrowing Frog	*Platyplectrum ornatum*	P			✓	
Green and Golden Bell Frog	*Litoria aurea*	E,P	V	✓	✓	
Green Tree Frog	*Litoria caerulea*	P			✓	
Bleating Tree Frog	*Litoria dentata*	P			✓	
Brown Tree Frog	*Litoria ewingii*	P			✓	
Eastern Dwarf Tree Frog	*Litoria fallax*	P			✓	
Freycinet's Frog	*Litoria freycineti*	P			✓	
Jervis Bay Tree Frog	*Litoria jervisiensis*	P			✓	
Broad-palmed Frog	*Litoria latopalmata*	P			✓	
Lesueur's Frog	*Litoria lesueuri*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Rocket Frog	*Litoria nasuta*	P			✓	
Peron's Tree Frog	*Litoria peronii*	P			✓	
Leaf-green Tree Frog	*Litoria phyllochroa*	P			✓	
Revealed Frog	*Litoria revelata*	P			✓	
Tyler's Tree Frog	*Litoria tyleri*	P			✓	
Verreaux's Frog	*Litoria verreauxii*	P			✓	
Stuttering Frog	*Myxophyes balbus*	E,P	V	Likely		
Giant Barred Frog	*Myxophes iteratus*	E,P	V	Likely		
Reptiles						
Loggerhead Turtle	*Caretta caretta*	E,P	E,Mi	✓	✓	
Green Turtle	*Chelonia mydas*	V,P	V,Mi	✓		
Leatherback Turtle	*Dermochelys coriacea*	E,P	E,Mi	✓		
Hawksbill Turtle	*Eretmochelys imbricata*	P	V,Mi	✓		
Flatback Turtle	*Natator depressus*	P	V,Mi	✓		
Eastern Snake-necked Turtle	*Chelodina longicollis*	P			✓	✓
Macquarie River Turtle	*Emydura macquarii macquarii*	P			✓	
Robust Velvet Gecko	*Nebulifera robusta*	P			✓	
Striped Legless Lizard	*Delma impar*	V,P	V	May		
Burton's Snake-lizard	*Lialis burtonis*	P			✓	
Common Scaly-foot	*Pygopus lepidopodus*	P			✓	
Punctate Worm-skink	*Anomalopus swansoni*	P			✓	
Land Mullet	*Bellatorias major*	P			✓	
Southern Rainbow-skink	*Carlia tetradactyla*	P			✓	
Barred-sided Skink	*Concinnia tenuis*	P			✓	
Cream-striped Shinning-skink	*Cryptoblepharus virgatus*	P			✓	
-	*Ctenotus orientalis*	P			✓	
Robust Ctenotus	*Ctenotus robustus*	P			✓	
Copper-tailed Skink	*Ctenotus taeniolatus*	P			✓	
Pink-tongued Lizard	*Cyclodomorphus gerrardii*	P			✓	
Mainland She-oak Skink	*Cyclodomorphus michaeli*	P			✓	
Yellow-bellied Water-skink	*Eulamprus heatwolei*	P			✓	
Eastern Water-skink	*Eulamprus quoyii*	P			✓	✓
Three-toed Earless Skink	*Hemiergis decresiensis*	P			✓	
Dark-flecked Garden Sunskink	*Lampropholis delicata*	P			✓	
Pale-flecked Garden Sunskink	*Lampropholis guichenoti*	P			✓	
White's Skink	*Liopholis whitii*	P			✓	
Tree-base Litter-skink	*Lygisaurus foliorum*	P			✓	
Three-toed Skink	*Saiphos equalis*	P			✓	
Weasel Skink	*Saproscincus mustelinus*	P			✓	
Eastern Blue-tongue	*Tiliqua scincoides*	P			✓	
Jacky Lizard	*Amphibolurus muricatus*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Nobbi Dragon	*Diporiphora nobbi*	P			✓	
Eastern Water Dragon	*Intellagama lesueurii*	P			✓	✓
Bearded Dragon	*Pogona barbata*	P			✓	
Gould's Goanna	*Varanus gouldii*	P			✓	
Lace Monitor	*Varanus varius*	P			✓	
Blackish Blind Snake	*Anilios nigrescens*	P			✓	
Diamond Python	*Morelia spilota spilota*	P			✓	
Common Tree Snake	*Dendrelaphis punctulatus*	P			✓	
American Corn Snake*	*Pantherophis guttatus**				✓	
Golden-crowned Snake	*Cacophis squamulosus*	P			✓	
Eastern Small-eyed Snake	*Cryptophis nigrescens*	P			✓	
Yellow-faced Whip Snake	*Demansia psammophis*	P			✓	
Red-naped Snake	*Furina diadema*	P			✓	
Black-bellied Swamp Snake	*Hemiaspis signata*	P			✓	
Tiger Snake	*Notechis scutatus*	P			✓	
Red-bellied Black Snake	*Pseudechis porphyriacus*	P			✓	
Eastern Brown Snake	*Pseudonaja textilis*	P			✓	
Bandy-bandy	*Vermicella annulata*	P			✓	
Birds						
Australian Brush-turkey	*Alectura lathami*	P			✓	
California Quail*	*Callipepla californica**				✓	
Stubble Quail	*Coturnix pectoralis*	P			✓	
Indian Peafowl*	*Pavo cristatus**				✓	
King Quail	*Synoicus chinensis*	P			✓	
Brown Quail	*Synoicus ypsilophora*	P			✓	
Magpie Goose	*Anseranas semipalmata*	V,P			✓	
Chestnut Teal	*Anas castanea*	P			✓	
Grey Teal	*Anas gracilis*	P			✓	✓
Mallard*	*Anas platyrhynchos**				✓	
Garganey	*Anas querquedula*	P	Mi		✓	
Australasian Shoveler	*Anas rhynchotis*	P			✓	
Pacific Black Duck	*Anas superciliosa*	P			✓	✓
Hardhead	*Aythya australis*	P			✓	
Musk Duck	*Biziura lobata*	P			✓	
Australian Wood Duck	*Chenonetta jubata*	P			✓	✓
Black Swan	*Cygnus atratus*	P			✓	
Wandering Whistling-Duck	*Dendrocygna arcuata*	P			✓	
Plumed Whistling-Duck	*Dendrocygna eytoni*	P			✓	
Pink-eared Duck	*Malacorhynchus membranaceus*	P			✓	
Blue-billed Duck	*Oxyura australis*	V,P			✓	
Freckled Duck	*Stictonetta naevosa*	V,P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Australian Shelduck	*Tadorna tadornoides*	P			✓	✓
Great Crested Grebe	*Podiceps cristatus*	P			✓	
Hoary-headed Grebe	*Poliocephalus poliocephalus*	P			✓	
Australasian Grebe	*Tachybaptus novaehollandiae*	P			✓	
Antipodean Albatross	*Diomedea antipodensis*	V,P	V,Mi	Likely		
Gibson's Albatross	*Diomedea antipodensis gibsoni*	V,P	V	Likely		
Southern Royal Albatross	*Diomedea epomophora*	P	V,Mi	Likely		
Wandering Albatross	*Diomedea exulans*	E,P	V,Mi	Likely		
Northern Royal Albatross	*Diomedea sanfordi*	P	E,Mi	May		
Buller's Albatross	*Thalassarche bulleri*	P	V,Mi	May		
Northern Buller's Albatross	*Thalassarche bulleri platei*	P	V	May		
Shy Albatross	*Thalassarche cauta*	V	E,Mi	Likely		
Chatham Albatross	*Thalassarche eremita*	P	E,Mi	May		
Campbell Albatross	*Thalassarche impavida*	P	V,Mi	May		
Black-browed Albatross	*Thalassarche melanophris*	V,P	V,Mi	Likely		
Salvin's Albatross	*Thalassarche salvini*	P	V,Mi	Likely		
White-capped Albatross	*Thalassarche steadi*	P	V,Mi	May		
Lesser Frigatebird	*Fregata ariel*	P	Mi	Likely		
Greater Frigatebird	*Fregata minor*	P	Mi	Likely		
Emerald Dove	*Chalcophaps indica*	P			✓	
White-headed Pigeon	*Columba leucomela*	P			✓	
Rock Dove*	*Columba livia**				✓	
Diamond Dove	*Geopelia cuneata*	P			✓	
Bar-shouldered Dove	*Geopelia humeralis*	P			✓	
Peaceful Dove	*Geopelia striata*	P			✓	
Wonga Pigeon	*Leucosarcia melanoleuca*	P			✓	
Topknot Pigeon	*Lopholaimus antarcticus*	P			✓	
Brown Cuckoo-Dove	*Macropygia phasianella*	P			✓	
Crested Pigeon	*Ocyphaps lophotes*	P			✓	✓
Common Bronzewing	*Phaps chalcoptera*	P			✓	
Brush Bronzewing	*Phaps elegans*	P			✓	
Wompoo Fruit-Dove	*Ptilinopus magnificus*	V,P			✓	
Rose-crowned Fruit-Dove	*Ptilinopus regina*	V,P			✓	
Superb Fruit-Dove	*Ptilinopus superbus*	V,P			✓	
Spotted Turtle-Dove*	*Spilopelia chinensis**				✓	
Tawny Frogmouth	*Podargus strigoides*	P			✓	
White-throated Nightjar	*Eurostopodus mystacalis*	P			✓	
Australian Owlet-nightjar	*Aegotheles cristatus*	P			✓	
Fork-tailed Swift	*Apus pacificus*	P	Mi	Likely	✓	
White-throated Needletail	*Hirundapus caudacutus*	P	V,Mi	✓	✓	
White-faced Storm-Petrel	*Pelagodroma marina*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Sooty Shearwater	*Ardenna grisea*	P	Mi	Likely		
Wedge-tailed Shearwater	*Ardenna pacifica*	P	Mi		✓	
Streaked Shearwater	*Calonectris leucomelas*	P	Mi	✓		
Southern Giant Petrel	*Macronectes giganteus*	E,P	E,Mi	May		
Northern Giant Petrel	*Macronectes halli*	V,P	V, Mi	Likely		
Providence Petrel	*Pterodroma solandri*	V,P			✓	
White-tailed Tropicbird	*Phaethon lepturus*	P	Mi	May		
Fairy Prion	*Pachyptila turtur subantarctica*	P	V	✓		
Little Penguin	*Eudyptula minor*	P			✓	
Australasian Darter	*Anhinga novaehollandiae*	P			✓	✓
Little Pied Cormorant	*Microcarbo melanoleucos*	P			✓	
Great Cormorant	*Phalacrocorax carbo*	P			✓	
Little Black Cormorant	*Phalacrocorax sulcirostris*	P			✓	✓
Pied Cormorant	*Phalacrocorax varius*	P			✓	
Australian Pelican	*Pelecanus conspicillatus*	P			✓	✓
Black-necked Stork	*Ephippiorhynchus asiaticus*	E,P			✓	
Intermediate Egret	*Ardea intermedia*	P			✓	✓
White-necked Heron	*Ardea pacifica*	P			✓	
Australasian Bittern	*Botaurus poiciloptilus*	E,P	E	✓	✓	
Cattle Egret	*Bubulcus ibis*	P			✓	✓
Striated Heron	*Butorides striata*	P			✓	
Eastern Great Egret	*Casmerodius modesta*	P			✓	
Little Egret	*Egretta garzetta*	P			✓	
White-faced Heron	*Egretta novaehollandiae*	P			✓	✓
Australian Little Bittern	*Ixobrychus dubius*	P			✓	
Black Bittern	*Ixobrychus flavicollis*	V,P			✓	
Nankeen Night Heron	*Nycticorax caledonicus*	P			✓	
Yellow-billed Spoonbill	*Platalea flavipes*	P			✓	
Royal Spoonbill	*Platalea regia*	P			✓	✓
Glossy Ibis	*Plegadis falcinellus*	P			✓	
Australian White Ibis	*Threskiornis moluccus*	P			✓	✓
Straw-necked Ibis	*Threskiornis spinicollis*	P			✓	
Collared Sparrowhawk	*Accipiter cirrocephalus*	P			✓	
Brown Goshawk	*Accipiter fasciatus*	P			✓	
Grey Goshawk	*Accipiter novaehollandiae*	P			✓	
Red goshawk	*Erythrotriorchis radiatus*	CE,P	V	May		
Wedge-tailed Eagle	*Aquila audax*	P			✓	
Pacific Baza	*Aviceda subcristata*	P			✓	
Swamp Harrier	*Circus approximans*	P			✓	
Spotted Harrier	*Circus assimilis*	V,P			✓	
Black-shouldered Kite	*Elanus axillaris*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V,P			✓	
Brahminy Kite	*Haliastur indus*	P			✓	
Whistling Kite	*Haliastur sphenurus*	P			✓	✓
Black-breasted Buzzard	*Hamirostra melanosternon*	V,P			✓	
Little Eagle	*Hieraaetus morphnoides*	V,P			✓	
Square-tailed Kite	*Lophoictinia isura*	V,P			✓	
Black Kite	*Milvus migrans*	P			✓	✓
Eastern Osprey	*Pandion cristatus*	V,P	Mi	✓	✓	
Brown Falcon	*Falco berigora*	P			✓	
Nankeen Kestrel	*Falco cenchroides cenchroides*	P			✓	
Grey Falcon	*Falco hypoleucos*	E,P	V	Likely		
Australian Hobby	*Falco longipennis*	P			✓	
Peregrine Falcon	*Falco peregrinus*	P			✓	
Black Falcon	*Falco subniger*	V,P			✓	
Eurasian Coot	*Fulica atra*	P			✓	✓
Dusky Moorhen	*Gallinula tenebrosa*	P			✓	✓
Buff-banded Rail	*Hypotaenidia philippensis*	P			✓	
Lewin's Rail	*Lewinia pectoralis*	P			✓	
Purple Swamphen	*Porphyrio porphyrio*	P			✓	✓
Australian Spotted Crake	*Porzana fluminea*	P			✓	
Baillon's Crake	*Porzana pusilla*	P			✓	
Spotless Crake	*Porzana tabuensis*	P			✓	
Black-tailed Native-hen	*Tribonyx ventralis*	P			✓	
Pied Oystercatcher	*Haematopus longirostris*	E,P			✓	
Banded Stilt	*Cladorhynchus leucocephalus*	P			✓	
Black-winged Stilt	*Himantopus himantopus*	P			✓	
Red-necked Avocet	*Recurvirostra novaehollandiae*	P			✓	
Double-banded Plover	*Charadrius bicinctus*	P	Mi	✓	✓	
Greater Sand-plover	*Charadrius leschenaultii*	V,P	V,Mi	Likely	✓	
Lesser Sand-plover	*Charadrius mongolus*	V,P	E,Mi	✓	✓	
Red-capped Plover	*Charadrius ruficapillus*	P			✓	
Black-fronted Dotterel	*Elseyornis melanops*	P			✓	
Red-kneed Dotterel	*Erythrogonys cinctus*	P			✓	
Pacific Golden Plover	*Pluvialis fulva*	P	Mi	✓	✓	
Grey Plover	*Pluvialis squatarola*	P	Mi	✓	✓	
Masked Lapwing	*Vanellus miles*	P			✓	✓
Banded Lapwing	*Vanellus tricolor*	P			✓	
Comb-crested Jacana	*Irediparra gallinacea*	V,P			✓	
Australian Painted Snipe	*Rostratula australis*	E,P	E	✓	✓	
Common Sandpiper	*Actitis hypoleucos*	P	Mi	✓	✓	
Ruddy Turnstone	*Arenaria interpres*	P	Mi	✓	✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Sharp-tailed Sandpiper	*Calidris acuminata*	P	Mi	✓	✓	
Red Knot	*Calidris canutus*	P	E,Mi	✓	✓	
Curlew Sandpiper	*Calidris ferruginea*	E,P	CE,Mi	✓	✓	
Pectoral Sandpiper	*Calidris melanotos*	P	Mi	✓	✓	
Little Stint	*Calidris minuta*	P			✓	
Red-necked Stint	*Calidris ruficollis*	P	Mi	✓	✓	
Great Knot	*Calidris tenuirostris*	V,P	CE,Mi	✓	✓	
Latham's Snipe	*Gallinago hardwickii*	P	Mi	✓	✓	
Swinhoe's Snipe	*Gallinago megala*	P	Mi	Likely		
Pin-tailed Snipe	*Gallinago stenura*	P	Mi	Likely		
Broad-billed Sandpiper	*Limicola falcinellus*	V,P	Mi	✓	✓	
Hudsonian Godwit	*Limosa haemastica*	P			✓	
Bar-tailed Godwit	*Limosa lapponica*	P	Mi	✓	✓	
Nunivak Bar-tailed Godwit	*Limosa lapponica baueri*	P	V,Mi	✓		
Black-tailed Godwit	*Limosa limosa*	V,P	Mi	✓	✓	
Eastern Curlew	*Numenius madagascariensis*	P	CE,Mi	✓	✓	
Little Curlew	*Numenius minutus*	P	Mi	Likely	✓	
Whimbrel	*Numenius phaeopus*	P	Mi	✓	✓	
Ruff	*Philomachus pugnax*	P	Mi	✓	✓	
Grey-tailed Tattler	*Tringa brevipes*	P	Mi	✓	✓	
Wood Sandpiper	*Tringa glareola*	P	Mi		✓	
Wandering Tattler	*Tringa incana*	P	Mi		✓	
Common Greenshank	*Tringa nebularia*	P	Mi	✓	✓	
Marsh Sandpiper	*Tringa stagnatilis*	P	Mi	✓	✓	
Buff-breasted Sandpiper	*Tryngites subruficollis*	P			✓	
Terek Sandpiper	*Xenus cinereus*	V,P	Mi	✓	✓	
Red-chested Button-quail	*Turnix pyrrhothorax*	P			✓	
Painted Button-quail	*Turnix varius*	P			✓	
Whiskered Tern	*Chlidonias hybrida*	P			✓	
White-winged Black Tern	*Chlidonias leucopterus*	P	Mi		✓	
Silver Gull	*Chroicocephalus novaehollandiae*	P			✓	
Gull-billed Tern	*Gelochelidon nilotica*	P	Mi		✓	
Caspian Tern	*Hydroprogne caspia*	P	Mi		✓	
Common Tern	*Sterna hirundo*	P	Mi		✓	
Little Tern	*Sternula albifrons*	E,P	Mi		✓	
Australian fairy tern	*Sternula nereis nereis*	P	V	May		
Crested Tern	*Thalasseus bergii*	P	Mi		✓	
Common Noddy	*Anous stolidus*	P	Mi	Likely		
Sulphur-crested Cockatoo	*Cacatua galerita*	P			✓	
Little Corella	*Cacatua sanguinea*	P			✓	✓
Long-billed Corella	*Cacatua tenuirostris*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V,P	E	✓	✓	
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V,P	V	✓	✓	
Galah	*Eolophus roseicapilla*	P			✓	✓
Cockatiel	*Nymphicus hollandicus*	P			✓	
Yellow-tailed Black-Cockatoo	*Zanda funereus*	P			✓	
Australian King-Parrot	*Alisterus scapularis*	P			✓	
Red-winged Parrot	*Aprosmictus erythropterus*	P			✓	
Musk Lorikeet	*Glossopsitta concinna*	P			✓	
Little Lorikeet	*Glossopsitta pusilla*	V,P			✓	
Swift Parrot	*Lathamus discolor*	E,P	CE	✓	✓	
Turquoise Parrot	*Neophema pulchella*	V,P			✓	
King/Superb Parrot	*Parrot Hybrid*	P			✓	
Crimson Rosella	*Platycercus elegans*	P			✓	
Eastern Rosella	*Platycercus eximius*	P			✓	✓
Red-rumped Parrot	*Psephotus haematonotus*	P			✓	
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	P			✓	
Rainbow Lorikeet	*Trichoglossus haematodus*	P			✓	
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	P			✓	
Brush Cuckoo	*Cacomantis variolosus*	P			✓	
Pheasant Coucal	*Centropus phasianinus*	P			✓	
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	P			✓	
Shining Bronze-Cuckoo	*Chalcites lucidus*	P			✓	
Oriental Cuckoo	*Cuculus optatus*	P	Mi	✓	✓	
Eastern Koel	*Eudynamys orientalis*	P			✓	✓
Pallid Cuckoo	*Heteroscenes pallidus*	P			✓	
Channel-billed Cuckoo	*Scythrops novaehollandiae*	P			✓	✓
Barking Owl	*Ninox connivens*	V,P			✓	
Southern Boobook	*Ninox novaeseelandiae*	P			✓	
Powerful Owl	*Ninox strenua*	V,P			✓	
Eastern Barn Owl	*Tyto javanica*	P			✓	
Eastern Grass Owl	*Tyto longimembris*	V,P			✓	
Masked Owl	*Tyto novaehollandiae*	V,P			✓	
Sooty Owl	*Tyto tenebricosa*	V,P			✓	
Azure Kingfisher	*Ceyx azureus*	P			✓	
Laughing Kookaburra	*Dacelo novaeguineae*	P			✓	✓
Forest Kingfisher	*Todiramphus macleayii*	P			✓	
Red-backed Kingfisher	*Todiramphus pyrrhopygius*	P			✓	
Sacred Kingfisher	*Todiramphus sanctus*	P			✓	
Rainbow Bee-eater	*Merops ornatus*	P			✓	
Dollarbird	*Eurystomus orientalis*	P			✓	
Noisy Pitta	*Pitta versicolor*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Superb Lyrebird	*Menura novaehollandiae*	P			✓	
Red-browed Treecreeper	*Climacteris erythrops*	P			✓	
Brown Treecreeper (eastern subsp.)	*Climacteris picumnus victoriae*	V,P			✓	
White-throated Treecreeper	*Cormobates leucophaea*	P			✓	
Green Catbird	*Ailuroedus crassirostris*	P			✓	
Satin Bowerbird	*Ptilonorhynchus violaceus*	P			✓	
Regent Bowerbird	*Sericulus chrysocephalus*	P			✓	
Superb Fairy-wren	*Malurus cyaneus*	P			✓	✓
Variegated Fairy-wren	*Malurus lamberti*	P			✓	
Southern Emu-wren	*Stipiturus malachurus*	P			✓	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	P			✓	
Striated Thornbill	*Acanthiza lineata*	P			✓	
Yellow Thornbill	*Acanthiza nana*	P			✓	
Brown Thornbill	*Acanthiza pusilla*	P			✓	
Buff-rumped Thornbill	*Acanthiza reguloides*	P			✓	
Pilotbird	*Pycnoptilus floccosus*	P	V	May		
Speckled Warbler	*Chthonicola sagittata*	V,P			✓	
Western Gerygone	*Gerygone fusca*	P			✓	
Mangrove Gerygone	*Gerygone levigaster*	P			✓	
Brown Gerygone	*Gerygone mouki*	P			✓	
White-throated Gerygone	*Gerygone olivacea*	P			✓	
Yellow-throated Scrubwren	*Neosericornis citreogularis*	P			✓	
White-browed Scrubwren	*Sericornis frontalis*	P			✓	
Weebill	*Smicrornis brevirostris*	P			✓	
Spotted Pardalote	*Pardalotus punctatus*	P			✓	
Striated Pardalote	*Pardalotus striatus*	P			✓	
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	P			✓	
Eastern Spinebill	*Acanthorhynchus tenuirostris*	P			✓	
Red Wattlebird	*Anthochaera carunculata*	P			✓	✓
Little Wattlebird	*Anthochaera chrysoptera*	P			✓	
Regent Honeyeater	*Anthochaera phrygia*	CE,P	CE	Likely	✓	
Yellow-faced Honeyeater	*Caligavis chrysops*	P			✓	
Blue-faced Honeyeater	*Entomyzon cyanotis*	P			✓	
White-fronted Chat	*Epthianura albifrons*	V,P			✓	
Painted Honeyeater	*Grantiella picta*	V,P	V	Likely		
Yellow-tufted Honeyeater	*Lichenostomus melanops*	P			✓	
Brown Honeyeater	*Lichmera indistincta*	P			✓	
Noisy Miner	*Manorina melanocephala*	P			✓	✓
Bell Miner	*Manorina melanophrys*	P			✓	
Lewin's Honeyeater	*Meliphaga lewinii*	P			✓	
Brown-headed Honeyeater	*Melithreptus brevirostris*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Black-chinned Honeyeater (eastern sub.)	*Melithreptus gularis gularis*	V,P			✓	
White-naped Honeyeater	*Melithreptus lunatus*	P			✓	
Scarlet Honeyeater	*Myzomela sanguinolenta*	P			✓	
White-eared Honeyeater	*Nesoptilotis leucotis*	P			✓	
Little Friarbird	*Philemon citreogularis*	P			✓	
Noisy Friarbird	*Philemon corniculatus*	P			✓	
White-cheeked Honeyeater	*Phylidonyris niger*	P			✓	
New Holland Honeyeater	*Phylidonyris novaehollandiae*	P			✓	
Striped Honeyeater	*Plectorhyncha lanceolata*	P			✓	
Fuscous Honeyeater	*Ptilotula fusca*	P			✓	
White-plumed Honeyeater	*Ptilotula penicillata*	P			✓	
Grey-crowned Babbler (eastern subsp.)	*Pomatostomus temporalis temporalis*	V,P			✓	
Logrunner	*Orthonyx temminckii*	P			✓	
Spotted Quail-thrush	*Cinclosoma punctatum*	P			✓	
Eastern Shrike-tit	*Falcunculus frontatus frontatus*	P			✓	
Eastern Whipbird	*Psophodes olivaceus*	P			✓	
Varied Sittella	*Daphoenositta chrysoptera*	V,P			✓	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	P			✓	✓
White-bellied Cuckoo-shrike	*Coracina papuensis*	P			✓	
Cicadabird	*Edolisoma tenuirostris*	P			✓	
White-winged Triller	*Lalage sueurii*	P			✓	
Grey Shrike-thrush	*Colluricincla harmonica*	P			✓	
Golden Whistler	*Pachycephala pectoralis*	P			✓	
Rufous Whistler	*Pachycephala rufiventris*	P			✓	
Olive-backed Oriole	*Oriolus sagittatus*	P			✓	
Australasian Figbird	*Sphecotheres vieilloti*	P			✓	✓
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V,P			✓	
White-breasted Woodswallow	*Artamus leucoryn*	P			✓	
Masked Woodswallow	*Artamus personatus*	P			✓	✓
White-browed Woodswallow	*Artamus superciliosus*	P			✓	
Pied Butcherbird	*Cracticus nigrogularis*	P			✓	✓
Grey Butcherbird	*Cracticus torquatus*	P			✓	✓
Australian Magpie	*Gymnorhina tibicen*	P			✓	✓
Pied Currawong	*Strepera graculina*	P			✓	
Grey Currawong	*Strepera versicolor*	P			✓	
Spangled Drongo	*Dicrurus bracteatus*	P			✓	
Grey Fantail	*Rhipidura albiscapa*	P			✓	
Willie Wagtail	*Rhipidura leucophrys*	P			✓	✓
Rufous Fantail	*Rhipidura rufifrons*	P	Mi	✓	✓	
Australian Raven	*Corvus coronoides*	P			✓	
Little Raven	*Corvus mellori*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Torresian Crow	*Corvus orru*	P			✓	✓
Magpie-lark	*Grallina cyanoleuca*	P			✓	✓
Black-faced Monarch	*Monarcha melanopsis*	P	Mi	✓	✓	
Satin Flycatcher	*Myiagra cyanoleuca*	P	Mi	✓	✓	
Restless Flycatcher	*Myiagra inquieta*	P			✓	
Leaden Flycatcher	*Myiagra rubecula*	P			✓	
Spectacled Monarch	*Symposiachrus trivirgatus*	P	Mi	✓		
White-winged Chough	*Corcorax melanorhamphos*	P			✓	
Eastern Yellow Robin	*Eopsaltria australis*	P			✓	
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V,P			✓	
Jacky Winter	*Microeca fascinans*	P			✓	
Scarlet Robin	*Petroica boodang*	V,P			✓	
Rose Robin	*Petroica rosea*	P			✓	
Golden-headed Cisticola	*Cisticola exilis*	P			✓	
Australian Reed-Warbler	*Acrocephalus australis*	P			✓	✓
Brown Songlark	*Cincloramphus cruralis*	P			✓	
Rufous Songlark	*Cincloramphus mathewsi*	P			✓	
Tawny Grassbird	*Cincloramphus timoriensis*	P			✓	
Little Grassbird	*Poodytes gramineus*	P			✓	
Welcome Swallow	*Hirundo neoxena*	P			✓	✓
Barn Swallow	*Hirundo rustica*	P	Mi		✓	
Fairy Martin	*Petrochelidon ariel*	P			✓	
Tree Martin	*Petrochelidon nigricans*	P			✓	
Red-whiskered Bulbul*	*Pycnonotus jocosus**				✓	
Eurasian Blackbird*	*Turdus merula**				✓	
Bassian Thrush	*Zoothera lunulata*	P			✓	
Common Myna*	*Acridotheres tristis**				✓	✓
Common Starling*	*Sturnus vulgaris**				✓	
Silvereye	*Zosterops lateralis*	P			✓	
Mistletoebird	*Dicaeum hirundinaceum*	P			✓	
Chestnut-breasted Mannikin	*Lonchura castaneothorax*	P			✓	
Nutmeg Mannikin*	*Lonchura punctulata**				✓	
Plum-headed Finch	*Neochmia modesta*	P			✓	
Red-browed Finch	*Neochmia temporalis*	P			✓	
Diamond Firetail	*Stagonopleura guttata*	V,P			✓	
Double-barred Finch	*Stizoptera bichenovii*	P			✓	
Zebra Finch	*Taeniopygia guttata*	P			✓	
House Sparrow*	*Passer domesticus**				✓	
Australian Pipit	*Anthus novaeseelandiae*	P			✓	
Yellow Wagtail	*Motacilla flava*	P	Mi	✓	✓	
Eastern Yellow Wagtail	*Motacilla tschutschensis tschutschensis*	P			✓	

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
European Goldfinch*	*Carduelis carduelis**				✓	
Mammals						
Platypus	*Ornithorhynchus anatinus*	P			✓	
Short-beaked Echidna	*Tachyglossus aculeatus*	P			✓	
Yellow-footed Antechinus	*Antechinus flavipes*	P			✓	
Mainland Dusky Antechinus	*Antechinus mimetes*	P			✓	
Brown Antechinus	*Antechinus stuartii*	P			✓	
Spotted-tailed Quoll	*Dasyurus maculatus*	V,P	E	✓	✓	
Brush-tailed Phascogale	*Phascogale tapoatafa*	V,P			✓	
Common Dunnart	*Sminthopsis murina*	P			✓	
Northern Brown Bandicoot	*Isoodon macrourus*	P			✓	
Long-nosed Bandicoot	*Perameles nasuta*	P			✓	
Long-nosed Potoroo	*Potorous tridactylus tridactylus*	V,P	V	Likely		
Koala	*Phascolarctos cinereus*	E,P	E	✓	✓	
Bare-nosed Wombat	*Vombatus ursinus*	P			✓	
Yellow-bellied Glider	*Petaurus australis*	V,P	V	Likely	✓	
Sugar Glider	*Petaurus breviceps*	P			✓	
Squirrel Glider	*Petaurus norfolcensis*	V,P			✓	
Greater Glider	*Petauroides volans*	E,P	E	✓	✓	
Common Ringtail Possum	*Pseudocheirus peregrinus*	P			✓	
Feathertail Glider	*Acrobates pygmaeus*	P			✓	
Short-eared Possum	*Trichosurus caninus*	P			✓	
Common Brushtail Possum	*Trichosurus vulpecula*	P			✓	
Eastern Grey Kangaroo	*Macropus giganteus*	P			✓	
Parma Wallaby	*Macropus parma*	V,P	V	Likely		
Red-necked Wallaby	*Notamacropus rufogriseus*	P			✓	
Common Wallaroo	*Osphranter robustus*	P			✓	
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E,P	V	May		
Swamp Wallaby	*Wallabia bicolor*	P			✓	
Black Flying-fox	*Pteropus alecto*	P			✓	
Grey-headed Flying-fox	*Pteropus poliocephalus*	V,P	V	✓	✓	
Little Red Flying-fox	*Pteropus scapulatus*	P			✓	
Eastern Horseshoe-bat	*Rhinolophus megaphyllus*	P			✓	
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V,P			✓	
White-striped Freetail-bat	*Austronomus australis*	P			✓	
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V,P			✓	✓
unidentified mastiff bat	*Molossidae sp.*	P			✓	
South-eastern Free-tailed Bat	*Ozimops planiceps*	P			✓	
Eastern Free-tailed Bat	*Ozimops ridei*	P			✓	✓
Large-eared Pied Bat	*Chalinolobus dwyeri*	V,P	V	✓	✓	
Gould's Wattled Bat	*Chalinolobus gouldii*	P			✓	✓

Common name	Scientific name	Status		Source		
		BC Act[1]/ FM Act[2]	EPBC Act[3]	DCCEEW 2022	DPE 2022a	Site visit
Chocolate Wattled Bat	*Chalinolobus morio*	P			✓	✓
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V,P			✓	
Southern Myotis	*Myotis macropus*	V,P			✓	✓
Corben's Long-eared Bat	*Nyctophilus corbeni*	V,P	V		✓	
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	P			✓	✓
Gould's Long-eared Bat	*Nyctophilus gouldi*	P			✓	✓
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V,P			✓	✓
Eastern Broad-nosed Bat	*Scotorepens orion*	P			✓	
Large Forest Bat	*Vespadelus darlingtoni*	P			✓	
Eastern Forest Bat	*Vespadelus pumilus*	P			✓	
Southern Forest Bat	*Vespadelus regulus*	P			✓	
Eastern Cave Bat	*Vespadelus troughtoni*	V,P			✓	✓
Little Forest Bat	*Vespadelus vulturnus*	P			✓	✓
Little Bent-winged Bat	*Miniopterus australis*	V,P			✓	✓
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V,P			✓	✓
Water-rat	*Hydromys chrysogaster*	P			✓	
House Mouse*	*Mus musculus**				✓	
New Holland Mouse	*Pseudomys novaehollandiae*	P	V	✓	✓	
Bush Rat	*Rattus fuscipes*	P			✓	
Swamp Rat	*Rattus lutreolus*	P			✓	
Brown Rat*	*Rattus norvegicus**				✓	
Black Rat*	*Rattus rattus**				✓	
Dog*	*Canis familiaris**				✓	✓
Dingo*	*Canis lupus dingo**				✓	
Fox*	*Vulpes vulpes**				✓	
Cat*	*Felis catus**				✓	✓
Brown Hare*	*Lepus capensis occidentalis**				✓	
Rabbit*	*Oryctolagus cuniculus**				✓	
Horse*	*Equus caballus**				✓	
Pig*	*Sus scrofa**				✓	
European cattle*	*Bos taurus**				✓	
Goat*	*Capra hircus**				✓	
Sheep (feral)*	*Ovis aries**				✓	
Rusa Deer*	*Cervus timorensis**				✓	
Fallow Deer*	*Dama dama**				✓	

Notes:

CE = Critically Endangered; E = Endangered; V = Vulnerable; Mi = Migratory; CD = Conservation Dependent.

* = Introduced species.

1. BC Act = conservation status under the NSW *Biodiversity Conservation Act 2016*.
2. FM Act = conservation status under the NSW *Fisheries Management Act 1994*.
3. EPBC Act = status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Appendix C: Threatened Vertebrate Fauna Species Identified from Database Searches

Table C1 Threatened vertebrate fauna species previously recorded from the Search Area, or with geographic ranges that overlap the Search Area

Common name	Scientific name	Status		Preferred habitat	Preferred habitat within Study Area	Source		
		BC Act[1] / FM Act[2]	EPBC Act[3]			DCCEEW 2022	DPE 2022a	Site visit
Fish								
Black Rockcod	*Epinephelus daemelii*	V[2]	V	Coastal reefs, estuaries and deep offshore.	N	✓		
Scalloped hammerhead	*Sphyma lewini*	E[2]	CD	Aquatic species restricted to marine environments.	N	✓		
Southern bluefin tuna	*Thunnus maccoyii*	E[2]	CD	Aquatic species restricted to marine environments.	N	✓		
Amphibians								
Wallum Froglet	*Crinia tinnula*	V		Acid swamps on coastal sand plains; sedgelands and wet heathlands.	✓^		✓	
Mahony's toadlet	*Uperoleia mahonyi*	E		Leached white sand in acid paperbark swamps.	N		✓	
Green and Golden Bell Frog	*Litoria aurea*	E	V	Marshes, dams and stream-sides; unshaded and free of mosquitofish (*Gambusia holbrooki*).	✓^	✓	✓	
Stuttering Frog	*Mixophyes balbus*	E	V	Rainforest and wet, tall open forest in foothills and escarpment.	N	✓		
Giant barred frog	*Myxophes iteratus*	E	V	Rainforest.	N	✓		
Reptiles								
Loggerhead Turtle	*Caretta caretta*	E	E	Marine species restricted to marine environments.	N	✓	✓	
Green Turtle	*Chelonia mydas*	V	V	Marine species restricted to marine environments.	N	✓		
Leatherback Turtle	*Dermochelys coriacea*	E	E	Marine species restricted to marine environments.	N	✓		
Hawksbill Turtle	*Eretmochelys imbricata*		V	Marine species restricted to marine environments.	N	✓		
Flatback Turtle	*Natator depressus*		V	Marine species restricted to marine environments.	N	✓		
Striped legless lizard	*Delma impar*	V	V	Temperate grassy plains, with loose rocks and/or grass tussocks.	N	✓		
Birds								
Magpie Goose	*Anseranas semipalmata*	V		Shallow wetlands with dense growth of rushes or sedges.	✓		✓	

Common name	Scientific name	Status		Preferred habitat	Preferred habitat within Study Area	Source		
		BC Act[1] / FM Act[2]	EPBC Act[3]			DCCEEW 2022	DPE 2022a	Site visit
Blue-billed Duck	*Oxyura australis*	V		Deep water in large permanent wetlands and swamps with dense vegetation.	✓		✓	
Freckled Duck	*Stictonetta naevosa*	V		Permanent freshwater swamps and creeks with heavy growth of cumbungi, lignum or tea-tree.	✓		✓	
Antipodean Albatross	*Diomedea antipodensis*	V	V	Subtropical to subantarctic oceans.	N	✓		
Gibson's Albatross	*Diomedea antipodensis gibsoni*	V	V	Subtropical to subantarctic oceans.	N	✓		
Southern Royal Albatross	*Diomedea epomophora*		V	Subtropical to subantarctic oceans.	N	✓		
Wandering Albatross	*Diomedea exulans*	E	V	Open oceans and edge of pack-ice.	N	✓		
Northern Royal Albatross	*Diomedea sanfordi*		E	Subtropical to subantarctic oceans.	N	✓		
Buller's Albatross	*Thalassarche bulleri*		V	Subtropical and subantarctic waters of the southern Pacific Ocean.	N	✓		
Northern Buller's Albatross	*Thalassarche bulleri platei*		V	Subtropical and subantarctic waters of the southern Pacific Ocean.	N	✓		
Shy Albatross	*Thalassarche cauta*	V	E	Subtropical to subantarctic oceans.	N	✓		
Chatham Albatross	*Thalassarche eremita*		E	Subtropical to subantarctic oceans.	N	✓		
Campbell Albatross	*Thalassarche impavida*		V	Subtropical to sub-Antarctic oceans.	N	✓		
Black-browed Albatross	*Thalassarche melanophris*	V	V	Inshore shallows, bays, channels to the edge of the continental shelf and beyond to pelagic oceans.	N	✓		
Salvin's Albatross	*Thalassarche salvini*		V	Subtropical to sub-Antarctic oceans.	N	✓		
White-capped Albatross	*Thalassarche steadi*		V	Subtropical to sub-Antarctic oceans.	N	✓		
Wompoo Fruit-Dove	*Ptilinopus magnificus*	V		Subtropical rainforest and adjoining sclerophyll habitats.	N		✓	
Rose-crowned Fruit-dove	*Ptilinopus regina*	V		Rainforest, monsoon forest, vine scrub, mangroves and swampy woodland.	N		✓	
Superb Fruit-Dove	*Ptilinopus superbus*	V		Rainforest and similar closed forests with fruit-bearing trees.	N		✓	
White-throated needletail	*Hirandapus caudacutus*	V		High open airspaces above almost any habitat, including oceans.	✓	✓	✓	

Common name	Scientific name	Status		Preferred habitat	Preferred habitat within Study Area	Source		
		BC Act[1] / FM Act[2]	EPBC Act[3]			DCCEEW 2022	DPE 2022a	Site visit
Southern Giant Petrel	*Macronectes giganteus*	E	E	Over open seas and inshore waters, favouring edges of continental shelf and pack-ice.	N	✓		
Northern Giant Petrel	*Macronectes halli*	V	V	Temperate and subantarctic seas, inshore and pelagic seas out from edges of continental shelves.	N	✓		
Providence Petrel	*Pterodroma solandri*	V		Marine, pelagic.	N		✓	
Fairy Prion (southern)	*Pachyptila turtur subantarctica*		V	Subtropical to sub-Antarctic oceans.	N	✓		
Black-necked Stork	*Ephippiorhynchus asiaticus*	E		Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers.	✓		✓	
Australasian Bittern	*Botaurus poiciloptilus*	E	E	Dense beds of reeds and rushes.	✓	✓	✓	
Black Bittern	*Ixobrychus flavicollis*	V		Terrestrial and estuarine wetlands with permanent water and dense vegetation.	✓		✓	
Red goshawk	*Erythrotriorchis radiatus*	CE	V	Forest and woodland with a mosaic of vegetation types, large prey populations, and permanent water. In NSW, preferred habitat is mixed subtropical rainforest and Melaleuca forest along coastal rivers, often in rugged terrain.	N	✓		
Eastern Osprey	*Pandion cristatus (haliaetus)*	V		Extensive areas of open fresh, brackish or saline wetland habitats inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes.	N	✓	✓	
Grey Falcon	*Falco hypoleucos*	E	V	Lightly timbered country, especially stony plains and lightly timbered *Acacia* scrub.	N	✓		
Black Falcon	*Falco subniger*	V		Primarily semi-arid and arid interior, using tree-lined watercourses and isolated stands of trees; in coastal regions, sticks to open country.	N		✓	
Pied Oystercatcher	*Haematopus longirostris*	E		Beaches and mudflats of inlets, bays, ocean beaches and offshore islets; also rocky coasts and headlands.	N		✓	

Common name	Scientific name	Status		Preferred habitat	Preferred habitat within Study Area	Source		
		BC Act[1] / FM Act[2]	EPBC Act[3]			DCCEEW 2022	DPE 2022a	Site visit
Greater Sand-plover	*Charadrius leschenaultii*	V	V	Sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	N	✓	✓	
Lesser Sand-plover	*Charadrius mongolus*	V	E	Beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats.	N	✓	✓	
Comb-crested Jacana	*Irediparra gallinacea*	V		Permanent freshwater wetlands, either still or slow-flowing, with good cover of floating macrophytes.	N		✓	
Australian Painted Snipe	*Rostratula australis (benghalensis)*	E	E	Fringes of wadable swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	✓	✓	✓	
Red Knot	*Calidris canutus*		E	Sheltered coasts on mudflats and sandbars of estuaries, harbours, lagoons; occasionally on beaches and reefs.	N	✓	✓	
Curlew Sandpiper	*Calidris ferruginea*	E	CE	Littoral and estuarine habitats, mainly on intertidal mudflats or sheltered coasts.	N	✓	✓	
Great Knot	*Calidris tenuirostris*	V	CE	Sheltered, coastal habitats containing large, intertidal mudflats or sandflats.	N	✓	✓	
Broad-billed Sandpiper	*Limicola falcinellus*	V		Sheltered estuarine sandflats, mudflats, harbours, embayments, lagoons, saltmarshes and reefs.	N	✓	✓	
Nunivak Bar-tailed Godwit	*Limosa lapponica baueri*		V	Large intertidal sandflats, banks, mudflats, ezstuaries, inlets, harbours, coastal lagoons and bays.	N	✓		
Black-tailed Godwit	*Limosa limosa*	V		Sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats.	N	✓	✓	
Eastern Curlew	*Numenius madagascariensis*		CE	Tidal mudflats, sand spits of estuaries, mangroves, wadable lake shores and ocean beaches.	N	✓	✓	
Terek Sandpiper	*Xenus cinereus*	V		Mudbanks and sandbanks located near mangroves; also rocky pools and reefs.	N	✓	✓	
Little Tern	*Sternula albifrons*	E		Coastal, sheltered environments, harbours, inlets and rivers.	N		✓	

Common name	Scientific name	Status		Preferred habitat	Preferred habitat within Study Area	Source		
		BC Act[1] / FM Act[2]	EPBC Act[3]			DCCEEW 2022	DPE 2022a	Site visit
Australian Fairy Tern	*Sternula nereis nereis*		V	Sheltered coasts, bays, islets, estuaries, coastal lagoons and ocean beaches.	N	✓		
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Dense, tall, wet forests of mountains and gullies, and alpine woodland.	N	✓	✓	
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V	V	Forest and woodland with abundant Casuarina trees.	N	✓	✓	
Little Lorikeet	*Glossopsitta pusilla*	V		Forests and woodland, favouring open country - trees along watercourses and open paddock trees.	✓		✓	
Swift Parrot	*Lathamus discolor*	E	CE	Where eucalypts are flowering profusely or where there are abundant lerp infestations.	N	✓	✓	
Turquoise Parrot	*Neophema pulchella*	V		Edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	N		✓	
Barking Owl	*Ninox connivens*	V		Open country with stands of trees, tree-lined watercourses and paperbark swamp, requiring large hollow-bearing trees or rock for breeding.	N		✓	
Powerful Owl	*Ninox strenua*	V		A range of vegetation, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	N		✓	
Eastern Grass Owl	*Tyto longimembris*	V		Areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, or floodplains.	N		✓	
Masked Owl	*Tyto novaehollandiae*	V		Dry eucalypt forests and woodlands from sea level to 1,100 m above sea level.	N		✓	
Sooty owl	*Tyto tenebricosa*	V		Tall wet eucalypt forest of coastal ranges.	N		✓	
Brown Treecreeper (eastern subsp.)	*Climacteris picumnus victoriae*	V		Eucalypt woodlands (without a dense shrub layer) and dry open forest.	N		✓	
Pilotbird	*Pycnoptilus floccosus*		V	Wet eucalypt and temperate rainforest, alpine and coastal woodland with dense undergrowth.	N	✓		
Speckled Warbler	*Chthonicola sagittata*	V		Open eucalypt woodlands with rocky gullies, ridges, tussocky grass and	N		✓	

Common name	Scientific name	Status		Preferred habitat	Preferred habitat within Study Area	Source		
		BC Act[1] / FM Act[2]	EPBC Act[3]			DCCEEW 2022	DPE 2022a	Site visit
				sparse shrubbery.				
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Dry open forest and woodland, particularly box-ironbark woodland, and riparian forests of river oak.	N	✓	✓	
White-fronted Chat	*Epthianura albifrons*	V		Open country, including inland salt lakes, estuaries, salt marshes with low and sparse samphire, swamp margins and open low heath.	N		✓	
Painted Honeyeater	*Grantiella picta*	V	V	Boree, brigalow and box-gum woodlands and box-ironbark forests.	N	✓		
Black-chinned Honeyeater (eastern subsp.)	*Melithreptus gularis gularis*	V		Forest or woodland of eucalypts or paperbarks, and inland tree-lined watercourses.	N		✓	
Grey-crowned Babbler (eastern subsp.)	*Pomatostomus temporalis temporalis*	V		Open forests and woodland.	N		✓	
Varied Sittella	*Daphoenositta chrysoptera*	V		Eucalypt forest and woodlands, especially with rough-barked species and mature smooth-barked gums.	N		✓	
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V		Woodlands and dry open sclerophyll forests dominated by eucalypts, and also shrublands, healthlands and regenerating forests.	N		✓	
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V		Lightly wooded country with structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	N		✓	
Scarlet Robin	*Petroica boodang*	V		Dry eucalypt forests and woodlands, with open and grassy understorey with few shrubs.	N		✓	
Diamond Firetail	*Stagonopleura guttata*	V		Grassy eucalypt woodlands, including box-gum woodlands and snow gum woodlands.	N		✓	
Mammals								
Spotted-tail Quoll	*Dasyurus maculatus*	V	E	Rainforest, open forest, woodland, coastal heath and inland riparian forest.	N	✓	✓	
Brush-tailed Phascogale	*Phascogale tapoatafa*	V		Dry sclerophyll open forest with sparse groundcover of herbs, grasses,	N		✓	

Common name	Scientific name	Status		Preferred habitat	Preferred habitat within Study Area	Source		
		BC Act[1] / FM Act[2]	EPBC Act[3]			DCCEEW 2022	DPE 2022a	Site visit
				shrubs or leaf litter.				
Long-nosed Potoroo	*Potorous tridactylus*	V	V	Coastal heaths and dry and wet sclerophyll forests, with dense understorey and occasional open areas.	N	✓	✓	
Koala	*Phascolarctos cinereus*	V	V	Eucalypt woodland and forests.	N	✓	✓	
Yellow-bellied Glider	*Petaurus australis*	V	V	Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	N	✓	✓	
Squirrel Glider	*Petaurus norfolcensis*	V		In coastal areas, blackbutt-bloodwood forest with heath understorey.	N		✓	
Greater glider	*Petauroides volans*	E	E	Eucalypt forests and woodlands with hollow-bearing trees.	N	✓	✓	
Parma Wallaby	*Macropus parma*	V	V	Moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	N	✓		
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	Rocky escarpments, outcrops and cliffs, with a preference for complex structures with fissures, caves and ledges, often facing north.	N	✓	✓	
New Holland Mouse	*Pseudomys novaehollandiae*		V	Open heathlands, woodlands and forests with a heathland understorey, and vegetated sand dunes.	N	✓	✓	
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps.	N	✓	✓	
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V		Forages above almost all habitats, with or without trees; roosts in tree hollows, buildings and mammal burrows.	✓		✓	
Eastern Coast Free-tailed Bat	*Micronomus norfolkensis*	V		Open spaces in woodland or forest, being more active in the upper slopes of forest areas, but forages over larger waterways; roosts in tree hollows.	✓		✓	✓
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Dry open forest and woodland in the vicinity of nearby roosts in caves, cliffs, derelict mines and fairy martin nests.	N	✓	✓	
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V		Moist habitats, with trees taller than 20 m; roosts in eucalypt hollows, under loose bark or in buildings.	N		✓	

Common name	Scientific name	Status		Preferred habitat	Preferred habitat within Study Area	Source		
		BC Act[1] / FM Act[2]	EPBC Act[3]			DCCEEW 2022	DPE 2022a	Site visit
Southern Myotis	*Myotis macropus*	V		Forage over streams and pools; roosting nearby in caves, mine shafts, tree hollows, structures and dense foliage.	✓		✓	✓
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	box/ironbark/cypress-pine communities; and a variety of other vegetation types, including mallee, bulloke and box eucalypt-dominated communities.	N		✓	
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V		Variety of habitats including rainforest, open woodland, *Melaleuca* swamp woodland, wet and dry sclerophyll forests, cleared paddocks with remnant trees and tree-lined creeks in open areas; roosting tree hollows, cracks, fissures, bark, and roofs of old buildings.	✓		✓	✓
Eastern Cave Bat	*Vespadelus troughtoni*	V		Tropical and mixed woodland and wet sclerophyll forests (when on the coast); roosting in sandstone overhang caves, boulder piles, mines, buildings and abandoned fairy martin nests under bridges and in culverts.	✓		✓	✓
Little Bent-winged Bat	*Miniopterus australis*	V		Moist forest, rainforest, vine thicket, sclerophyll forests, *Melaleuca* swamps, dense coastal forests, banksia scrub; roosting in caves.	✓		✓	✓
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V		Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, *Melaleuca* forests and open grasslands; roosting in caves but also man-made structures including road culverts.	✓		✓	✓

Notes:

^ Habitat potentially available within the inaccessible component of the Study Area, being the wetland north-east of the rail line.

CE = Critically Endangered; E = Endangered; V = Vulnerable.

N = No/unlikely.

1. BC Act = conservation status under the NSW *Biodiversity Conservation Act 2016*.
2. FM Act = conservation status under the NSW *Fisheries Management Act 1994*.
3. EPBC Act = status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Appendix D: Migratory Species Identified from Database Searches

Table D1 Migratory species previously recorded from the Search Area, or with geographic ranges that overlap the Search Area

Common name	Scientific name	Status	Preferred habitat	Preferred habitat within Study Area	Source		
		EPBC Act[1]			DCCEEW 2022	DPE 2022a	Site visit
Fish							
Mackerel shark	*Lamna nasus*	Mi	Aquatic species restricted to marine environments.	N	May		
Reef Manta Ray	*Mobula alfredi*	Mi	Aquatic species restricted to marine environments.	N	May		
Giant Manta Ray	*Mobula birostris*	Mi	Aquatic species restricted to marine environments.	N	May		
Reptiles							
Loggerhead Turtle	*Caretta caretta*	E,Mi	Aquatic species restricted to marine environments.	N	✓	✓	
Green Turtle	*Chelonia mydas*	V,Mi	Aquatic species restricted to marine environments.	N	✓		
Leatherback Turtle	*Dermochelys coriacea*	E,Mi	Aquatic species restricted to marine environments.	N	✓		
Hawksbill Turtle	*Eretmochelys imbricata*	V,Mi	Aquatic species restricted to marine environments.	N	✓		
Flatback Turtle	*Natator depressus*	V,Mi	Aquatic species restricted to marine environments.	N	✓		
Birds							
Garganey	*Anas querquedula*	Mi	Freshwater wetlands, swamps, shallow lakes, flooded grasslands and floodplains.	✓		✓	
Antipodean Albatross	*Diomedea antipodensis*	V,Mi	Subtropical to subantarctic oceans.	N	Likely		
Southern Royal Albatross	*Diomedea epomophora*	V,Mi	Subtropical to subantarctic oceans.	N	Likely		
Wandering Albatross	*Diomedea exulans*	V,Mi	Open oceans and edge of pack-ice.	N	Likely		
Northern Royal Albatross	*Diomedea sanfordi*	E,Mi	Subtropical to subantarctic oceans.	N	May		
Buller's Albatross	*Thalassarche bulleri*	V,Mi	Subtropical and subantarctic waters of the southern Pacific Ocean.	N	May		
Shy Albatross	*Thalassarche cauta*	E,Mi	Subtropical to subantarctic oceans.	N	Likely		
Chatham Albatross	*Thalassarche eremita*	E,Mi	Subtropical to subantarctic oceans.	N	May		
Campbell Albatross	*Thalassarche impavida*	V,Mi	Subtropical to sub-Antarctic oceans.	N	May		
Black-browed Albatross	*Thalassarche melanophris*	V,Mi	Inshore shallows, bays, channels to the edge of the continental shelf	N	Likely		

Common name	Scientific name	Status	Preferred habitat	Preferred habitat within Study Area	Source		
		EPBC Act[1]			DCCEEW 2022	DPE 2022a	Site visit
			and beyond to pelagic oceans.				
Salvin's Albatross	*Thalassarche salvini*	V,Mi	Subtropical to sub-Antarctic oceans.	N	Likely		
White-capped Albatross	*Thalassarche steadi*	V,Mi	Subtropical to sub-Antarctic oceans.	N	May		
Lesser Frigatebird	*Fregata ariel*	Mi	Airspace over tropical seas; breeding colonies on islands, often low cays.	N	Likely		
Greater Frigatebird	*Fregata minor*	Mi	Airspace over tropical seas; breeding on coastal islands.	N	Likely		
Fork-tailed Swift	*Apus pacificus*	Mi	Airspace over varied habitat, rainforest to semi-desert.	✓	Likely	✓	
White-throated Needletail	*Hirundapus caudacutus*	V,Mi	High open airspaces above almost any habitat, including oceans.	✓	✓	✓	
Sooty Shearwater	*Ardenna grisea*	Mi	Antarctic to subtropical seas; occasionally coastal waters; breeds on higher parts of islands, often on headlands.	N	Likely		
Wedge-tailed Shearwater	*Ardenna pacifica*	Mi	Tropical and sub-tropical seas; pelagic, frequenting and feeding across the ocean surface.	N		✓	
Streaked Shearwater	*Calonectris leucomelas*	Mi	Pelagic oceans, shelf waters and edges; rarely close inshore.	N	✓		
Southern Giant Petrel	*Macronectes giganteus*	E,Mi	Over open seas and inshore waters, favouring edges of continental shelf and pack-ice.	N	May		
Northern Giant Petrel	*Macronectes halli*	V, Mi	Temperate and subantarctic seas, inshore and pelagic seas out from edges of continental shelves.	N	Likely		
White-tailed Tropicbird	*Phaethon lepturus*	Mi	Oceanic, probably pelagic; rarely seen over inshore waters, except at nesting colonies – the nearest at Ashmore Reef off the Kimberley coast.	N	May		
Eastern Osprey	*Pandion cristatus*	Mi	Extensive areas of open fresh, brackish or saline wetland habitats inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs, large lakes and waterholes.	N	✓	✓	
Double-banded Plover	*Charadrius bicinctus*	Mi	Tidal mudflats, beaches, exposed reefs, salt marshes, freshwater	✓	✓	✓	

Common name	Scientific name	Status	Preferred habitat	Preferred habitat within Study Area	Source		
		EPBC Act[1]			DCCEEW 2022	DPE 2022a	Site visit
			wetlands, inland salt lakes, short grass of golf courses and airfields.				
Greater Sand-plover	*Charadrius leschenaultii*	V,Mi	Sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	N	Likely	✓	
Lesser Sand-plover	*Charadrius mongolus*	E,Mi	Beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats.	N	✓	✓	
Pacific Golden Plover	*Pluvialis fulva*	Mi	Estuaries, inter-tidal mudflats, beaches, reefs, salt marshes and offshore islands.	N	✓	✓	
Grey Plover	*Pluvialis squatarola*	Mi	Marine shores of estuaries or lagoons on broad, open mudflats, sandy bars or beaches, rock platforms and reef flats of rocky coasts; also margins of salt lakes and swamps.	✓	✓	✓	
Common Sandpiper	*Actitis hypoleucos*	Mi	Narrow muddy edges of billabongs, river pools, mangroves, among rocks and snags and reefs or rocky beaches. Avoids wide open mudflats.	N	✓	✓	
Ruddy Turnstone	*Arenaria interpres*	Mi	Ocean coasts with exposed rock, stony or shelly beaches, mudflats, exposed reefs and wave platforms; occasionally inland on shallow pools.	N	✓	✓	
Sharp-tailed Sandpiper	*Calidris acuminata*	Mi	Fresh or salt wetlands and the muddy edges of lagoons, swamps, lakes, dams, soaks, sewage farms and temporary floodwaters.	✓	✓	✓	
Red Knot	*Calidris canutus*	E,Mi	Sheltered coasts on mudflats and sandbars of estuaries, harbours, lagoons; occasionally on beaches and reefs.	N	✓	✓	
Curlew Sandpiper	*Calidris ferruginea*	CE,Mi	Littoral and estuarine habitats, mainly on intertidal mudflats or sheltered coasts.	N	✓	✓	
Pectoral Sandpiper	*Calidris melanotos*	Mi	Coastal wetland, both fresh and saline, also inland on permanent and temporary wetlands, preferring mudflats, fringing vegetation, and swamps with heavy overgrowth of vegetation.	✓	✓	✓	
Red-necked Stint	*Calidris ruficollis*	Mi	Diverse habitat range. Tidal and inland mudflats, salt marshes,	N	✓	✓	

Common name	Scientific name	Status	Preferred habitat	Preferred habitat within Study Area	Source		
		EPBC Act[1]			DCCEEW 2022	DPE 2022a	Site visit
			beaches, saltfields and temporary floodwaters.				
Great Knot	*Calidris tenuirostris*	CE,Mi	Sheltered, coastal habitats containing large, intertidal mudflats or sandflats.	N	✓	✓	
Latham's Snipe	*Gallinago hardwickii*	Mi	Low vegetation around wetlands in shallows, sedges, reeds, heaths, salt marsh and irrigated crops.	N	✓	✓	
Swinhoe's Snipe	*Gallinago megala*	Mi	Billabongs, swamps, flooded grassland, sewage ponds and claypans.	✓	Likely		
Pin-tailed Snipe	*Gallinago stenura*	Mi	Coastal freshwater wetlands – swamps, river pools, sewage ponds, usually with grass.	✓	Likely		
Broad-billed Sandpiper	*Limicola falcinellus*	Mi	Sheltered estuarine sandflats, mudflats, harbours, embayments, lagoons, saltmarshes and reefs.	N	✓	✓	
Bar-tailed Godwit	*Limosa lapponica*	Mi	Coastal mudflats, sandbars, shores of estuaries and salt marsh.	N	✓	✓	
Nunivak Bar-tailed Godwit	*Limosa lapponica baueri*	V,Mi	Large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	N	✓		
Black-tailed Godwit	*Limosa limosa*	Mi	Sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats.	N	✓	✓	
Eastern Curlew	*Numenius madagascariensis*	CE,Mi	Tidal mudflats, sand spits of estuaries, mangroves, wadable lake shores and ocean beaches.	N	✓	✓	
Little Curlew	*Numenius minutus*	Mi	Dry grassland of clay and blacksoil plains, river floodplains, woodlands with grassy understorey and around billabongs and freshwater swamps.	✓	Likely	✓	
Whimbrel	*Numenius phaeopus*	Mi	Mudflats of estuaries, lagoons, preferably with mangroves. Less often sandy beaches, reefs and salt lakes.	N	✓	✓	
Ruff	*Philomachus pugnax*	Mi	Mud flats and sedges around fresh or saline lakes, estuaries, tidal pools.	✓	✓	✓	
Grey-tailed Tattler	*Tringa brevipes*	Mi	Coastal – inter-tidal pools, shallows, mudflats, sand beaches, rock ledges and reefs.	N	✓	✓	

Common name	Scientific name	Status	Preferred habitat	Preferred habitat within Study Area	Source		
		EPBC Act[1]			DCCEEW 2022	DPE 2022a	Site visit
Wood Sandpiper	*Tringa glareola*	Mi	Shallows of wooded lakes or swamps with trees, including freshwater swamps, lakes and flooded pasture.	✓		✓	
Wandering Tattler	*Tringa incana*	Mi	Rocky coasts – wave-washed tidal platforms and exposed reefs around headlands or high islands.	N		✓	
Common Greenshank	*Tringa nebularia*	Mi	Permanent and temporary wetlands, sheltered estuaries and bays with extensive mudflats, mangrove swamps, muddy shallows of harbours and lagoons, occasionally rocky tidal ledges.	N	✓	✓	
Marsh Sandpiper	*Tringa stagnatilis*	Mi	Salt or freshwater wetlands. Estuarine and mangrove mudflats, beaches, shallows or swamps, lakes, billabongs, temporary floodwaters, sewage farms and saltworks ponds.	✓	✓	✓	
Terek Sandpiper	*Xenus cinereus*	Mi	Mudbanks and sandbanks located near mangroves; also rocky pools and reefs.	N	✓	✓	
White-winged Black Tern	*Chlidonias leucopterus*	Mi	Marine and freshwater coastal wetland, including river pools, billabongs and inundated floodplains.	✓		✓	
Gull-billed Tern	*Gelochelidon nilotica*	Mi	Inland fresh or salt waters during breeding. Lagoons and saltmarshes near the coast all other times.	✓		✓	
Caspian Tern	*Hydroprogne caspia*	Mi	Sheltered estuaries, inlets, bays, harbours, lagoons with muddy or sandy shores.	N		✓	
Common Tern	*Sterna hirundo*	Mi	Marine, typically well offshore, but occasionally coastal waters, bays, estuaries, ocean beaches.	N		✓	
Little Tern	*Sternula albifrons*	Mi	Coastal, sheltered environments, harbours, inlets and rivers.	N		✓	
Crested Tern	*Thalasseus bergii*	Mi	Ocean beaches, offshore islands, deep pelagic waters, estuaries, bays, harbours, coastal lagoons, major rivers, saline lakes and salt ponds near the coast.	N		✓	
Common Noddy	*Anous stolidus*	Mi	Oceanic; breeds in coastal waters near islands colonies off WA and Queensland.	N	Likely		

Common name	Scientific name	Status	Preferred habitat	Preferred habitat within Study Area	Source		
		EPBC Act[1]			DCCEEW 2022	DPE 2022a	Site visit
Oriental Cuckoo	*Cuculus optatus*	Mi	Rainforest margins, monsoon forest, vine scrubs, riverine thickets, wetter, densely canopied eucalypt forests, paperbark swamps and mangroves.	N	✓	✓	
Rufous Fantail	*Rhipidura rufifrons*	Mi	Rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation.	N	✓	✓	
Black-faced Monarch	*Monarcha melanopsis*	Mi	Rainforests, mangroves, eucalypt forests and woodlands.	N	✓	✓	
Satin Flycatcher	*Myiagra cyanoleuca*	Mi	Forests and woodlands, mangroves and coastal heath scrubs. Avoids rainforest.	N	✓	✓	
Spectacled Monarch	*Symposiachrus trivirgatus*	Mi	Usually rainforests, mangroves, but also moist gullies of dense wet eucalypt forest.	N	✓		
Barn Swallow	*Hirundo rustica*	Mi	Open sites, often near water; summer migrant to Australia.	✓		✓	
Yellow Wagtail	*Motacilla flava*	Mi	Open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground.	✓	✓	✓	

Notes:

M = Migratory; CE = Critically Endangered; E = Endangered; V = Vulnerable.

N = No/unlikely.

1. EPBC Act = status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.