

Fivebough and Tuckerbil Swamps a Wetland of International Importance (RAMSAR)

Fivebough and Tuckerbil Swamps were designated a Wetland of International Importance (RAMSAR) on October 21, 2002. The wetlands are Ramsar site 1224, and the 62nd Australian Ramsar site.

The information presented in this document reflects the format of the formal Ramsar Information Sheet submitted for the nomination of Fivebough and Tuckerbil Swamps to be listed as Wetlands of International Importance under the Ramsar Convention. The following provides a description of these wetlands.

Information on the Ramsar Wetlands

1. Date this sheet was completed/updated:

October 2002

2. Country:

Australia

3. Name of wetland:

Fivebough and Tuckerbil Swamps

4. Geographical coordinates:

Fivebough Swamp Lat 34° 32' S Long 146° 25'E
Tuckerbil Swamp Lat 34° 29' S Long 146° 21'E

5. Elevation:

Approximately 135 metres above sea level

6. Area:

Total – 689ha
(Fivebough Swamp – 400ha; Tuckerbil Swamp – 289ha)

7. Overview:

Fivebough Swamp is a permanent, but fluctuating, fresh-brackish, shallow wetland and Tuckerbil Swamp is a seasonal, shallow, brackish-saline wetland. Both are of national and international importance because of the presence, abundance and diversity of waterbirds that have been recorded there, including migratory shorebirds and threatened species. Both wetlands operate as important waterbird habitat and refuge within an agricultural landscape and in fact gain some of these habitat values from the human uses of the areas such as grazing, flood mitigation and sewage treatment. As such, the site is a good demonstration of Ramsar's wise use principle which also has considerable potential for the development of waterbird-related eco-tourism.

8. Wetland Types

marine-coastal:	A	B	C	D	E	F	G	H	I	J	K	Zk(a)
inland:	L	M	N	O	P	Q	R	Sp	Ss	Tp	Ts	U
	Va	Vt	W	Xf	Xp	Y	Zg	Zk(b)				
human-made:	1	2	3	4	5	6	7	8	9	Zk(c)		

Q = Permanent saline/brackish/alkaline lakes, **Ss** = Seasonal/intermittent saline/brackish/alkaline marshes/pools

Ranking from the most to the least dominant types:

Fivebough Swamp: Q, Ss

Tuckerbil Swamp: Ss

9. Ramsar Criteria:

Fivebough and Tuckerbil Swamps qualify as a Wetland of International Importance against the following criteria.

1 2 3 4 5 6 7 8

These criteria are:

- Criterion 2:** “A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.”
- Criterion 3:** “A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.”
- Criterion 4:** “A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.”
- Criterion 5:** “A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.”

Criterion 6: “A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.”

The most significant criterion applicable to the site: 3

11. Name and address of the compilers of this form:

Mike Schultz, PO Box 87 Leeton NSW 2705
Telephone: 02 6953 2541 Facsimile 02 6953 5914, Email, Mike.Schultz@dragnet.com.au

NSW National Parks and Wildlife Service, PO Box 1967 Hurstville NSW 2220
Telephone: 02 9585 6692 Facsimile 02 9585 6495. Contact: Penny Brett

Dr Bill Phillips, MainStream Environmental Consulting Pty Ltd
8 Huon Place, Lyons, ACT, 2606. Bill.Phillips@bigpond.com

NSW Department of Land and Water Conservation
Telephone: 02 6953 0700 Facsimile 02 6953 4468. Contact: Phil Green

12. Justification of the criteria selected under point 9.

Criterion 2: *Supports vulnerable, endangered, or critically endangered species or threatened ecological communities*

Fivebough and Tuckerbil Swamps support Australasian Bittern (*Botaurus poiciloptilus*) which is listed as ‘Vulnerable’ globally by the World Conservation Union (IUCN 2000). These Swamps are important sites for this species, supporting more than 1% (10 birds) of the estimated population in south-eastern Australia (Rose and Scott 1997). Australasian Bittern were recorded at only six other sites during the 1994-97 Murray - Darling Waterbird Project (Hutchinson *in* Glazebrook and Taylor 1998).



Australasian Bittern. Photo courtesy of NSW NPWS

The Murrumbidgee Field Naturalists have recorded numerous sightings of the Bittern over the years 1994-2001 (Stevens *et al.* 1994-2002). Taylor and Richardson (2000) recorded Australasian Bittern five times during surveys from October 1999 to January 2000. Two of these counts (14 and 17 birds) were greater than the 1% population threshold for the species.

Australasian Bittern have been recorded at Fivebough Swamp since prior to 1940 (Hindwood *in* Glazebrook and Taylor 1998). The site remains important habitat for the Bittern as much of the habitat needed to maintain this species in the Riverina bioregion has been lost (Mike Schultz pers comm.). Bittern favour wetlands with large areas (>5ha) of tall, dense vegetation (eg *Typha* spp. and *Phragmites australis*) which is primary habitat for the species (DLWC 2002). Fivebough Swamp has large patches of Cumbungi (*Typha* spp.).

Criterion 3: *A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.*

Fivebough and Tuckerbil Swamps are important for maintaining a high diversity of species of waterbirds within the Riverina bioregion, an area with few other non-riparian wetlands. The number of species listed under international treaties, or as threatened species and the abundances of some bird species are amongst the highest recorded in the Murray-Darling Basin.

Fivebough Swamp had the highest, and Tuckerbil Swamp the second highest number of waterbird species recorded (65 and 64 species respectively) in the 1994-97 Murray - Darling Waterbird Project that surveyed 360 wetlands (Hutchinson *in* Glazebrook and Taylor 1998). Fivebough Swamp ranked number two of the 360 sites for the maximum number of species recorded in a single survey (43 species). Tuckerbil Swamp ranked seven, with 33 species recorded in a single survey.

A total of 84 species of waterbirds have been identified at Fivebough Swamp and 69 species at Tuckerbil Swamp (see Appendix 1).



Several waterbird species classified as threatened in NSW are found at Fivebough and Tuckerbil Swamps, including Brolga. Photograph taken by the late Graham Pizzey, and included here with the kind permission of Sue Pizzey.

Criterion 4: *Supports populations of plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.*

Fivebough and Tuckerbil Swamps have special value as a breeding ground for many species of waterbirds. Twenty-two species of waterbird have been recorded breeding at Fivebough Swamp and eleven species of waterbird have been recorded breeding at Tuckerbil Swamp (Appendix 1). At least 12 of these species are known to breed regularly at the Swamps. Tuckerbil Swamp is also a flocking area for Brolga (*Grus rubicunda*) (see under Criterion 6 below).

Fivebough Swamp provides important feeding habitat for Great Egret (*Ardea alba*), Intermediate Egret (*Ardea intermedia*), Little Egret (*Egretta garzetta*), and Cattle Egret (*Ardea ibis*) during their breeding season from September/ October to January/ February. An Egret breeding colony with around 500-700 nests and located approximately 600m south of Fivebough Swamp is regularly used each year (Glazebrook and Taylor 1998; Richardson 1999).

Fivebough Swamp may be a drought refuge as part of the Swamp (Management Zone 2, see Map 3) retains water year round and provides habitat during dry periods (Glazebrook and Taylor 1998; Taylor and Richardson 2000).

The site is important for migratory waterbirds: Twenty-four species recorded at Fivebough Swamp and 13 species recorded at Tuckerbil Swamp are listed under the Japan-Australia Migratory Bird Agreement (JAMBA) and/or the China-Australia Migratory Bird Agreement (CAMBA) (Appendix 1).

Criterion 5: Regularly supports 20,000 or more waterbirds.

Surveys of the abundance of waterbirds have not been undertaken for the entire Ramsar site however the Swamps have regularly been recorded supporting over 20,000 waterbirds. At Fivebough Swamp counts of 20,000 Whiskered Terns (*Chlidonias hybridus*) and 20,000 Glossy Ibis (*Plegadis falcinellus*) are the highest recorded for Australia (Hutchison *in* Glazebrook and Taylor 1998). On 28 December 1995, a total of approximately 50,000 birds were counted at Fivebough Swamp by local naturalists and verified by the Royal Australasian Ornithologists Union (RAOU) (Glazebrook and Taylor 1998). Taylor and Richardson (2000) recorded in excess of 20,000 waterbirds across the eastern half of Fivebough Swamp in November and December, 1999.

Criterion 6: Regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Fivebough and Tuckerbil Swamps have recorded five species of waterbird at numbers estimated to represent greater than 1% of their population (based on Rose and Scott 1997) (see Appendix 1 for further details):

Glossy Ibis (*Plegadis falcinellus*) - Counts of 20,000 recorded at Fivebough Swamp and 500 at Tuckerbil Swamp; the 1% threshold is 10,000.

Sharp-tailed Sandpiper (*Calidris acuminata*) - Counts of 2015 recorded at Fivebough Swamp and 2253 at Tuckerbil Swamp; the 1% threshold is 1,700.

Whiskered Tern (*Chlidonias hybridus*) (see photo on previous page) - Counts of 20,000 recorded at Fivebough Swamp and 900 at Tuckerbil Swamp; the 1% threshold is 10,000.

Australasian Bittern (*Botaurus poiciloptilus*) (see photo on previous page) - Counts of 17 recorded at Fivebough Swamp and 6 at Tuckerbil Swamp; the 1% threshold is 10.

Brolga (*Grus rubicunda*) - Counts of nine recorded at Fivebough Swamp and 81 at Tuckerbil Swamp; the 1% threshold is 10. Tuckerbil Swamp is particularly important as a regular flocking area for Brolga.

13. General location:

Fivebough and Tuckerbil Swamps are located near Leeton in the Riverina region of New South Wales. Fivebough Swamp is 2 km north-east of Leeton, and Tuckerbil Swamp, less than 10 km from Fivebough, is approximately 12 km north-west of Leeton.

14. Physical features:

Regional setting and microrelief

Fivebough and Tuckerbil Swamps are located in shallow, circular depressions on the eastern margin of the Riverine Plain of NSW (Riverina bioregion) (Glazebrook and Taylor *in* Environment Australia 2001). Major relief in the area includes the Cocoparra Range which rises up to 250 m above the Plain and is located north-east of Griffith; the Brobenah Range which lies about 10km north-east of Fivebough Swamp and comprises wooded, dry rocky hills; and the Corbie and Merungle Hills to the south-east of Leeton, also dry rocky hills, emerging from the Quaternary deposits which are part of the same base rock system as the Narrandera Ranges (Glazebrook and Taylor 1998).

The Fivebough Swamp basin is believed to be a relic lake bordered on its eastern margin by a low lunette dune comprising saline clay sediments. Tuckerbil Swamp is bordered on its south-eastern margin by an extensive sandhill. Saline flats occupy much of the southern and central portions of Tuckerbil Swamp (Glazebrook and Taylor *in* Environment Australia 2001). There are two small dams on the site of Tuckerbil Swamp.

Microrelief is provided in the northern section of Fivebough and the north-eastern section of Tuckerbil by Gilgai (Glazebrook and Taylor *in* Environment Australia 2001). Gilgai can form a series of small pools when flooded, enhancing the diversity of habitats found in the Swamps.

A series of ponds in the central-west of Fivebough Swamp (previously the formal effluent containment area from the Leeton Sewage Treatment Plant) contain water all year round. The remainder of the Swamp, mainly land to the east and south, is covered by shallow water at various times of the year and forms extensive mudflats as the water evaporates. Land to the north and the far west is higher and tends to flood only after excessive rainfall (Glazebrook and Taylor *in* Environment Australia 2001).

Climate

The climate of the area is characterised by hot summers and cool winters. Rainfall is evenly distributed throughout the year with October being the wettest month and February the driest. Mean annual rainfall is 433 mm. Total evaporation from October to March inclusive is 1547 mm and between April and September only 490 mm. Monthly evaporation exceeds rainfall by 9.7 to 1 in December, and only exceeds rainfall by 1.3 to 1 in June and July (Glazebrook and Taylor *in* Environment Australia 2001).

Soils and groundwater

Soils in the Fivebough Swamp basin are cracking grey clays with varying degrees of self-mulching properties. These soils have a moderate to high clay content and marked shrink-swell potential. Crusting and sealing is counteracted by shrinkage and cracking. The basin is underlain by at least 10 metres of extensive, impermeable clays (Glazebrook and Taylor *in* Environment Australia 2001). Before irrigation began, regional shallow groundwater levels were generally about 20 metres below the surface. Groundwater data collected by the NSW Department of Land and Water Conservation (DLWC), 1969-96, suggests the watertable is now within 2.5 metres of the Swamp basin. The Water Resource Commission reported in 1984 on the development of a perched saline watertable at a depth of 1-2 metres in that area.

The surface of the Tuckerbil Swamp is predominantly grey/dark grey clay to an average depth of 7.2m. A lens of sandy soils intersects beneath the clay and extends to a depth of 11.6m (Glazebrook and Taylor *in* Environment Australia 2001). Data collected by the Water Resources Commission between 1966 and 1996 indicated that the watertable is within two metres of the surface and that there is a general rising groundwater trend in the area (Glazebrook and Taylor 1998). There are some areas within the Swamp that show signs of being salt affected.

Water regime

Fivebough and Tuckerbil Swamps are natural inland drainage depressions within the Yanco Irrigation Area. The water regime was originally determined by the balance between rainfall and evaporation. Good rains in winter filled the Swamps, which generally remained wet until the following spring/summer when most water was lost through evaporation and possibly percolation. Only after exceptionally heavy and prolonged rainfall was water likely to flow out of the Swamps (Glazebrook and Taylor *in* Environment Australia 2001). In 1939 an earthen contour drain was constructed to intercept the original drainage line and redirect natural drainage around the Swamps.

The main sources of water to the Swamps today are: rainfall; stormwater runoff from the surrounding catchment; some irrigation runoff from cropping and watering of pasture; automatic overflow of drainage water when the contour drain overflows following heavy rainfall; deliberate release of excess drainage water by Murrumbidgee Irrigation from the contour drain; and a small amount of escape

water from the irrigation supply because of rain rejection. Fivebough Swamp also receives water from treated sewage effluent discharges (Glazebrook and Taylor *in* Environment Australia 2001).

Regulatory structures on the contour drain around each of the Swamps enable water to pass from the drain into the Swamps. During times of heavy rainfall, water can spill into the Swamp at these points via automatic overflow structures. Murrumbidgee Irrigation can also manually divert excess drainage into the Swamps during times of particularly heavy rainfall to alleviate flooding further along the drainage system (Glazebrook and Taylor 1998). As part of current management, from around June until November/December (the length of time varies depending on the season) the southern regulatory structure is opened, permitting natural rainfall runoff from the Fivebough Swamp catchment to flow into the wetland.

Water levels in Fivebough Swamp fluctuate considerably from season to season. After heavy rainfall, water levels in the basin can rise rapidly. Waterlogging following excessive wet periods is common, especially if rainfall occurs during the winter and autumn months. Water levels gradually recede over the spring and early summer months as temperatures rise and the rate of evaporation increases, exposing mudflats and providing a shallow water habitat (Glazebrook and Taylor *in* Environment Australia 2001). Treated effluent is constantly released into the Swamp basin and as a consequence, a series of ponds in the central-west of the Swamp (previously the formal effluent containment area) contain water all year round. Historically, the Swamp would have received a major flood every 10-15 years, the last major flood being in 1989 (Glazebrook and Taylor 1998).

The north-western section of Tuckerbil Swamp receives water from surrounding farms via the Stony Point Main Drain. Tuckerbil Swamp fills swiftly after heavy rain and the entire basin becomes submerged. The Swamp can hold a maximum depth of approximately 30-40 cm of water. As water levels recede, the central and south-western parts of the Swamp dry first, with the 'basin' near and extending beyond the far south-eastern boundary of the Swamp generally remaining full of water all year round. The Swamp usually dries out completely during late spring/early summer with the exception of a small flow of drainage water in the north-western section. As the Swamp dries out there may be groundwater discharge via evaporation, and subsequent salt concentration (Glazebrook and Taylor *in* Environment Australia 2001).

15. Hydrological values:

The natural hydrological patterns of both Swamps have been highly modified by the surrounding landuses and regulation of water flows, affecting both the volume of water entering the wetlands and its seasonal timing.

Originally, Fivebough Swamp was a natural drainage depression with a water regime determined by the balance between rainfall and evaporation. In 1939, a contour drain was constructed to intercept and redirect the natural drainage around the Swamp, permanently altering its natural flooding regime. Fivebough now plays an important role in alleviating flooding in the irrigation and urban drainage system that surrounds the Swamp. During prolonged or heavy rainfall, excess water in the drainage system is directed into Fivebough Swamp. In circumstances of extreme storm conditions (1 in 10 year events), Murrumbidgee Irrigation can release water into the Swamp via several regulatory structures. The volume and frequency of excess water entering the Swamp from the drainage system has not been quantified. The contour drain does not completely encircle the Swamp and consequently a considerable volume of stormwater runoff enters the Swamp from the southern end of the basin. Treated sewage from Leeton Sewage Treatment System is also discharged into the Swamp for disposal by evaporation. The water regime of the Swamp is described in more detail in Category 14 above.

On the western edge of Fivebough Swamp, a prior stream was thought to act as an intake area for regional groundwaters, but further investigations found that the aquifer associated with this prior stream is shallow and of limited extent. It is uncertain what the relationship is between this aquifer and the perched watertables of the Swamp (Glazebrook and Taylor 1998).

As with Fivebough, Tuckerbil Swamp was once a natural drainage depression which filled from local rainfall in winter and dried out via evaporation/percolation by spring/summer. Following the establishment

of the contour drain at Fivebough Swamp, a drainage network was constructed to carry water via the south-western boundary of Tuckerbil Swamp and north-west to Barren Box Swamp 35 km west of Griffith. This network of drains captured water that would previously have flowed directly into Tuckerbil. The Swamp is now used for flood control, receiving excess water from the local supply/drainage channel system and the drainage channel from Fivebough Swamp, as well as water released by Murrumbidgee Irrigation and irrigation runoff. Large volumes of water can be diverted into the Swamp during prolonged or heavy rain and the basin can fill within 24 hours, often encroaching onto higher ground. Tuckerbil Swamp is too low for floodwaters to drain out naturally and Murrumbidgee Irrigation has only a limited ability to drain the Swamp (see Category 14 for more information).

16. Ecological features:

Prior to European settlement and broadscale clearing of land for agricultural purposes, the dominant vegetation at Fivebough Swamp was a Black Box (*Eucalyptus largiflorens*) – Lignum (*Muehlenbeckia cunninghamii*) association. During the 1930s, the Swamp filled with water for a prolonged period, following the rupture of a drainage pipe, and this changed the vegetation profoundly. Most of the Black Box trees died and were subsequently removed by woodcutters. The remainder were killed by a fire that swept through the Swamp sometime in the 1940s. The Swamp became extensively covered with a thick growth of Cumbungi (*Typha spp*). However, the Swamp was subsequently leased for grazing, which helped reduce the extent of Cumbungi, and other emergent plants, to the permanently wet effluent containment area, drainage lines and wetter sections on the southern end of the basin. By the 1980s, heavy grazing, together with drought, resulted in loss of vegetation in the central part of the Swamp, which became open mud flats (Taylor and Richardson, 2000).

Grazing of livestock (cattle) temporarily ceased in parts of the Swamp in August 1997 and since that time there has been rapid regeneration of Cumbungi, as well as Water Couch (*Paspalum disticum*) which has produced a vegetation structure in some parts of the Swamp preferred by cryptic waterbird species. This has significantly reduced the amount of mudflat available to shorebirds. Most of the migratory shorebirds prefer to feed in the open areas of mud where vegetation is absent, short or sparse. Common Couch (*Cynodon dactylon*) and Barley Grass (*Hordeum leporinum*) are found on drier areas and Seablight (*Suaeda baccifera*) is present on some Gilgai puffs indicating the presence of saline conditions.

In a study conducted over the main part of Fivebough Swamp, Taylor and Richardson (2000) estimated that about 42-46% of the area was not vegetated, having a bare mud substrate. Of the remainder, very little had short vegetation less than 20 cm tall. Modal vegetation heights were between 21 and 40 cm, with this band making up 42% of the Swamp area. A small percentage of the area had vegetation over 50 cm tall. Vegetation taller than 100 cm was mostly Cumbungi which occurred mainly in the south of the Swamp and in the western central section. In both areas the Cumbungi was recovering from heavy grazing. It was still spreading and occurred as clumps with spaces of open mud between them. Tall vegetation up to 2 metres also occurred in the very north of the Swamp, but in these areas it mostly consisted of introduced weeds. Most of the vegetation of 50 cm and less was Water Couch which formed dense deep mats. It also was spreading rapidly, especially in the wetter areas, following the removal of livestock.

Fivebough Swamp has fluctuating water levels, providing habitat for many resident waterbirds, as well as migratory shorebirds during the annual wetting-drying cycle. The various species of waterbird using Fivebough have different water depth preferences related to their size and foraging technique. There is a succession of species, each reaching their maximum numbers at different stages as the Swamp dries. Consequently, the pattern of wetting and drying is essential to maintain the productivity and diversity of waterbird species using Fivebough.

Like Fivebough Swamp, the dominant vegetation at Tuckerbil Swamp was once a Black Box-Lignum association with thick stands of Black Box and Belah (*Casuarina cristata*) around the edges and stands of open Black Box in wet patches through the centre of the Swamp. Following the establishment of irrigated farming, Tuckerbil Swamp served as a drainage basin and held irrigation water for extended periods. As a result, the Black Box died and were replaced by thick growth of Cumbungi and Water Couch. A fire burned through the Swamp sometime in the 1960s reducing the extent of Cumbungi.

Today, Tuckerbil Swamp has some localised areas of saline flats which are covered by salt-tolerant species such as Samphire (*Sclerostegia tenuis*). Scalded areas were once more widespread and recent management actions taken by the lessee have seen these reduced. Seablite (*Suaeda baccifera*) increases in abundance towards the margins of these flats and in areas inundated for considerable periods. Sea Barley Grass (*Hordeum marinum*) and Samphire dominate the Gilgai country in the north east of the Swamp, with Sea Barley on the rises and Samphire in the depressions. Higher, drier areas of the Swamp are dominated by Sea Barley Grass and introduced 'grazing' species. Some remnants of the original vegetation remain on and near the northern, eastern and southern margins of the Swamp including Black Box, Belah and Lignum. Cumbungi (*Typha domingensis*) grows along the central western part of the Swamp and all the way along the Stony Point Main Drain to the north (Tiffin pers. comm. and Dufty pers. comm. in Glazebrook and Taylor 1998). During a particularly dry period in December 1997, Seablite was observed growing among the Cumbungi (Glazebrook and Taylor 1998). Water couch is restricted to the wetter north-western end of the Swamp and is sustained by water from the drainage outflow.

Tuckerbil Swamp is less than 10 km from Fivebough Swamp (see Maps 1 and 2) and the two Swamps are considered to be key parts of the wetland (and surrounding rice field) habitats of the local region. Waterbirds could move between the Swamps, and use the habitat variation between them advantageously. Tuckerbil Swamp is generally shallower throughout and tends to dry out before Fivebough, offering more shallow water and wet mud habitat for smaller shorebirds when water depths in Fivebough Swamp are higher. A variety of other wetland habitats, including ricefields which are filled with shallow open water in October, are available in the immediate area. Further studies are required to demonstrate the importance of each habitat and its use by waterbirds at each site.

17. Noteworthy flora:

As noted above, the dominant vegetation at Fivebough Swamp was once a Black Box (*Eucalyptus largiflorens*) - Lignum (*Muehlenbeckia cunninghamii*) association, but little of this remains today. Vegetation data collected to date consists of species presence/absence and most surveys have been carried out during the drier months (see Appendix 3). There have been no formal surveys of vegetation structure, species abundance or the seasonal/spatial distribution of vegetation. It is not known whether any threatened species, populations or communities exist at Fivebough Swamp (Glazebrook and Taylor 1998).

The vegetation at Tuckerbil Swamp was also originally a Black Box (*Eucalyptus largiflorens*), Belah (*Casuarina cristata*) and Lignum (*Muehlenbeckia cunninghamii*) association (see above) but only small remnants of these communities now remain on higher ground in the north-eastern corner of the Swamp. As with Fivebough, no formal vegetation surveys have been conducted at Tuckerbil Swamp.

18. Noteworthy fauna:

Both Fivebough and Tuckerbil Swamps have long been recognised as important sites for birdlife (Glazebrook and Taylor 1998). Waterbird records for both sites date back to the period 1900-1930 (Hindwood 1940). However, clearing for agriculture, urban development and changes to the water regime of the Swamps have favoured some species of waterbirds over others. It is only recently, following surveys undertaken for the RAOU Murray-Darling Basin Waterbird Project (Hutchison 1998) and long-term observations by local naturalists, that these sites have been recognised as important habitat for migratory shorebirds. Count information of waterbird species is given in Appendix 1.

Of 360 wetlands surveyed during the RAOU Murray-Darling Basin Waterbird Project, Fivebough Swamp recorded the highest number of waterbird species and it ranked second within the Murray-Darling Basin for the maximum number of species recorded in a single survey. Eighty-three waterbird species have been recorded at Fivebough Swamp of which 24 species are listed under the Japan-Australia Migratory Bird Agreement (JAMBA) and/or the China-Australia Migratory Bird Agreement (CAMBA), and protected under Commonwealth legislation. During the RAOU

Waterbird Project, Tuckerbil Swamp recorded the second highest number of waterbird species and it ranked seventh for the maximum number of species recorded in a single survey. Sixty-nine species of waterbird have been recorded at Tuckerbil Swamp, thirteen of which are JAMBA and/or CAMBA species.

Seven species listed under the NSW Threatened species legislation have been recorded at Fivebough Swamp; namely Australasian Bittern (*Botaurus poiciloptilus*), Magpie Goose (*Anseranas semipalmata*), Freckled Duck (*Stictonetta naevosa*), Blue-billed Duck (*Oxyura australis*), Brolga (*Grus rubicunda*), Painted Snipe (*Rostratula benghalensis*) and Black-tailed Godwit (*Limosa limosa*) (see Appendix 1) and at Tuckerbil Swamp, four species; namely, Australasian Bittern, Painted Snipe, Freckled Duck and Brolga. Australasian Bittern is also listed as 'Vulnerable' globally by the World Conservation Union (IUCN 2000).

Fivebough and Tuckerbil Swamps have also recorded a number of waterbird species at numbers considered to represent greater than 1% of their population estimate. This includes Glossy Ibis, Sharp-tailed Sandpiper, Whiskered Tern, Australasian Bittern and Brolga.

There have been no surveys of mammals, reptiles, amphibians or fish at the Swamps, however those species observed at Fivebough Swamp are listed in Appendix 2

19. Social and cultural values:

The area surrounding Fivebough Swamp is likely to contain Aboriginal relics (possibly including Aboriginal burial sites in the lunette on the eastern side) (Robson 1997).

Tuckerbil Swamp is a traditional hunting/fishing area for the Wiradjuri Aboriginal people. The Koonadan Historic Site is nearby to the south-east of Tuckerbil Swamp and is of cultural heritage significance to the Aboriginal people of the area. Aboriginal skeletal remains have been found in the dunes and the local Aboriginal community believes that Koonadan is an ancestral Wiradjuri burial ground (NPWS 1996).

Currently, Fivebough Swamp is used by a small number of local, Australian and international visitors, who are attracted by the waterbirds at the site. Visitors are aware of the site by 'word of mouth' and there is little promotion of the site. There is no commercial tourism at either Fivebough or Tuckerbil Swamps at present.

The wetland has excellent potential as an educational resource, as well as a regionally, nationally and internationally important tourist destination for nature-based recreation focusing on the rich birdlife that is attracted to the Swamp.

Murrumbidgee Field Naturalists have obtained funding to set up a field study centre at Fivebough Swamp, which will cater for passive recreational activities centred on the natural values of the wetland and the waterbirds it supports. Since some species of waterbird may be little tolerant of human intrusion (such as Brolgas), a study of waterbird fright distances was incorporated into research on the ecology and management of waterbirds at Fivebough Swamp (Taylor and Richardson 2000). The results of this study will influence visitor management at this site. There are few visitors to Tuckerbil Swamp because of difficulties of access, so this site will primarily be managed for conservation rather than recreation and eco-tourism.

20. Land tenure/ownership of:

(a) site

Fivebough and Tuckerbil Swamps are Crown Land administered by Land New South Wales, a business unit of DLWC under the *Crown Lands Act 1989* and the *Crown Lands (Continued Tenures) Act 1989*. Maps showing the boundaries are provided below (Maps 3 and 4).

Two portions of Fivebough Swamp, Zones 3 and 4b (Map 3), are not part of the wetland proper but are included in the Ramsar site. Approximately 2ha of perpetual leasehold land adjoining the north-eastern part of the Ramsar site are inundated with water at times but lie outside the Ramsar site boundary. The entire area of Tuckerbil Swamp is wetland and is included in the Ramsar site.

Fivebough Swamp is vacant Crown Land, which is divided into several Management Zones (Map 3) and is bounded by a contour drain, except along a section of the southern boundary. Since the 1940s, Fivebough Swamp has been leased for the purposes of grazing and cultivation. Leeton Council leased approximately 10ha between 1965-1972 and leased Management Zone 2 between 1972-1987 for the disposal of sewage effluent. Since 1987, Leeton Council has had an agreement with the DLWC to dispose of treated effluent over the entire area of the Swamp and it leases an area of 6.5ha on the southern end of the Swamp for the Leeton Sewage Treatment Plant (STP) tertiary treatment ponds. Fivebough Swamp was subsequently leased for grazing and cultivation. On August 30, 1997, these grazing leases were terminated. Management Zone 1 was again leased for grazing in February 2001. The lease conditions for grazing of domestic stock determine that this is to assist management of the wetland to maintain and enhance the conservation values of Fivebough Swamp.

In 1967, Tuckerbil Swamp was divided into three blocks and leased on a four-yearly basis for dry grazing only. In the late 1970s, the northern block was subdivided and added to adjoining farms for the purpose of mixed farming. The remaining two blocks continue to be leased for dry grazing and make up the entire area of Tuckerbil Swamp today.

The Fivebough and Tuckerbil Wetlands Management Trust Inc. provides advice to Land NSW on the management of the site. The Trust also undertakes a range of the day-to-day management actions as set out in the Management Plan, and which are not the responsibility of the lessees involved as specified in their respective lease conditions. Membership of the Trust was established by open invitation.

(b) surrounding area

The area immediately outside the contour drain of Fivebough Swamp consists of freehold blocks varying in size from less than 1ha to approximately 15ha. Several small parcels of land on the eastern edge of the Swamp are held either under permissible occupancy agreements or perpetual licence by adjoining landholders. Three blocks of privately owned land impinge on the Swamp, but these have not been included in the boundary of the Ramsar nominated area. Large area irrigation farms surround Tuckerbil Swamp and are mainly used for growing rice, winter cereals and grazing. These former leasehold lands have been converted to freehold over time. Tuckerbil Swamp, and the surrounding land, was a traditional hunting/fishing area for the Wiradjuri Aboriginal people. The Koonadan Historic Site lies to the south-east of Tuckerbil Swamp and is considered to have significant cultural heritage value to the Aboriginal people of the area.

21. Current land use:

(a) Site

Both Swamps are zoned Rural 1(a) in the Leeton Local Environmental Plan (LEP) 35 which means that they can be used for any rural activity. The Swamps are used for flood mitigation during periods of heavy rainfall (see Category 15).

Fivebough Swamp is currently being managed for conservation, education and research, with part of the area leased for grazing purposes. Tuckerbil Swamp, while leased for grazing purposes, is also managed with waterbird conservation outcomes in mind.

Leeton Shire Council uses Fivebough Swamp to dispose of tertiary treated effluent by evaporation. The Leeton STP has been operating since 1937 and is located at the southern end of Fivebough Swamp. The STP has been augmented over the years to service unsewered subdivisions in Leeton. See Category 22 following for further details.

(b) surroundings/catchment

The area immediately west of the contour drain consists of allotments varying in size from 0.4 to approximately 15ha. This privately owned land is zoned 2. Living and 7(a) Fivebough Environmental Buffer under Leeton LEP No. 35.

The 2. Living zone permits land to be subdivided into 1200m² residential allotments subject to the provision of reticulated sewerage. Where sewerage is not available, the minimum lot size for a dwelling is 4000m². The buffer zone is 500 metres wide and while development is permitted, Council can control inappropriate development and require revegetation of land.

Land to the north and east of Fivebough Swamp is zoned Rural 1(a) under Leeton LEP No. 4 and No. 27. LEP No. 27, gazetted on 9 January 1998, increased the minimum lot size for a dwelling from 2 to 20ha for horticultural land and 150ha for broad acre crops. The effect of LEP No. 27 is to retain land for agricultural purposes and prevent rural residential subdivisions. Rural Industries are provided for in LEP No. 27 with no minimum lot size.

Large area farms surround Tuckerbil Swamp and are mainly used for rice, winter cereals and grazing.

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects:

(a) at the site

In the past, both Fivebough and Tuckerbil Swamps have been used for agricultural production, including grazing and cultivation, as well as flood mitigation and sewage effluent disposal, which have resulted in significant changes to the ecological character of the sites. The water regime and hydrology of both Fivebough and Tuckerbil Swamps have also changed markedly since the development of irrigation.

The drainage system

The effect of excess water on the ecology of the Swamps is unknown (Glazebrook and Taylor 1998). Little is currently known about the quality of the diverted drainage water (described in Category 14) that spills into the Swamps from the drainage system. Murrumbidgee Irrigation have stated that stormwater can contain high levels of nutrients (phosphorus and nitrogen) and large amounts of micro-organisms and organic matter, which can impact on biological oxygen demand in the receiving water (Pygram 1977). Murrumbidgee Irrigation recently began sampling drainage water entering the Swamp during periods of heavy rain.

The use of pesticides and herbicides for rice farming and horticulture in surrounding areas could impact on the Swamps. A drainage strategy developed by the ricegrowers, in conjunction with the EPA and Murrumbidgee Irrigation, stipulates that rice cannot be drained within 21-28 days of using chemicals (Glazebrook and Taylor 1998).

Groundwater levels have risen to within 2m of the surface over approximately 85% of Fivebough Swamp. This is a critical zone for salinisation of soils, waterlogging and associated problems. Patches of bare ground exist within Fivebough Swamp and the presence of salt tolerant species such as Seablite (*Suaeda baccifera*) and Sea Barley Grass (*Hordeum marinum*) indicates that these areas may be salt affected. Samphire (*Sclerostegia tenuis*) has also regenerated on some Gilgai puffs since stock removal.

The disposal of treated sewage effluent

Leeton Shire Council uses Fivebough Swamp to dispose of tertiary treated effluent by evaporation. The STP treats both domestic sewage and industrial waste. Treated effluent from the ponds is discharged into the Swamp via two outflow lines around the western side of the Swamp and forms

pools in the effluent containment area. Approximately 35ha of Fivebough Swamp are always wet as a result of this daily effluent disposal.

Prior to the recent augmentation of the STP, concerns were expressed about the quality of sewage being treated and the implications of this for effluent release into Fivebough Swamp. Leeton Shire Council monitors effluent regularly in line with EPA licence conditions and DLWC also monitor effluent quality at the humus tanks and tertiary ponds. The provision of nutrient removal is being considered, to further improve the quality of the effluent.

Increased sewage loads are expected with new and expanding citrus, rice, cheese and wine industries (DPWS 1999). The volume of effluent produced by the Leeton STP in 1996 required an evaporation area of 75ha. This will increase to approximately 120ha for projected effluent volumes by the year 2021 (DPWS 1996). While the quantity of waste treated is expected to double over the next 20 years, discharges from individual industries are expected to fall with the introduction of trade waste charges and penalties for discharging above licence conditions. Leeton STP was upgraded (\$2.50 million) during 1999/2000 to increase the capacity of the plant and improve the level of treatment.

Weeds

Several species of weed have been identified at Fivebough Swamp which occur on the Leeton Council's noxious weeds list (Plus *in* Glazebrook and Taylor 1998). These are Khaki Weed (*Alternanthera pungens*), Star Thistle (*Centaurea calcitrapa*), Golden Dodder (*Cuscuta cumpestris*), African Boxthorn (*Lycium ferocissimum*), Horehound (*Marrubium vulgare*), Galvanised Burr (*Sclerolaena birchii*), Cat Head (*Tribulus terrestris*), Heliotrope (*Heliotropium* sp.) and Bathurst Burr (*Xanthium spinosum*). Bathurst Burr has been a problem in sections of Fivebough for many decades.

Introduced vegetation will compete with native aquatic, emergent and grass species growing in the Swamp basin and may have implications for relations with neighbouring landholders who might be concerned about the potential spread of these species. The Management Plan for the site addresses these issues.

Grazing

No long-term studies have been conducted to quantify the effect of domestic livestock grazing on the ecology of Fivebough or Tuckerbil Swamps. It is clear that poorly regulated grazing in the past has had an impact, especially on Fivebough Swamp where the extent of Cumbungi has been greatly reduced (Hutton pers. comm. and Schultz pers. comm. *in* Glazebrook and Taylor 1998; Taylor and Richardson 2000). The direct impact of stock on wetlands can include alterations to soil structure and nutrient levels, reduction in vegetation biomass and changes to water quality.

(b) around the site

Urban and industrial development

In the future, careful planning and development controls will be needed to ensure Fivebough Swamp is not affected by possible nearby urban and industrial developments. It has been estimated that over the next 20 years a further 200 allotments will be required in the Petersham Road area to the south-west of Fivebough Swamp. Consideration is also being given to the development of a fruit juice plant and a pectin processing plant nearby.

23. Conservation measures taken:

The site is administered by Land NSW, a business unit of DLWC. The Fivebough and Tuckerbil Wetlands Management Trust, an incorporated body comprising representatives from local naturalist groups, government agencies, local council, local land council and industry, has been established to provide advice to Land NSW and DLWC with respect to management, and to undertake some of the actions set down in the Management Plan. The Trust also liaises with the lessees of the two sites in terms of their management activities, as specified in the respective conditions of lease.

The Trust has developed a Management Plan designed to maintain the 'ecological character' of the wetlands, while also undertaking some management actions to address threats and some degradation caused by past activities. While the Plan has been under development the Trust has begun to implement some of the actions outlined in this framework, including:

- Construction of internal fencing for zoned management of the wetland;
- Reconstruction and repair of levees to contain and manage treated sewage effluent;
- Installing water management structures to control treated effluent water;
- Constructing walkways for access around the permanent wetland, Management Zone 2;
- Viewing mounds have been placed along walking trails;
- Design and planting of endemic plants as part of a field study area, in Management Zone 3;
- Construction of the Budyaa Baamirra Interpretive Centre (see photos);
- Revegetating Management Zones 3 and 4 with 10,000 local native plants;
- Development of two car parking areas and a wetland observation site (see photo);
- Management of weeds, by spraying, chipping, and mowing;
- Removal of all rubbish from the basin; and
- Construction of a bird hide.

The on-ground works have been carried out with the assistance of the Murrumbidgee Field Naturalists Inc. These works will be reviewed with the ongoing development of the Management Plan.

Leeton Local Environment Plan No. 35 has rezoned the area around the western side of Fivebough Swamp as an Environmental Buffer, with the aim of providing some protection for the Swamp.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* is relevant for both Fivebough and Tuckerbil Swamps due to the presence of migratory waterbirds (JAMBA, CAMBA and Bonn Convention-listed). The NSW *Threatened Species Conservation Act 1995* may protect species and communities considered at risk, and the NSW *Native Vegetation Conservation Act 1997* serves to provide for the conservation and management of native vegetation. These Acts have the potential to provide protection for both Swamps from inappropriate developments in the future.

24. Conservation measures proposed but not yet implemented:

The Fivebough and Tuckerbil Wetlands Management Trust Inc. has developed a Management Plan for both Swamps. Two particular studies, *Fivebough and Tuckerbil Swamps: A review of their history, conservation values and future managements options* (Glazebrook and Taylor 1998) and *The ecology and management of waterbirds on Fivebough Swamp* (Taylor and Richardson 2000), and other wetland reports have provided the basis for the development of the Management Plan for the Swamps.

Actions outlined in the Management Plan that are proposed but not yet implemented include:

- Developing a range of habitats for shorebirds and larger wading birds in the various compartments of Management Zone 2 in order to provide alternative habitats for these species when it is not available in Management Zone 1 for whatever reason;
- Erecting interpretative signs etc. along the walking tracks and in association with the proposed hides; and
- Providing internal protective fencing of walkways, embayments and other infrastructure to allow cattle grazing within compartments.

25. Current scientific research and facilities:

Current research and monitoring at the site includes:

- Baseline data collection and monitoring of grazing regarding provision and maintenance of waterbird habitats. This is ongoing and is being carried out by the Fivebough and Tuckerbil Wetlands Management Trust; and

- A study of Painted Snipe at Fivebough Swamp being carried out by Prof. Lew Oring at Charles Sturt University. This study is expected to be completed in December 2002.

26. Current conservation education:

Murrumbidgee Field Naturalists were successful in obtaining Natural Heritage Trust funding in 1997 for a three year project which in part is to carry out on-ground works associated with setting up a field study centre at Fivebough Swamp. These works include the provision of interpretative signage, hides, walkways and facilities for school visits. Tuckerbil Swamp is relatively inaccessible, so this site will primarily be managed for conservation rather than education or eco-tourism, but results from research at the site will inform the management of both Swamps.

Fivebough Swamp is used by local schools as a study resource. One of the main Management objectives for the Swamps is to provide opportunities and facilities for wetland and environmental education.

27. Current recreation and tourism:

Currently, Fivebough Swamp is used by a small number of local, Australian and international visitors, who are attracted by the waterbirds at the site. Visitors are aware of the site by 'word of mouth' and there is little promotion of the site. There is no commercial tourism at either Fivebough or Tuckerbil Swamps.

28. Jurisdiction:

Territorial:	State of New South Wales Commonwealth of Australia
Functional:	Department of Lands Department of Infrastructure Planning and Natural Resources Leeton Shire Council Murrumbidgee Irrigation Department of Environment and Conservation The Department of Environment and Heritage (Environment Australia)

29. Management authority:

As Crown Land, the site is administered by Land NSW, a business unit of DLWC. The Fivebough and Tuckerbil Wetlands Management Trust provides advice to Department of Lands and DIPNR with respect to management, and to undertake some of the actions set down in the Management Plan. The Trust also liaises with the lessees of the two sites in terms of their management activities, as specified in the respective conditions of lease.

Officeholders of the Fivebough and Tuckerbil Wetlands Management Trust

1. Chair, Mike Schultz, PO Box 87, Leeton NSW 2705 Australia.
2. Secretary, Phil Green, PO Box 97, Leeton NSW 2705 Australia.
3. Treasurer, Richard Faulder, PO Box 136, Yanco NSW 2703 Australia.

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WATERBIRDS RECORDED AT FIVEBOUGH AND TUCKERBIL SWAMPS

Bird sequence and taxonomy follow Christidis and Boles (1994).

Scientific name	Common name	Key Icons	Fivebough Swamp	Tuckerbil Swamp
ANSERIFORMES				
WATERFOWL				
Anseranatidae	Magpie Goose			
<i>Anseranas semipalmata</i>	Magpie Goose	T	8	nr
Anatidae	Ducks, Geese and Swans			
<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck		811	33
<i>Dendrocygna arcuata</i>	Wandering Whistling-Duck		9	nr
<i>Oxyura australis</i>	Blue-billed Duck	T	8(b)	nr
<i>Biziura lobata</i>	Musk Duck		6(b)	1
<i>Stictonetta naevosa</i>	Freckled Duck	T	1	2
<i>Cygnus atratus</i>	Black Swan		812(b)	285(b)
<i>Tadorna tadornoides</i>	Australian Shelduck		590	164
<i>Chenonetta jubata</i>	Australian Wood Duck		127	10
<i>Anas platyrhynchos</i>	Mallard	I	nr	1
<i>Anas superciliosa</i>	Pacific Black Duck		265(b)	2330(b)
<i>Anas rhynchotis</i>	Australasian Shoveler		489(b)	90
<i>Anas gracilis</i>	Grey Teal		6504(b)	5500(b)
<i>Anas castanea</i>	Chestnut Teal		60	115
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck		200	110
<i>Aythya australis</i>	Hardhead		700(b)	68
PODICIPEDIFORMES				
GREBES				
Podicipedidae	Grebes			
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe		18	4
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe		180	16
<i>Podiceps cristatus</i>	Great Crested Grebe	*	1	nr
PELECANIFORMES				
PELICANS AND ALLIES				
Anhingidae	Darters			
<i>Anhinga melanogaster</i>	Darter		1	2
Phalacrocoracidae	Cormorants			
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant		16	7
<i>Phalacrocorax varius</i>	Pied Cormorant		nc	6
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant		3	53
<i>Phalacrocorax carbo</i>	Great Cormorant		7	26(b)
Pelecanidae	Pelicans			
<i>Pelecanus conspicillatus</i>	Australian Pelican		33	30
CICONIIFORMES				
HERONS, STORKS AND IBIS				
Ardeidae	Herons and Egrets			
<i>Egretta novaehollandiae</i>	White-faced Heron		180	319(b)
<i>Egretta garzetta</i>	Little Egret		4	10
<i>Ardea pacifica</i>	White-necked Heron		31	11
<i>Ardea alba</i>	Great Egret	JC	32	11
<i>Ardea intermedia</i>	Intermediate Egret		233	84
<i>Ardea ibis</i>	Cattle Egret	JC	76	nc
<i>Nycticorax caledonicus</i>	Nankeen Night Heron		14	15
<i>Ixobrychus minutus</i>	Little Bittern	*	6	nr
<i>Botaurus poiciloptilus</i>	Australasian Bittern	T,S	17	6
Threskionithidae	Ibis and Spoonbills			
<i>Plegadis falcinellus</i>	Glossy Ibis	S,JC	20000	500
<i>Threskiornis molucca</i>	Australian White Ibis		474	90
<i>Threskiornis spinicollis</i>	Straw-necked Ibis		4000	1750

Scientific name	Common name	Key Icons	Fivebough Swamp	Tuckerbil Swamp
<i>Platalea regia</i>	Royal Spoonbill		12	23
<i>Platalea flavipes</i>	Yellow-billed Spoonbill		90	52
GRUIFORMES		RAILS, CRANES AND BUSTARDS		
Gruidae	Cranes			
<i>Grus rubicunda</i>	Brolga	S,T	9	81
Rallidae	Rails, Crakes and Gallinules			
<i>Gallirallus philippensis</i>	Buff-banded Rail		5(b)	1
<i>Rallus pectoralis</i>	Lewin's Rail	*	1	1
<i>Porzana pusilla</i>	Baillon's Crake		20	1
<i>Porzana flumina</i>	Australian Spotted Crake		11(b)	8
<i>Porzana tabuensis</i>	Spotless Crake		1	1
<i>Porphyrio porphyrio</i>	Purple Swamphen		288(b)	273(b)
<i>Gallinula tenebrosa</i>	Dusky Moorhen		14(b)	1
<i>Gallinula ventralis</i>	Black-tailed Native-hen		500	37
<i>Fulica atra</i>	Eurasian Coot		1451(b)	65
CHARADRIIFORMES		SHOREBIRDS AND GULLS		
Scolopacidae	Curlews, Snipe, Sandpipers, Stints			
<i>Gallinago hardwickii</i>	Latham's Snipe	P	6	4
<i>Limosa limosa</i>	Black-tailed Godwit	T,P	7	nr
<i>Limosa lapponica</i>	Bar-tailed Godwit	*P	1	nr
<i>Numenius minutus</i>	Little Curlew	*P	3	nr
<i>Tringa stagnatilis</i>	Marsh Sandpiper	P	360	661
<i>Tringa nebularia</i>	Common Greenshank	P	42	95
<i>Tringa glareola</i>	Wood Sandpiper	P	16	2
<i>Actitis hypoleucos</i>	Common Sandpiper	*P	1	1
<i>Arenaria interpres</i>	Ruddy Turnstone	*P	2	nr
<i>Calidris canutus</i>	Red Knot	*P	1	nr
<i>Calidris ruficollis</i>	Red-necked Stint	P	15	4
<i>Calidris subminuta</i>	Long-toed Stint	*P	1	nr
<i>Calidris melanotos</i>	Pectoral Sandpiper	P	11	2
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	S,P	2015	2253
<i>Calidris ferruginea</i>	Curlew Sandpiper	P	12	nr
<i>Philomachus pugnax</i>	Ruff	*P	2	nr
Rostratulidae	Painted Snipe			
<i>Rostratula benghalensis</i>	Painted Snipe	T,JC	8	1
Recurvirostridae	Stilts and Avocets			
<i>Himantopus himantopus</i>	Black-winged Stilt		2835(b)	1347(b)
<i>Cladorhynchus leucocephalus</i>	Banded Stilt	*	21	3
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet		600(b)	196
Charadriidae	Plovers and Lapwings			
<i>Pluvialis fulva</i>	Pacific Golden Plover	*P	2	2
<i>Charadrius ruficapillus</i>	Red-capped Plover		113(b)	42
<i>Charadrius bicinctus</i>	Double-banded Plover	NZ	11	nr
<i>Elsayornis melanops</i>	Black-fronted Dotterel		68 (b)	11
<i>Erythrogonyx cinctus</i>	Red-kneed Dotterel		265(b)	96(b)
<i>Vanellus miles</i>	Masked Lapwing		330(b)	187(b)
<i>Vanellus tricolor</i>	Banded Lapwing	*	2	1
Laridae	Gulls, Terns and Skuas			
<i>Larus novaehollandiae</i>	Silver Gull		21	250
<i>Sterna nilotica</i>	Gull-billed Tern		18	1
<i>Sterna caspia</i>	Caspian Tern	*JC	2	nr
<i>Chlidonias hybridus</i>	Whiskered Tern	S	20000(b)	900
<i>Chlidonias leucopterus</i>	White-winged Black Tern	*JC	2	nr

Scientific name	Common name	Key Icons	Fivebough Swamp	Tuckerbil Swamp
Glareolidae	Pratincoles			
<i>Stiltia isabella</i>	Australian Pratincole	*	nc	nc

Key

- T Threatened Species, NSW *Threatened Species Conservation Act 1995*
- S Species recorded occurring in numbers greater than 1% of their population estimate
- P Palearctic migrant shorebird species (JAMBA and/or CAMBA listed)
- JC Other waterbird species (JAMBA and/or CAMBA)
- NZ Winter migrant from New Zealand
- I Introduced species
- (b) Recorded breeding in wetlands (nests and eggs, altricial and precocial young observed etc)
- nr Not recorded at this Swamp
- nc Observed at this site, but no count provided
- * Nil or few observations of the species in the past 10 years at Fivebough and Tuckerbil Swamps

Acknowledgements:

Count information is from 1979 to 2001, and are the highest species counts recorded during the RAOU Murray-Darling Basin Waterbird Project (Hutchison 1998), and by the following ornithologists and naturalists: Adam Bester, Richard Langdale-Smith, (pers. comms.); Keith Hutton (pers. comms. and *in* Glazebrook and Taylor 1998); Mike Schultz (pers. comms., *in* Stevens *et al.* 1994-2002 and *in* Glazebrook and Taylor 1998); Michael Hutchison, Phil Straw (*in* Glazebrook and Taylor 1998); Adam Richardson, Iain Taylor (*in* Taylor and Richardson and *in* Stevens *et al.* 1994-2002); Peter Bird (pers. comms. and *in* Stevens *et al.* 1994-2002); Dot Green, Phil Green, Henry Hancock, Bill Moller, Les Mulloy, Ian Oag, Lew Oring, Bill Phillips, Tom Smith and David Webb (*in* Stevens *et al.* 1994-2002).