Appendix 4

Pambalong Nature Reserve Monitoring Plan: 2008/09

Baseline Report

This appendices is presented on the CD included on the inside front cover of this report.

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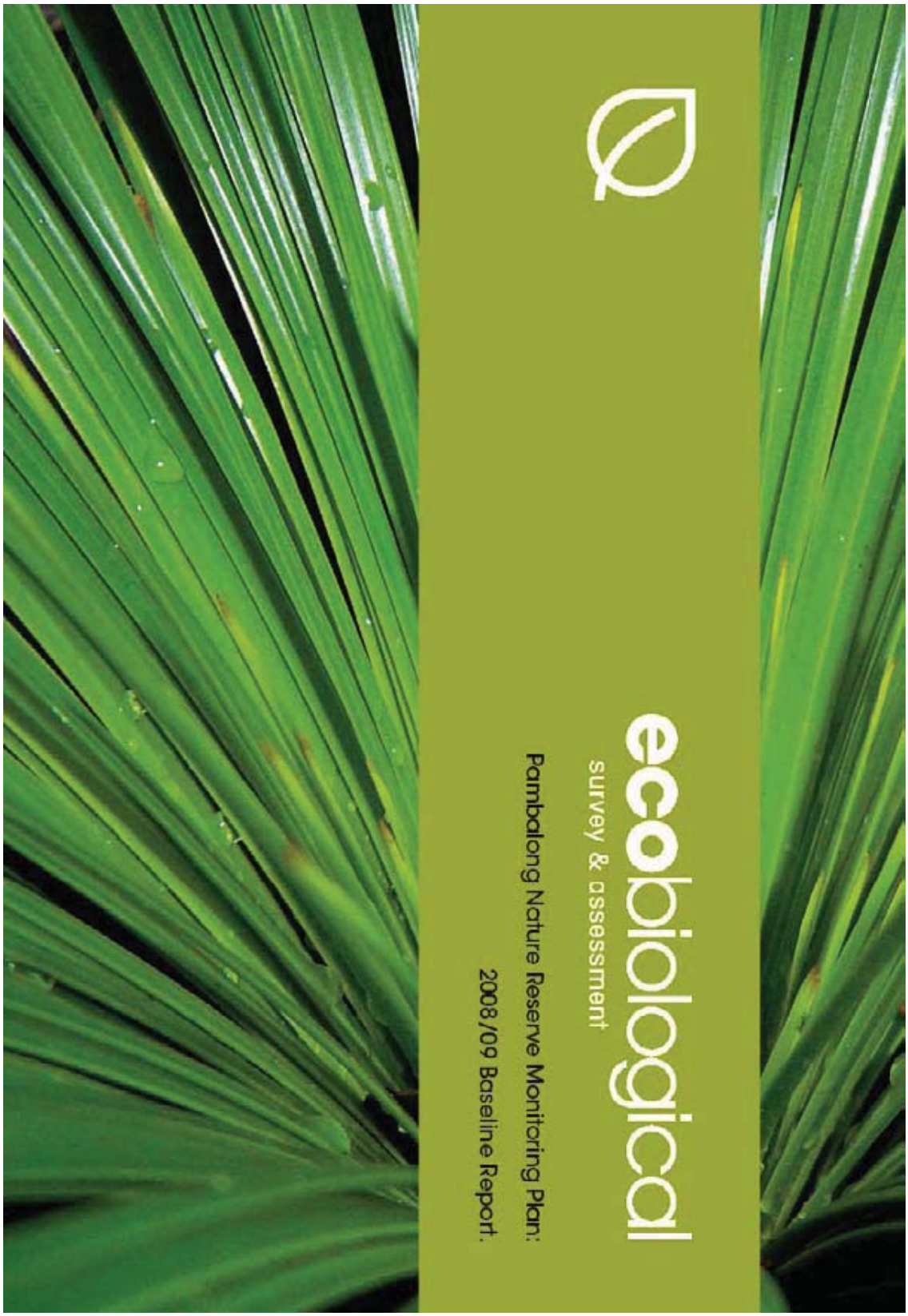
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survey & assessment
Pambalong Nature Reserve Monitoring Plan:
2008/09 Baseline Report.

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May 2009

Report prepared for Donaldson Coal Pty Ltd.

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Executive Summary

Donaldson Coal Pty Ltd commenced operations at Abel Underground Coalmine at Beresfield in the lower Hunter Valley, New South Wales, during 2006. To comply with part of the conditions of consent a Flora and Fauna Management Plan was prepared in late 2007 by EcoBiological.

This plan identified the need to establish a monitoring plan for Pambalong Nature Reserve (a 34ha freshwater wetland located between the eastern extent of the Abel coal mine lease and the F3 freeway). The reserve provides critical habitat for wader and water bird species and is part of a chain of protected wetlands (including Hexham Swamp, Shortland Wetlands and Kooragang Nature Reserve). The wetland depends on freshwater from Blue Gum Creek to maintain and replenish aquatic and terrestrial habitats in the reserve. Consequently any changes to the quantity and quality of water delivered from the Blue Gum Creek catchment arising from mining activities or subsidence could compromise the ecological integrity of the wetland (EcoBiological 2007).

It is estimated that it will be approximately 15 years before there could be any potential for subsidence impacts on Pambalong Nature Reserve. Specific potential detrimental impacts on the wetland could be brought about by increased rates of sedimentation and a decline in the quantity and quality of water, producing a decline in wetland area and an overall loss of aquatic and terrestrial floral and faunal biodiversity. Negative impacts could also result from weeds and/or feral animals, and population increases of exotic species could occur as a result of the reserve ecosystem being weakened by external factors (EcoBiological 2007).

This is the first annual report to establish baseline conditions at Pambalong Nature Reserve against which any changes over time can be measured and evaluated. It is important that data is collected over approximately the next 15 years to determine what constitutes normal variation so that any impacts resulting from subsidence can be properly identified and addressed with suitable management actions.

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1. Introduction

Donaldson Coal Pty Ltd (Donaldson) commenced mining during 2008 at a new underground mine (known as Abel Underground Coal Mine), located approximately 23 kilometres north-west of Newcastle. The mine will extract up to 4.5 million tonnes per year over 21 years using high productivity continuous miner based bord and pillar systems, and pillar extraction techniques.

Underground coal mining is often associated with adverse environmental impacts because of subsidence (Bell *et al.* 2000, Sidle *et al.* 2000). Subsidence can cause loss of productive land, damage to underground pipelines and above-ground structures, decreased stability of slopes and escarpments, contamination of groundwater by acid drainage and dewatering of streams and groundwater supplies (Sidle *et al.* 2000). Of these, one of the major environmental concerns arising from the Abel mine is the effect of subsidence on local and regional hydrology. Surface and sub-surface cracking associated with mining subsidence can alter and create preferential flow paths, thus causing dewatering and rerouting of surface water and groundwater (Sidle *et al.* 2000). Alterations in channel and drainage morphology may also affect channel erosion, sediment delivery, and pooling in streams and riparian habitat.

Associated with development approval for the Abel coal mine were a number of conditions of consent. These conditions included a requirement for the preparation of a Flora and Fauna Management Plan (F & FMP) which was prepared by EcoBiological in 2007. The F & FMP, which forms part of a comprehensive Environmental Management System for the Abel mine, sets out a strategy to monitor the effectiveness of the conservation measures proposed in the Environmental Assessment (EA) Statement of Commitments for the overall operation of the mine. Part of this strategy was to establish a Surface Ecological Monitoring Plan (SEMP) to monitor the effectiveness of the conservation measures proposed in the EA to mitigate against subsidence impacts on three distinct habitat areas; farm dams that form a belt across the mine site; subtropical rainforest areas of Long Gully Creek; and Pambalong Nature Reserve.

The SEMP outlines a monitoring plan for each of these areas by which baseline and subsequent monitoring data are to be gathered to inform future management. This report forms the baseline report for Pambalong Nature Reserve which forms part of the overall SEMP.

2. Location

The Abel Underground Mine is located within Newcastle, Cessnock and Maitland local government areas (LGAs). The majority of the underground mine and surface infrastructure area is within the Cessnock LGA. The seams to be mined are located under the Black Hill rural residential and adjoining forested areas. Mine access and associated surface infrastructure is located within the existing Donaldson Coal mine open cut void at Beresfield, with transfer of coal to the existing Bloomfield Coal Handling and Preparation Plant (CHPP) immediately to the north for coal washing and rail transport to the Port of Newcastle (Figure 1).

The Abel underground mine area is approximately 2750 ha and consists of low undulating forested hills with patches of cleared land for 110 rural/residential properties. A ridgeline associated with Black Hill runs east-west through the proposed underground mine area. Tributaries of Buttai Creek, Viney Creek, Weakley's Flat Creek and Four Mile Creek drain northwards from this ridgeline. A wide catchment containing Long Gully and Blue Gum Creek drains from the ridgeline providing water to the wet swamp at Pambalong Nature Reserve. Some cliff-lines and steeper gullies are located along sections of the Black Hill ridge.

The underground mine area is bounded on the eastern side by Pambalong Nature Reserve and the F3 Freeway; the western and southern sides by a tract of forest that extends south to the Central Coast and beyond to Hornsby, and the northern side by existing open cut coal mining activities within the Donaldson and Bloomfield mine leases (Figure 1).

Pambalong Nature Reserve consists of 34 hectares of predominantly freshwater wetland on the western side of the of the F3 freeway, approximately 20km north-west of Newcastle (Figure 2 and 3). The reserve was gazetted in December 2000 over former farmland acquired by the Roads and Traffic Authority during construction of the freeway (DEC 2006).

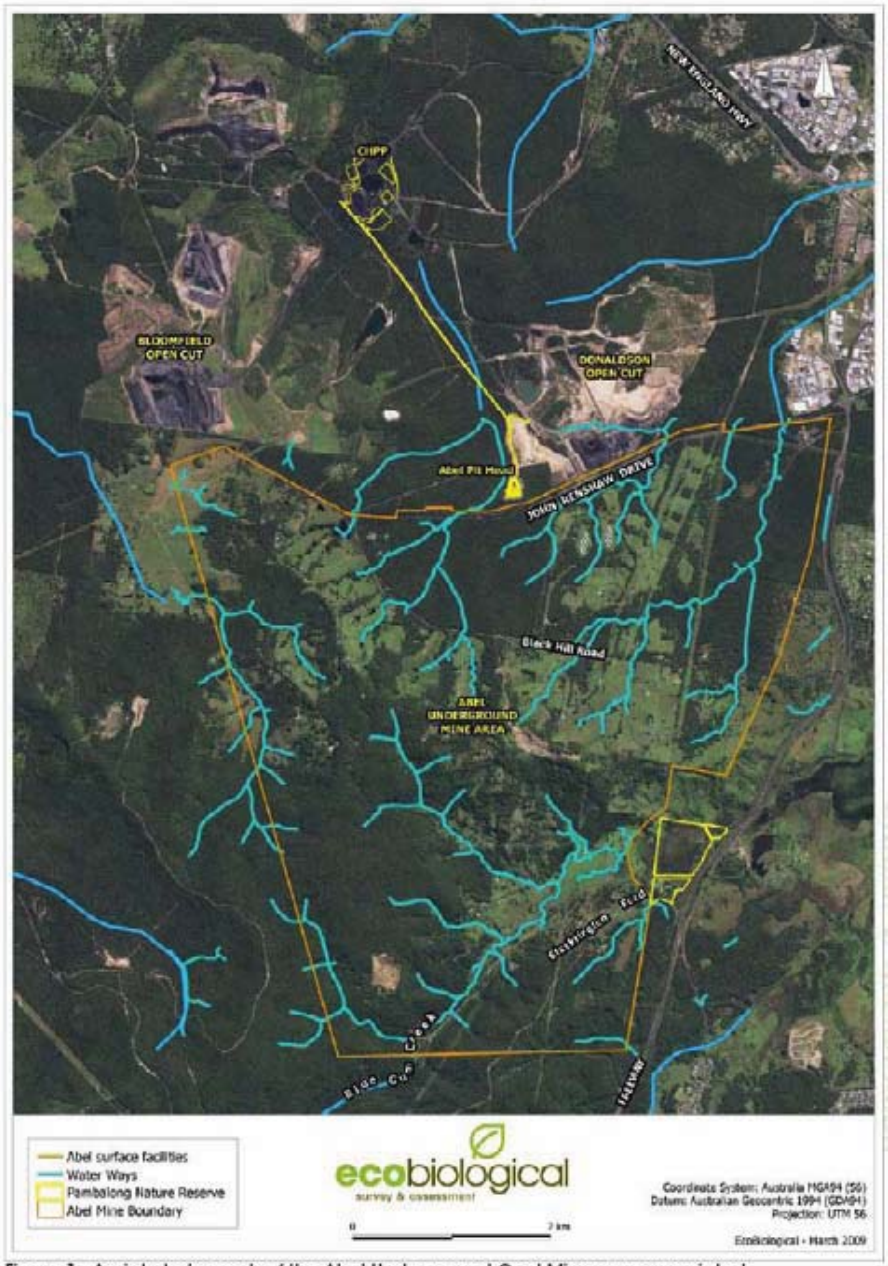

Figure 1: Aerial photograph of the Abel Underground Coal Mine area associated surface facilities and proximity to Pambalong Nature Reserve.

Figure 2: The location of Pambalong Nature Reserve within the region and proximity to areas of native vegetation, SEPP 14 wetlands and protected reserves.

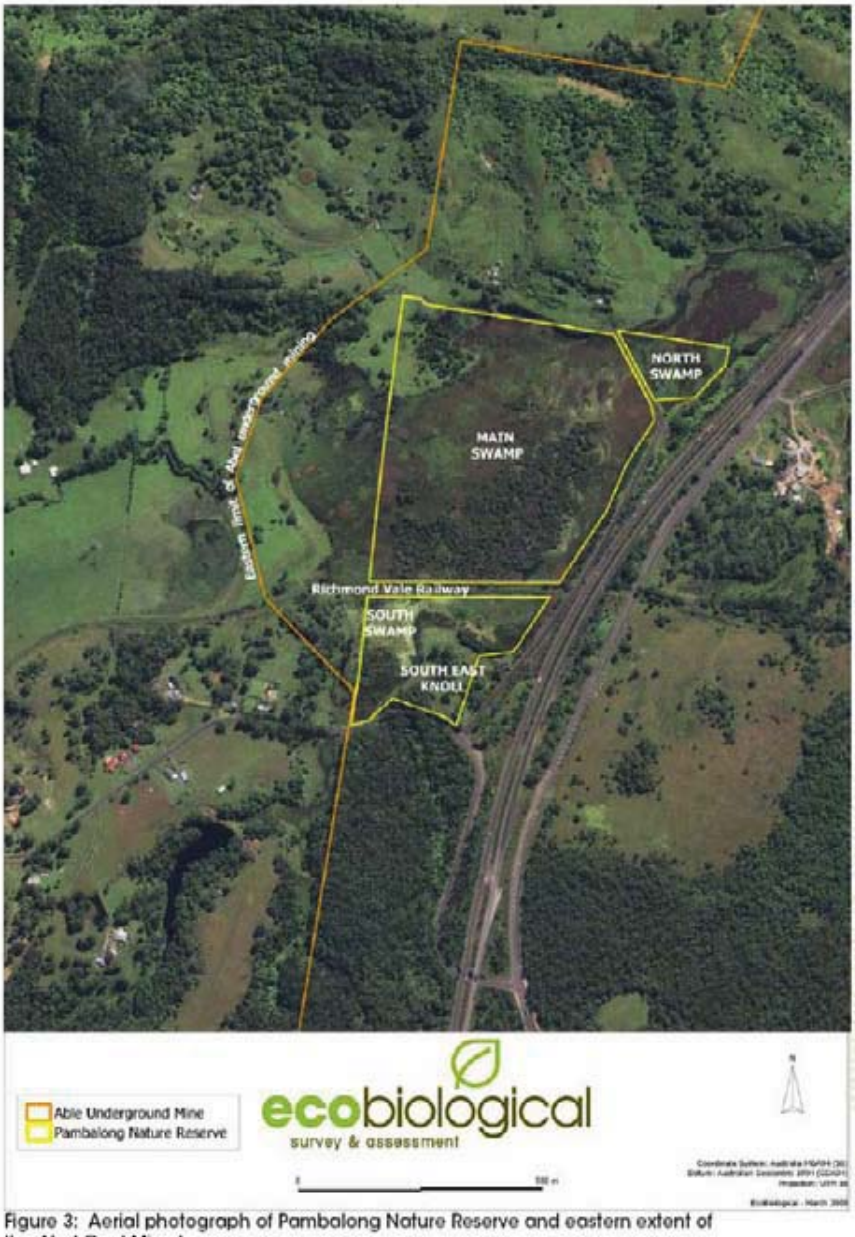

Figure 3: Aerial photograph of Pambalong Nature Reserve and eastern extent of the Abel Coal Mine lease.

3. Review of Previous Ecological Studies

Pambalong Nature Reserve is managed by the Department of Environment & Climate Change (DECC) to provide critical habitat for wader and water bird species. The reserve is an integral part of a chain of wetland reserves that includes Hexham Swamp Nature Reserve, Shortland Wetlands and Kooragang Nature Reserve (Figure 2). The latter two wetlands comprise the internationally significant Ramsar-listed Hunter Estuary Wetlands. The reserve contains a range of freshwater wetland habitats including open water, reed beds, mud flats, emergent and fringing melaleuca forest, open woodlands and pasture (DEC 2006). This variety in such a relatively small area ensures a wide variety of flora and fauna species inhabit the reserve.

The following ecological studies and the reserve's Plan of Management were considered in the preparation of this report and have been reviewed below for information on past disturbance history at the site and for threatened and/or rare species records:

- EcoLogical Australia (2003). An Investigation and Description of the Vegetation of the Pambalong Swamp (Pambalong Nature Reserve). Report prepared for NSW National Parks and Wildlife Service.
- Straw, Phil (2000). Birds of Pourmalong Nature Reserve – Management Strategy: Avifauna. Avifauna Studies for NSW National Parks and Wildlife Service.
- White, Dr. Arthur (2000). Frog, Reptile and Mammal Survey - Minmi Swamp. Report prepared by Biosphere Environmental Consultants for NSW National Parks and Wildlife Service.
- Department of Environment & Conservation (2006). Pambalong Nature Reserve Plan of Management. NPWS Hunter Region.

A flora species list from the Eco Logical (2003) report and an avifauna species list from the Straw (2000) study have been included in this report (Appendix 1 and 2).

3.1. Native plant species and communities

Plant communities that depend on the wetland, including rushes, sedges and melaleuca woodland, dominate the reserve. These communities are generally in good condition; however, the fringing woodlands are in poor condition due to past clearing and grazing (DEC 2006).

Approximately half of the area of the reserve is open water or fringing wetland vegetation. Conservation of the wetland vegetation communities is a high priority in the reserve because of their regional significance and the habitat these communities provide for waterbirds (DEC 2006). The reserve's Plan of Management notes that the nature and extent of the various wetland plant communities varies with water level, especially the fringing sedge and rush communities. There is evidence, such as dieback in the melaleuca trees in the south swamp that changes to the vegetation communities have also been caused by past alterations such as the construction of the railway embankment and roads (DEC 2006).

A vegetation survey conducted by EcoLogical Australia (2003) identified seven plant communities within the reserve, of which only two (Spotted Gum–Ironbark Forest and Introduced Grassland) are not dependent on the wetland. The survey did not find any rare or threatened species as listed on the Register of Threatened Australian Plants (ROTAP) or under the NSW TSC Act 1995. However, the following regionally significant species and communities were identified:

- *Cyperus odoratus* (a sedge) is at the northern extent of its range and is considered rare north of Wyong;
- *Melaleuca linariifolia* (a woody shrub or small tree) is regionally significant as its extent has been severely reduced by saturation of its habitat from increased urban run off;
- *Enydra fluctuans* (a water plant) is common on the site but is not common outside the Newcastle area;
- *Pseudoraphis spinescens* (a grass) grows only in the Wyong area and is otherwise uncommon in the region; and,
- The wetland vegetation communities that include paperbark sedgeland, swamp meadow, spikerush sedgeland, paperbark

woodland and standing water are all considered regionally significant by the Lower Hunter and Central Coast Regional Environment Management Strategy (LHCCREMS) remnant vegetation assessment. These wetland communities have been reduced in extent by and are under threat from wetland reclamation and hydrological changes (DEC 2006).

Since the preparation of Eco Logical's report in 2003 these wetland and swamp communities have been listed as forming part of the "*Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community*" and the "*Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*" (NSW Scientific Committee 2004a, 2004b).

3.2. Native fauna

Several threatened fauna species have been recorded on the site including the endangered Black-necked Stork (*Ephippiorhynchus asiaticus*) and the vulnerable Magpie Goose (*Anseranas semipalmata*), Freckled Duck (*Stictonetta naevosa*), Australian Painted Snipe (*Rostratula australis*), Turquoise Parrot (*Neophema pulchella*) and Comb-crested Jacana (*Irediparra gallinacea*) (DEC 2006; Birds Australia 2009).

The Department of Environment & Climate Change also has obligations relating to the management of the reserve under international agreements ratified by the Australian Government. These agreements are:

- The Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA);
- The Agreement between the Peoples Republic of China and the Government of Australia for the Protection of Migratory Birds and their Environment (CAMBA); and,
- The Agreement between the Republic of Korea and the Government of Australia on the Protection of Migratory Birds (RoKAMBA).

The agreements with Japan, China and Korea list a species found to frequent the reserve, the Latham's snipe (*Gallinago hardwickii*). The Hunter Bird Observers Club (HBOC) has been undertaking annual summer counts of this species at Pambalong Nature Reserve since 1997, with fluctuating numbers of this species being recorded over the last 11 years.

Latham's Snipe (*Gallinago hardwickii*) breeds in Japan and migrates to Australia for our summer. The species has an important place in shorebird conservation in the East Asia-Australia Flyway, as concern for its status at the time was a significant factor in development of the JAMBA. This species is also listed under CAMBA and RoKAMBA. The world population of Latham's snipe is estimated at 36,000 and the several hundred who, in some seasons, roost and feed at Pambalong Nature Reserve represent up to 1% of the Australian population (Straw, 2000). Due to the destruction of Latham's Snipe habitat throughout the Hunter, particular attention should be paid to retaining its habitat within the reserve (DEC 2006).

Several other migratory wader species listed under the EPBC Act 1999, the JAMBA, CAMBA and RoKAMBA treaties and the Bonn Convention have also been recorded on the site. These species include: Marsh Sandpiper (*Tringa stagnatilis*), Common Greenshank (*Tringa nebularia*), Wood Sandpiper (*Tringa glareola*), Sharp-tailed Sandpiper (*Calidris acuminata*), and the Curlew Sandpiper (*Calidris ferruginea*) (DEC 2006). Surveys conducted over the last 11 years by the Hunter Bird Observers Club have also recorded the following additional bird species listed under migratory bird agreements: Cattle Egret (*Ardea ibis*), Eastern Great Egret (*Ardea modesta*), Glossy Ibis (*Plegadus falcinellus*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), and White-throated Needletail (*Hirundapus caudacutus*).

The emergent melaleuca forest provides a roosting site for several species of egrets, cormorants and ibis, where up to 1000 birds have been observed. The open water provides habitat for ducks, swans and grebes, and birds have been observed using this area for moulting. Over 150 species of bird have been observed within the reserve with several species (predominantly ducks species and Black Swans) have been observed nesting and raising chicks (Straw 2000, HBOC 2008).

Pambalong Nature Reserve is an integral part of the Hunter Estuary wetlands and could be considered as providing critical habitat for wader and water bird species at a regional, state, national and international level. As such the health of the reserve must be closely monitored (DEC 2006).

The swamp and surrounding bushland also supports a large frog population. The five species identified by White (2000) are all species commonly found on the eastern coast. Specific attempts to locate the endangered Green and Golden Bell Frog (*Litoria aurea*) and Wallum Froglet (*Crinia tinnula*) did not find any on the site, although Green and Golden Bell Frogs do occur in nearby freshwater wetlands on the eastern edge of the Hexham Swamp (DEC 2006).

Only a small number of mammal species have previously been recorded on the site, with none of them considered significant, although the presence of the Brown Antechinus (*Antechinus stuartii*) in the melaleuca thickets was considered unusual by White (2000). Other mammals observed in the reserve included the Bush Rat (*Rattus fuscipes*), Sugar Glider (*Petaurus breviceps*) and five bat species.

Despite its proximity to the freeway, it is noted that there is some potential for the reserve to act as a habitat corridor and refuge. Movement of fauna is possible to the west of the freeway, where the catchment is forested and relatively undeveloped. Movement to the east, to and from Hexham Swamp, is likely to be restricted, except for bird species, which are generally able to cross the freeway safely (DEC 2006).

3.3. Disturbance history

Changes to the vegetation communities have occurred due to past activities on and off the reserve. Grazing and land clearing has altered habitat for animal species, reducing forest cover on the reserve and connectivity to nearby bushland and swamp, while increasing open grasslands (DEC 2006). Over time, the wetlands have been divided by the construction of the Richmond Vale Railway and by Cedar Hill Road, and although connected by pipes and culverts, the three sections of wetland are distinct in structure supporting varying flora and fauna assemblages (Straw 2000).

The Plan of Management notes that there is potential for rapid spread of some native species such as water couch, typha and phragmites which may alter the habitat value of some areas of the reserve. Aquatic weeds, particularly water hyacinth, have invaded the wetland areas. A control program has reduced its extent but reinfestation continues. Some noxious and environmental weeds are a problem in cleared and remnant bushland areas. Pasture grasses, particularly couch and kikuyu, are a potential weed threat now that grazing has ceased (DEC 2006).

Straw (2000) noted that weeds are likely to have a significant impact on birds if they are allowed to increase. Blackberry, lantana and couch have the potential to spread and cover areas of diurnal roosting habitat and feeding habitat of the Latham's Snipe. Water hyacinth impacts on areas of open water by affecting the accessibility of other aquatic plants, open water, shallows and muddy margins depended upon by many species of waterbird (Straw 2000).

Foxes are known to occur in the reserve and other feral predators such as dogs, cats, pigs and rats are common in the surrounding areas due to the rich food source provided by birds and other wetland animals. Introduced species that occur in surrounding areas are likely to occur in the reserve (DEC 2006).

Domestic stock occasionally enter the reserve from neighbouring properties. This may impact by direct grazing on vegetation in the reserve, threaten waterbird nesting sites, as well as spreading weeds and increasing nutrient loads in the wetland (DEC 2006).

4. Methods

4.1. Floral Diversity and Vegetation Mapping

Flora and vegetation mapping has been undertaken in accordance with the requirements of the F&FMP (section 5.2.3.2).

A base vegetation map of the wetland was prepared using a combination of aerial photograph interpretation and ground-truthing to delineate community boundaries. Communities were classified based on the type of habitat provided as well as on the floristic content and structure. Vegetation community boundaries will be mapped and monitored yearly to identify any variations from year to year.

Standard 0.04ha (20m x 20m) floristic plots and a 50m transect were established in representative areas of identifiable vegetation structure. Data collected in these quadrats included total floristic content and the cover abundance score for each species in the plots using the Braun-Blanquet scale which will be applied consistently over time.

Targeted searches for threatened flora species (*Tetratheca juncea, Maundia triglochinoides, Persicaria elatior* and *Zannichellia palustris*) were also conducted through random meandering. The location of any threatened flora species would be recorded using a GPS.

The surveys also recorded the presence and distribution of weed species across the subject site. The dominant weed species and outbreak areas were mapped.

Floristic identification and nomenclature was based on Harden (1992, 1993, 2000, 2002) with subsequent revisions as published on PlantNet (http://plantnet.rbgsyd.nsw.gov.au). Plants listed under the ROTAP scheme (Briggs and Leigh 1996) were also considered in this assessment along with species and vegetation deemed to be of local conservation significance.

4.2. Faunal Diversity

All observation points and transects were established and documented in such a way as to ensure that data collected for each year is from the same location. Faunal diversity monitoring was centred on two transects, one situated in the Spotted Gum – Ironbark open forest fringing the South Swamp and the other situated in the Melaleuca Swamp Forest fringing the Main Swamp.

Table 1 depicts the total trap night count. Table 2 provides details of survey effort undertaken to record faunal diversity across the subject site. The location of fauna survey activities is shown in Figure 4.

Table 1: Trapping statistics for the subject site.

Trap type	Traps	Nights	Trap nights
Elliott A	40	4	160
Elliott B Tree	6	4	24
Elliott B Ground	6	4	24
Cage trap	4	4	16
Harp Trap	2	4	8
Hair tubes	8	4	32

Table 2: Fauna survey effort for the subject site.

Survey method	Days/nights	Locations	Time spent
Anabat recording hours	2	4	4.5 recording hrs
Spotlighting	2	2	2.5 person hrs
Owl call playback	2	3	1.5 person hrs
Frog survey	3	3	15 person hrs
Bird transect survey	2	2	1.33 person hrs
Bird water body survey	8	3	8 person hrs
Roosting bird abundance estimate	2	1	0.5 person hrs
Opportunistic fauna observations	15	Across entire site	Approx. 7.5 person hours

Figure 4: Aerial photograph showing the location of flora and fauna survey methods within Pambalong Nature Reserve.

4.2.1. Arboreal Mammals

For arboreal mammals, 6 Elliott B traps and 8 hair tubes were placed in trees at heights of 3m or above, along 2 transects and baited with a mixture of rolled oats, honey, peanut butter and treacle. The trunks of trees containing the traps were sprayed with a mixture of honey and water. These traps were checked daily for arboreal species and wafers from the hair tubes were collected after a 4 night period and checked for the presence of hair samples. Hair identification methods followed those of Brunner *et al.* (2002). If any hair sample was from a vulnerable or endangered species, the sample was sent to Barbara Triggs, an expert in the field of hair identification for a second opinion.

Spotlighting was undertaken along each transect from dusk for a total of 2.5 person hours over 2 nights to identify the presence of any arboreal mammals. Trees were inspected during daylight hours for the presence of habitat hollows and if present these were watched at dusk to see if any nocturnal birds or mammals emerged.

4.2.2. Terrestrial Mammals

Forty Elliott A, 6 Elliott B and 4 cage traps were placed along 2 transects at regular intervals to target terrestrial mammal species. The traps were baited with a mix of rolled oats, honey, peanut butter and treacle and set in position for 4 consecutive nights and checked each morning.

Spotlighting was undertaken along each transect from dusk for a total of 2.5 person hours over 2 nights to identify the presence of any terrestrial mammals. Careful daytime searches were conducted to detect the presence of fauna activity such as diggings, droppings or scratch marks.

4.2.3. Bats

A harp trap was erected along each transect in bat 'flyways' such as across a track at the South Swamp and in a natural forest opening in the Main Swamp to maximise the likelihood of captures. The harp traps were set in position for 4 consecutive nights and checked each morning. Bats captured were identified in the field and placed in specially designed 'soft release' boxes tethered to nearby trees which enable the bats to shelter during the day and exit the boxes on nightfall from narrow openings at the base of the box.

Anabat II bat-call recorders (Titley Electronics, Ballina) were used to record the calls of any Microchiropteran bats feeding in the area. The units were set up at dusk and recording occurred for a total of 4.5 hours at 4 locations over 2 nights. Spotlighting searches of blossoming trees were also undertaken to identify any Megachiropteran bat species.

4.2.4. Birds

A bird survey of vegetation fringing the Main Swamp and South Swamp was undertaken by walking the lengths of each trapping transect for 20 minutes on 8 October 2008 and again on 16 October 2008. Birds were identified either visually, with the aid of binoculars, or by call interpretation.

Four surveys (two dusk and two dawn) of each water body (North, Main and South) was undertaken approximately 1-week apart in Spring (October 2008) and replicated in Autumn (March 2009). A permanent monitoring location was established at each site and marked with a star picket to allow replication in future years. One observer undertook all surveys which involved a 20-minute survey of all birds seen and heard within the radius of each monitoring location (focusing on open water bodies). Birds were identified either visually, with the aid of binoculars and/or a spotting scope, or by call interpretation.

At the completion of one of the dusk surveys in October 2008 and one of the dusk surveys in March 2009, an abundance estimate of birds roosting in the Melaleuca Swamp Forest within the Main Swamp was undertaken. This method will be replicated at the same time in future years to facilitate statistical comparison of changes in roosting bird density and/or diversity.

After dark calls of threatened owl species (Powerful Owl, Masked Owl, Sooty Owl, Barking Owl and Grass Owl) were broadcast over a megaphone in an attempt to encourage a call back response. The subject site was also searched to locate any regurgitated owl pellets. The size, shape and content of any pellets found were analysed to determine the species of owl from which the pellet originated as well as the prey species the owl had been feeding on. Analysis methods followed those of Brunner *et al.* (2002) and Triggs (1996).

4.2.5. Amphibians

Standardised survey techniques for amphibians were carried out at each of the three main water bodies in the reserve across three days and nights by two staff members (totalling 15 person hours). Survey techniques included diurnal habitat searches, nocturnal spotlight surveys, call playback and dip netting for tadpoles. During diurnal surveys, dip netting and visual searches were carried out to locate any tadpoles present in any water bodies. During nocturnal surveys, spotlight searches were carried out by walking lengths of suitable habitat and using head torches to search for frogs by eye shine or by physical sightings. Call playback for the endangered Green and Golden Bell Frog was carried out due to the species' historical occurrence at the site and suitable habitat being present.

Adult frogs encountered were identified by visual confirmation or by their distinct advertisement calls. Tadpoles were keyed out using diagnostic features including mouthparts (tooth rows, jaw sheaths and papillae), pigmentation, body size, tail structure (musculature, fin depth, fin shape, tip shape), eye direction and spacing, pupil pigmentation, nare shape and spacing, spiracle height and direction, vent length and direction, and tadpole behaviour according to Anstis (2002).

4.2.6. Feral fauna

Several species of feral fauna such as Black Rats, rabbits, foxes, Common Myna, Spotted Dove, House Sparrow, Red-whiskered Bulbul and Common Starling have previously been recorded within the reserve (White, 2000; Straw, 2000; HBOC 1990 - 2008). The biodiversity of the reserve can be negatively impacted by increases in these species. Observations of any introduced species were recorded during field surveys of the subject site. Liaison with DECC staff throughout the monitoring process will be undertaken to address any evidence of increasing numbers of feral fauna within the Reserve.

5. Results

5.1. Weather Conditions and Survey Activities

The prevailing weather conditions throughout the trapping survey period at the subject site were mild to warm, humid days and mild nights with clear skies to light cloud cover and light winds. The mean minimum temperature was 11 ° C, and the mean maximum temperature was 22.5° C. A full list of survey activities and weather conditions during the survey period are provided in Table 3.

Table 3: Schedule of activities and weather conditions during the survey period.

Activity	Day	Date	Weather Conditions
Flora			
Transect and plot surveys and vegetation community mapping	Wednesday	8/10/08	Cool to mild (12.1°C – 19.5°C), relatively humid morning, no rain , cloud or wind
Transects and plot surveys	Wednesday	13/03/09	22 °C, clear.
Fauna			
Trapping	Monday to Friday	6-10/10/08	Warm to hot days and mild nights, clear to overcast skies, light to moderate winds with the occasional light shower
Nocturnal field work (Spotlighting, owl call playback, Anabat recording)	Monday	27/10/08	Warm, clear night, slight breeze
	Thursday	30/10/08	Warm, humid night, overcast, no rain or wind
Bird survey – Transects and morning water body surveys	Wednesday	8/10/08	Cool to mild (12.1°C – 19.5°C), relatively humid morning, no rain , cloud or wind
Bird survey – Dusk water body surveys	Wednesday	15/10/08	Mild (17.1°C - 20.3°C) evening, no rain, partly cloudy, no wind
Bird survey – Transects and morning water body surveys	Thursday	16/10/08	Cool to mild (12.3°C – 22°C), relatively humid morning, no rain or cloud, calm to light breezes
Bird survey – Dusk water body surveys	Thursday	30/10/08	Warm (23.9°C) evening, no rain, partly cloudy, no wind
Bird survey – Morning water body surveys	Tuesday	3/03/09	Mild (18.9°C – 20.3°C) morning, no rain, light cloud, calm conditions
Bird survey – Dusk water body surveys	Thursday	5/03/09	Mild (16.7°C – 19.7°C) evening, no rain, partly cloudy, calm to light breezes
Bird survey – Morning water body surveys	Thursday	12/03/09	Mild (15.9°C – 19.1°C) morning, no rain, cloud or wind
Bird survey – Dusk water body surveys	Wednesday	11/03/09	Warm (21.7°C – 22.6°C) evening, no rain, partly cloudy, calm to light breezes
Amphibian survey	Thursday	25/09/08	Mild , clear evening with no rain and slight breeze
Amphibian survey	Wednesday	1/10/08	Mild in the day (~24°C) with a light breeze leading to a mild, still night (~22°C)
Amphibian survey	Thursday	9/10/08	Mild, clear evening with no rain and slight breeze.

5.2. General Environmental Monitoring

Changes in the wetland and surrounds could be caused by a variety of activities not associated with mining such as rainfall levels, bushfire events and large scale farming activities (EcoBiological 2007). No significant bushfire events occurred within proximity of Pambalong Nature Reserve during 2008 and EcoBiological is not aware of any large scale farming activities such as clearing, road construction or dam building in the surrounding area that would have impacted on water flow or quality.

Presently, there is no rainfall monitoring station at Pambalong Nature Reserve or within immediate proximity that can provide reliable long-term rainfall data. Instead, historical rainfall data has been sourced from the Cockle Creek (Pasminco Metals) rainfall station (Source: Rainman Streamflow v4) as it is relatively close by (~10km directly to the south of Pambalong and a simular distance ~14km inland) and provides rainfall data over a 109-year period (1900 – 2008). Historical mean monthly rainfall (mm) from 1900 – 2008 and monthly rainfall (mm) from 2008 is presented for comparison in Table 4 and Figure 5.

Table 4: Monthly rainfall (mm) recorded from Cockle Creek (Pasminco Metal) in 2008 compared with mean monthly rainfall (mm) from 1900 - 2008

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2008 actual	169	210	109	284	11	169	36	26	178	100	68	60	1470
1900-2008 historical mean	97	119	125	116	96	105	74	63	66	72	73	91	1097

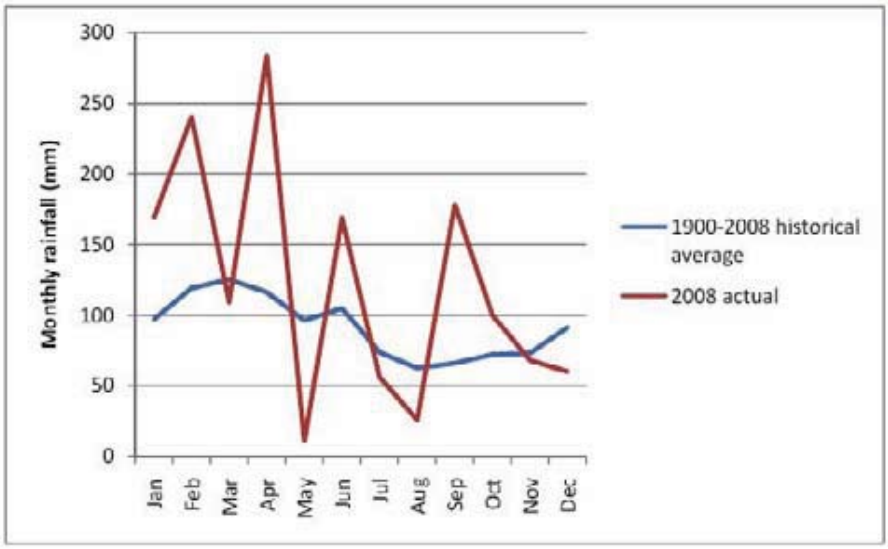

Figure 5: Monthly rainfall (mm) recorded from Cockle Creek (Pasminco Metal) in 2008 compared with mean monthly rainfall (mm) from 1900 - 2008.

Well above average rainfall was recorded during 2008 as compared with the historical yearly average. In particular, heavy falls were recorded in February, April and September 2008 with these months recording double to almost triple the historical monthly average. During EcoBiological's field surveys in October 2008 each of the three water bodies had high water levels with no muddy margins present.

The F&FMP (EcoBiological 2007) recommends that sufficient weather stations are to be established in order to record rainfall in the catchment. This would assist in the collection of more accurate rainfall data over the next 10 – 15 years of pre-mining monitoring.

5.3. Survey limitations

It is acknowledged that water levels within Pambalong Nature Reserve fluctuate in response to climatic conditions. Climatic conditions are also recognised to affect the distribution and abundance of flora and fauna (predominantly amphibians and waterbirds) species within the swamp.

Flora and fauna surveys conducted by EcoBiological were undertaken during a wet period where open water covered significant parts of the swamp. Aerial photographs used in this report were taken in March 2008; however, conditions during the October 2008 survey period are similar to that shown in the aerial photograph with large areas of open water present in the North, Main and South Swamps. Access to some of these areas covered by open water was restricted due to water depth, thereby reducing our ability to place survey plots in these areas. EcoBiological acknowledge this limitation and have reviewed the flora survey work undertaken by Eco Logical in 2002 (Eco Logical 2003) which was undertaken during a particularly dry period and enabled access into these areas. The species list from the Eco Logical report has been included in Appendix 1 to provide a more complete flora species list. Over time as conditions allow, EcoBiological will rectify collection of flora species data in each representative vegetation community as required by the F & FMP (EcoBiological 2007).

It is also acknowledged that collection of bird species presence and abundance in only two seasons (Spring and Autumn) does not fully account for the total diversity likely to occur within the wetland. To address this, EcoBiological will incorporate records from the Birds Australia Atlas, Hunter Bird Observers Club and any other reputable sightings in addition to its own in each annual report.

5.4. Flora

Flora surveys and vegetation mapping were conducted during October 2008 and May 2009. A total of 152 flora species were identified within four survey plots, a single 50m transect and a meandering survey (Appendix 3).

The Coastal Foothills Forest (dry sclerophyll) was found to have the highest species diversity with 50 species recorded in Plot 1, followed by the Paperbark Swamp Forest with 15 species recorded in Plot 3 and 12 species recorded in Plot 4 and the Freshwater Wetland with 10 species in Plot 2 and 14 species in the transect.

No threatened flora species were recorded during field surveys. Three regionally significant species were detected in the surveys (*Cyperus odoratus, Melaleuca linariifolia* and *Enydra fluctuans*). All three species have been recorded in previous studies.

5.4.1. Weeds

The Reserve has significant weed infestations across both disturbed areas and within the natural vegetation. The total weed count was 62 species. The primary weeds at the time of survey were:

- Water Hyacinth (*Eichornia crassipes*) – survives in the system for a long time and when conditions are favourable, can spread rapidly and cover large areas of open water. This rapid spread can choke out sunlight for natural inundated plant species and reduce open water access and usage for water birds. The plant was found dominating the water outlet from the Main Swamp to the North Swamp (Plate 1, Figure 6). It is likely the species has established from local seed and plant sources on the site and upstream. The life cycle of this plant means that it would continue to become established from both local and regional sources as it can float downstream and seeds can be delivered by transient birdlife. Ongoing management would need to be coordinated through local government and stakeholders. The NPWS Hunter Region Pest Management Strategy (2002) has identified control of Water Hyacinth at Pambalong Nature Reserve as a "high priority" and an active program has been operating in the reserve since 2002.

Plate 1: Water Hyacinth at the Northern Swamp inlet.

- Kikuyu (*Pennisetum clandestinum*) is forming dense, monoculture grassy thickets at the disturbed areas of the subject site. The thickets are preventing any other growth at the wetland edges. The boundary of Kikuyu dominance is restricted by the hydrological regime, and the thickets are unlikely to spread into the wetland areas.

- Blackberry (*Rubus fruticosus* aggregate) is found in areas of previous disturbance, and forms a dense thicket to 1m high, preventing natural regeneration. The main outbreaks are shown in Figure 6. The species has capabilities to restrict access to the wetland areas and provide shelter for feral animals. The NPWS Hunter Region Pest Management Strategy (2002) identifies Blackberry as a "high priority" weed, although at this stage there is no specific control program for this species in the reserve.

- Lantana (*Lantana camara*) is a primary weed of the dry sclerophyll woodland at the southern portion of the subject site (Figure 6). The plant is dominating the shrub and mid stratum, effectively out-competing natural vegetation regeneration. The thickets of Lantana reduce the natural plant biodiversity and also offer refuge for feral wildlife. The NPWS Hunter Region Pest Management Strategy (2002) identifies Lantana as a "high priority" weed, although at this stage there is no specific control program for this species in the reserve.

- Crofton Weed (*Ageratina adenophera*) is tolerant of wet soils and will extend into wetlands if unmanaged. The NPWS Hunter Region Pest Management Strategy (2002) identifies Crofton Weed as a "high priority" weed, although at this stage there is no specific control program for this species in the reserve.

- Other weeds found at the subject site were general weeds of disturbed areas and pastures. These weeds are confined to the fringes of the reserve, roadsides and the former rail line. Generally these species are located outside the natural vegetation areas.

Other significant weeds not identified during field surveys but likely to be present were:

- Alligator Weed (*Alternanthera philoxeroides*) – has been identified from previous studies. Alligator Weed has the potential to infest waterways and invade adjoining land. Alligator Weed is easily spread and once established it is virtually impossible to eradicate. It is a declared

noxious weed and eradication measures are required. The NPWS Hunter Region Pest Management Strategy (2002) identifies Alligator Weed as a "high priority" weed, although at this stage there is no specific control program for this species in the reserve.

- Noogoora Burr (*Xanthium occidentale*) – has been identified from previous studies. The NPWS Hunter Region Pest Management Strategy (2002) identifies Noogoora Burr as a "high priority" weed, although at this stage there are no specific control programs for this species in the reserve.

Legislation requires that noxious weeds be controlled. Alligator Weed, Blackberry, Crofton Weed, Water Hyacinth and Lantana are considered noxious in the Newcastle and Cessnock City Council LGA's.

Some naturally occurring species may also present a problem if they become too abundant. Typha (*Typha orientalis*) and Phragmites (*Phragmites australis*) have the potential to spread into areas of open water, restricting the habitat of species preferring or utilising open water, such as pelicans, ducks and swans. If these native plant species threaten the habitat value of the reserve, they may require control.

Figure 6: Aerial photograph showing the main locations of weed infestation within Pambalong Nature Reserve.

5.5. Vegetation Communities

Three natural vegetation communities and associated variations, and two altered vegetation types were mapped on the subject site (Figure 7).

Figure 7: Mapped vegetation communities as at October 2009 – areas constituting Endangered Ecological Communities (EEC) are delineated.

5.5.1. Coastal Foothills Spotted Gum – Ironbark Forest (Dry Sclerophyll Forest)

Open forest on the knoll at the southern portion of the subject site (Plate 2). The community overall shows significant past disturbance and weed infestation.

The community is dominated by *Corymbia maculata* and *Eucalyptus sideraphloia* with some *Eucalyptus acmenoides* scattered. The mid stratum had a high abundance of *Lantana camara* and to a lesser extent, *Bursaria spinosa* and *Acacia maidenii*. The shrub layer had *Daviesia ulicifolia* common and the ground cover was grassy with *Themeda australis, Dichelachne micrantha, Entolasia stricta, Echinopogan caespitosus* and *Aristida vagans* common.

This community is not dependent on the wetland and associated hydrology. Coastal Foothills Spotted Gum – Ironbark Forest is not listed as an Endangered Ecological Community.

Plate 2. Coastal Foothills Spotted Gum – Ironbark Forest survey quadrat.

5.5.2. Paperbark Swamp Forest (Swamp Sclerophyll Forest)

The Paperbark communities at the subject site were restricted to more elevated ground and areas bordering the freshwater wetland complex. The Paperbark community at the centre of the Reserve was the most mature, and had a scattered *Casuarina glauca* canopy over dense Melaleuca sub-canopy. At the time of surveying, the majority of this community was inundated, and the quadrat survey was conducted at the northern portion, adjacent to the Water Couch-Triglochin Swamp Meadow community (Plate 3). At the time of surveys, there was standing water within the quadrat.

The species composition within the quadrat was typically dominated by *Melaleuca linariifolia* and *Melaleuca styphelioides* in the canopy. One juvenile *Ficus macrophylla* was found in the quadrat. The vine *Parsonsia straminea* was found within the quadrat, however, is more common in mature vegetation. Some *Melaleuca ericifolia* was present within the quadrat indicating the frequency of inundation is significant; however, this species was more common in permanent swamp at the ecotone between the Paperbark community and the freshwater wetlands (Plate 4).

The mid stratum was sparse or absent. The ground cover within the quadrat comprised *Bolboschoenus caldwellii, Eleocharis acuta, Triglochin procera, Triglochin striata, Paspalum distichum, Persicaria hydropiper* and *Juncus usitatus*. Other common ground species found in the Paperbark communities but not within the quadrat included *Casuarina glauca, Commelina cyanea, Dichondra repens, Persicaria decipiens, Viola hederacea, Carex appressa, Cynodon dactylon, Entolasia marginata, Lomandra longifolia, Microlaena stipoides var. stipoides, Oplismenus imbecillus* and *Phragmites australis*.

The Paperbark Swamp Forest and Paperbark Woodland would form a part of the NSW TSC Act-listed *Swamp Sclerophyll Forest on Coastal Floodplains EEC*.

Plate 3 . Paperbark Swamp Forest survey quadrat 1.

Plate 4. Paperbark Swamp Forest merging with Typha Reedland on western side of the main swamp.

5.5.3. Freshwater Wetland Complex (Freshwater Wetland)

The Freshwater Wetland Complex occurs in deep depressions having a permanent or periodical inundation of fresh water. At the subject site the Freshwater Wetland Complex consisted of three variations: Typha Reedland; Rushland Swamp/Open Water; and Water Couch-Triglochin Swamp Meadow.

Specifically, these mapped freshwater wetland variations changed from open water bodies, with tall reeds and sedges, to a mixed reedland, rushland or swamp meadow integrating with the Paperbark Swamp Forest community. The integration is likely to be a dynamic and moving boundary, at the present time directed by seasonal and climatic conditions.

The Freshwater Wetland Complex would form a part of the NSW TSC Act-listed *Freshwater Wetlands on Coastal Floodplains* EEC.

5.5.3.1. Typha Reedland

The Typha Reedland dominated permanently inundated areas and related directly to the depth within Open Water freshwater lagoons. The Typha Reedland generally borders the lagoon areas as the water is generally too deep within these open water lagoons. The extent of Typha relates to the seasons and water levels. During the warmer months, growth in the Typha Reedland areas will expand and is likely to reduce in the cooler months or when water levels rise.

5.5.3.2. Rushland Swamp/Open Water

The Rushland Swamp was in shallow semi permanent and permanent water. The species composition within this community was relatively low. The water levels varied from flowing water to boggy substrate in the survey quadrat (Plate 5). The community was dominated by *Bolboschoenus caldwellii, Eleocharis acuta* and *Paspalum distichum. Ludwigia peploides* subsp. *montevidensis, Spirodela punctata* and *Triglochin procera* were common throughout. A few *Melaleuca linariifolia* were present in the swamp surrounding the quadrat, and became more dominant away from the core drainage lines and on higher ground. The survey quadrat was set out in this community at the South Swamp.

The Open Water areas occupied large portions of the Main Swamp and the North Swamp at the time of surveying (Plate 6). This community is very variable due to seasonal and local climatic conditions and is related to the extent of the Typha Reedland and Rushland Swamp.

5.5.3.3. Water Couch-Triglochin Swamp Meadow

The Water Couch-Triglochin Swamp Meadow is found at the northern end of the Main Swamp. The presence of ruined fence lines indicated the previous land use for grazing purposes. The community is dominated by dense *Paspalum distichum* with *Triglochin sp.* and *Persicaria sp.* also common. The Swamp Meadow is fringed on the lower inundations by Typha Reedland.

Plate 5. Rushland Swamp/Open Water at the Freshwater Wetland Complex survey quadrat location (note dense Kikuyu Grassland in the foreground).

Plate 6. Large areas of open water integrating with Typha Reedlands at the time of survey.

5.5.4. Altered Vegetation - Swamp Oak Forest (planted)

Two isolated sections of the subject site had monospecific *Casuarina glauca* stands that have been physically planted. These communities are not natural and composition does not adequately represent a natural community. However, the *Casuarina glauca* is found naturally throughout the Paperbark Swamp Forest.

5.5.5. Altered Vegetation - Disturbed/Kikuyu Grassland

The Kikuyu dominated grasslands and disturbed areas are shown in Figure 7. These areas had a monoculture of Kikuyu or a weed dominated composition.

The rail line between South Swamp and Main Swamp had a weed infestation; however, this was relatively contained to the elevated area and did not impact upon the swamp areas.

5.5.6. Endangered Ecological Communities

The vegetation mapping encompasses two natural vegetation communities listed as EEC's; *Freshwater Wetlands on Coastal Floodplains* EEC; and, *Swamp Sclerophyll Forest on Coastal Floodplains* EEC. The EEC areas are delineated in Figure 7. These EEC's comprise a majority of the subject site.

5.5.6.1. Freshwater Wetlands

Description

Freshwater Wetlands are associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Soils are typically silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains (DEC 2005).

The species composition of freshwater wetlands at the subject site are indicative of the EEC as they are dominated by herbaceous plants and have few woody species. The vegetation composition (grassland, open water or sedgeland vegetation) is known to vary both spatially and temporally depending on the water regime.

Distribution

Hexham Swamp and Pambalong Nature Reserve are recognised as important reserves for freshwater wetlands.

5.5.6.2. Swamp Sclerophyll Forests

Description

The Paperbark Swamp Forest is recognised as a Swamp Sclerophyll Forest EEC. The community composition of mainly *Melaleuca linariifolia, Melaleuca cricifolia* and *Melalcuca styphelioides* (paperbarks) and scattered *Casuarina glauca* is indicative of a sclerophyllous community; however, it does lack a tree layer of eucalypts. The subject site was inundated at the time of surveying; however, previous reports indicate these areas become dry land during extended dry periods.

The groundcover was indicative of the EEC and is composed of abundant sedges, ferns, forbs, and grasses.

Distribution

Within the Lower Hunter district, this community includes 'Swamp Mahogany-Paperbark Swamp Forest' (map unit 37), Riparian Melaleuca Swamp Woodland (map unit 42) and Melaleuca Scrub (map unit 42a) of NPWS (2000).

5.6. Faunal diversity

Fauna trapping and surveys were conducted in October 2008 with bird surveys repeated in March 2009. A total of 107 fauna species were recorded on the subject site (Appendix 4 – Table 1). These comprised 1 fish, 5 frogs, 2 reptiles, 4 terrestrial mammals, 10 bats and 85 birds. Of these, five species are listed as significant (Vulnerable) under the NSW TSC Act (Table 5). Additional frog, reptile and mammal species recorded by White (2000) are also noted in Appendix 4.

Table 5: Threatened fauna species recorded on the subject site.

Scientific Name	Common Name	Survey Method
Miniopterus australis	Little Bentwing-bat	Anabat recording
Miniopterus oceanensis	Eastern Bentwing-bat	Anabat recording
Micronomus norfolkensis	East-coast Freetail-bat	Anabat recording
Pteropus poliocephalus	*Grey-headed Flying-fox	Spotlighting
Scoteanax rueppellii	Greater Broadnosed-bat	Anabat recording

*also listed as Vulnerable on the EPBC Act.
NB: taxonomy for bats follows Churchill (2008)

Bird surveys were conducted in the morning or late afternoon when bird activity is maximised (Bibby *et al.* 2000). Opportunistic sightings were also recorded and listed separately to actual survey results. Transect surveys were intended to record species diversity, not density whereas water body surveys were designed to assess water bird density, therefore counts, wherever possible, or density estimates were made to facilitate statistical comparison in future years.

Records from the Hunter Bird Observers Club have been obtained which provide diversity and density data on 155 species of bird detected within Pambalong Nature Reserve between 1997 and 2008 (Appendix 5). Data from the Birds Australia New Atlas collected between 1998 and 2009 was also obtained of 145 bird species recorded from Pambalong Nature Reserve (Appendix 6). This information and any other reputable opportunistic sightings will continue to be incorporated on a yearly basis to provide a more complete record of the variations in bird assemblages and abundance at Pambalong Nature Reserve.

Photographs of each water body surveyed for birds and amphibians are provided in Appendix 7. Photographs from both the October 2008 and March 2009 survey period are provided to enable a visual comparison of water levels, areas of open water and aquatic vegetation occurring at each of the three water bodies.

Six introduced fauna species were recorded during field surveys. The Black Rat (*Rattus rattus*) and House Mouse (*Mus domesticus*) were trapped within the forested areas of the Reserve and the following bird species were recorded as individuals or in low numbers (<5 individuals): Northern Mallard, Spotted Dove, Common Myna and Common Starling.

6. Conclusion

Monitoring of Pambalong Nature Reserve has been undertaken in 2008/09 in accordance with the Flora and Fauna Management Plan for Abel Underground Coalmine (EcoBiological 2007). This first annual monitoring report commences the data collection that will build a picture of what constitutes normal variation so that any impacts from subsidence can be identified and appropriate management actions taken.

In all there were 152 flora species recorded; and 107 species of fauna comprising 1 fish, 5 frogs, 2 reptiles, 4 terrestrial mammals, 10 bats and 85 birds within Pambalong Nature Reserve. The following threatened species were recorded during field surveys (NB: taxonomy follows Churchill 2008):

- Eastern Bentwing-bat (*Miniopterus oceanensis*);
- Little Bentwing-bat (*Miniopterus australis*);
- East-coast Freetail bat (*Micronomus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

Vegetation mapping identified 3 natural vegetation communities and 2 altered vegetation types as occurring within the reserve, with 3 variations described within the Freshwater Wetland complex. Two of the natural vegetation communities were mapped as forming part of Endangered Ecological Communities listed under the NSW TSC Act - *Freshwater Wetlands on Coastal Floodplains* and *Swamp Sclerophyll Forests on Coastal Floodplains*. These EECs were mapped over a majority of the subject site.

Ongoing annual monitoring will be undertaken over the same time period each year describing the results of the current year's investigation and placing them in the context of the cumulative data. Additional data collected over the period of initial monitoring will be recorded for ongoing analytical purposes. At an appropriate time, statistical analysis will be applied to investigate whether any significant trends are developing. The future implications of any evident trends should be used to inform best practice measures to be incorporated into the Subsidence Management Plan (SMP).

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Appendix 1 – Eco Logical (2003) flora results

Appendix 1: Species List for Pambalong Swamp

Scientific Name	Common Name	ELA Systematic sighting	Observed Sainty	Likely to occur	ELA Opportunistic sighting
Regionally Significant					
Enydra fluctuans		•	•		
Lepidospermum quadrangulatum				•	
Melaleuca linariifolia		•	•		
Morndia triglochinoides				•	
Pseudoraphis paradoxa				•	
Pseudoraphis spinescens				•	
Valarsia excaltata				•	
Zannachelia pulustrus				•	
Native Species					
Acacia falcata				•	
Acacia fimbriata	Fringed Wattle			•	
Acacia floribunda	White Sally	•			
Acacia implexa	Hickory Wattle			•	

Scientific Name	Common Name	ELA Systematic sighting	Observed Sainty	Likely to occur	ELA Opportunistic sighting
Acacia irrorata	Green Wattle			•	
Alisma plantago-aquatica	Water Plantain	•	•		
Alphitonia excelsa	Red Ash	•			
Alternanthera denticulata	Lesser Joyweed	•	•		
Austrodanthonia tenuior		•			
Azolla filiculoides			•		
Bacopa monnieri			•		
Bolboschoenus caldwellii		•	•		
Breynia oblongifolia	Coffee Bush	•			
Bursaria spinosa	Native Blackthorn	•			
Carex inversa	Knob Sedge	•			
Casuarina cunninghamiana	River Oak		•		
Casuarina glauca	Swamp Oak	•			
Ceratophyllum demersum	Hornwort		•		
Cheilanthes sieberi		•			
Citriobatus pauciflorus	Orange Thorn				•
Clematis glycinoides	Headache Vine				•

Scientific Name	Common Name	ELA Systematic sighting	Observed Sainty	Likely to occur	ELA Opportunistic sighting
Clerodendrum tomentosum					•
Commelina cyanea	Native Wandering Jew			•	
Corymbia maculata	Spotted Gum	•			
Cynodon dactylon	Common Couch	•			
Cyperus odoratus		•	•		
Daviesia ulicifolia	Gorse Bitter Pea			•	
Dendrobium linguiforme	Tongue Orchid	•			
Dianella caerulea		•			
Dichondra repens	Kidney Weed	•			
Dillwynia juniperina				•	
Echinopogon caespitosus		•			
Eleocharis equisetina		•	•		
Eleocharis sphacelata	Tall Spike Rush		•		
Entolasia stricta	Wiry Panic	•			
Epilobium billardiereanum		•			
Eucalyptus crebra	Narrow-leaved Ironbark	•			
Eucalyptus eugenioides	Thin-leaved Stringybark	•			

Scientific Name	Common Name	ELA Systematic sighting	Observed Sainty	Likely to occur	ELA Opportunistic sighting
Eucalyptus paniculata	Grey Ironbark	•			
Eucalyptus tereticornis	Forest Red Gum	•			
Ficus rubiginosa	Port Jackson Fig, Rusty Fig			•	
Imperata cylindrica var major	Blady Grass	•			
Juncus subsecundus		•			
Juncus usitatus		•			
Lemna minor			•		
Lomandra filiformis ssp filiformis		•			
Lomandra multiflora ssp multiflora	Many-flowered Mat-rush	•			
Ludwigia peploides			•		
Ludwigia peploides ssp montevidensis	Water Primrose	•			
Lythrum hyssopifolia	Hyssop Loosestrife			•	
Maclura cochinchinensis	Cockspur Thorn			•	
Maytenus silvestris	Narrow-leaved Orangebark				•
Melaleuca ericifolia		•	•		
Melaleuca styphelioides	Prickly-leaved Tea Tree	•	•		

Scientific Name	Common Name	ELA Systematic sighting	Observed Sainty	Likely to occur	ELA Opportunistic sighting
Melia azedarach	White Cedar	•			
Microlaena stipoides				•	
Notelaea longifolia	Large Mock-olive	•			
Oplismenus imbecillis					•
Ozothamnus diosmifolius	White Dogwood			•	
Pandorea pandorana	Wonga Wonga Vine				•
Parsonsia straminea	Common Silkpod				•
Paspalum distichum	Water Couch	•	•		
Persicaria decipiens	Slender Knotweed	•	•		
Pittosporum revolutum	Rough Fruit Pittosporum				•
Plectranthus parviflorus		•			
Ranunculus inundatus		•			
Rhodamnia rubescens	Scrub Turpentine				•
Rumex brownii	Swamp Dock			•	
Sarcocornia quinqueflora			•		
Sarcopetalum harveyanum	Pearl Vine				•
Schoenoplectus validus		•	•		

Scientific Name	Common Name	ELA Systematic sighting	Observed Sainty	Likely to occur	ELA Opportunistic sighting
Solanum brownii	Violet Nightshade	•			
Themeda australis	Kangaroo Grass	•			
Triglochin procerum	Water Ribbons		•		
Triglochin striatum	Streaked Arrowgrass	•	•		
Typha domingensis	Narrow-leaved Cumbungi		•		
Typha orientalis	Broad-leaved Cumbungi				•
Utricularia gibba	Floating Bladderwort		•		
Exotic Species					
*Alternanthera philoxeroides**	Alligator Weed		•		
Aster subulatus	Wild Aster	•			
Bromus catharticus		•			
Chloris gayana	Rhodes Grass	•			
Cirsium vulgare	Spear Thistle	•			
Conyza spp.	Fleabane	•			
Cortaderia selloana	Pampas Grass			•	
Cotula coronopifolia	Water Buttons		•		

Scientific Name	Common Name	ELA Systematic sighting	Observed Sainty	Likely to occur	ELA Opportunistic sighting
Cymbopogon refractus	Barbed Wire Grass			•	
*Eichhornia crassipes**	Water Hyacinth		•		
Eragrostis curvula	African Lovegrass				•
Hypochaeris radicata	Catsear	•			
Isolepis prolifera		•			
Juncus articulatus		•			
Lantana camara	Lantana	•			
Paspalum dilatatum	Paspalum	•			
Pennisetum clandestinum	Kikuyu Grass	•			
Persicaria lapathifolia	Pale Knotweed	•			
Plantago lanceolata	Lamb's Tongues	•			
Ranunculus sceleratus	Celery Buttercup	•			
Rubus ulmifolius	Blackberry			•	
Rumex crispus	Curled Dock	•	•		
Senecio madagascariensis	Fireweed	•			
Senecio pterophorus		•			
Senecio spp.		•			

Scientific Name	Common Name	ELA Systematic sighting	Observed Sainty	Likely to occur	ELA Opportunistic sighting
Sida rhombifolia	Paddy's Lucerne	•			
Sonchus asper ssp glaucescens	Prickly Sowthistle	•			
Sonchus oleraceus	Common Sowthistle	•			
Verbena bonariensis	Purpletop			•	
Unknown					
Wolffia spp.			•		

* Noxious Weed (W3) within Newcastle Control Area (*source: NSW Department of Agriculture*)

Appendix 2 – Straw (2000) bird survey results

Birds of Pourmalong Nature Reserve - Management Strategy

Table 1.

Birds recorded at Pourmalong NR or likely to occur at the site

HBO: birds recorded by the Hunter Bird Observers Club. TS: This study. N: NPWS Wildlife Atlas for the greater area of Hexham Swamp & Kooragang Nature Reserves.
n = birds considered to nest in the NR. m= migratory waders protected under JAMBA and CAMBA.
v = threatened species listed under Section 5 of the TSC Act 1995. ++ = introduced species.
(Counts considered significant are included)

		HBO	TS	N	
Stubble Quail	*Coturnix pectoralis*			*	
Brown Quail	*Coturnix ypsilophora*		*	*	n
Magpie Goose	*Anseranas semipalmata*	20		*	
Plumed Whistling Duck	*Dendrocygna eytoni*	*	*	*	
Wandering Whistling Duck	*Dendrocygna arcuata*		*	*	
Black Swan	*Cygnus atratus*	*	*	*	n
Australian Wood Duck	*Chenonetta jubata*	*	*	*	
Mallard (also Mallard hybrids)++	*Anas platyrhynchos*		*		
Australian Shelduck	*Tadorna tadornoides*			*	
Pacific Black Duck	*Anas superciliosa*	*	*	*	n
Australasian Shoveler	*Anas rhynchotis*	*	*	*	
Grey Teal	*Anas gracilis*	*	*	*	n
Chestnut Teal	*Anas castanea*	*	*	*	n
Pink-eared Duck	*Malacorhynchus membranaceus*	*		*	
Freckled Duck	*Stictonetta naevosa*			*	
Hardhead	*Aythya australis*			*	
Blue-billed Duck	*Oxyura australis*			*	
Musk Duck	*Biziura lobata*			*	
Australasian Grebe	*Tachybaptus novaehollandiae*	*	*	*	n
Hoary-headed Grebe	*Poliocephalus poliocephalus*			*	
Great Crested Grebe	*Podiceps cristatus*			*	
Darter	*Anhinga melanogaster*	*	*	*	
Little Pied Cormorant	*Phalacrocorax melanoleucos*	*	*	*	
Pied Cormorant	*Phalacrocorax varius*	*		*	
Little Black Cormorant	*Phalacrocorax sulcirostris*	*	*	*	
Great Cormorant	*Phalacrocorax carbo*		*	*	
Australian Pelican	*Pelecanus conspicillatus*	*	*	*	
White-faced Heron	*Egretta novaehollandiae*	*	*	*	
Little Egret	*Egretta garzetta*		*	*	
White-necked Heron	*Ardea pacifica*	*	*		
Great Egret	*Ardea alba*	*	*	*	
Intermediate Egret	*Ardea intermedia*	*	*	*	
Cattle Egret	*Ardea ibis*	*	*	*	
Nankeen Night Heron	*Nycticorax caledonicus*	*	*	*	
Little Bittern	*Ixobrychus minutus*			*	
Australasian Bittern	*Botaurus poiciloptilus*			*	
Glossy Ibis	*Plegadis falcinellus*	42	*	*	
Australian White Ibis	*Threskiornis molucca*	*	*	*	
Straw-necked Ibis	*Threskiornis spinicollis*	*	*	*	
Royal Spoonbill	*Platalea regia*	*	*	*	
Yellow-billed Spoonbill	*Platalea flavipes*	*	*	*	

Birds of Pourmalong Nature Reserve - Management Strategy

Osprey	*Pandion haliaetus*			*	v
Pacific Baza	*Aviceda subcristata*	*		*	
Black-shouldered Kite	*Elanus axillaris*		*	*	
Square-tailed Kite	*Lophoictinia isura*			*	
Black Kite	*Milvus migrans*			*	
Whistling Kite	*Haliastur sphenurus*	*	*	*	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	*	*	*	
Swamp Harrier	*Circus approximans*	*	*	*	
Brown Goshawk	*Accipiter fasciatus*			*	
Grey Goshawk	*Accipiter novaehollandiae*			*	
Wedge-tailed Eagle	*Aquila audax*	*		*	
Little Eagle	*Hieraaetus morphnoides*			*	
Black Falcon	*Falco subniger*			*	
Brown Falcon	*Falco berigora*	*	*	*	
Australian Hobby	*Falco longipennis*	*	*	*	
Peregrine Falcon	*Falco peregrinus*			*	
Nankeen Kestrel	*Falco cenchroides*	*		*	
Buff-banded Rail	*Gallirallus philippensis*			*	
Lewin's Rail	*Rallus pectoralis*			*	
Baillon's Crake	*Porzana pusilla*	*		*	
Australian Spotted Crake	*Porzana fluminea*			*	
Spotless Crake	*Porzana tabuensis*	*		*	
Purple Swamphen	*Porphyrio porphyrio*	*	*	*	n
Dusky Moorhen	*Gallinula tenebrosa*	*	*	*	n
Eurasian Coot	*Fulica atra*	*	*	*	
Latham's Snipe	*Gallinago hardwickii*	475	*	*	m
Marsh Sandpiper	*Tringa stagnatilis*	20		*	m
Common Greenshank	*Tringa nebularia*	20		*	m
Wood Sandpiper	*Tringa glareola*	6	*	*	m
Red-necked Stint	*Calidris ruficollis*			*	m
Sharp-tailed Sandpiper	*Calidris acuminata*	2		*	m
Curlew Sandpiper	*Calidris ferruginea*	*		*	m
Painted Snipe	*Rostratula benghalensis*	*		*	v
Comb-crested Jacana	*Irediparra gallinacea*	**		*	v
Black-winged Stilt	*Himantopus himantopus*	*	*	*	
Red-capped Plover	*Charadrius ruficapillus*			*	
Black-fronted Dotterel	*Elseyornis melanops*	*	*	*	n
Red-kneed Dotterel	*Erythrogonys cinctus*	*		*	
Masked Lapwing	*Vanellus miles*	*	*	*	n
Banded Lapwing	*Vanellus tricolor*			*	
Silver Gull	*Larus novaehollandiae*			*	
Gull-billed Tern	*Sterna nilotica*			*	
Caspian Tern	*Sterna caspia*			*	
Whiskered Tern	*Chlidonias hybridus*			*	
White-winged Black Tern	*Chlidonias leucopterus*			*	
Rock Dove++	*Columba livia*			*	
White-headed Pigeon	*Columba leucomela*			*	
Spotted Turtle-Dove++	*Streptopelia chinensis*	*	*	*	n
Brown Cuckoo-Dove	*Macropygia amboinensis*			*	

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Emerald Dove	*Chalcophaps indica*			*	
Common Bronzewing	*Phaps chalcoptera*			*	
Brush Bronzewing	*Phaps elegans*			*	
Crested Pigeon	*Ocyphaps lophotes*	*	*	*	
Peaceful Dove	*Geopelia striata*			*	
Bar-shouldered Dove	*Geopelia humeralis*			*	
Wompoo Fruit-Dove	*Ptilinopus magnificus*			*	
Superb Fruit-Dove	*Ptilinopus superbus*			*	
Topnot Pigeon	*Lopholaimus antarcticus*			*	
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	*		*	
Galah	*Cacatua roseicapilla*	*		*	
Little Corella	*Cacatua sanguinea*		*	*	
Sulphur-crested Cockatoo	*Cacatua galerita*	*		*	
Rainbow Lorikeet	*Trichoglossus haematodus*			*	
Australian King-Parrot	*Alisterus scapularis*			*	
Crimson Rosella	*Platycercus elegans*	*		*	
Eastern Rosella	*Platycercus eximius*	*	*	*	n
Red-rumped Parrot	*Psephotus haematonotus*			*	
Turquoise Parrot	*Neophema pulchella*			*	
Oriental Cuckoo	*Cuculus saturatus*			*	
Pallid Cuckoo	*Cuculus pallidus*			*	
Brush Cuckoo	*Cuculus variolosus*	*	*	*	
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	*	*	*	
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*		*	*	n
Shining Bronze-Cuckoo	*Chrysococcyx lucidis*	*		*	
Common Koel	*Eudynamis scolopacea*	*		*	
Channel-billed Cuckoo	*Scythrops novaehollandiae*	*	*	*	
Pheasant Coucal	*Centropus phasianinus*		*	*	
Powerful Owl	*Ninox strenua*			*	
Barking Owl	*Ninox connivens*			*	
Southern Boobook	*Ninox novaeseelandiae*			*	
Masked Owl	*Tyto novaehollandiae*			*	
Tawny Frogmouth	*Podargus strigoides*			*	
White-throated Nightjar	*Eurostopodus mystacalis*			*	
Australian Owlet-nightjar	*Aegotheles cristatus*			*	
White-throated Needletail	*Hirundapus caudacutus*			*	
Fork-tailed Swift	*Apus pacificus*			*	
Azure Kingfisher	*Alcedo azurea*			*	
Laughing Kookaburra	*Dacelo novaeguineae*	*	*	*	
Forest Kingfisher	*Todiramphus macleayii*			*	
Sacred Kingfisher	*Todiramphus sanctus*	*	*	*	n
Rainbow Bee-eater	*Merops ornatus*			*	
Dollarbird	*Eurystomus orientalis*	*	*	*	n
White-throated Treecreeper	*Cormobates leucophaeus*	*	*	*	
Superb Fairy-wren	*Malurus cyaneus*	*	*	*	n
Variegated Fairy-wren	*Malurus lamberti*			*	
Spotted Pardalote	*Pardalotus punctatus*	*		*	
Striated Pardalote	*Pardalotus striatus*	*		*	
White-browed Scrubwren	*Sericornis frontalis*			*	

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Weebill	*Smicrornis brevirostris*			*	
Brown Gerygone	*Gerygone mouki*			*	
White-throated Gerygone	*Gerygone olivacea*	*		*	
Brown Thornbill	*Acanthiza pusilla*	*		*	
Buff-rumped Thornbill	*Acanthiza reguloides*			*	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	*		*	
Yellow Thornbill	*Acanthiza nana*	*	*	*	n
Striated Thornbill	*Acanthiza lineata*			*	
Red Wattlebird	*Anthochaera carunculata*			*	
Little Wattlebird	*Anthochaera chrysoptera*	*		*	
Striped Honeyeater	*Plectorhyncha lanceolata*			*	
Noisy Friarbird	*Philomen corniculatus*	*	*	*	
Little Friarbird	*Philomen citreogularis*			*	
Blue-faced Honeyeater	*Entomyzon cyanotis*			*	
Bell Miner	*Manorina melanophrys*	*	*	*	n
Noisy Miner	*Manorina melanocephala*	*	*	*	n
Lewin's Honeyeater	*Meliphaga lewinii*	*	*	*	n
Yellow-faced Honeyeater	*Lichenostomus chrysops*	*		*	
Yellow-tufted Honeyeater	*Lichenostomus melanops*			*	
Fuscous Honeyeater	*Lichenostomus fuscus*			*	
Brown-headed Honeyeater	*Melithreptus brevirostris*			*	
White-naped Honeyeater	*Melithreptus lunatus*			*	
Brown Honeyeater	*Lichmera indistincta*			*	
White-cheeked Honeyeater	*Phylidonyris nigra*			*	
Eastern Spinebill	*Acanthorhynchus tenuirostris*			*	
Scarlet Honeyeater	*Myzomela sanguinolenta*		*	*	
White-fronted Chat	*Epthianura albifrons*			*	
Jacky Winter	*Microeca fascinans*			*	
Scarlet Robin	*Petroica multicolor*			*	
Rose Robin	*Petroica rosea*	*			
Hooded Robin	*Melanodryas cucullata*			*	
Eastern Yellow Robin	*Eopsaltria australis*			*	
Eastern Whipbird	*Psophodes olivaceus*	*	*	*	
Spotted Quail-thrush	*Cinclosoma punctatum*			*	
Varied Sittella	*Daphoenositta chrysoptera*			*	
Crested Shrike-tit	*Falcunculus frontatus*			*	
Golden Whistler	*Pachycephala pectoralis*	*		*	
Rufous Whistler	*Pachycephala rufiventris*		*	*	
Grey Shrike-thrush	*Colluricincla harmonica*			*	
Magpie-lark	*Grallina cyanoleuca*	*	*	*	n
Black-faced Monarch	*Monarcha melanopsis*			*	
Leaden Flycatcher	*Myiagra rubecula*			*	
Restless Flycatcher	*Myiagra inquieta*			*	
Rufous Fantail	*Rhipidura rufifrons*			*	
Grey Fantail	*Rhipidura fuliginosa*	*	*	*	
Willie Wagtail	*Rhipidura leucophrys*	*	*	*	n
Spangled Drongo	*Dicrurus bracteatus*			*	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	*	*	*	n
White-bellied Cuckoo-shrike	*Coracina papuensis*			*	

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White-winged Triller	*Lalage sueurii*		*	*	
Olive-backed Oriole	*Oriolus sagittatus*	*	*	*	
White-breasted Woodswallow	*Artamus leucorhynchus*	*	*		n
Dusky Woodswallow	*Artamus cyanopterus*	*	*	*	n
Grey Butcherbird	*Cracticus torquatus*	*	*	*	n
Pied Butcherbird	*Cracticus nigrogularis*	*	*	*	n
Australian Magpie	*Gymnorhina tibicen*	*	*	*	n
Pied Currawong	*Strepera graculina*	*	*	*	n
Australian Raven	*Corvus coronoides*	*	*	*	n
White-winged Chough	*Corcorax melanorhamphos*			*	
Regent Bowerbird	*Sericulus chrysocephalus*			*	
Satin Bowerbird	*Ptilonorhynchus violaceus*		*	*	
Richard's Pipit	*Anthus novaeseelandiae*	*	*	*	n
House Sparrow++	*Passer domesticus*	*	*	*	
Zebra Finch	*Taeniopygia guttata*			*	
Double-barred Finch	*Taeniopygia bichenovii*			*	
Red-browed Finch	*Neochmia temporalis*	*	*	*	n
Chestnut-breasted Mannikin	*Lonchura castaneothorax*	*		*	
European Goldfinch++	*Carduelis carduelis*			*	
Mistletoebird	*Dicaeum hirundinaceum*	*		*	
White-backed Swallow	*Cheramoeca leucosternum*	*			
Welcome Swallow	*Hirundo neoxena*	*	*	*	
Tree Martin	*Hirundo nigricans*	*		*	
Fairy Martin	*Hirundo ariel*	*	*	*	
Red-whiskered Bulbul++	*Pynonotus jocosus*			*	
Clamorous Reed-Warbler	*Acrocephalus stentoreus*	*	*	*	n
Tawny Grassbird	*Megalurus timoriensis*		*	*	
Little Grassbird	*Megalurus gramineus*		*	*	n
Golden-headed Cisticola	*Cisticola exilis*	*	*	*	n
Brown Songlark	*Cincloramphus cruralis*		*	*	
Rufous Songlark	*Cincloramphus mathewsi*			*	
Silvereye	*Zosterops lateralis*	*	*	*	
Common Blackbird++	*Turdus merula*			*	
Common Starling++	*Sturnus vulgaris*	*	*	*	n
Common Myna++	*Acridotheres tristis*	*	*	*	n

Appendix 3: Eco Biological (08/09) flora results

Key to symbols/abbreviations	
P1 = Dry Sclerophyll Forest Plot	**Cover abundance (CA)**
P2 = Freshwater Wetland Plot	1 = <5% cover, few individuals or sparse occurrence
T1 = Freshwater Wetland 50m Transect	2 = <5% cover, many individuals
P3 = Swamp Sclerophyll Paperbark Swamp Plot 1	3 = 5 - <25% cover
P4 = Swamp Sclerophyll Paperbark Swamp Plot 2	4 = 25 - <50% cover
* Introduced species	5 = 50 - <75% cover
+ Indicates presence in transect survey	6 = 75 - 100% cover

			CA/Occurrence (+)				
Family	Botanical Name	Common Name	P1	P2	T1	P3	P4
Adiantaceae	*Cheilanthes sieberi*	Mulga Fern	1				
Alismataceae	*Alisma plantago-aquatica*	Water Plantain					
Apiaceae	**Foeniculum vulgare*	Fennel					
Apiaceae	**Hydrocotyle bonariensis*	Pennywort					
Apocynaceae	**Araujia sericifera*	Moth Vine					
Apocynaceae	**Gomphocarpus fruticosus*	Wild Cotton					
Apocynaceae	*Parsonsia straminea*	Monkey Rope				1	
Asparagaceae	**Protasparagus aethiopicus*	Fern Asparagus					
Asteraceae	**Ageratina adenophora*	Crofton Weed					
Asteraceae	**Ambrosia tenuifolia*	Lacy Ragweed					
Asteraceae	**Aster subulatus*	Wild Aster					
Asteraceae	**Bidens pilosa*	Cobblers peg	1				
Asteraceae	**Cirsium vulgare*	Black Thistle					
Asteraceae	**Conyza canadensis var. canadensis*	Canadian Fleabane					
Asteraceae	**Conyza sumatrensis*	Tall Fleabane					
Asteraceae	**Crassocephalum crepidioides*	Thickhead					
Asteraceae	**Euchiton sp.*	Cudweed					
Asteraceae	**Hypochaeris radicata*	Catsear	1				
Asteraceae	**Senecio madagascariensis*	Fireweed	1				
Asteraceae	**Sonchus oleraceus*	Milk Thistle	1				
Asteraceae	**Tagetes minuta*	Stinking Roger					
Asteraceae	*Brachyscome multifida var dilatata*	Cut-leaf daisy	1				
Asteraceae	*Cotula coronopifolia*	Water Buttons					
Asteraceae	*Enydra fluctuans*				+		2
Asteraceae	*Euchiton involucratus*	Star Cudweed	1				
Asteraceae	*Ozothamnus diosmifolius*	White dogwood	1				
Asteraceae	*Senecio pterophorus*						
Asteraceae	*Vernonia cinerea var cinerea*		1				
Azollaceae	*Azolla filiculoides*	Pacific Azolla			+		5
Bignoniaceae	*Pandorea pandorana ssp pandorana*	Wonga Wonga Vine	1				
Campanulaceae	*Wahlenbergia gracilis*	Native Bluebell	1				
Caryophyllaceae	**Stellaria media*	Chickweed					
Casuarinaceae	*Casuarina glauca*	Swamp Oak					3
Celastraceae	*Maytenus silvestris*	Orange bark	1				
Ceratophyllaceae	*Ceratophyllum demersum*	Hornwort			+		2

			CA/Occurrence (+)				
Family	Botanical Name	Common Name	P1	P2	T1	P3	P4
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	1			2	
Commelinaceae	**Tradescantia albiflora*	Wandering Jew					
Commelinaceae	*Commelina cyanea*	Scurvy Weed					
Convolvulaceae	**Ipomoea purpurea*	Common Morning Glory					
Convolvulaceae	*Dichondra repens*	Kidney weed	2				
Cyperaceae	**Cyperus difformis*						
Cyperaceae	*Cyperus odoratus*				+		
Cyperaceae	*Bolboschoenus caldwellii*			4		3	
Cyperaceae	*Cyperus inovera*						
Cyperaceae	*Eleocharis acuta*	Tall Spike-rush					
Cyperaceae	*Eleocharis equisetina*				+		2
Cyperaceae	*Eleocharis sphacelata*	Tall Spike-rush		4	+	2	
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge					
Cyperaceae	*Schoenoplectus subulatus*			2			
Cyperaceae	*Schoenoplectus validus*				+		
Euphorbiaceae	**Ricinus communis*	Castor Oil Plant					
Fabaceae - Faboideae	**Trifolium repens*	White Clover					
Fabaceae (Caesalpinoideae)	**Senna pendula subsp glabrata*	Cassia					
Fabaceae (Faboideae)	**Trifolium dubium*	Yellow Suckling Clover					
Fabaceae (Faboideae)	**Trifolium fragiferum*	Strawberry Clover					
Fabaceae (Faboideae)	**Vicia sativa*	Common Vetch					
Fabaceae (Faboideae)	**Vicia sativa*	Common Vetch					
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	3				
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	1				
Fabaceae (Faboideae)	*Glycine clandestina*	Twining Glycine					
Fabaceae (Faboideae)	*Glycine tabacina*		1				
Fabaceae (Faboideae)	*Hardenbergia violacea*	Purple Twining Pea	1				
Fabaceae (Faboideae)	*Kennedia rubicunda*	Red Kennedy Pea	2				
Fabaceae (Faboideae)	*Kennedia rubicunda*	Red Kennedy Pea					
Fabaceae (Mimosoideae)	*Acacia falcata*	Sickle Wattle					
Fabaceae (Mimosoideae)	*Acacia fimbriata*						
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory					
Fabaceae (Mimosoideae)	*Acacia irrorata subsp irrorata*						
Fabaceae (Mimosoideae)	*Acacia maidenii*	Maidens Wattle	2				
Gentianaceae	**Centaurium erythraea*	Common Centaury					
Goodeniaceae	*Goodenia heterophylla*		1				
Juncaceae	*Juncus continuus*						
Juncaceae	*Juncus usitatus*	Common Juncus				1	
Juncaginaceae	*Triglochin procera*			2		3	
Juncaginaceae	*Triglochin striata*	Steaked Arrowgrass				2	2
Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower	2				
Lemnaceae	*Spirodela punctata*	Duck Weed		2	+		
Lobeliaceae	*Pratia purpurascens*	White root	2				
Lomandraceae	*Lomandra multiflora*	Iron Grass	2				

			CA/Occurrence (+)				
Family	Botanical Name	Common Name	P1	P2	T1	P3	P4
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	2				
Malvaceae	**Sida rhombifolia*	Paddy's Lucerne	1				
Moraceae	*Ficus macrophylla*	Moreton Bay Fig				1	
Myoporaceae	*Eremophila debilis*	Winter Apple	1				
Myrtaceae	*Corymbia maculata*	Spotted Gum	3				
Myrtaceae	*Eucalyptus acmenoides*	White mahogany	2				
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark	4				
Myrtaceae	*Eucalyptus tereticornis*	Forest Redgum					
Myrtaceae	*Melaleuca ericifolia*					2	5
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark		1		5	3
Myrtaceae	*Melaleuca stypheliodes*					4	
Oleaceae	*Notelaea longifolia*	Mock olive	1				
Onagraceae	**Oenothera stricta*	Evening Primrose					
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water Primrose		2	+		2
Passifloraceae	**Passiflora edulis*	Common Passionfruit					
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	2				
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	1				
Pittosporaceae	*Bursaria spinosa*	Box Thorn	3				
Plantaginaceae	**Plantago lanceolata*	Lambs Tongue	1				
Poaceae	**Andropogon virginicus*	Whisky Grass					
Poaceae	**Axonopus fissifolius*	Narrow-leafed Carpet Grass					
Poaceae	**Briza maxima*	Quaking Grass					
Poaceae	**Bromus catharticus*	Praire Grass					
Poaceae	**Chloris gayana*	Rhodes Grass					
Poaceae	**Cortaderia selloana*	Pampas Grass					
Poaceae	**Cynodon dactylon*	Couch					
Poaceae	**Ehrharta erecta*	Panic Veldtgrass	2				
Poaceae	**Eragrostis curvula*	African Lovegrass					
Poaceae	**Hyparrhenia hirta*	Coolatai Grass					
Poaceae	**Lolium perenne*	Perennial Ryegrass					
Poaceae	**Melinis repens*	Red Natal Grass					
Poaceae	**Panicum maximum*	Guinea Grass					
Poaceae	**Paspalum dilatatum*	Paspalum					
Poaceae	**Paspalum urvillei*	Tall Paspalum					
Poaceae	**Pennisetum clandestinum*	Kikuyu					
Poaceae	**Setaria pumilla*	Pale Pigeon Grass					
Poaceae	**Setaria sphacelata*	South African Pigeon Grass					
Poaceae	**Setaria verticillata*	Whorled Pigeon Grass					
Poaceae	**Sporobolus africanus*	Parramatta Grass					
Poaceae	*Aristida vagans*	Three-awned Spear Grass	2				
Poaceae	*Capillipedium parviflorum*	Scented-top Grass					
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass					
Poaceae	*Cynodon dactylon*	Couch			+	3	
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass	3				
Poaceae	*Echinopogon caespitosus*	Tufted Hedgehog Grass	2				

			CA/Occurrence (+)				
Family	Botanical Name	Common Name	P1	P2	T1	P3	P4
Poaceae	*Entolasia stricta*	Wiry panic	2				
Poaceae	*Imperata cylindrica*	Bladey grass	2				
Poaceae	*Imperata cylindrica var. major*	Bladey grass					
Poaceae	*Oplismenus aemulus*	Basket Grass	1				
Poaceae	*Panicum simile*	Two Colour Panic	2				
Poaceae	*Paspalum distichum*	Water Couch		4	+		2
Poaceae	*Themeda australis*	Kangaroo grass	5				
Poaceae	*Austrodanthonia tenuior*	Wallaby Grass					
Polygonaceae	**Polygonum arenastrum*	Wireweed				2	
Polygonaceae	**Rumex crispus*	Dock				2	
Polygonaceae	*Persicaria decipiens*	Slender Knotweed		1	+		2
Polygonaceae	*Persicaria hydropiper*	Water Pepper				2	
Ranunculaceae	**Ranunculus repens*	Creeping Buttercup					
Ranunculaceae	*Clematis glycinoides*	Old Mans Beard					
Ranunculaceae	*Ranunculatus inundatus*	River Buttercup					
Rhamnaceae	*Alphitonia excelsa*	Red Ash	1				
Rosaceae	**Rubus fruticosus* aggregate	Blackberry					
Rubiaceae	*Opercularia diphylla*		1				
Scrophulariaceae	*Bacopa monnieri*	Bacopa					
Solanaceae	**Solanum mauritianum*	Wild Tobacco					
Solanaceae	**Solanum nigrum*	Blackberry Nightshade					
Solanaceae	*Solanum brownii*	Violet Nightshade	2				
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	1				
Typhaceae	*Typha orientalis*	Broadleaf Cumbungi		2	+		2
Verbenaceae	**Lantana camara*	Lantana	4				
Verbenaceae	**Verbena bonariensis*	Purpletop					
Violaceae	*Viola hederacea*	Ivy-leaved Violet					
Vitaceae	*Cayratia clematidea*	Native Grape	1				
		Total no. of species in survey	50	10	14	15	12

Appendix 4: Fauna species recorded on the subject site

Table 1: Fauna species recorded from trapping and nocturnal survey activities by EcoBiological in October 2008 and White (2000).

Scientific Name	Common Name	Method	EcoBiological (2008)	White (2000)
Fish				
Gambusia holbrooki	Plague Minnow	Tadpole search	+	+
Amphibians				
Crinia signifera	Common Eastern Froglet	Nocturnal amphibian survey	+	
Limnodynastes peronii	Striped Marsh Frog	Nocturnal amphibian survey	+	
Litoria fallax	Eastern Dwarf Tree Frog	Nocturnal amphibian survey	+	
Litoria freycineti	Freycinet's Frog	Nocturnal and diurnal survey		+
Litoria latopalmata	Broad-palmed Frog	Nocturnal and diurnal survey		+
Litoria peronii	Peron's Tree Frog	Nocturnal amphibian survey	+	
Litoria tyleri	Southern Laughing Tree Frog	Nocturnal amphibian survey	+	
Reptiles				
Chelodina longicollis	Eastern Long-necked Turtle	Diurnal reptile survey		+
Eulamprus quoyii	Eastern Water Skink	Diurnal reptile survey		+
Amphibolurus muricatus	Jacky Lizard	Diurnal reptile survey		+
Cteniotus robustus	Robust Ctenotus	Diurnal reptile survey		+
Lampropholis delicata	Garden Skink	Diurnal reptile survey		+
Physignathus lesueurii lesueurii	Eastern Water Dragon	Opportunistic sighting	+	
Pseudechis porphyriacus	Red-bellied Black Snake	Opportunistic sighting	+	+
Terrestrial/ Scansorial Mammals				
Antechinus stuartii	Brown Antechinus	Trapping	+	+
Mus domesticus	House Mouse	Trapping	+	
Petaurus breviceps	Sugar Glider	Spotlighting		+
Rattus fuscipes	Bush Rat	Trapping	+	+
Rattus rattus	*Black Rat	Trapping/spotlighting	+	+
Vulpes vulpes	*Red Fox	Spotlighting/scat analysis		+

Table 1 cont: Fauna species recorded from trapping and nocturnal survey activities by EcoBiological in October 2008 and White (2000).

Scientific Name	Common Name	Method	EcoBiological (2008)	White (2000)
Bats				
Pteropus poliocephalus	# Grey-headed Flying-fox	Spotlighting	+	+
Austronomus australis	White-striped Mastiff-bat	Anabat analysis		+
Chalinolobus gouldii	Gould's Wattled Bat	Anabat analysis/trapping	+	+
Chalinolobus morio	Chocolate Wattled Bat	Anabat analysis/trapping		+
Miniopterus australis	# Little Bentwing-bat	Anabat analysis	+	
Miniopterus oceanensis	# Eastern Bentwing-bat	Anabat analysis	+	
Micronomus norfolkensis	# East-coast Freetail-bat	Anabat analysis	+	
Mormopterus ridei	Eastern Freetail-bat	Anabat analysis	+	
Nyctophilus sp.	Unidentified Long-eared Bat	Anabat analysis	+	
Nyctophilus gouldii	Gould's Long-eared Bat	Trapping		+
Scoteanax rueppellii	# Greater Broad-nosed Bat	Anabat analysis	+	
Vespadelus pumilus	Eastern Forest Bat	Anabat analysis	+	
Vespadelus vulturnus	Little Forest Bat	Trapping & Anabat analysis	+	+

* denotes an introduced species
# denotes a threatened species under the NSW TSC Act 1995

NB: Taxonomy for bats follows Churchill (2008).

Table 2: Bird species recorded along Transects by EcoBiological during Spring 2008.

Family	Scientific Name	Common Name	Transect 1 – Nth 8/10/08	Transect 2 – Sth 8/10/08	Transect 1 – Nth 16/10/08	Transect 2 – Sth 16/10/08
Acanthizidae	*Gerygone mouki*	Brown Gerygone	h		h	
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill			h	
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren	h		h	h
Acanthizidae	*Acanthiza nana*	Yellow Thornbill	A			
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	1			
Acrochephalidae	*Acrocephalus australis*	Australian Reed-Warbler	h	h		
Ardeidae	*Egretta novaehollandiae*	White-faced Heron		1		
Artamidae	*Cracticus tibicen*	Australian Magpie	h	+	h	h
Artamidae	*Cracticus torquatus*	Grey Butcherbird	h	h		
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	h	h	h	
Artamidae	*Strepera graculina*	Pied Currawong	h			
Artamidae	*Artamus leucorhynchus*	White-breasted Woodswallow		A		
Cacatuidae	*Eolophus roseicappilus*	Galah			h	h
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	h			
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		h	h	
Charadriidae	*Vanellus miles*	Masked Lapwing	h		h	
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola	h		h	h
Columbidae	*Ocyphaps lophotes*	Crested Pigeon			h	
Corvidae	*Corvus coronoides*	Australian Raven	h			h
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo		h	h	
Cuculidae	*Eudynamys orientalis*	Eastern Koel			h	
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo		h	h	
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo		h		
Estrildidae	*Neochmia temporalis*	Red-browed Finch	A		h	
Eupetidae	*Psophodes olivaceus*	Eastern Whipbird	h	h	h	
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra		h	2	
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher	A	A	h	h
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	A		h	

Table 2 cont: Bird species recorded along Transects by EcoBiological during Spring 2008.

Family	Scientific Name	Common Name	Transect 1 - Nth 8/10/08	Transect 2 - Sth 8/10/08	Transect 1 - Nth 16/10/08	Transect 2 - Sth 16/10/08
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	h	h	h	h
Maluridae	*Malurus lamberti*	Variegated Fairy-wren			h	h
Megaluridae	*Megalurus gramineus*	Little Grassbird		h		
Meliphagidae	*Manorina melanophrys*	Bell Miner		h		h
Meliphagidae	*Melithreptes brevirostris*	Brown-headed Honeyeater		h		
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater	h	h	h	h
Meliphagidae	*Manorina melanocephala*	Noisy Miner		h		h
Meliphagidae	*Myzomela sanguinolenta*	Scarlet Honeyeater	h	h	h	h
Meliphagidae	*Plectorhyncha lanceolata*	Striped Honeyeater		h		h
Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater		h	h	h
Meropidae	*Merops ornatus*	Rainbow Bee-eater	h			
Monarchidae	*Grallina cyanoleuca*	Magpie-lark		h	h	
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole		h		
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	h	h		h
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	h		h	h
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	h			
Psittacidae	*Platycercus eximius*	Eastern Rosella	h	h	A	4
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet		h		2
Rallidae	*Porphyrio porphyrio*	Purple Swamphen		h		
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail	h		h	
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	h	h	h	h
Sturnidae	*Sturnus vulgaris*	*Common Starling			2	
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis	2	1		
Timaliidae	*Zosterops lateralis*	Silvereye	h		B	
		No. of Species	**29**	**30**	**30**	**19**

The list follows the taxonomy of Christidis & Boles (2008).
h = heard only.
Where numbers were counted, these are shown. In other cases the estimate of abundance is represented by the following approximations:
A=1-5 birds present; B=6-20 birds present; C=21-50 birds present; D=51-100 birds present; E=more than 100 birds present.

Table 3: Bird species recorded from the North Swamp by EcoBiological during Spring 2008 and Autumn 2009.

			Spring 2008				Autumn 2009			
Family	Scientific Name	Common Name	Dawn - 8/10/08	Dusk - 15/10/08	Dawn - 16/8/08	Dusk - 30/10/08	Dawn - 3/3/09	Dusk - 5/3/09	Dusk - 11/3/09	Dawn 2 - 12/3/09
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren							h	
Acanthizidae	*Acanthiza nana*	Yellow Thornbill		B						
Accipitridae	*Circus approximans*	Swamp Harrier	1							
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	1							
Accipitridae	*Haliastur sphenurus*	Whistling Kite				1				
Acrocephalidae	*Acrocephalus australis*	Australian Reed-Warbler	h	h	h	1				
Anatidae	*Anas platyrhynchos*	*Northern Mallard				1				
Anatidae	*Anas rhynchotis*	Australasian Shoveler		2						
Anatidae	*Chenonetta jubata*	Australian Wood Duck		2						
Anatidae	*Cygnus atratus*	Black Swan		4			3	3	1	2fo
Anatidae	*Anas castanea*	Chestnut Teal	13		1	1			9	8
Anatidae	*Anas gracilis*	Grey Teal	53	7	4		2			
Anatidae	*Aythya australis*	Hardhead	25	7	9	12				
Anatidae	*Anas superciliosa*	Pacific Black Duck	63	15	23	16	9		6	4
Anatidae	*Dendrocygena arcuata*	Wandering Whistling Duck			8	5				
Anhingidae	*Anhinga melanogaster*	Australasian Darter		1						
Anhingidae	*Anhinga melanogaster*	Australasian Darter						1		
Ardeidae	*Ardea ibis*	Cattle Egret					5			1
Ardeidae	*Egretta novaehollandiae*	White-faced Heron	2				1			
Artamidae	*Cracticus torquatus*	Grey Butcherbird								h
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird			h					
Artamidae	*Artamus leucorhynchus*	White-breasted Woodswallow	1	3	1					
Cacatuidae	*Cacatua sanguinea*	Little Corella								7fo
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo					h			
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike			1			1		
Charadriidae	*Vanellus miles*	Masked Lapwing	1		h	1	2		2	2

Table 3 cont: Bird species recorded from the North Swamp by EcoBiological during Spring 2008 and Autumn 2009.

			Spring 2008				Autumn 2009			
Family	Scientific Name	Common Name	Dawn - 8/10/08	Dusk - 15/10/08	Dawn - 16/8/08	Dusk - 30/10/08	Dawn - 3/3/09	Dusk - 5/3/09	Dusk - 11/3/09	Dawn 2 - 12/3/09
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	A							
Columbidae	*Streptopelia chinensis*	Spotted Dove*		h						
Columbidae	*Leucosarcia picata*	Wonga Pigeon	h							
Corvidae	*Corvus coronoides*	Australian Raven	h				h	2	2	h
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo			h					
Cuculidae	*Eudynamys orientalis*	Eastern Koel			h					
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	h							
Estrildidae	*Neochmia temporalis*	Red-browed Finch	A							
Eupetidae	*Psophodes olivaceus*	Eastern Whipbird		h	h	h	h	h		h
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra					h	1		1fo
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher	1		2	h				
Hirundinidae	*Hirundo neoxena*	Welcome Swallow			A					
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	h	h	h	h	h	h	h	h
Maluridae	*Malurus lamberti*	Variegated Fairy-wren					h	h		h
Megaluridae	*Megalurus gramineus*	Little Grassbird					h	h		
Meliphagidae	*Manorina melanophrys*	Bell Miner					h			
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater					h	h		
Meliphagidae	*Manorina melanocephala*	Noisy Miner					2	2		
Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater		h	h					
Monarchidae	*Grallina cyanoleuca*	Magpie-lark		4	h	2	h	h		h
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	h	h	h			h	h	
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler		h	h	h				
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote						h		
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant				2				
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant	1					1		2
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant		1			3			
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	17	3	7	8				1

Table 3 cont: Bird species recorded from the North Swamp by EcoBiological during Spring 2008 and Autumn 2009.

			Spring 2008				Autumn 2009			
Family	Scientific Name	Common Name	Dawn - 8/10/08	Dusk - 15/10/08	Dawn - 16/8/08	Dusk - 30/10/08	Dawn - 3/3/09	Dusk - 5/3/09	Dusk - 11/3/09	Dawn 2 - 12/3/09
Psittacidae	*Platycercus eximius*	Eastern Rosella			h					
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen		2	2		2			1
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	4	1	3	3	h	3	3	1
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail		h	h	h	h	1	h	h
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	A	h	h	h	h	h	h	h
Sturnidae	*Sturnus tristis*	*Common Myna	A			1				
Sturnidae	*Sturnus vulgaris*	*Common Starling				1		1		
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis					1		10fo	
Threskiornithidae	*Platalea regis*	Royal Spoonbill	1							
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis			2					
Timaliidae	*Zosterops lateralis*	Silvereye	h		h		h	h	h	h
		No. of Species	25	23	26	20	23	20	13	20

The list follows the taxonomy of Christidis & Boles (2008).
h = heard only.
Where numbers were counted, these are shown. In other cases the estimate of abundance is represented by the following approximations:
A=1-5 birds present; B=6-20 birds present; C=21-50 birds present; D=51-100 birds present; E=more than 100 birds present.

Table 4: Bird species recorded from the Main Swamp by EcoBiological during Spring 2008 and Autumn 2009.

			Spring 2008				Autumn 2009			
Family	Scientific Name	Common Name	Dawn - 8/10/08	Dusk - 15/10/08	Dawn - 16/8/08	Dusk - 30/10/08	Dawn - 3/3/09	Dusk - 5/3/09	Dusk - 11/3/09	Dawn 2 - 12/3/09
Acanthizidae	*Acanthiza nana*	Yellow Thornbill								A
Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk							1	
Accipitridae	*Circus approximans*	Swamp Harrier		1						
Accipitridae	*Haliastur sphenurus*	Whistling Kite	1		1					
Acrochephalidae	*Acrocephalus australis*	Australian Reed-Warbler	h	h	h					
Anatidae	*Cygnus atratus*	Black Swan	9				2	3	1	1
Anatidae	*Anas castanea*	Chestnut Teal					4	2	4	2
Anatidae	*Anas superciliosa*	Pacific Black Duck		2	1		8	4	9	3
Ardeidae	*Ardea ibis*	Cattle Egret		Dfo						
Ardeidae	*Egretta novaehollandiae*	White-faced Heron			1		2		1	
Artamidae	*Cracticus torquatus*	Grey Butcherbird		h			h		h	
Artamidae	*Artamus leucorhynchus*	White-breasted Woodswallow	1							
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	10fo							
Charadriidae	*Vanellus miles*	Masked Lapwing					1			
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola								h
Corvidae	*Corvus coronoides*	Australian Raven	1	3					h	
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo			h					
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	h		h					
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo	h							
Estrildidae	*Neochmia temporalis*	Red-browed Finch					h		h	B
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra						1		
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher	1		h	h				
Hirundinidae	*Petrochelidon ariel*	Fairy Martin			8					
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	6							
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	h	h	h	h	h	h	h	5
Maluridae	*Malurus lamberti*	Variegated Fairy-wren						h	h	

Table 4 cont: Bird species recorded from the Main Swamp by EcoBiological during Spring 2008 and Autumn 2009.

			Spring 2008				Autumn 2009			
Family	Scientific Name	Common Name	Dawn - 8/10/08	Dusk - 15/10/08	Dawn - 16/8/08	Dusk - 30/10/08	Dawn - 3/3/09	Dusk - 5/3/09	Dusk - 11/3/09	Dawn 2 - 12/3/09
Megaluridae	*Megalurus gramineus*	Little Grassbird								
Meliphagidae	*Manorina melanophrys*	Bell Miner			h		h	h	h	h
Meliphagidae	*Manorina melanocephala*	Noisy Miner	h							
Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater			1					
Monarchidae	*Myiagra rubecula*	Leaden Flycatcher		1						
Monarchidae	*Grallina cyanoleuca*	Magpie-lark		C	h		h		h	
Phalacrocoracidae	*Phalocrocorax melanoleucos*	Little Pied Cormorant	1							
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe			1					
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen		2	1	h	1	2	1	2
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	3	3	5	2	6	1	5	1
Rhipidruridae	*Rhipidura albiscapa*	Grey Fantail				h	h			
Rhipidruridae	*Rhipidura leucophrys*	Willie Wagtail	h			h	h	h	1	h
Threskiornithidae	*Threskiornis moluccs*	Australian White Ibis	1fo							1fo
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis	7fo	9fo	6fo					
Timaliidae	*Zosterops lateralis*	Silvereye								h
		No. of Species	17	12	16	6	14	10	15	13

The list follows the taxonomy of Christidis & Boles (2008).
h = heard only.
Where numbers were counted, these are shown. In other cases the estimate of abundance is represented by the following approximations:
A=1-5 birds present; B=6-20 birds present; C=21-50 birds present; D=51-100 birds present; E=more than 100 birds present.

Table 5: Bird species recorded from the South Swamp by EcoBiological during Spring 2008 and Autumn 2009.

			Spring 2008				Autumn 2009			
Family	Scientific Name	Common Name	Dawn - 9/10/08	Dusk - 15/10/08	Dawn - 16/8/08	Dusk - 30/10/08	Dawn - 3/3/09	Dusk - 5/3/09	Dusk - 11/3/09	Dawn 2 - 12/3/09
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill						A		
Accipitridae	*Circus approximans*	Swamp Harrier	1		1			1		
Accipitridae	*Haliastur sphenurus*	Whistling Kite			2					
Acrochephalidae	*Acrocephalus australis*	Australian Reed-Warbler	h	h	h	h				
Anatidae	*Cygnus atratus*	Black Swan			6		4	1		6
Anatidae	*Anas castanea*	Chestnut Teal	2	4	20					
Anatidae	*Anas superciliosa*	Pacific Black Duck	7	9	8	7	10	29	6	12
Ardeidae	*Egretta novaehollandiae*	White-faced Heron			1		1			2fo
Ardeidae	*Ardea pacifica*	White-necked Heron		1	1					
Artamidae	*Cracticus tibicen*	Australian Magpie	h	A	h		h			
Artamidae	*Cracticus torquatus*	Grey Butcherbird	h	1	h		h	1		h
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird					h			h
Artamidae	*Strepera graculina*	Pied Currawong			h					h
Artamidae	*Artamus leucorhynchus*	White-breasted Woodswallow	8	4	2			1		
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	+							h
Campephagidae	*Coracina tenuirostris*	Cicadabird			h					
Charadriidae	*Vanellus miles*	Masked Lapwing		h	h	2				2
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola	+	h						h
Coraciidae	*Eurystomus orientalis*	Dollarbird			h					
Corvidae	*Corvus coronoides*	Australian Raven	+	h		h	h	h		h
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo			h	h				
Cuculidae	*Eudynamys orientalis*	Eastern Koel	h							
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	+			h				
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo	h							
Estrildidae	*Neochmia temporalis*	Red-browed Finch						A		
Eupetidae	*Psophodes olivaceus*	Eastern Whipbird			h		h			h
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra	+						h	

Table 5 cont: Bird species recorded from the South Swamp by EcoBiological during Spring 2008 and Autumn 2009.

			Spring 2008				Autumn 2009			
Family	Scientific Name	Common Name	Dawn - 8/10/08	Dusk - 15/10/08	Dawn - 16/8/08	Dusk - 30/10/08	Dawn - 3/3/00	Dusk - 5/3/00	Dusk - 11/3/00	Dawn 2 - 12/3/00
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher	h		3					
Hirundinidae	*Hirundo neoxena*	Welcome Swallow		1	A					2
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	h	h	A	h	h	h		
Megaluridae	*Megalurus gramineus*	Little Grassbird	+			h			h	h
Megaluridae	*Megalurus timoriensis*	Tawny Grassbird	+							
Meliphagidae	*Manorina melanophrys*	Bell Miner	+	h	h		h	h	h	h
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater					h			h
Meliphagidae	*Philemon corniculatus*	Noisy Friarbird	h							
Meliphagidae	*Manorina melanocephala*	Noisy Miner	h	1	A	h		h		h
Meliphagidae	*Plectorhyncha lanceolata*	Striped Honeyeater	h	h				h		
Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater		h	h					
Meropidae	*Merops ornatus*	Rainbow Bee-eater	A		h					
Monarchidae	*Myiagra rubecula*	Leaden Flycatcher			h					
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	h	1	h	h	h			h
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	+	h						
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler			h					
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote		h						
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant	1		1					
Psittacidae	*Platycercus eximius*	Eastern Rosella	h	1	2		3	h		2
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet					h			
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen		2	11		3	4	1	5
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	4	3	1	1	5	3	3	4
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail			h		h	h		h
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	h	1	h	h	h	h	h	3
		No. of Species	29	23	33	12	18	17	7	22

The list follows the taxonomy of Christidis & Boles (2008). h = heard only.
Where numbers were counted, these are shown. In other cases the estimate of abundance is represented by the following approximations:
A=1-5 birds present; B=6-20 birds present; C=21-50 birds present; D=51-100 birds present; E=more than 100 birds present.

Table 6: Roosting bird count results from the Main Swamp during Spring 2008 and Autumn 2009.

Family	Scientific Name	Common Name	15/10/08 - 7.15pm	5/3/09 - 7.40pm
Ardeidae	*Ardea ibis*	Cattle Egret	57	170
Ardeidae	*Ardea pacifica*	White-necked Heron	1	-
Phalacrocoracidae	*Phalocrocorax sulcirostris*	Little Black Cormorant	17	10
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	9	50
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis	125	40
		No. of individuals	**209**	**270**

Appendix 5 - Hunter Bird Observers Club Records of bird species found in Pambalong Nature Reserve 1990-2008

HUNTER BIRD OBSERVERS CLUB (2008) – PREFACE TO LIST

This list of the species found in the Pambalong Nature Reserve is compiled using observations made by Hunter Bird Observers Club members on field outings and surveys of the specified area. The species listed are those that have been positively identified as using the area on the occasions shown. It should be noted that the absence of any species should not be considered to imply that such species does not occur; only that it was not found present on these specific occasions.

The list follows the Taxonomy of Christidis & Boles, (2008).

Where symbols are used these represent the fact that only occurrence of the species was recorded at the time. Where numbers were counted, these are shown. In other cases the estimate of abundance is represented by the following approximations: - A=1-5 birds present; B=6-20 birds present; C=21-50 birds present; D=51-100 birds present; E=more than 100 birds present.

Breeding: fy = fledged young; cf = birds seen carrying food; ffy = birds seen feeding fledged young; n = nest.

RAOU #	Species	Scientific Name	5.90	20.6.93	20.12.97	21.6.98	19.12.98	18.12.99	3.10.00	10.12.00	7/8/01	9.12.01	7.12.02	19.7.03	7.12.03	9.7.04	5.12.04	5.7.05	23.1.06	4.12.06	17.12.06	16.12.07	2.11.08	14.12.08
205	Plumed Whistling Duck	*Dendrocygna eytoni*													2								18	
204	Wandering Whistling Duck	*Dendrocygna arcuata*	√												3			3	18					
203	Black Swan	*Cygnus atratus*	√	A	Bdy	151on	3	Don	B	B	E	B		E	A	Ady	B	Edy	√	2	A	B	25	2
202	Australian Wood Duck	*Chenonetta jubata*	√	D	C		2	B				B		A	B	B	A	A	8	B	B	4		C
212	Australasian Shoveler	*Anas rhynchotis*		A	1	2								C		B		C			A		2	
211	Grey Teal	*Anas gracilis*	√	E	B			B	C	A		C		C	C	B	B	B	√	B	E	A	5	6
210	Chestnut Teal	*Anas castanea*	√	E	B	60	B	B	D	D	C	C		D	C	B	C	C	50	C	D	6	A	
948	Northern Mallard	*Anas platyrhynchos*	√																					
208	Pacific Black Duck	*Anas superciliosa*	√	B	B	B	B	C	B	C	A	B	1	E		C	C		6dy	C	C	6	78	C
215	Hardhead	*Aythya australis*								B				1	B			B			A		36	A
061	Australasian Grebe	*Tachybaptus novaehollandiae*			10	B		17+	2		C			A	A		B				B		7	
062	Hoary-headed Grebe	*Poliocephalus poliocephalus*												1				2						
969	Spotted Dove	*Streptopelia chinensis*	√	A	A			A								H					2		√	
029	Brown Cuckoo-dove	*Macropygia amboinensis*															2							
034	Common Bronzewing	*Phaps chalcoptera*																				H		
043	Crested Pigeon	*Ocyphaps lophotes*	√	b	A	b	A	A			z		z		z		A	3	A		b	z	√	
032	Bar-shouldered Dove	*Geopelia humeralis*				H											1	H			H	2		
044	Wonga Pigeon	*Leucosarcia picata*															H		H	H	H	H		
334	White-throated Needletail	*Hirundapus caudacutus*								B												+200		
101	Australasian Darter	*Anhinga melanogaster*						A											1				1	
100	Little Pied Cormorant	*Phalocrocorax melanoleucos*	√		1	2		A				A										2	4	
096	Great Cormorant	*Phalocrocorax carbo*	√					A		1					1				2					
097	Little Black Cormorant	*Phalocrocorax sulcirostris*	√		A			A	4								A		1	1	A			
099	Pied Cormorant	*Phalocrocorax varius*					3																	
106	Australian Pelican	*Pelecanus conspicillatus*	√		8			A		A	3	A	10	1	10	B			55	1		5	12	3
109	White-necked Heron	*Ardea pacifica*			1			c	2		D	A	2	1	1	1					2			1
187	Eastern Great Egret	*Ardea modesta*			2			B	A	B	A	A			1			A	2		1	1		1
186	Intermediate Egret	*Ardea intermedia*	√		B		B	B	2	3		B			3				1	3	14			3
977	Cattle Egret	*Ardea ibis*		A	1	A	A	~100	A	B		B	A		B	A	B		C	B	A	B		6

RAOU #	Species	Scientific Name	6.90	20.6.93	20.12.97	21.6.98	19.12.98	18.12.99	3.10.00	10.12.00	7/8/01	8.12.01	7.12.02	19.7.03	7.12.03	6.7.04	5.12.04	5.7.05	23.1.05	4.12.05	17.12.06	16.12.07	2.11.08	14.12.08
188	White-faced Heron	*Egretta novaehollandiae*	√		C	23		B	A	B	B	A	B	B	A	2	1	1	A	2	B	1		
185	Little Egret	*Egretta garzetta*	√					A		3							1							
192	Nankeen Night Heron	*Nycticorax caledonicus*			15			3							2		1				1			1
178	Glossy Ibis	*Plegadis falcinellus*			42							15									71			
179	Australian White Ibis	*Threskiornis molucca*	√	B	c	1		A	2	1	B	B		B	2	A	A	2		9	C	4		B
180	Straw-necked Ibis	*Threskiornis spinicollis*	√		b		B	B	1		B	B	A	A	7	A	B	3			A	1		1
181	Royal Spoonbill	*Platalea regia*	√	A	8			C	B		B	A	4						16	2	1			12
182	Yellow-billed Spoonbill	*Platalea flavipes*			1			1	3	1						2					6			
232	Black-shouldered Kite	*Elanus axillaris*	√			2				1	1		2	2				1						
234	Pacific Baza	*Aviceda subcristata*			1																	1		
226	White-bellied Sea-eagle	*Haliaeetus leucogaster*	√	A	2		1		2	2				1		2		1						
228	Whistling Kite	*Haliastur sphenurus*	√	A	1	1			1		2		2	2	1	1	1	1	1	1	1	1	√	
221	Brown Goshawk	*Accipiter fasciatus*											1											
220	Grey Goshawk	*Accipiter novaehollandiae*													1		1	1						
222	Collared Sparrowhawk	*Accipiter cirrocephalus*																						
219	Swamp Harrier	*Circus approximans*	√			1		1	2	1	2	1	1	1	1	2	1	1	1	1	2	1	√	1
224	Wedge-tailed Eagle	*Aquila audax*			2					1						2			2		1			2
225	Little Eagle	*Hieraaetus morphnoides*	√										2	1										
240	Nankeen Kestrel	*Falco cenchroides*	√			1					1	1				2								
239	Brown Falcon	*Falco berigora*				1				1						2								1
235	Australian Hobby	*Falco longipennis*				2	1	1		1				1			1		1					
237	Peregrine Falcon	*Falco peregrinus*								2		1												
058	Purple Swamphen	*Porphyrio porphyrio*	√	C		D	B	C	C	C	B	C	4	C	B5n	B	B	B	Bdy	B	Bdy	3	8	B
046	Buff-banded Rail	*Gallirallus philippensis*			C												1				1			
050	Baillon's Crake	*Porzana pusilla*			1																			
051	Spotless Crake	*Porzana fabuensis*	√		1																			
055	Black-tailed Native-hen	*Tribonyx ventralis*																						
056	Dusky Moorhen	*Gallinula tenebrosa*	√	B	C	C	B	B	A	B	C	B			B	B	B						1	
059	Eurasian Coot	*Fulica atra*	√		B			B						B	B		A		A		1		9	
146	Black-winged Stilt	*Himantopus himantopus*	√	C	B			B	2	B	C	A		B		B			2		C			A
143	Red-capped Plover	*Charadrius ruficapillus*																						
144	Black-fronted Dotterel	*Elsevornis melanops*		A	B				6	27+	2	A	3			1			2				√	

RAOU #	Species	Scientific Name	5.90	20.6.93	20.12.97	21.6.98	19.12.98	18.12.99	3.10.00	10.12.00	7/8/01	5.12.01	7.12.02	19.7.03	7.12.03	6.7.04	5.12.04	5.7.05	23.1.05	4.12.05	17.12.06	16.12.07	2.11.08	14.12.08
132	Red-kneed Dotterel	*Erythrogonis cinctus*		A																				
133	Masked Lapwing	*Vanellus miles*	√	B	B	B	B	B	B	A	B	B	4	2	A	A	2	4	Bdy	6	B			4
170	Australian Painted Snipe	*Rostratula australis*			1																			
168	Latham's Snipe	*Gallinago hardwickii*			475		230	115		66		35	7		35		36		120	66	98	5		18
154	Wood Sandpiper	*Tringa glareola*			6					1														
163	Sharp-tailed Sandpiper	*Calidris acuminata*			2																			
125	Silver Gull	*Chroicocephalus novaehollandiae*	√																					
267	Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*					3							B										
273	Galah	*Eolophus roseicapillus*	√			A	A	A	3			A		A	A		B	A	A	A	1	6	√	
272	Long-billed Corella	*Cacatua tenuirostris*											2					3						
271	Little Corella	*Cacatua sanguinea*	√					3				A		2	2		A	2						
269	Sulphur-crested Cockatoo	*Cacatua galerita*	√			4	A	H	2			A	A	3	B		A	2	B	A	B	A	√	h
254	Rainbow Lorikeet	*Trichoglossus haematodus*											4				1							
261	Australian King Parrot	*Alisterus scapularis*																				2		
262	Crimson Rosella	*Platycercus elegans*				1																		
268	Eastern Rosella	*Platycercus eximius*	√		Cdy	C	B	C		A	2	B	C	C	B		Bffy	B	B	B	B	B	√	B
295	Red-rumped Parrot	*Psephotus haematonotus*	√									A							1					
302	Turquoise Parrot	*Neophema pulcella*											1											
349	Pheasant Coucal	*Centropus phasianinus*						II		A		1	2	II			2		II	3	II	1		
347	Eastern Koel	*Eudynamys orientalis*			A		1	H		H			1		1		H		H		H	H	√	
348	Channel-billed Cuckoo	*Scythrops novaehollandiae*					H	B		2			3		2		A		1		H	3		2
342	Horsfield's Bronze-Cuckoo	*Chalcites basalis*						1		H			Ady								1	1		
344	Shining Bronze-Cuckoo	*Chalcites lucidus*			A					1			Ady	C								H		
337	Pallid Cuckoo	*Cacomantis pallidus*															1							
338	Fan-tailed Cuckoo	*Cacomantis flabelliformis*	√			1			H	H					1		H				H			
339	Brush Cuckoo	*Cacomantis variolosus*			II		II			II		1								1	1	1		
319	Azure Kingfisher	*Ceyx azureus*							1										2					
322	Laughing Kookaburra	*Dacelo novaeguineae*	√	A	2	2	A	H	H	H	H	A	A	A	1		2	1	Ady		A	H	√	h

RAOU #	Species	Scientific Name	6.90	20.6.93	20.12.97	21.6.98	19.12.98	18.12.99	3.10.00	10.12.00	7/8/01	8.12.01	7.12.02	19.7.03	7.12.03	6.7.04	5.12.04	5.7.05	23.1.06	4.12.05	17.12.06	16.12.07	2.11.08	14.12.08
320	Sacred Kingfisher	*Todiramphus sanctus*			A		A	A	2	A		A	D		4		2		2	1	2	2	√	A cf
318	Dollarbird	*Eurystomus orientalis*			A		A	B		A		A	1		1		A		3			2		9
558	White-throated Treecreeper	*Cormobates leucophaea*					1	A												1				
529	Superb Fairy-wren	*Malurus cyaneus*	√	A	A	C	C	C	B	A	B	C	C	B	B	B	C	Acf	B	B	B	Bcf	√	B
536	Variegated Fairy-wren	*Malurus lamberti*													B									
526	Southern Emu-wren	*Stipiturus malachurus*	√																					
468	White-browed Scrubwren	*Sericornis frontalis*	√																		1	3	√	h
464	Brown Gerygone	*Gerygone mouki*															√							
453	White-throated Gerygone	*Gerygone albogularis*	√				H	H		H		A			A		H			H				h
470	Striated Thornbill	*Acanthiza lineata*															A							B
471	Yellow Thornbill	*Acanthiza nana*	√		A	A	A	A		B	2	A	B	H	B			B			A	6		
486	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	√	B	B	B				B		A	A	A	A		A							
475	Brown Thornbill	*Acanthiza pusilla*	√			A								1			H	H						
565	Spotted Pardalote	*Pardalotus punctatus*	√				H								H			H			H			
976	Striated Pardalote	*Pardalotus striatus*	√				H	H		H					H							H		
591	Eastern Spinebill	*Acanthorhynchus tenuirostris*												3		H	A			1				h
605	Lewin's Honeyeater	*Meliphaga lewinii*				A	A				A			H			A	H	H			1			
614	Yellow-faced Honeyeater	*Lichenostomus chrysops*	√			1	A	A	1	H			1	H	2		B	A		2	A	B	√	A
625	White-plumed Honeyeater	*Lichenostomus penicillatus*								1														
633	Bell Miner	*Manorina melanophrys*			H	H	H	H	H	H	H	B	B	H	C	H	H	H	B	H	H	H	√	C
634	Noisy Miner	*Manorina melanocephala*	√		B	A	A	B	1	Bny		B	B	B	A	H	B		A	A	B	B		
637	Little Wattlebird	*Anthochaera chrysoptera*				1																		
1	Red Wattlebird	*Anthochaera carunculata*	√											1				1		1				
586	Scarlet Honeyeater	*Myzomela sanguinolenta*						H		H					A		B					B		
645	Noisy Friarbird	*Philemon corniculatus*				3			1		3		A	B										
585	Striped Honeyeater	*Plectorhyncha lanceolata*	√																		H	H		
421	Eastern Whipbird	*Psophodes olivaceus*			A		H	H	H	H	H	H			2			H	H		H	H	√	
424	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	√		A		B	A	2	A		A	2	B	A	A	H	1	A	Affy	A	3	√	1
429	Cicadabird	*Coracina tenuirostris*								H														

RAOU #	Species	Scientific Name	6.90	20.6.93	20.12.97	21.6.98	19.12.98	18.12.99	3.10.00	10.12.00	7/8/01	6.12.01	7.12.02	19.7.03	7.12.03	6.7.04	5.12.04	5.7.05	23.1.05	4.12.05	17.12.06	16.12.07	2.11.08	14.12.08
430	White-winged Triller	*Lalage sueurii*						2					1		2									
549	Varied Sittella	*Lalage leucomela*																			2			1
398	Golden Whistler	*Pachycephala pectoralis*	√		1							A		H		H			H			H		
401	Rufous Whistler	*Pachycephala rufiventris*	√				1			H		A	Ady		B		A		1dy	Affy	H	H	√	A
408	Grey Shrike-thrush	*Colluricincla harmonica*		H									A	A	1	H	A							
671	Olive-backed Oriole	*Oriolus sagittatus*					A			H		H		1	A					1		H		
543	White-breasted Woodswallow	*Artamus leucorhynchus*			B		C	A	3	Bon		Ady	3dy		Bdy		Bn		B	Bny	C	Bdy	√	C
547	Dusky Woodswallow	*Artamus cyanopterus*			B		2	A		2		Ady	2dy							1cf				
701	Grey Butcherbird	*Cracticus torquatus*	√				1	A		1ffy	1	Ady	H	H			A			4	A	H		h
700	Pied Butcherbird	*Cracticus nigrogularis*	√		A			A	1	A	A			2	1	1			A			H	√	
706	Australian Magpie	*Cracticus tibicen*	√		A		A	A	H	A	A	B	A	B	2	A	B	A	A	B	4	2dy	√	4
694	Pied Currawong	*Strepera graculina*	√		A			H			A			A	1	H								
361	Grey Fantail	*Rhipidura albiscapa*	√		A		1	B				A	1	1	Bdy	A	1	A	A			2	√	
364	Willie Wagtail	*Rhipidura leucophrys*	√	A	B		B	B	A	Any	A	B	A	B	Bdy	A	B	A	B	b		B	√	B
930	Australian Raven	*Corvus coronoides*	√	A	A		B	A	A	Any	A	A	3	A	A	A	A	B	A	H	2	3	√	1
365	Leaden Flycatcher	*Mylagra rubecula*	√														2							
415	Magpie-lark	*Grallina cyanoleuca*	√	A	A		B	A	2	B	B	B	2	B	Ady	2	2	A	B	Affy	Bon	A	√	2
377	Jacky Winter	*Microeca fascinans*	√						1															
384	Rose Robin	*Petroica rosea*			1																			
392	Eastern Yellow Robin	*Eopsaltria australis*															A							1
525	Golden-headed Cisticola	*Cisticola exilis*			4		A						B	H	A		B	H	C	A	B	B		h
524	Australian Reed-Warbler	*Acrocephalus australis*			A		1	A	A	H		A	A		Bdy		A		B	B	C	B	√	C
523	Tawny Grassbird	*Megalurus timoriensis*											A		H				H		A	2cf		h
522	Little Grassbird	*Megalurus gramineus*						A		H		H		H	Bdy		H	1	1	H	H	H	√	h
506	Brown Songlark	*Cincloramphus cruralis*						1																
574	Silvereye	*Zosterops lateralis*			A				B	A			Bnb		B		B	B	C	A		A	√	2
357	Welcome Swallow	*Hirundo neoxena*		B	B		C	B	B	C	D	B	Bnb	A	C	1	B	A	A	C	B	B	√	B
360	Fairy Martin	*Petrochelidon ariel*					C	A			2						1		B	E	A			B
359	Tree Martin	*Petrochelidon nigricans*			C		C			B		A	Bnb						A			50		
999	Common Starling	*Sturnus vulgaris*			B		A	B	B	B	A	B	D		A		B		A			A	√	A
998	Common Myna	*Sturnus tristis*			A		B	B	B	A		B	A		An		1		A	A	A	B	√	A

RAOU #	Species	Scientific Name	6.90	20.6.93	20.12.97	21.6.98	19.12.98	18.12.99	3.10.00	10.12.00	7/8/01	8.12.01	7.12.02	19.7.03	7.12.03	6.7.04	5.12.04	5.7.05	23.1.06	4.12.05	17.12.06	16.12.07	2.11.08	14.12.08
564	Mistletoebird	*Dicaeum hirundinaceum*			H					1			A		A		A		3ndy			1		1
655	Double-barred Finch	*Taeniopygia bichenovii*																	H					
662	Red-browed Finch	*Neochmia temporalis*	√		C					B	2	B	8nb	C	B	B	C	80+	C	A	Cnb	10nb		
657	Chestnut-breasted Mannikin	*Lonchura castaneothorax*			1													6				2nb		
995	House Sparrow	*Passer domesticus*	√				1	A			1				2									
647	Australian Pipit	*Anthus novaeseelandiae*	√	A	A			A																

Appendix 6 – Birds Australia Atlas Data of bird species found in Pambalong Nature Reserve 1998 – 2009

Common Name	Scientific Name	Last recorded date	NSW TSC Act	Jamba	Camba	EPBC marine
Magpie Goose	*Anseranas semipalmata*	13/03/2005	+			+
Plumed Whistling-Duck	*Dendrocygna eytoni*	5/02/2005				
Wandering Whistling-Duck	*Dendrocygna arcuata*	5/07/2005				+
Black Swan	*Cygnus atratus*	14/03/2009				
Australian Wood Duck	*Chenonetta jubata*	14/03/2009				
Australasian Shoveler	*Anas rhynchotis*	22/05/2008				
Grey Teal	*Anas gracilis*	14/03/2009				
Chestnut Teal	*Anas castanea*	14/03/2009				
Pacific Black Duck	*Anas superciliosa*	14/03/2009				
Hardhead	*Aythya australis*	5/10/2008				
Australasian Grebe	*Tachybaptus novaehollandiae*	5/10/2008				
Hoary-headed Grebe	*Poliocephalus poliocephalus*	5/07/2005				
*Spotted Dove	*Streptopelia chinensis*	21/03/2008				
Brown Cuckoo-Dove	*Macropygia amboinensis*	5/12/2004				
Common Bronzewing	*Phaps chalcoptera*	16/12/2007				
Crested Pigeon	*Ocyphaps lophotes*	16/12/2007				
Bar-shouldered Dove	*Geopelia humeralis*	16/12/2007				
Wonga Pigeon	*Leucosarcia picata*	16/12/2007				
Topknot Pigeon	*Lopholaimus antarcticus*	21/03/2008				
White-throated Needletail	*Hirundapus caudacutus*	16/12/2007		+	+	+
Australasian Darter	*Anhinga novaehollandiae*	6/07/2008				
Little Pied Cormorant	*Microcarbo melanoleucos*	5/10/2008				
Great Cormorant	*Phalacrocorax carbo*	23/01/2005				
Little Black Cormorant	*Phalacrocorax sulcirostris*	14/03/2009				
Pied Cormorant	*Phalacrocorax varius*	7/12/2002				
Australian Pelican	*Pelecanus conspicillatus*	5/10/2008				+
White-necked Heron	*Ardea pacifica*	8/09/2007				
Eastern Great Egret	*Ardea modesta*	31/01/2009		+	+	+

Common Name	Scientific Name	Last recorded date	NSW TSC Act	Jamba	Camba	EPBC marine
Intermediate Egret	*Ardea intermedia*	31/01/2009				+
Cattle Egret	*Ardea ibis*	31/01/2009		+	+	+
White-faced Heron	*Egretta novaehollandiae*	9/10/2000				
Little Egret	*Egretta garzetta*	5/12/2004				+
Nankeen Night-Heron	*Nycticorax caledonicus*	17/12/2006				+
Glossy Ibis	*Plegadis falcinellus*	10/01/2007			+	+
Australian White Ibis	*Threskiornis molucca*	31/01/2009				+
Straw-necked Ibis	*Threskiornis spinicollis*	16/12/2007				+
Royal Spoonbill	*Platalea regia*	31/01/2009				
Yellow-billed Spoonbill	*Platalea flavipes*	8/09/2007				
Black-shouldered Kite	*Elanus axillaris*	20/05/2007				
Pacific Baza	*Aviceda subcristata*	16/12/2007				
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	29/10/2006			+	+
Whistling Kite	*Haliastur sphenurus*	22/05/2008				+
Brown Goshawk	*Accipiter fasciatus*	1/11/2007				+
Grey Goshawk	*Accipiter novaehollandiae*	6/07/2008				
Swamp Harrier	*Circus approximans*	21/03/2008				+
Wedge-tailed Eagle	*Aquila audax*	14/03/2009				
Little Eagle	*Hieraaetus morphnoides*	19/07/2003				
Nankeen Kestrel	*Falco cenchroides*	6/07/2004				+
Brown Falcon	*Falco berigora*	20/05/2007				
Australian Hobby	*Falco longipennis*	20/05/2007				
Purple Swamphen	*Porphyrio porphyrio*	31/01/2009				+
Buff-banded Rail	*Gallirallus philippensis*	17/12/2006				+
Black-tailed Native-hen	*Tribonyx ventralis*	15/11/2002				
Dusky Moorhen	*Gallinula tenebrosa*	14/03/2009				
Eurasian Coot	*Fulica atra*	5/10/2008				
Black-winged Stilt	*Himantopus himantopus*	10/03/2007				+
Red-necked Avocet	*Recurvirostra novaehollandiae*	22/11/2003				+
Black-fronted Dotterel	*Elseyornis melanops*	23/01/2005				
Red-kneed Dotterel	*Erythrogonys cinctus*	15/11/2002				
Masked Lapwing	*Vanellus miles*	14/03/2009				
Comb-crested Jacana	*Irediparra gallinacea*	25/01/2004	+			
Latham's Snipe	*Gallinago hardwickii*	16/12/2007		+	+	+

Common Name	Scientific Name	Last recorded date	NSW TSC Act	Jamba	Camba	EPBC marine
Pectoral Sandpiper	*Calidris melanotos*	15/11/2002		+		+
Sharp-tailed Sandpiper	*Calidris acuminata*	10/01/2007		+	+	+
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	19/07/2003				
Galah	*Eolophus roseicapillus*	31/01/2009				
Long-billed Corella	*Cacatua tenuirostris*	5/07/2005				
Little Corella	*Cacatua sanguinea*	5/07/2005				
Sulphur-crested Cockatoo	*Cacatua galerita*	16/12/2007				
Rainbow Lorikeet	*Trichoglossus haematodus*	22/05/2006				
Australian King-Parrot	*Alisterus scapularis*	5/10/2006				
Eastern Rosella	*Platycercus eximius*	5/10/2006				
Red-rumped Parrot	*Psephotus haematonotus*	23/01/2005				
Turquoise Parrot	*Neophema pulchella*	7/12/2002	+			
Pheasant Coucal	*Centropus phasianinus*	16/12/2007				
Eastern Koel	*Eudynamys orientalis*	16/12/2007				+
Channel-billed Cuckoo	*Scythrops novaehollandiae*	16/12/2007				+
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	16/12/2007				+
Shining Bronze-Cuckoo	*Chalcites lucidus*	16/12/2007				+
Pallid Cuckoo	*Cacomantis pallidus*	17/11/2007				+
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	17/12/2006				+
Brush Cuckoo	*Cacomantis variolosus*	16/12/2007				
Azure Kingfisher	*Ceyx azureus*	23/01/2005				
Laughing Kookaburra	*Dacelo novaeguineae*	31/01/2009				
Sacred Kingfisher	*Todiramphus sanctus*	5/10/2006				+
Dollarbird	*Eurystomus orientalis*	16/12/2007				+
Superb Lyrebird	*Menura novaehollandiae*	6/07/2004				
Superb Fairy-wren	*Malurus cyaneus*	31/01/2009				
Variegated Fairy-wren	*Malurus lamberti*	5/07/2005				
White-browed Scrubwren	*Sericornis frontalis*	16/12/2007				
Brown Gerygone	*Gerygone mouki*	5/12/2004				
White-throated Gerygone	*Gerygone albogularis*	4/12/2005				
Striated Thornbill	*Acanthiza lineata*	30/03/2006				
Yellow Thornbill	*Acanthiza nana*	21/03/2006				
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	5/12/2004				
Brown Thornbill	*Acanthiza pusilla*	6/07/2006				

Common Name	Scientific Name	Last recorded date	NSW TSC Act	Jamba	Camba	EPBC marine
Spotted Pardalote	*Pardalotus punctatus*	17/12/2006				
Striated Pardalote	*Pardalotus striatus*	16/12/2007				
Eastern Spinebill	*Acanthorhynchus tenuirostris*	6/07/2006				
Lewin's Honeyeater	*Meliphaga lewinii*	31/01/2009				
Yellow-faced Honeyeater	*Lichenostomus chrysops*	16/12/2007				
Bell Miner	*Manorina melanophrys*	31/01/2009				
Noisy Miner	*Manorina melanocephala*	30/03/2006				
Red Wattlebird	*Anthochaera carunculata*	21/03/2006				
Scarlet Honeyeater	*Myzomela sanguinolenta*	21/03/2006				
Noisy Friarbird	*Philemon corniculatus*	30/03/2006				
Striped Honeyeater	*Plectorhyncha lanceolata*	5/10/2006				
Eastern Whipbird	*Psophodes olivaceus*	5/10/2006				
Varied Sittella	*Daphoenositta chrysoptera*	17/12/2006				
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	31/01/2009				+
White-winged Triller	*Lalage sueurii*	29/10/2006				
Golden Whistler	*Pachycephala pectoralis*	21/03/2006				
Rufous Whistler	*Pachycephala rufiventris*	16/12/2007				
Grey Shrike-thrush	*Colluricincla harmonica*	10/03/2007				
Olive-backed Oriole	*Oriolus sagittatus*	16/12/2007				
White-breasted Woodswallow	*Artamus leucorynchus*	5/10/2006				
White-browed Woodswallow	*Artamus superciliosus*	10/01/2007				
Dusky Woodswallow	*Artamus cyanopterus*	4/12/2005				
Grey Butcherbird	*Cracticus torquatus*	6/07/2006				
Pied Butcherbird	*Cracticus nigrogularis*	22/05/2006				
Australian Magpie	*Cracticus tibicen*	31/01/2009				
Pied Currawong	*Strepera graculina*	6/07/2004				
Grey Fantail	*Rhipidura albiscapa*	31/01/2009				
Willie Wagtail	*Rhipidura leucophrys*	31/01/2009				
Australian Raven	*Corvus coronoides*	14/03/2009				
Leaden Flycatcher	*Mylagra rubecula*	5/12/2004				
Restless Flycatcher	*Mylagra inquieta*	6/03/2004				
Magpie-lark	*Grallina cyanoleuca*	14/03/2009				+
Eastern Yellow Robin	*Eopsaltria australis*	31/01/2009				
Golden-headed Cisticola	*Cisticola exilis*	16/12/2007				

Common Name	Scientific Name	Last recorded date	NSW TSC Act	Jamba	Camba	EPBC marine
Australian Reed-Warbler	*Acrocephalus australis*	5/10/2006				+
Tawny Grassbird	*Megalurus timoriensis*	16/12/2007				
Little Grassbird	*Megalurus gramineus*	6/07/2006				
Silvereye	*Zosterops lateralis*	5/10/2006				+
Welcome Swallow	*Hirundo neoxena*	5/10/2006				+
Fairy Martin	*Petrochelidon ariel*	17/12/2006				
Tree Martin	*Petrochelidon nigricans*	16/12/2007				+
*Red-whiskered Bulbul	*Pycnonotus jocosus*	4/12/2005				
*Common Starling	*Sturnus vulgaris*	16/12/2007				
*Common Myna	*Sturnus tristis*	16/12/2007				
Mistletoebird	*Dicaeum hirundinaceum*	16/12/2007				
Double-barred Finch	*Taeniopygia bichenovii*	23/01/2005				
Red-browed Finch	*Neochmia temporalis*	6/07/2006				
Chestnut-breasted Mannikin	*Lonchura castaneothorax*	21/03/2006				
*House Sparrow	*Passer domesticus*	7/12/2003				

*Introduced species

Appendix 7: Water body photographs

Plate 1: Stitched photograph of South Swamp taken in October 2008

Plate 2: Stitched photograph of South Swamp taken in March 2009.

Plate 3: Photograph of Main Swamp taken in October 2008.

Plate 4: Photograph of Main Swamp taken in March 2009.

Plate 5: Stitched photograph of North Swamp taken in October 2008.

Plate 6: Photograph of North Swamp taken in March 2009.

Appendix 8: Contributions and qualifications of EcoBiological staff

Name	Qualification	Title	Contribution
Kristy Peters	D. ParkMgt.	Ecologist (Ornithologist)	Bird surveys, report writing, Anabat analysis, nocturnal fieldwork
Dan Pedersen	B. Sc.	Ecologist (Botanist)	Flora survey and ID, vegetation mapping
Ryan Parsons	B. Env Sc.	Ecologist (Botanist)	Flora survey and ID
Adam Blundell	B. Env Sc. (Hons)	Senior Environmental Scientist	Fauna hair identification, trap layout and checks, nocturnal fieldwork, report review
Simon Clulow	B. Sc. / B. Teach	Ecologist (Herpetologist)	Amphibian survey
Dianna Brettschneider	B. App Sc.	GIS Manager	Preparation of map layouts for report

Appendix 9: Licensing matters relating to the survey

EcoBiological employees involved in the current study are licensed or approved under the *National Parks and Wildlife Act* 1974 (License Number. S12398, Expiry: 30 November 2009) and the *Animal Research Act* 1985 to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.