

Information Sheet on Ramsar Wetlands (RIS) – 2006-2008 version

1. Name and address of the compiler of this form:

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Designation date

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Site Reference Number

2. Date this sheet was completed/updated:

August 2007

3. Country:

Australia

4. Name of the Ramsar site:

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

“Riverland” South Australia

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only):

- a) Designation of a new Ramsar site ; or
b) Updated information on an existing Ramsar site

6. For RIS updates only, changes to the site since its designation or earlier update:**a) Site boundary and area**

The Ramsar site boundary and site area are unchanged:

or

If the site boundary has changed:

- i) the boundary has been delineated more accurately ; or
ii) the boundary has been extended ; or
iii) the boundary has been restricted**

and/or

If the site area has changed:

- i) the area has been measured more accurately ; or
ii) the area has been extended ; or
iii) the area has been reduced**

** **Important note:** If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

The Riverland Ramsar site was established in 1987. A RIS update was completed in 1998. This is the second updated RIS but the first to register that the site meets additional Ramsar criteria, set out increased ecological knowledge and describe a site boundary and area change.

This 2007 RIS update describes two changes to the registered boundary of the Riverland Ramsar site: (a) revised calculation of the Site's original registered area; (b) change in the boundary delineation.

Revised calculation of the Site's original registered area

The original area of the Riverland Ramsar was recorded as 30,600 ha at designation in 1987. Subsequently, technological improvements in geographic information systems and remote imagery have provided a more accurate calculation of the Site's area as registered at the time of designation. The original site boundary was more accurately calculated as 34,618 ha. This calculation was undertaken using ArcGIS software at the scale of 1:20 000.

This change in the described boundary (area) is consistent with guidance provided by the Ramsar Convention, notably Res. VII.23 and VIII.21, which recognises that there are situations in which Ramsar boundaries may warrant further definition, for example where boundaries were erroneously or inaccurately defined at the time of listing, where the change is minor and does not substantially affect the fundamental objectives for which the site was listed, and results from improvements in technology that allows for a higher resolution and more accurate definition of the site boundary than was available at the time of Listing.

Change in boundary delineation

In 2003, a consultation process was initiated during the development of a management plan for the site. During this consultation, concerns were raised from the community about the appropriateness of the boundary of the Ramsar site. The original boundary of the site included elevated areas of private land used for horticultural and agricultural purposes with little or no wetland value. Following these concerns being raised, an extensive community consultation process was initiated, which investigated options for any boundary change that would be consistent with Ramsar Convention guidance. A proposal was developed to amend the boundary so that it follows the 1956 floodline, rather than roads and other boundaries. In South Australia, the floodline from the 1956 Murray River floods is used as a management unit and planning boundary. Horticultural development does not occur below the 1956 floodline.

The boundary amendment has the support of landowners and is in accord with Ramsar Convention rules about Ramsar site boundary changes.

The amendment to the delineation of the boundary has reduced the overall area by 3,978 ha to 30,640 ha (based on the revised original area) through: the removal of the major non-wetland areas dominated by agriculture; and the inclusion of additional high value floodplain area.

While the proposed change did not reduce the total area of the site, it increased the area of wetland within the site by 2,347 hectares by including Lake Woolpolool, a seasonal brackish lake, and has improved waterbird and vegetation diversity within the listed site. The removal of the major non-wetland areas will have no adverse impact on the ecological character of the Riverland Ramsar site.

In considering the boundary change, Australia drew on guidance from Ramsar Convention Articles 2.5, 4.2 and Resolutions VIII.20, VIII.21, VIII.22 and IX.6. One of the scenarios outlined in Resolution IX.6 is where "A set of linear boundaries has been used to define the Ramsar site boundaries which do not relate to the eco-geography of the wetlands and their associated catchments". This equates to the Riverland situation, where roads have been used for the boundary, rather than a management unit which better fits the extent of the wetland floodplain — in this instance the 1956 floodline. Therefore the proposal to amend the boundary to the 1956 floodline is consistent with this scenario and therefore complies with Resolution IX.6.

Under Article 4.2, Parties should look to compensate for any loss of wetland resources if a Ramsar site is de-listed or its boundary restricted. In the Riverland case, while the overall size of the Ramsar site is decreased under the boundary change, the area of wetland within the site is increased. Therefore, the proposal meets the Convention's requirements in relation to compensatory actions.

Changes in applying Ramsar Listing Criteria

The Criteria description (see section 14) has significantly changed since the previous RIS and now indicates that the site meets eight out of the nine Criteria, due to a significant increase in knowledge of the site.

7. Map of site:

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

- i) a **hard copy** (required for inclusion of site in the Ramsar List): ✓;
- ii) an **electronic format** (e.g. a JPEG or ArcView image) ✓;
- iii) a **GIS file providing geo-referenced site boundary vectors and attribute tables** ✓

b) Describe briefly the type of boundary delineation applied:

e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The boundary of the Ramsar site follows the 1956 flood line west from the NSW border at point A (Lat -33° 55' 50" Long 141° 00' 10") through to the western side of Ral Ral creek at point B (Lat -34° 3' 56" Long 140° 42' 4"). It follows the western bank of the Ral Ral Creek to the junction of the River Murray. The boundary crosses the River Murray to Causeway Road and follows the northern edge of the road to point C (Lat -34° 9' 59" Long 140° 46' 45"). The boundary follows the 1956 flood line east to point D (Lat -33° 59' 12" Long 140° 57' 49") where it meets the Victorian border. It follows the Victorian border north to the River Murray where it then follows the northern bank of the river east where it meets the New South Wales border at point E (-34° 1' 14" Long 141° 00' 10").

The 1956 flood line is defined as the River Murray Flood Zone by the following Development Plans under the South Australian Development Act 1993:

Northern section of 1956 flood line reference – "Land not within a Council Area (Riverland) Development Plan 25th Sept 2003. Maps LNWCA (R) 8-11".

Southern section of 1956 flood line reference – "Renmark Paringa District Council Development Plan 8th March 2007. Maps RePa/4-6, 8 & 9".

A map of the boundary is included at Appendix 1.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):

Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

Coordinates for the approximate centre of the Ramsar site: Latitude: 34° 02' South; Longitude 140° 50' East

Coordinates for the;

North-east corner - Latitude: 33° 55' 49.7" South; Longitude 141° 00' 9.7" East

South-east corner - Latitude: 34° 01' 14.2" South; Longitude 140° 00' 9.9" East

Southern central point- Latitude: 34° 09' 59.3" South; Longitude 140° 46' 45.4" East

9. General location:

Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

Located within the South Australian section of the Murray-Darling Basin Catchment, along the River Murray between Renmark and the Victorian and New South Wales border.

10. Elevation: (in metres: average and/or maximum & minimum)

The elevation ranges from 15 to 20 metres above mean sea level (Australian Height Datum)

11. Area: (in hectares)

The total area of the site is 30,640 hectares.

12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The wetland area encompasses two major anabranch systems along an 80km section of the River Murray. This segment of the broad Lower River Murray floodplain incorporates a series of creeks, channels, lagoons, billabongs, swamps and lakes. Between the water-bodies, extensive areas of low-lying floodplain are flooded during high river levels and some areas retain water temporarily.

The floodplain supports extensive stands of River Red Gum (*Eucalyptus camaldulensis*) and Black Box (*E. largiflorens*) woodlands and contains 11 of the 12 vegetation communities within the Riverina Biogeographical Region (Environment Australia 2000). Nationally threatened species such as Regent Parrot (Eastern) (*Polytelis anthopeplus monarchoides*), Southern Bell Frog (*Litoria raniformis*, Murray Cod (*Maccullochella peelii*) and Murray Hardyhead (*Craterocephalus fluviatilis*) are found at the site. The wetland is important habitat for a large number of migratory and nomadic birds and state threatened species. The area regularly supports 1% or more of the biogeographical populations of Freckled Duck (*Stictonetta naevosa*), Red-necked Avocet (*Recurvirostra novaehollandiae*) and Red-kneed Dotterel (*Erythronyx cinctus*) and the wetland's native fish populations display a high degree of biodisparity.

13. Ramsar Criteria:

Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

1	•	2	•	3	•	4	•	5	•	6	•	7	•	8	•	9
✓		✓		✓		✓		✓		✓		✓		✓		X

14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Criterion 1 *Containing a representative example of a near-natural wetland type found within the Riverina biogeographical region.*

The Riverland Ramsar site is a representative example of a major floodplain system within the Murray Scroll Belt Subregion of the Riverina Biogeographical Region of the Murray-Darling Basin (Environment Australia 2000). Due to the size and hydrological complexity of the site it provides a substantial hydrological, biological and ecological role in the natural functioning of the River Murray below the junction of the Darling River.

Criterion 2 *Providing habitat for listed threatened species.*

The Riverland Ramsar site supports the following nationally threatened species defined under section 179 of the Australian *Environment Protection and Biodiversity Conservation Act 1999*:

English Name	Scientific Name	IUCN Status	CMS Status	CITES Appendix	National Status
Birds					
Australasian Bittern	<i>Botaurus poiciloptilus</i>	Endangered	NA	NA	Endangered
Regent Parrot (Eastern)	<i>Polytelis anthopeplus</i>	LC	NA	NA	Vulnerable
Amphibians					
Southern Bell Frog	<i>Litoria raniformis</i>	Endangered	NA	NA	Vulnerable
Fish					
Murray Cod	<i>Maccullochella peelii</i>	Critically Endangered	NA	NA	Vulnerable
Murray Hardyhead	<i>Craterocephalus fluviatilis</i>	Endangered	NA	NA	Endangered

The (Eastern) Regent Parrot (*Polytelis anthopeplus monarchoides*) breeds in hollows in River Red Gum (*Eucalyptus camaldulensis*) trees close to or over water. The site supports a breeding population of over one hundred pairs that have been recorded nesting at ten locations adjacent to the main river channel (Smith 1992 & 2002).

The Southern Bell Frog (*Litoria raniformis*) is regionally common with populations recorded at most of the large wetlands throughout the site. Particularly common in seasonally inundated wetlands where the majority of breeding occurs. Recorded by O'Malley & Sheldon (1990) Australian Landscape Trust (2002) and Harper (*Pers.comm.* 2006).

The main population of Murray Cod (*Maccullochella peelii*) is located within the main channel of the River Murray and associated deep-water anabranch creeks. However in times of flood individuals may move onto the floodplain via the anabranch systems and flooded lentic channels. It is regularly caught by professional fishers (Pierce 1997).

Limited site surveys have located a single population of Murray Hardyhead (*Craterocephalus fluviatilis*) adjacent to Lake Littra - Chowilla Anabranch. Recorded by Nichols (*Pers. comm.* 2003).

Criterion 3 *Supporting populations of plant and animal species important for maintaining the biological diversity of the Riverina biogeographical region.*

The maintenance of remnant populations of endangered flora and fauna within the site that are uncommon or extinct elsewhere in the lower Murray has been acknowledged in numerous studies, and has been attributed to unique flowing waters and habitat diversity in the site's anabranch systems (O'Malley and Sheldon, 1990; Pierce, 1990; Sharley and Huggan, 1995; Zampatti et al, 2006a). The Riverland Ramsar site contains a broad range of biological diversity occurring in the region (including habitat types) and supports elements of biological diversity that are rare and particularly characteristic of the region. The site contains the full range of the region's lowland riverine vegetation communities (Margules et al.1990).

The site provides a range of ecosystem services including promotion of survival, growth, reproduction, and recruitment of a range of biological communities, and supports twenty-eight plant species on a permanent or seasonal basis that are important to the region's biodiversity. Of particular importance are River Red Gum woodlands; Black Box woodlands; Lignum, chenopod and samphire

shrublands; herbfields; billabongs, anabranches and basins. These vegetation communities and habitats sustain diverse bird assemblages, wetland, woodland, shrubland and grassland species, and species not found elsewhere in South Australia.

In addition to the species listed at the national level, the site also contains other animal species, including twenty-two species important to the region's biodiversity, that inhabit the site on a permanent or seasonal basis (Appendix VIII). The Feather-tailed Glider (*Acrobates pygmaeus*) is endangered regionally.

Criterion 4 Provides habitat for animal species at a critical stage in their life cycle and provides refuge during adverse conditions.

The Riverland wetland provides critical summer or stopover habitat for migratory birds listed under the following agreements; Agreement between the Government of Australia and the Government of Japan for the protection of Migratory Birds in Danger of extinction and their Environment (JAMBA); People's Republic of China (CAMBA); and Republic of Korea (ROKAMBA) for the protection of Migratory Birds in Danger of extinction and their Environment.

Species Common Name	Species Scientific Name	Relevant Agreement
White Egret	<i>Egretta alba</i>	JAMBA, CAMBA
Glossy Ibis	<i>Plegadis falcinellus</i>	CAMBA
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	CAMBA
Red-necked Stint	<i>Calidris ruficollis</i>	JAMBA, CAMBA, ROKAMBA
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	JAMBA, CAMBA, ROKAMBA
Curlew Sandpiper	<i>Calidris ferruginea</i>	JAMBA, CAMBA, ROKAMBA
Greenshank	<i>Tringa nebularia</i>	JAMBA, CAMBA, ROKAMBA
Caspian Tern	<i>Hydroprogne caspia</i>	CAMBA

The site is also habitat for nomadic waterbirds during times of drought in central and eastern Australian when the areas wetlands dry. The site is important for the following species:

Species Common Name	Species Scientific Name	IUCN
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	Least Concern
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	Least Concern
Freckled Duck	<i>Stictonetta naevosa</i>	Least Concern
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	Least Concern
Grey Teal	<i>Anas gibberifrons</i>	Least Concern
Australasian Shoveler	<i>Anas rhynchotis</i>	Least Concern
Hardhead	<i>Aythya australis</i>	Least Concern
Black-tailed Native-hen	<i>Gallinula ventralis</i>	Least Concern
Eurasian Coot	<i>Fulica atra</i>	Least Concern
Banded Stilt	<i>Cladorhynchus leucocephalus</i>	Least Concern
White-headed Stilt	<i>Himantopus leucocephalus</i>	Least Concern
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>	Least Concern
Red-caped Plover	<i>Charadrius ruficapillus</i>	Least Concern
Whiskered Tern	<i>Chlidonias hybridus</i>	Least Concern
Caspian Tern	<i>Hydroprogne caspia</i>	Least Concern

The site is important for providing habitat for the nomadic bush-bird species listed in the following table, during the dry southern Australian summer period (November to March)

Species Common Name	Species Scientific Name
Cockatiel	<i>Nymphicus hollandicus</i>

Budgerigar	<i>Melopsittacus undulatus</i>
Pallid Cuckoo	<i>Cuculus pallidus</i>
Fan-tailed Cuckoo	<i>Cuculus pyrrhophanus</i>
Black-eared Cuckoo	<i>Chrysococcyx osculans</i>
Horsfield's Bronze Cuckoo	<i>Chrysococcyx basalis</i>
Red-backed Kingfisher	<i>Halcyon pyrrhopygia</i>
Whited-breasted Wood Swallow	<i>Artamus leucorhynchus</i>
Black-faced Wood Swallow	<i>Artamus cinereus</i>
White-winged Triller	<i>Lalage sueurii</i>

Criterion 5 *Provides habitat that regularly supports 20,000 or more waterbirds.*

Due to the rehabilitation of a number of wetland sites within the Riverland Ramsar site, the area regularly supports 20,000 or more waterbirds involving fifty-nine species (see Appendix III for list of species). Over 23,000 birds were counted at Lake Merreti one day in February 2002, over 18,500 at the same site in May 2001 and over 19,000 in March 2007 (Harper, unpublished data). These high numbers are from one site within the wetland – ‘whole-of-site’ numbers would be much larger but have not been gathered. The same data set displays over 8,000 birds at Lake Woolpolool in May 2001 and over 4,700 in February 2002, on the same days as high numbers were recorded at Lake Merreti.

<u>Site</u>	<u>Month & Year</u>	<u>Total Waterbird Count</u>	<u>Reference</u>
Lake Merreti	Feb 2002	>23,000*	Harper (unpub. data)
Lake Merreti	May 2001	>18,500*	Harper (unpub. data)
Lake Merreti	March 2001	>19,000*	Harper (unpub. data)

* Please note: Due to the remote nature of the site, counts were undertaken for components of the site, whole of site numbers are not available.

Criterion 6 *Provides habitat that regularly supports 1% of the global population of one species of waterbirds.*

At the Riverland wetland, Freckled Duck (*Stictonetta naevosa*), Red-necked Avocet (*Recurvirostra novaehollandiae*) and Red-kneed Dotterel (*Erythrogonys cinctus*) have been recorded at the site in numbers (at times) representing greater than 1% of the estimated global population.

Due to the size and relative remoteness of the site, counts are undertaken at components of the site rather than as a whole. Unpublished data from Harper (*pers. comm.*) show that between October 2000 and November 2002, the number of Freckled Duck on Lake Merreti exceeded 200 on three occasions (May 2001, February 2002 and November 2002), with a highest number of 620 birds in February 2002. The same unpublished data show Red-necked Avocets exceeding 1,100 at Lake Merreti on four occasions between February and May 2002, and again in October 2002; and 277 Red-kneed Dotterel at the site in March 2002. At a different part of the site - Lake Woolpolool - the number of Red-necked Avocets exceeded 1,600 in January 2002, was over 6,000 in October 2002 and greater than 2,500 in November 2002. In February 2005 numbers reached 1000 at Lake Littra.

<u>English Name</u>	<u>Scientific Name</u>	<u>Subspecies/ Population (if applicable)</u>	<u>Count (min-max)</u>	<u>1% Threshold</u>
Freckled Duck	<i>Stictonetta naevosa</i>	East Australia	>200* Max 620	250

Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>	Australia	Min >1,100* Max >6,000*	1,100
Red-kneed Dotterel	<i>Erythronyx cinctus</i>	Australia	>277*	No population data available

* Please note: counts were undertaken in a component of the site, whole of site numbers are not available and would be expected to be much greater. Source: *Waterbird Population Estimates: 4th Edition* (Wetlands International 2006).

Criterion 7 Supporting a significant proportion of indigenous fish species or families and life-history stages that are representative of wetland benefits and/or values and thereby contributes to global biodiversity.

The Riverland Ramsar site supports over half (14 of the 26) solely freshwater native fish species within the Murray-Darling Basin. As a group, these fish have adapted to significant flow and water quality variability resulting in the population displaying a high biodiversity. Nine family groups are represented within the 14 species and the population displays six different reproductive styles.

Indigenous fish species found within the Riverland Ramsar site

Family	Species	Common Name	Reproductive Style
Clupeidea	<i>Nematalosa erebi</i>	Bony bream	1
Retroppinnidea	<i>Retroppinna semoni</i>	Australian smelt	3
Plotosidae	<i>Tandanus tandanus</i>	Freshwater catfish	4
Melanotaeniidae	<i>Melanotaenia fluviatilis</i>	Crimson-spotted rainbow fish	3
Atherinidae	<i>Craterocephalus fluviatilis</i>	Murray hardyhead	3
	<i>Craterocephalus stercusmuscarum</i>	Flyspecked hardyhead	3
Percichthyidae	<i>Maccullochella peeli</i>	Murray cod	4
	<i>Macquaria ambigua</i>	Golden perch	1
Teraponidea	<i>Bidyanus bidyanus</i>	Silver perch	1
Kuhliidae	<i>Nannoperca australis</i>	Southern pigmy perch	2
Eleotridae	<i>Hypseleotris klunzingeri</i>	Western carp gudgeon	5
	<i>Hypseleotris sp. A</i>	Midgley's carp gudgeon	5
	<i>Hypseleotris sp. B</i>	Lake's carp gudgeon	5
	<i>Philypnodon grandiceps</i>	Flat-headed gudgeon	6
	<i>Philypnodon sp. 2</i>	Dwarf flat-headed gudgeon	6

Reproductive Styles:	4	eggs laid in a nest with parental care
1 pelagic (floating eggs)	5	eggs adhered to plants etc. with parental care
2 scatter eggs		
3 eggs sink and attach to plants etc, no parental care	6	eggs attached to rocks, no parental care

Criterion 8 Supplying an important source of food for fishes, spawning ground, nursery and migration path on which fish stocks, either within the wetland or elsewhere, depend.

Two of the site's fish species, the Golden Perch (*Macquaria ambigua*) and Silver Perch (*Bidyanus bidyanus*) are potamodromous i.e. truly migratory fish whose migrations occur wholly within fresh water (Mackay 1990). The Chowilla Anabranch within the Riverland wetland is an important pathway for these fish to migrate around Lock 6, a fish barrier, during low to medium flows. The site also provides fish breeding and nursery habitats in warm shallow floodwaters overlaying the extensive floodplain and wetlands during spring and early summer flood events. As the floodwaters spread over

previously dry ground there is an abundant production of plankton and subsequent proliferation of larger food organisms, all of which contribute to the diet of young fish.

15. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region: Riverina

An ancient riverine plain and alluvial fans composed of unconsolidated sediments with evidence of former stream channels. The Murray and Murrumbidgee Rivers and their major tributaries, the Lachlan and Goulburn Rivers flow westwards across this plain. Vegetation consists of River Red Gum and Black Box forests, box woodland, sedge and herb lands, saltbush shrubland, and extensive grassland and swamp communities.

b) biogeographic regionalisation scheme (include reference citation):

Interim Biogeographic Regionalisation for Australia (IBRA) "Environment Australia (2000), Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1".

16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Geology and Geomorphology – The site consists of a series of horizontal sedimentary formations ranging from Permian sandstones to Tertiary limestone. This is overlain with Pliocene Sands consisting of two extensive formations of estuarine deposits of fine to coarse sands known as the Loxton/Parilla Sands. The whole floodplain is filled with two recently deposited alluvial formations, the Monoman Formation sands overlaid by the Coonambidgal Formation clays, in which the existing river and anabranches are entrenched. The Riverland wetland is located on a very wide section (up to 10Kms) of an incised ancestral floodplain and comprises active meander plain, low relict meander plain, high relict meander plain and terrace with the upland rise and near-vertical cliffs bordering the floodplain (Hollingsworth *et al.* 1990).

Soil Type and Chemistry Range - Soil type changes greatly over the landscape with both neutral and alkaline grey self-mulching cracking clays, neutral brown siliceous sands and neutral firm grey siliceous sands dominating the ancestral floodplain (Laut *et al.* 1977).

Sediment Characteristics - Range from deep poorly drained self-mulching cracking clays to deep well drained sands and calcareous earths (Laut *et al.* 1977). There is significant variation in organic content in the wetland sediments that reflects the degree of wetland formation (Thomson 1975).

Origins - Natural

Hydrology – Before regulation with the construction of the locks and weirs in the 1930s the River Murray experienced seasons with highly variable flows. In spring and early summer the river was generally high, cool, turbid and fast flowing, gradually changing to become low, warm, clear and slow moving towards the end of summer. During times of droughts, the flow would cease completely and a series of saline pools would remain through the interception of regional saline ground water that mainly originates from the Pliocene Sands aquifer within which the Coonambidgal and Monoman Formation are incised (Sharley & Huggan 1995).

Since river regulation the River and the main anabranch systems flow continuously and many wetlands are permanently inundated due to the water level in the river having risen three metres by the

establishment of Locks 5 and 6. Regional saline ground water that has a salinity of 30,000 to 40,000mg/L Total Dissolved Solids now flows into the anabranch creeks. Up to 145 tonnes of salt per day can enter the Chowilla Anabranch system following a major flood compared to the steady background level of 43 tonnes per day, which re-establish after the effects of floods have passed (Sharley & Huggan 1995). Saline ground water mounding has occurred beneath irrigated areas adjacent to the Riverland wetland e.g. the Renmark and Chaffey Irrigation Areas contribute approximately 34 tonnes of salt per day to the Ral Ral Anabranch (Woodward-Clyde 1999).

River regulation has greatly modified the frequency, height and duration of flows through the Riverland wetland. Outside of flood events the River Murray flow into South Australia is regulated through an agreement between the five Murray-Darling Basin States and the Australian Government. South Australia has a yearly minimum allocation of 1,850 gegalitres per year of which 1,154 GL/year is allocated to consumptive use. Entitlement flows vary from month to month depending on water use requirements and can range from 7,000ML/day and greater during December and January down to 3,000ML/day and greater during May and June. Due to the topography of the River Murray floodplain within the Riverland Ramsar site, a significant river flow is required to flood the majority of the floodplain. It takes a flow greater than 50,000ML/day into the state before there is general over the riverbank flow onto the floodplain. To inundate approximately half of the floodplain an 80,000ML/day flood is required. Total inundation of the floodplain is achieved when flows reach approximately 150,000ML/day into the state.

Water Quality: is variable from site to site and is effected by periods of low and high flows, saline groundwater inflows and as a result of a drying event (Thompson 1986; Wetlands Working Party 1989; Suter et al. 1993).

Salinity (TDS): Lake Merreti: 193-1,070 mg/L, Clover Lake: 321-3,330 mg/L, Lake Woolpoolool: 1,710-44,000 mg/L (Suter et al. 1993), River channel Lock 5: 215-452 mg/L, (Crabb 1997), Pilby Lagoon: 200-343 mg/L (Tucker 2003).

Total phosphorus: Lake Merreti: 0.010-0.097 mg/L, Clover Lake: 0.015-0.086mg/L, Lake Woolpoolool: 0.027-0.256 mg/L (Suter et al.1993), River channel Lock 5: 0.032-0.440 mg/L (Crabb 1997).

pH: Lake Merreti: 7.6-9.1, Clover Lake:7.9-9.9, Lake Woolpoolool: 7.4-9.8 (Suter et al. 1993).

Turbidity: Lake Merreti: 20-430 NTU, Clover Lake: 45-200 NTU, Lake Woolpoolool: 3.6-90 NTU (Suter et al. 1993), River channel Lock 5: 9.5-530 NTU, (Crabb 1997) Pilby Lagoon: 15.5-437 NTU (Tucker 2003).

Depth, Fluctuations and Permanence of Water: Due to the range of different wetland types at the site, water depth can vary greatly. Examples of water depth are; main river 4-8m, anabranch creeks 1-3m, permanent wetlands <1-2m and temporary wetlands 1-2m. Since the construction of Locks 5 and 6 the river, main anabranch systems and many wetlands are permanently inundated, with little water fluctuation occurring throughout the year, except during flood periods. For many temporary wetlands the reverse is true with areas receiving water less often and for shorter durations. Flooding which can occur during spring and early summer will inundate the site to varying degrees, depending on the quantity of floodwater. Generally the floodplain will begin to become significantly inundated once general over the bank flows occur at approximately 50,000ML/day flow into the site. These flows now only occur on an average once in 3 to 5 years.

Downstream Area: Once the River Murray flows through the Riverland wetlands it continues down through the Mallee Trench for another 144kms where it then enters the Mallee Gorge. The river

flows through the gorge for 280kms before entering the terminal Lakes Alexandrina and Albert. From there it enters the Northern Lagoon of the Coorong before making it's way into Encounter Bay and then the Southern Ocean.

Climate: The site has a temperate climate with cool winters and warm to hot summers. Diurnal and seasonal temperature variations can be significant as the area is considered to be within the southern extension of Australia's central arid zone. Average summer maximum temperature is 31.6°Celsius and minimum 16° Celsius. In winter months these fall to 17° Celsius and 5.5° Celsius, respectively.

Based on records for the last 100 years annual rainfall is low and irregular, varying between 100mm and 550mm, but averaging 260mm per annum, with a slight winter and spring predominance. Drought occurs frequently but there is no clear pattern in occurrence of good years and drought (Sharley & Huggan 1995). Average annual evaporation is 1960mm.

17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

Surface Area: The Murray-Darling Basin occurs within five states of Australia and has a surface area of 1.06 million square kilometres (14% of Australia). The River Murray is 2,530km long from its source in the Australian Alps to its mouth on Encounter Bay. The Riverland Ramsar site is located approximately 568Km from the Murray Mouth at Encounter Bay.

General Geology and Geomorphological Features: Much of the Basin is flat, largely comprising aeolian and alluvial deposits of sands, silts and clays. An outcrop of folded metamorphic rocks extends northwest across the centre of the basin and provides slightly elevated relief. The highlands bordering the east and south occur where metamorphic and igneous rocks outcrop, providing the greatest relief in the basin. Sandstones and other sedimentary rocks also outcrop in the Basin (Murray-Darling Basin Ministerial Council 1987).

The River Murray traverses five distinct geomorphological regions (Mackay & Eastburn 1990) of which the Riverland Ramsar site is located in the The Mallee Trench;

The Headwaters: with its source in the Snowy Mountains and covers about 450 river kilometres. It comprises less than 2% of the basin but contributes nearly 40% of the river inflow.

The Riverine Plains: a vast, flat tract of river and lake deposits where the River flows in shallow, branching channels covering about 800 river kilometres.

The Mallee Trench: a wide plain of marine origin crossed by the River in a single, well-defined channel which cuts deeper into the surrounding plain as it moves downstream for another 850 river kilometres.

The Mallee Gorge: here the River has cut down through hard limestone rock during a period of low sea level, forming steep cliffs along the river channel for a distance of 350kms.

The Lakes and Coorong: The terminal lakes, Lake Alexandrina and Albert, together with the Coorong once formed a huge estuarine system. Barrages now separate the lakes and Coorong and retain fresh water in the lakes.

General Soil Types: In the east where the Great Dividing Range is close to the coast, higher rainfalls produce acid leached soils. Shallow stony loams and well-structured red and brown soils occur on the steeper slopes. Yellow and red textured contrast soils dominate the tableland areas, but where basic volcanic rocks are found, there are areas of deep, fertile red clay loams and black cracking clays (Murray-Darling Basin Ministerial Council 1987).

On the western margins, soils range from skeletal to desert loams in the northwest to red-brown earths and other highly calcareous soils in the southwest. On the westerly draining plains of the Basin's

northern rivers there are extensive areas of fertile black cracking clay soils. In contrast, the plains of the Basin's southern rivers have poorer grey and brown clay soils. These alluvial plains occupy one-third of the Basin (Murray-Darling Basin Ministerial Council 1987).

General land Use: The Murray-Darling Basin has a population of 2 million people, however, except for a few areas such as the nation's capital Canberra, it is sparsely populated. Agriculture is the dominant economic activity in the Basin and is Australia's most important agriculture region. Most of the basin's area is devoted to pastoral and dryland farming (sheep, cattle and grain crops). However there are parts of the Basin where irrigation dominates the landscape and involves the growing of pasture, fodder and grain crops, cotton, and horticulture crops. Almost 75% of Australia's irrigated crops occur in the Murray-Darling Basin. Forestry, mining and electricity generation are also significant economic activities within the Basin. The Basin provides just over 41 percent of Australia's gross value of agriculture production. In addition to the water needs of agriculture, the Basin's rivers provide drinking water for over three million people, more than one third of whom live outside its borders (Crabb 1997).

Climate: The Murray-Darling Basin extends from 24 degrees to about 38 degrees south latitude, with climate patterns typically inland sub-tropical in the north, cool and humid in the eastern highlands, temperate in the south, and dry and hot inland from the ranges. Rainfall varies from over 1400mm per annum in the highlands to below 300mm in the west and northwest, with the annual variability of rainfall increasing towards the inland. Virtually the entire Basin experiences droughts and floods from time to time. Temperatures range from average summer maxima in the northwest of over 30° Celsius down to winter maxima averaging less than 0° Celsius in the alpine areas. Annual evaporation rates in the alpine areas are approximately equal to annual rainfall but elsewhere potential evaporation far exceeds rainfall (Murray-Darling Basin Ministerial Council 1987).

18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

The aquatic vegetated backwaters adjacent to the main River Murray channel can trap sediments, and their complex food chains are capable of using up nutrients, thus reducing the risk of toxic blue-green algae blooms further down stream.

Large dry wetlands such as Coombool Swamp and Lake's Limbra and Littra within the Riverland Ramsar site are able to absorb large volumes of water during periods of floods. They slow the rate at which floodwaters rise and cause flood peaks at lower levels than if water was confined to the main channel.

Floodwater is stored in Lake Merreti and through agreement with local irrigators and water managers is released to dilute flows down Ral Ral Creek, once salinity levels following the flood recession become elevated.

19. Wetland Types

a) presence:

Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

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)

b) dominance:

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

Xf – Freshwater, tree-dominated wetlands; (approximately 4032 hectares) scroll floodplain landform which supports River Red Gum forest and woodland (e.g. opposite Bunyip Reach and Nil Nil).

M - Permanent rivers/streams/creeks; (approximately 1845 hectares) active floodplain channels (e.g. River Murray, Chowilla and Ral Ral Anabranh systems)

P – Seasonal/intermittent freshwater lakes; (approximately 770 hectares) deflation basins (e.g. Coombool Swamp and Lake Limbra) and lentic channels such as ancestral river oxbows (e.g. Punkah Island Horseshoe Lagoon)

O – Permanent freshwater lakes; (approximately 535 hectares) deflation basin (eg Lake Merreti) and lentic channels such as oxbows (eg Isle of Man) and remnant channels (eg Woolenook Horseshoe Lagoon)

Tp – permanent freshwater marshes/pools; (approximately 343 hectares) scroll swales (eg Nil Nil), slack water areas (eg Chowilla Anabranh), discrete depositional basins (eg Pilby Creek complex) Interconnected depositional basin (eg Bunyip Reach), impounded wetlands (eg Whirlpool Corner) and miscellaneous floodplain depressions (eg Weila/Murtho Park)

R – Seasonal saline/brackish lake; (approximately 330 hectares) Lake Woolpoolool a deflation basin which was salinised in the 1950's due to land management practices.

N – Seasonal/intermittent/irregular rivers/stream/creek; lentic channels such as distributary channels and “crevasse” channels (eg Reny and Chowilla islands)

Ts – seasonal/intermittent freshwater marshes/pools on inorganic soils; discrete depositional basins (eg Longwang Island), lentic channels such as remnant channels (eg Brandy Bottle Waterhole) and miscellaneous floodplain depressions (eg Gum Flat)

20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

The Riverland Ramsar site has a rich diversity of both terrestrial and aquatic habitats. Terrestrial habitats range from forest, woodland shrubland, herbfield and grassland areas. On the floodplain these habitats can intermittently become aquatic systems for varying degrees of time depending on the size and length of a flood event and the elevation of the particular habitat. The truly aquatic habitats range from deep to shallow open freshwater areas, saline shallow open water to shallow and deep freshwater marshes.

The major vegetation types within the wetland are:

River Red Gum *Eucalyptus camaldulensis* forest/woodland over low open shrubs of Ruby Saltbush *Enchylaena tomentosa*, Nitre Goosefoot *Chenopodium nitrariaceum* or Spreading Emu-bush *Eremophila divaricata* or with forb +/- sedge +/- grass understorey or floating freshwater aquatic herbland.

Black Box (*Eucalyptus largiflorens*) woodland with either ephemeral forb/grass, chenopod shrubland dominated by *Atriplex* and *Sclerolaena* spp. or Pigface *Disphyma clavellatum* understorey.

Lignum (*Muehlenbeckia florulenta*) shrubland +/- River Red Gum, Black Box and River Cooba *Acacia stenophylla* and/or a understorey of herbland or grassland.

River Saltbush (*Atriplex rhagodioides*) chenopod shrubland.

Low chenopod shrubland dominated by *Atriplex* and *Sclerolaena* spp.

Sapphire low shrubland dominated by *Halosarcia indica*, *H. pergranulata* and *Pachycornia triandra*

Herbfield dominated by *Calocephalus sonderi*, *Plantago cunninghamii* and *Lepidium* spp., or grassland dominated *Bromus rubens* and *Vulpia* spp. and /or *Sporobolus mitchellii*

The permanently inundated wetlands such as creeks and billabongs are often fringed by; Common Reed (*Phragmites australis*), Spiny Sedge (*Cyperus gymnocaulos*) and Cumbungi (*Typha domingensis*). The aquatic areas themselves contain submergent vegetation such as Red Milfoil (*Myriophyllum verrucosum*) and Ribbonweed (*Vallisneria americana*).

Within the Riverland Ramsar Wetland the following numbers of native animal species have been recorded;

Fourteen species of fish ranging from Murray Cod (*Maccullochella peelii*) and Golden Perch (*Macquaria ambigua*) that are sought after by recreational fishers to the small fish species such as Australian Smelt (*Retropinna semoni*) and Flat-headed Gudgeon (*Philypnodon grandiceps*).

Thirty-eight reptile species which includes three turtle species, lizards such as gecko, dragon, monitor and skink species and six species of snake.

All eight frog species known to inhabit the River Murray floodplain within the region. They include Peron's Tree Frog (*Litoria peroni*), Southern Bell Frog (*Litoria raniformis*), Eastern Sign-bearing Froglet (*Crinia parinsignifera*), Eastern Banjo Frog (*Limnodynastes dumerilli*), Long-thumbed Frog (*Limnodynastes fletcheri*), Spotted Grass Frog (*Limnodynastes tasmaniensis*), Painted Frog (*Neobatrachis pictus*) and Burrowing Frog (*Neobatrachis sudelli*).

Nineteen native mammal species which includes species such as Red Kangaroo (*Macropus rufus*), Euro (*Macropus robustus*), Paucident Planigale (*Planigale gilesi*), Water Rat (*Hydromys chrysogaster*), Common Brushtail Possum (*Trichosurus vulpecula*) and Short-beaked Echidna (*Tachyglossus aculeatus*). There are also eight species of bats.

One hundred and seventy-nine species of birds of which sixty-three species are wetland dependant. (see Appendix 2 for list of wetland dependant species)

During medium to large flood events, colonial nesting waterbirds nest on both Lake Merriti and Lake Littra. Lake Merriti has the largest colonies and in a year when there is a large flood, can number over 1,000 nests of up to six breeding species. The dominant species are Australian Ibis (*Threskiornis molucca*) and Straw-necked Ibis (*Threskiornis spinicollis*). Both Ibis species also breed at Lake Woolpoolool when inundated.

Ecosystem services include; (see section 23 for more detail)

Wetland products: drinking water for humans and livestock, water for irrigated agriculture and livestock fodder,

Regulating services: flood retardation and sediment and nutrient deposition and replenishment of groundwater.

Cultural services: Aesthetic values, cultural heritage, sense of place (cultural significance), educational values, recreational fishing and hunting, water sports and activities, camping and touring and nature observation and commercial based ecotourism.

Supporting services: maintaining bioregional biodiversity, supporting an abundance of particular species, supporting a significant proportions of particular species populations, being representative of

a bioregion, supporting threaten species and being important as habitat for animal taxa as a refuge during adverse conditions.

21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

The Riverland site is located in the western-most section of the Murray-Darling Basin Drainage Division in an arid zone. This means that while some of the fauna and flora are common in the wetter areas of the bioregion, they are locally rare and play an important role in regional biodiversity.

The vegetation communities and habitats at the site sustain diverse bird assemblages, including wetland, woodland, shrubland and grassland species, and species not found elsewhere in South Australia. This reflects the habitat diversity of the site, its relatively low disturbance and its remoteness from human population centres (Carpenter 1990).

The site supports wetland and floodplain vegetation communities including arid and semi-arid hummock community, Black Box (*Eucalyptus largiflorens*) woodland, chenopod shrubland, fringing aquatic reed/sedge, herbfield, Lignum (*Muehlenbeckia florulenta*) shrubland, low chenopod shrubland, *Melaleuca* forest/woodland, River Cooba (*Acacia stenophylla*) shrubland, River Redgum (*Eucalyptus camaldulensis*) woodland, River Redgum forest, river saltbush (*Atriplex rhagodioides*) chenopod shrubland, and samphire low shrubland.

Twenty-eight significant plant species are listed at the State level under the *National Parks and Wildlife Act 1972* and inhabit the site on a permanent or seasonal basis. These are listed in Appendix VII.

Invasive species are detailed in the following table:

Weeds of environmental significance

Common name	Scientific name
African Boxthorn	<i>Lycium ferocissimum</i>
Prickly Pear	<i>Opuntia spp.</i>
Bathurst Burr	<i>Xanthium spinosum</i>
California Burr	<i>Xanthium californicum</i>
Golden Dodder	<i>Cuscuta campestris</i>
Willow trees	<i>Salix sp</i>
Poison Buttercup	<i>Ranunculus sceleratus</i>
Lippia	<i>Phyla canescens</i>

22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

As indicated under section 14, the Riverland site supports the following nationally threatened species defined under section 179 of the Australian “*Environment Protection and Biodiversity Conservation Act 1999*”:

- Regent Parrot (Eastern) (*Polytelis anthopeplus monarchoides*) listed as Vulnerable
- Australiasian Bittern (*Botaurus poiciloptilus*) listed as Endangered
- Southern Bell Frog (*Litoria raniformis*) listed as Vulnerable
- Murray Cod (*Maccullochella peeli*) listed as Vulnerable

- Murray hardyhead (*Craterocephalus fluviatilis*) listed as Endangered.

The Riverland site provides critical summer or stopover habitat for migratory birds listed under the international migratory bird agreements. Species include the Red-necked Stint (*Calidris ruficollis*) and the Sharp-tailed Sandpiper (*Calidris acuminata*).

The site is also habitat for nomadic waterbirds during times of drought in central and eastern Australian when the areas wetlands dry. Species include the Pink-eared Duck (*Malacorhynchus membranaceus*), White-headed Stilt (*Himantopus leucocephalus*), Red-caped Plover (*Charadrius ruficapillus*) and the Whiskered Tern (*Chlidonias hybridus*).

Significant fauna species listed at a State level and inhabiting the site on a permanent or seasonal basis are displayed in Appendix 5.

Invasive mammal species are listed in the following table:

Common name	Scientific name
European red fox	<i>Vulpes vulpes</i>
Feral cat	<i>Felis catus</i>
Feral pig	<i>Sus scrofa</i>
European rabbit	<i>Oryctolagus cuniculus</i>
European hare	<i>Lepus capensis</i>
House mouse	<i>Mus domesticus</i>
Black rat	<i>Rattus rattus</i>

23. Social and cultural values:

a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

Socio-economic values - There has been a long history of recreational fishing of both native and introduced fish along the River Murray and backwaters within the Riverland Ramsar site. The area provides an exceptional location for a range of tourism and recreational such as bush camping, fishing, boating, house boating and accommodation in shearers quarters. The area is also recognised as being the most valuable of all areas in South Australia for the canoeing component of outdoor educational programs for secondary schools, tertiary educational classes and youth agencies. Significant environmental scientific research has been undertaken throughout the Riverland wetland over the last 10 to 15 years, primarily due to both the Chowilla floodplain integrated natural resource management program in the early 1990's and more recently through the Riverland Biosphere Reserve program and activities associated with Chowilla being dedicated a Significant Ecological Asset under Murray-Darling Basin Commission's program - The Living Murray.

Due to the continuity of the Riverland wetlands with the Murray-Darling Basin, the water resource flowing down this section of the River Murray has been the catalyst for the regions economic development, whether the pastoral industry or riverboat trade during the 1880's, or the high tech irrigation industry of the present day.

Historical/Archaeological - The Riverland region has a rich cultural history, both in terms of its occupation by Aboriginal people that goes back some 12,000 years and its relatively recent exploration and occupation by European settlers some 150 years ago. This has resulted in a number of both Aboriginal and European heritage sites located across the Riverland Ramsar site and beyond.

Prior to European settlement the Maraura, Ngintait and Erawirung Aboriginal groups occupied the area. The Aboriginal population had a strong ritualist culture, with strict spiritual laws and taboos. They had a keen understanding of plants and animals and incorporated the physical features of the land into their rich mythology. They were skilled craftsmen, making reed baskets and reed and grass nets that were used to catch fish and waterfowl. They also made canoes from the bark of River Red Gum trees. Possums, kangaroos, mussels, yabbies and turtles were eaten along with Cumbungi (*Typha spp.*) tubers and bulrush sprouts and seeds that were often ground into flour. Possum skins were sewn with tendons from kangaroo tails and used as cloaks. Turtle shells were used to carry water. Even before the arrival of European settlers to the region, smallpox and other diseases spread down the River Murray causing considerable loss of life. A large number of sites of Aboriginal significance have been identified throughout the Riverland wetland. As rocks are rare on the floodplain, burnt clay was used to retain heat for baking. Scattered lumps of burnt clay and “middens” of mussel shells mark old Aboriginal campsites. Other sites of significance include burial sites, scarred trees and isolated artefacts.

The first Europeans to settle in the region were pastoralists in 1846 that were known as “squatters”. The first pastoral lease over the region north of the river, known as Chowilla Station was issued in 1851. In 1864 after the lease had changed ownership several times, Richard Holland obtained the lease for his three stepsons (the Robertson’s) who were the descendants of the present day lessees of Chowilla Station. The biggest tally of sheep shorn at Chowilla Station was in 1881 when 30 hand blade shearers sheared 70,250 sheep. The first recorded owner of the area south of the river between where Renmark Township is located and the Victorian border was E. M. Bagot. In 1887 the South Australian Government set 30,000 acres of the downstream end of Chowilla that was then known as Bookmark for an irrigation area to be controlled by the Chaffey Brothers. However by 1893 the State Government passed the *Renmark Irrigation Trust Act*, which placed the control of the water in the hands of the settlers, not the Chaffey Brothers. The town of Renmark was laid out on this land in 1886. The Robertson partnership dissolved in 1896 and the Chowilla/Bookmark property was split to create the Chowilla and Calperum Stations.

In the 1880’s Longwang Island and the southern portion of Bulyong Island on the Ral Ral Anabranche became a community commonage for the settlement of Renmark. At the end of World War I the commonage was leased to the Returned Servicemen League for horse grazing agistment. In 1967 an irrigation evaporation basin was established in the centre of Bulyong Island that received drainage water from the Renmark and Chaffey Irrigation areas. The drainage basin was decommissioned after the flood of 1989 breached the basin embankment. The Bulyong and Longwang Islands have subsequently become part of the River Murray National Park.

The south side of the River settlement was also becoming more advanced with the establishments of the Hundreds of Murtho and Paringa being proclaimed in 1893. Between May 1942 and May 1945 a Prisoner of War wood cutting camp functioned at Woolenook Bend in the Murtho Forest Reserve. The camp held 243 Japanese internees. Reports from this period state that black box densities were reduced by wood cutting to 1 to 2 trees per acre in the Forest Reserve (PIRSA 1997). However, Black Box has a remarkable capacity to re-sprout after being logged and many of the trees that were harvested during this period did not die and can be identified on the floodplain by the multi stem growth pattern and large scars on the trunks. A great majority of the black box within the Riverland Wetland was logged. The timber was used for fences, buildings and vineyard trellises and to supply fuel for the Renmark irrigation pumps, electricity generators, domestic needs and passing steamboats.

Prior to the establishment of the Commonwealth of Australia in 1901 “Littra House” was built in 1871 on the northern side of the river on the NSW border to house the Stock Inspector. An Inspector had been stationed at the site since 1863 to prevent the entry of the dreaded sheep disease, Scabby Mouth into South Australia. Before the disease was eradicated, some hundreds of thousands of sheep were inspected as they were driven west. The house later became a Customs House of which the

ruins still stand. On the south side of the River a Customs House was established in 1884 adjacent to the Victorian Border at Border Cliffs as an inspection point for river trade between States. The house is to this day still occupied but has been modified.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box and describe this importance under one or more of the following categories:

- i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
- iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

24. Land tenure/ownership:

a) within the Ramsar site:

- Murtho Forest Reserve 1,709 hectares, South Australian Government – Primary Industries and Resources SA.
- River Murray National Park (Bulyong Island section) 2,382 hectares, South Australian Government – Department for Environment and Heritage.
- Part Chowilla Game Reserve 14,916 hectares, South Australian Government – Department for Environment and Heritage and leased to Robertson-Chowilla Pty Ltd.
- Part Calperum Station 8,500 hectares, South Australian Government Pastoral Lease - invested in Director National Parks, Australian Government Department of the Environment and Water Resources.
- Crown land, South Australian Government - vested in the Minister for Environment and Conservation, River Murray channel (793ha) and the 150 link wide reserve for public use along the majority of the River's southern bank that became the practise to retain after 1898.
- Local Government 9 hectares – District Council of Renmark Paringa
- Privately owned land, 2,306 hectares involving a number of companies, partnerships or individual owners.

A map of land tenure is provided at Appendix 3.

b) in the surrounding area:

To the north is Chowilla Regional Reserve owned by the South Australian Government - Department for Environment and Heritage and the continuation of Calperum Station a pastoral lease owned by the Australian Government. Privately owned or local government (Renmark Paringa District Council) land adjoins the remainder of Ramsar site.

25. Current land (including water) use:

a) within the Ramsar site:

The dominant land use of the Riverland Ramsar site is biodiversity conservation (27,213ha) that is under Australian, State and Local Government or private ownership. Stock grazing, predominantly sheep, is the next largest land use within the Ramsar site and involves an area of 3,370 hectares.

A limited number of commercial fishers have been issued a license to take Common Carp, Bony Bream (*Nematalosa erebi*) (a common native fish) and other non-native species from the backwaters of the River Murray in South Australia using a gill net. A number of sites within the Riverland Ramsar site are available for the commercial utilisation of these fish species.

Approximately 70 domestic or irrigation pumps take water from the main channel, backwaters or anabranch creeks within the Riverland wetland.

Two small irrigation based enterprises exist within the Ramsar site a vineyard (32ha) and an irrigated pasture (37ha).

The site supports a significant tourism industry that relies on the wetland's values for survival. Tourism operators supply the following products; houseboat hire, nature based boat and vehicle tours, pastoral industry tours and on-site accommodation. Visitor recreational pursuits are dominantly centered on water-based activities such as fishing, pleasure craft boating, bush camping, canoeing, waterfowl hunting, water-skiing and driving tours.

Over the last 20 years extensive research and monitoring has been undertaken at a number of sites throughout the Riverland Ramsar site. Efforts have focused on ecosystem and threatening processes and the interactions of management.

b) in the surroundings/catchment:

Irrigation pumps located within the Ramsar site supply water to the Cooltong/Chaffey Irrigation Area (1,118 ha), private irrigators from the Ral Ral Anabranch and the Paringa/Murtho area (4,000ha) to irrigated adjacent crops. The dominant horticulture enterprises involve vines and orchards with small areas of vegetables and sown pastures. Dryland farming also occurs to the south of the site and involves cereal grain crops, pastures for hay and livestock. To the north lies Chowilla Regional Reserve that supports a commercial pastoral operation and the remainder of Calperum Station that is managed for biodiversity outcomes.

Located adjacent to the Riverland wetland are the towns of Renmark and Paringa with a district population of over 9,800.

See section 25 for current land use within the catchment

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

a) within the Ramsar site:

Alteration to the natural hydrological regime - The river, main anabranch systems and many wetlands within the Riverland wetland became permanently inundated as a result of the construction of Weir 5 and 6 in 1927 and 1930 respectively. The Slaney Creek and Pipeclay Creek weirs were also constructed during the same era. Weir construction raised the water level of the river approximately three metres and has allowed the maintenance of stable water levels to favour water extraction, navigation and minimise saline inflows from riverbanks and wetlands directly connected to the river. Ecological impacts consist of; no natural summer drying leading to loss of ephemeral habitats, reduced range of bank habitats, loss of in-stream habitat diversity necessary to maintain biological diversity, barrier to fish passage, degradation of natural low flow channel shape and thermal stratification that develops anoxic bottom water that favours cyanobacteria. Artificially high water levels have also raised saline ground water levels into the root zone of floodplain vegetation, causing dieback and soil scalding. Basin wide flow regulation has created additional hydrological impacts such as constant flow for sustained periods, unseasonable flow and increased minimum flow. The

construction of weir pools within the Riverland Ramsar site has to a major extent masked these ecological impacts.

River regulation has greatly modified the frequency, height and duration of flood events. Under natural conditions a flood event that would cover approximately 40% of the floodplain that would have happened on an average every two years for a period of nearly four months, has been reduced to once every three years on average for just less than three months. However with a flood that would cover approximately 80% of the floodplain it would under natural conditions, happen every four years on average for a period of over two months, has now been reduced to once every 20 years on average for three months. Ecological impacts include; reduced and even loss of species requirements for reproduction and regeneration, loss or redistribution of habitats, reduced exchange of organic material and carbon, nutrients, sediment, etc., between floodplain and river, and reduced flushing of salt from floodplain soils and freshwater recharge.

The floodplain hydrology has also been impacted through flow restrictions between the main river channel and the floodplain by the construction of levee banks and blockages on anabranch creeks and other channels. Ecological impacts are similar to reduced frequency, height and duration of flood events that leads to diminished area and quality of wetland and floodplain habitats.

Reduced water quality

To maintain agreed water flow entitlements into South Australia throughout the summer period, stored water located in New South Wales from both the Menindee Lakes (when water is available) and Lake Victoria is accessed. Water from both storages can have significant impact on the ecology of the main river channel and the adjoining wetlands. The out of season high turbid water from the Menindee Lakes impacts on in-stream productivity while water from Lake Victoria can at times adversely affect fish health (Pierce 1990).

Increased salinity

Floodplain soils and surface water have become increasingly saline due to the mobilisation of underlying saline ground water. The floodplain can now be regarded as a net discharger of salt instead of a net recharger. These changes have placed the riparian vegetation under great stress and in many areas have caused extensive vegetation death. Factors affecting the upward movement of saline ground water are; the hydraulic pressure exerted by Weirs 5 and 6 on the River Murray, increased regional ground water recharge from wide spread land clearing, recharge from ground water mounds under adjoining highland irrigation areas and reduced frequency and length of floodplain inundation since river regulation. At Lake Woolpoolool, an embankment and inlet structure was built to control the hydrology of the wetland that enabled the lakebed to be irrigated for cropping. Further degradation of this site occurred when attempts were made to prevent water entering the lake during the historically high flood of 1956. These actions caused regional saline ground-water to rise followed by salinisation of the Lake and surrounding floodplain. Salinity across the Ramsar site varies considerably, resulting in areas where species such as River Red Gum and Black Box die back during periods of drought, through to a total change in the landscape to a saline system dominated by dead trees and Samphire low shrubland.

Introduced fish

Evidence indicates that both Common Carp (*Cyprinus carpio*) and Plague Minnow (*Gambusia affinis*) are significantly impacting on the aquatic ecology of the wetland. Carp through the displacement of shallow rooted aquatic macrophytes and increased water turbidity attributed to their feeding behaviour and the competition with small native fish for food and habitat and predation of frog eggs, fry and tadpoles. The aggressive Plague Minnow is a well-recognised threat to small native fish like the Carp Gudgeon that they attack, and compete with for resources as well as consuming their eggs and young. They are also known to have adverse effects on macro-invertebrate populations and are considered a

major factor in the decline of several species of frogs including the Southern Bell Frog, which is listed as vulnerable in Australia.

De-snagging

In the early settlement days of South Australia, the River Murray was used extensively for navigation purposes in the transporting of freight. Both sand bars and snags posed navigational hazards during times of low river flows. Attempts by governments and vessel operators to remove snags for the navigational path are recorded as far back as the 1850's. The South Australian Government river work boat the P. S. Industry removed 3 million snags along the South Australian section of the River Murray between 1911 and the late 1960's. (Thoms *et. al.* 2000) indicates that the records of snag removal along the River Murray are roughly equivalent to 2,500 snags for each river kilometre. In recent years de-snagging the River Murray navigational path continued in an endeavor to supply safe boating for large pleasure craft. During the mid 1960's extensive snag removal was undertaken throughout the upper end of the Ral Ral Anabranh to facilitate water flow to the Chaffey Irrigation Pumping Station. The most common snag in the main river channel and anabranh creeks is the result of a fallen River Red Gum. Woody debris and snags are an important structural habitat not only in waterways and wetlands but also along lentic channels and on the floodplain during floods. Snags create diverse water depths and velocities and supply critical habitat for aquatic biota, such as fish, macroinvertebrates and biofilms. Above water, snags are habitat for other aquatic and terrestrial animals such as waterbirds, tortoises and water rats. Thoms *et. al.* (2000) indicates that an adequate density of snags is about 12 large snags from native trees (mostly River Red Gum) per 100 metres of bank.

Excessive grazing pressure by domestic stock, feral herbivores and abundant native animals

Eleven per cent of the Riverland wetland is grazed by domestic stock. Populations of feral herbivores such as Pigs (*Sus scrofa*), Goats (*Capra hircus*), European Rabbits (*Oryctolagus cuniculus*) and European Hares (*Lepus capensis*) vary across the site considerably. Density of feral animals depends on the control effort by the individual landowner, and the area's location within the landscape. For example the floodplain to the north of the River Murray is more susceptible to invasion by feral goats than the southern floodplain due to the area adjoining the eastern district pastoral zone. Both the Red Kangaroo (*Macropus rufus*) and Western Grey kangaroo (*Macropus fuliginosus*) densities are highly variable both between locations and over time with one area having densities ranging from 36 to two kangaroos per Km² within a 12 month period. High density grazing by a combination of domestic, feral and/or native herbivores or just one herbivore species can greatly suppress regrowth of native vegetation. Combined with increased soil salinity and reduced flood inundation, high density grazing by herbivores can reduce the ability for regeneration and cause changes in native vegetation species and structure, destroy the value of river bank habitat for invertebrates and fish and increase river bank instability.

Loss of Native Species

Although the local historical information is limited, most sources recognise that major changes to South-eastern Australia's fauna has occurred since European settlement. The knowledge of the previous mammal fauna in this region is almost completely limited to an expedition led by William Blandowski in 1856-57 to the junction of the Murray and Darling Rivers, about 100km to the east of the Riverland Ramsar Site. The Blandowski expedition recorded 29 species of mammals (not including bats) of which 17 are now locally extinct (58%) and five are totally extinct (17%). Groups of species such as the small wallabies (*Macropus* and *Wallabia* sp.) bettongs (*Bettongia* sp.) and bandicoots (*Isodon* and *Perameles* sp.) are now not found in this region. The precise time of the disappearances is not known, however they probably disappeared within the first few decades of settlement. It is speculated that the main cause of extinctions of medium size mammals throughout South-eastern Australia was due to the impacts of grazing by introduced stock, exacerbated by the invasion and rapid population increase of Rabbits. Other factors such as predation from introduced carnivores such as Foxes and Cats and disease would have also impacted on native fauna. Evidence

suggests that a number of bird species have also disappeared from the region. Species that once inhabited the Riverland floodplain and associated wetlands are Azure Kingfisher (*Alcedo azureus*), Brolga (*Grus rubicundus*), Magpie Goose (*Anseranas semipalmata*), and Spotted Bowerbird (*Chlamydera maculata*). Fish species such as River Blackfish (*Gadopsis marmoratus*), Trout Cod (*Maccullochella macquariensis*) and Purple-spotted Gudgeon (*Mogurnda adspersa*) and the Murray Crayfish (*Elasticus armatus*) have also become locally extinct.

Introduced pest plant species

A floodplain vegetation survey conducted during 1988 and 1989 on one of the major pastoral properties (Chowilla) within the Riverland wetland revealed a significant proportion (22%) of the 307 species of vascular plants were introduced (O'Malley & Sheldon 1990). The majority of these introduced species were ephemeral forbs or grasses that are dependent on seasonal rainfall or flooding events for their growth. Greater than 50% of these species corresponded to localities that had been exposed to intensive pastoral activities. The most frequently recorded introduced species during the survey came from either the grass or composite (daisy) families (O'Malley & Sheldon 1990). A number of introduced plant species are of significant environmental and/or economic concern. They are: African Boxthorn (*Lycium ferocissimum*), Bathurst Burr (*Xanthium spinosum*) and California Burr (*Xanthium californicum*), Golden Dodder (*Cuscuta campestris*), Prickly Pear (*Opuntia spp.*), Willows (*Salix sp.*) and Poison Buttercup (*Ranunculus scleratus*).

African Boxthorn (*Lycium ferocissimum*) is scattered at low density throughout most of the vegetation types within the high level floodplain. Prickly Pear (*Opuntia spp.*) is predominately located in large patches along the southern margin of the floodplain adjacent to the sandstone cliffs. The Bathurst Burr (*Xanthium spinosum*), California Burr (*Xanthium californicum*) and Golden Dodder (*Cuscuta campestris*) are found throughout the seasonal/intermittent wetlands and the areas of the floodplain that flood regularly. Both plants have patchy distribution at low to high densities within grassland, Lignum and River Red Gum vegetation communities. Willow trees (*Salix sp.*) have established along sections of the banks of both the River Murray main stream and the Ral Ral Anabranck system creeks. Willow trees impact on stream ecology and morphology, and floodplain landscape values. Poison Buttercup (*Ranunculus scleratus*) has only just been discovered in the region and presently has a small distribution along the margins of the wetlands on Chowilla Island and Queens Bend. All six species impact or displace native plants

Introduced animals

A significant number of introduced mammal, bird and fish species inhabit the Riverland wetland including:

Mammals - European Rabbit (*Oryctolagus cuniculus*), European Hare (*Lepus capensis*), Red Fox (*Vulpes vulpes*), House Mouse (*Mus domesticus*), Black Rat (*Rattus rattus*), Feral Pig (*Sus scrofa*), Feral Goat (*Capra hircus*), and Feral Cat (*Felis catus*).

Birds - Rock Dove (*Columba livia*), Common Starling (*Sturnus vulgaris*) and House Sparrow (*Passer domesticus*).

Fish - Common Carp (*Cyprinus carpio*), Goldfish (*Carassius auratus*), carp and goldfish hybrids, European Perch (redfin), (*Perca fluviatilis*) and Plague Minnow (*Gambusia affinis*).

Both Foxes (*Vulpes vulpes*) and Cats (*Felis catus*) are well established throughout the Riverland wetland. To varying degrees these two introduced predators are a major threat to most ground and lower shrub strata dwelling fauna species. Threatened species within the Ramsar site that are at significant risk from predation from these two introduced predators, are species such as Broad-shell Tortoise (*Macrochelodina expansa*), Carpet Python (*Morelia spilota*), Brush-tailed Possum (*Trichosurus vulpecula*) and Bush Stone-curlew (*Burhinus grallarius*).

Unsustainable recreational use

A significant proportion of visitation to the site is via pleasure craft such as houseboats and aluminum dinghies using the main stream of the River Murray and aluminum dinghies and canoes accessing the anabranch creek systems. State laws enable unrestricted public access to waterways from the main river channel regardless of the type of land tenure and/or ownership. The 150-link public access reserve along most of the privately owned River Murray frontage is a considerable public asset, which visitors usually access by boat. The land tenure of the 150 Link Reserve is “crown land” and the State Government Department responsible for managing the area, the Department for Environment and Heritage does not have the appropriate legal powers and/or resources to effectively manage the recreational use of this strip of river frontage.

The majority of vehicle-based access is centered on government owned land such as Chowilla Game Reserve, Murtho Forest Reserve and Calperum Station. Active management of visitor activities within these lands is undertaken however the lack of sufficient resources and a social resistance to change has reduced the ability of land managers to implement effective sustainable policies and practices.

Management issues associated with recreational activities include;

- sanitation and waste disposal;
- denudation of sites through soil compaction and firewood removal;
- destruction of vegetation through the establishment of camping sites, firewood collection, indiscriminate boat mooring in natural areas and acts of vandalism,
- vehicle and motorbike track proliferation,
- uncontrolled pets,
- interference with private property,
- disturbance to colonial nesting waterbirds from boating, and
- river and creek bank erosion and sedimentation from wave wash resulting from boating activities, particularly associated with large vessels.

While many impacts are clearly visible, low level and/or cumulative impacts can also cause significant environmental damage over time due to the nature of the recreational activity and the semi arid conditions of the site.

b) in the surrounding area:

A recent environmental audit of the rivers within the Murray-Darling Basin (Norris *et.al.*2001) determined river condition by rating from good to extremely poor, four biotic features and eight environmental features. The results for the river zone in which the Riverland Ramsar site is located revealed the following;

Biotic Features - macro invertebrates very poor, fish extremely poor, riparian vegetation extremely poor and wetlands no condition measure,

Environmental Features - hydrology condition poor, wetland inundation very poor, nutrient and sediment loads poor, nutrient concentrations very poor, in-stream salinity good, riverine habitat poor, bank condition very poor, catchment impacts on river poor.

Hydrological changes - Increased storage and regulatory structures throughout the Murray-Darling Basin have resulted in a significant reduction in the numbers and height of flood events. Whilst the very big floods are affected to only a limited extent the small to medium size floods have reduced dramatically on most of the catchments rivers. Very little variation in flows down the River Murray occurs throughout the year except, during flood periods. These major changes in the hydrological regime have had significant impacts on the overall ecology and health of the river system especially in the lower Murray, where most biota has been impacted.

Decreasing water quality – Water quality within the Murray-Darling Basin was historically highly variable both between locations and over time. Long term monitoring by the Murray-Darling Basin

Commission has demonstrated that salinity, turbidity and nutrient levels have increased in the lower Murray due to unsustainable land practices within the catchment and reduced environment flows. Biological diversity within the lower Murray has significantly declined due to reduced water quality.

Degraded habitat – Land use activities have modified most of the catchment resulting in degraded habitat conditions in much of the Murray-Darling Basin. Land clearing, overgrazing of native vegetation and dryland salinity are major causes of highland and floodplain habitat decline within the catchment. Along the waterways themselves the loss of riparian vegetation, changed hydrological regime and increased sand and gravel bed-load are principal components causing in-stream habitat degradation.

27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

A significant proportion of the Riverland Ramsar site is under some type of government legal protection. The areas are as follows;

- The whole of the Riverland Ramsar site is incorporated into the Riverland Biosphere Reserve, which is part of UNESCO's Man and Biosphere Program. This was established in 1994 and has an endorsed management plan dated 1999.
- Murtho Forest Reserve 1,709 hectares, gazetted 1901, managed by the Department for Environment and Heritage, South Australian Government and has a draft management plan dated 1995. The Field and Game Association of South Australia - Renmark and Berri Branch lease 437.5 ha of the reserve for hunting.
- River Murray National Park (Bulyong Island section) 2,382 hectares, gazetted 1991, managed by the Department for Environment and Heritage, South Australian Government and has an approved management plan dated 1994.
- Part Chowilla Game Reserve 14,916 hectares, gazetted 1993, managed by the Department for Environment and Heritage, South Australian Government and Robertson-Chowilla Pty Ltd and has an approved management plan dated 1995.
- Part Calperum Station 8,500 hectares invested in the Director National Parks 1993, Australian Government and managed by the Australian landscape Trust under contract to implement UNESCO's Man and Biosphere program objectives.
- Native Vegetation Heritage Agreement 90 hectares, privately owned land under State Government Native Vegetation Act Agreement.

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ; Ib ; II ; III ; IV ; V ; VI

c) Does an officially approved management plan exist; and is it being implemented?:
No, however a draft plan is being developed.

d) Describe any other current management practices:

Legal protection - Aspects of the Riverland Ramsar Site are protected and/or threats controlled by the following governmental legislation;

South Australian

- *Aboriginal Heritage Act*, 1988 – protects aboriginal sites and artifacts.
- *Development Act* 1993 - implements controls on development.
- *Environmental Protection Act* 1988 - controls pollution and waste disposal.
- *Fisheries Act* 1982 – protects and manages state fisheries.

- *Harbors and Navigation Act*, 1993 - controls boat access and use.
- *National Parks and Wildlife Act*, 1972 - protects and manages conservation sites and native flora and fauna.
- *Native Vegetation Act*, 1991 - controls the clearing of native vegetation, Heritage Agreements.
- *Pastoral Land Management and Conservation Act*, 1989 – manages land use of pastoral land.
- *River Murray Act*, 2003 – promotes the integrated management of the River and its resources.
- *Natural Resource Management Act 2005* – integrates natural resource management at a regional level.

Commonwealth Government

- *Environment Protection and Biodiversity Conservation Act*, 1999 - protects matters of national environmental significance including threatened species and ecological communities, migratory species and Ramsar wetlands.

Plans of Management - A number of catchment and local plans regulate or promote protective actions throughout and/or adjacent to the site. They are;

- Water Allocation Plan for the River Murray Prescribed Watercourse, 2002
- South Australian Murray-Darling Basin Natural Resources Management Plan 2009 , 2003 (SA Murray-Darling Basin Natural Resources Management Board .).
- Biodiversity Plan for the South Australian Murray-Darling Basin, 2001 (Department for Environment and Heritage).
- Renmark to the Border Local Action Plan, 1999 (Renmark to the Border Local Action Planning Association Incorporated).
- Murtho Land and Water Management Plan, 1999, Ral Ral Land and Water Management Plan, 1999 and Merreti Land and Water Management Plan, 1999 (Renmark to the Border Local Action Planning Association Incorporated).

A number of wetland site plans and guidelines have been developed. They are;

- Chowilla Regional Reserve and Game Reserve Management Plan, 1995.
- Murray River National Park Management Plan, 1994.
- Chowilla Resource Management Plan, 1995.
- Lakes Woolpoolool and Merreti Wetland Complex Habitat Management Plan, 2002.
- Management and Restoration Plan – Lake Woolpoolool, 2003.
- Lake Merreti - Hydrological Management Guidelines, 2002.
- Wetland Management Plans for Lakes Littra and Limbra, Werta Wert Lagoons, Slaney and Pipeclay Billabong and the Pibly Complex, 2006.
- Chowilla Floodplain Living Murray Asset Plan 6.3, 2006

Community Participation - The following community groups are involved in either the management of a particular site or issues within the Riverland Ramsar site:

- South Australian Murray-Darling Natural Resources Management Board – responsible for integrated natural resource management at a regional level, has a range of responsibilities and powers under the *Natural Resources Management Act 2005*.
- Renmark to the Border Local Action Planning Association Inc. – promotes community on ground action through the development and implementation of local Land and Water Management Plans
- National Parks and Wildlife Murraylands Consultative Committee – provides management advice to the Department for Environment and Heritage regarding Chowilla Game Reserve and the Murray River National Park.
- Friends of Riverland Parks – assist Department for Environment and Heritage staff in the management of Chowilla Game Reserve and the Murray River National Park.
- The Field and Game Association of South Australia - Renmark and Berri Branch manage under lease a section of Murtho Forest Reserve as a game reserve.

- Woolenook Wetlands Association - undertake environmental management and restoration actions within the Woolenook Bend wetland complex.
- Whirlpool Corner Wetland Group - undertake environmental management and restoration actions on the Whirlpool Corner wetland and adjacent floodplain.
- Templeton Wetland group - undertake environmental management and restoration actions on the Templeton Wetland and adjacent floodplain
- Pilby Lagoon Committee – assists the Department for Environment and Heritage in the management of Pilby Lagoon wetland.
- Community Land Management Inc. – assists Australian Landscape Trust in the management of biodiversity on Calperum Station.

The Living Murray - In 2002, the Murray-Darling Basin Ministerial Council established The Living Murray Initiative in response to concerns about the environmental and economic health of the River Murray system. The initiative involves a number of collective actions to return the system to a healthy working river. The vision of The Living Murray Initiative is:
...”*a healthy River Murray system, sustaining communities and preserving unique values.*”

In 2003 a decision was made to commit \$500m to the First Step of The Living Murray Initiative, that is, to recover 500GL of water over five years (from 2004) to improve environmental flows at six Icon Sites along the River Murray. The six sites that will benefit from the First Step are the Barmah-Millewa Forests, Gunbower-Pericoota Forests, Hattah Lakes, Chowilla Floodplain and Lindsay-Wallpolla Islands, the Murray Mouth (including the Coorong and the Lower Lakes) and the River Murray Channel.

As part of The Living Murray Initiative First Step Decision, three broad ecological objectives were identified for the Chowilla Floodplain Icon Site *to maintain high biodiversity values of the Chowilla floodplain. These are:*

- High value wetlands maintained;
- Current area of River red gum maintained; and
- At least 20% of the original area of Blackbox vegetation maintained.

The Chowilla Floodplain Icon Site has limited chance of achieving the MDBMC objectives without intervention. Through mechanisms such as weir pool manipulation, modification of existing flow control structures, the installation of new flow control structures, groundwater management schemes, wetland management including watering initiatives, land management, the recovery of 500GL/year, and by maximising water releases from local storages; it is anticipated that significant ecological benefits to the Chowilla Floodplain Icon Site will be delivered. This will help preserve the significant environmental, social and cultural heritage values of the site.

28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

As indicated in section 27 a number of governmental endorsed management plans have been developed for sites and/or cover management issues within the Ramsar site. A management plan for the Riverland Ramsar wetland that integrates existing plans, government policies and strategies is presently being developed by the South Australian Department for Environment and Heritage in conjunction with a Community Steering Group.

29. Current scientific research and facilities:

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

A number of research institutions, Universities, government agencies, private organisations and community groups are currently undertaking the following research and monitoring activities;

- Environmental flow enhancement,
- Saline groundwater distribution and impacts on river salinity and floodplain vegetation health,
- Hydrological management of wetlands and ecosystem response,

- Total grazing impacts on floodplain vegetation communities,
- Threatened species natural history and distribution,
- Floodplain biological surveys,
- Cultural heritage surveys
- Species ecology, and
- Surface and ground water quality.

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The majority of environmental education activities within the Riverland Ramsar site are centered on Calperum Station and Chowilla Game Reserve. However students from local and non-local educational institutions also utilise other sites within the Riverland wetland as an outside classroom especially for Waterwatch and other related activities.

Calperum Station has accommodation facilities and conducts programs aimed at students from primary school to university. In partnership with the local Rotary Club and volunteers, practical conservation camps are conducted each year. The site is also a focal point for the annual state frog census survey that attracts over 150 local students and parents. To assist visitor orientation, Calperum has a major information bay located adjacent to the Wentworth road that describes the properties programs and partnerships, the Man and Biosphere Reserve program, and the mallee and floodplain ecosystems. A booklet has been published which describes the properties history, ecology and management programs.

Chowilla Game Reserve focuses on visitor education due to the high recreational use of the Reserve. Two information bays have been established at visitor focal points and are designed to inform visitors and encourage them to utilise the area in a sustainable manner. At the Border Cliffs Customs House the Game Reserve offers a 4km self guided wetland walking trail and board walk that provides visitors with an insight into the natural environment. A booklet has also been published on the history of the Border Cliffs Customs House. Following the Chowilla Anabranh for 25 kilometres is the Old Coach Road self guided vehicle trail that informs visitors of past and present human occupation and management and aspects of the natural environment.

31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Recreation - The Riverland wetland contains many features of interest to visitors and locals especially along the River Murray and adjacent anabranch systems. Features include rapidly changing and contrasting scenery, remoteness, a sense of adventure and excitement, relatively undisturbed areas, closeness to flora and fauna, good camping spots, environmental diversity and the availability of produce such as yabbies, fish and waterfowl. The main activities pursued are; fishing both fin-fish and crustaceans, house boating, bush camping, canoeing, waterfowl hunting, general boating, water-skiing and driving tours. Public use of sandbars for camping and day water-based recreation pursuits is very popular especially during periods of high use such as the Easter and October long weekends. For example, there are 38 campsites along the Chowilla Anabranch and during most Easter long weekends all these sites can be occupied with in excess of 170 visitors. Dinghy Derby's are significant social events that involve an organised boat race through the anabranch creek systems using aluminum dingies. These events can attract up to 50 boats and foster numerous pre-event practice sessions by competitors. There are six public boat ramps located within the wetland, four on the main stream of the River Murray and two on the Ral Ral Anabranch. Significant numbers of boats travel the Riverland Ramsar site section of the River Murray. The following numbers of boats and the people they carry past through lock 6 during 2001/2002 2,199 boats carrying 10,211 people and during 2002/2003 2,051 boats carrying 8,827 people (SA Water *pers.comm.*). Approximately 80 percent of the boats passing through Lock 6 were houseboats.

Tourism - The site supports a significant tourism industry that relies on the wetland's values for survival. Three houseboat marinas are located within the Ramsar site, one with 33 sites on the down stream end of the Ral Ral Anabranch, and two sites on the River Murray. One with 6 sites located opposite the Dix's Cutting Island and the other on the Victorian Border that has 7 sites. The total number of houseboats utilising the Ramsar site on a regular basis from marinas located in or adjacent to the wetland is over 80. A number of tourism operators within the Riverland wetland market under the banner of the Riverland Guides. This group of independent operators conduct nature based boat tours (eg the "Big River Rambler" licensed to carry 60 people and "Creek Rambler" licensed to carry 4 people), bird-watching vehicle based tours (eg Jolly Goodfellows Birding), pastoral industry and natural and culture history tours and on-site accommodation (eg Chowilla Station). The paddle steamer "Industry" licensed to carry 70 people and operated by the local community conducts tours along the River Murray within the Riverland wetland.

32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

Murray-Darling Basin Commission

South Australian Government; The Department of Water, Land and Biodiversity Conservation
Department for Environment and Heritage
Primary Industries & Resources SA

South Australian Murray-Darling Basin Natural Resources Management Board
Renmark Paringa Council

33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

At present there is no single management authority, however the following Government department has taken on a coordination role:

Department for Environment and Heritage
Regional Conservation Directorate
Murraylands Region
PO Box 231Berri, South Australia, 5343
Australia
Telephone Number 08 8595 2222

Contact Person: Mr. Mike Harper, Wetland Officer

34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

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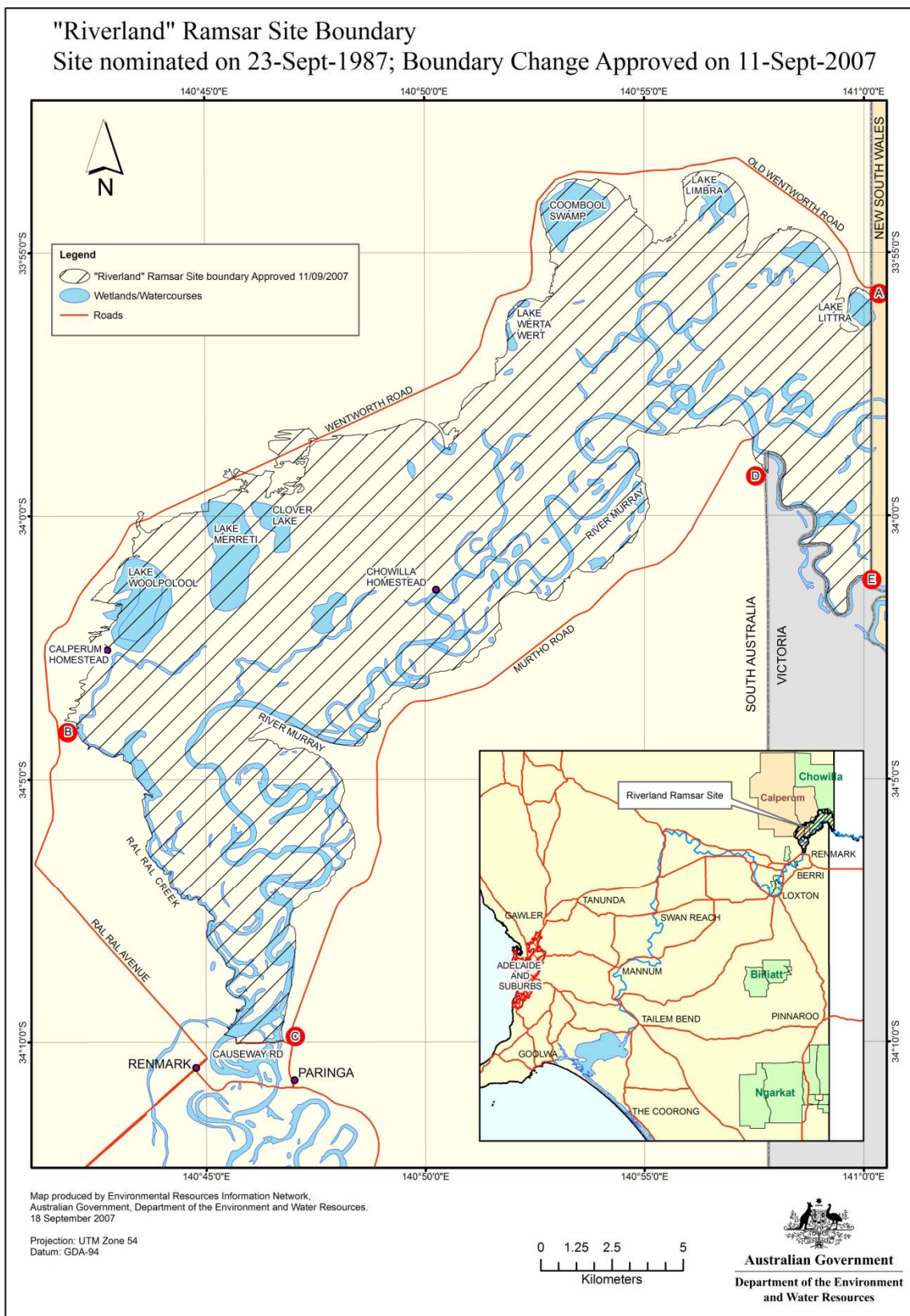
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Appendix 1

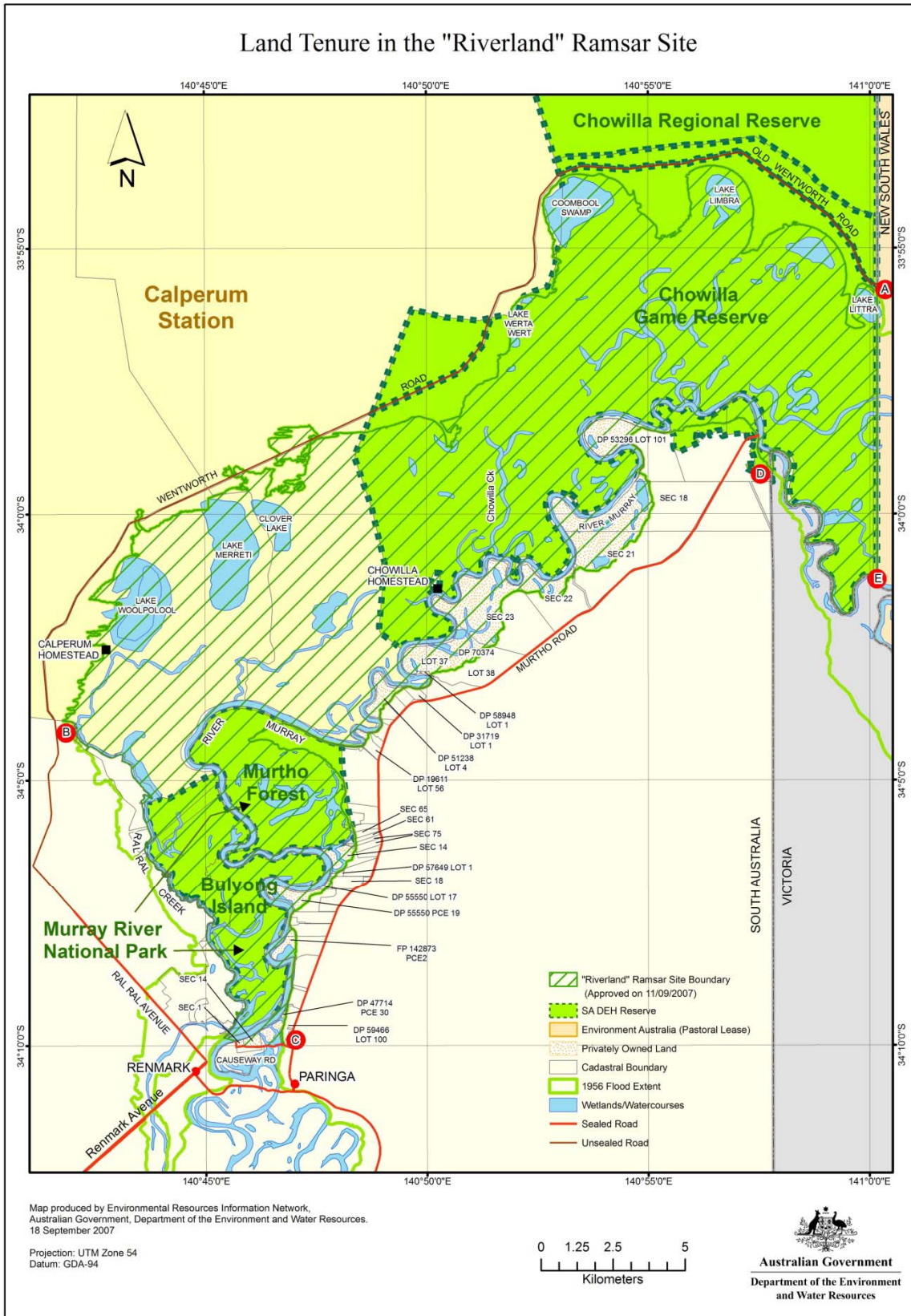


Appendix 2

Birds recorded Utilising the Riverland Ramsar Wetland

Hoary-headed Grebe (<i>Poliiocephalus poliocephalus</i>)	Hardhead (<i>Aythya australis</i>)
Australian Grebe (<i>Tachybaptus novaehollandiae</i>)	Australian Wood Duck (<i>Chenonetta jubata</i>)
Great Crested Grebe (<i>Podiceps cristatus</i>)	Blue-billed Duck (<i>Oxyura australis</i>)
Australian Pelican (<i>Pelecanus conspicillatus</i>)	Musk Duck (<i>Biziura lobata</i>)
Great Cormorant (<i>Phalacrocorax carbo</i>)	White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>)
Little Black Cormorant (<i>P. sulcirostris</i>)	Swamp Harrier (<i>Circus approximans</i>)
Pied Cormorant (<i>P. varius</i>)	Buff-banded Rail (<i>Rallus philippensis</i>)
Little Pied Cormorant (<i>P. melanoleucos</i>)	Australian Spotted Crake (<i>P. fluminea</i>)
Australian Darter (<i>Anhinga novaehollandiae</i>)	Dusky Moorhen (<i>Gallinula tenebrosa</i>)
White-necked Heron (<i>Ardea pacifica</i>)	Black-tailed Native-hen (<i>G. ventralis</i>)
Great (Large) Egret (<i>A. Alba</i>)	Purple Swamphen (<i>Porphyrio porphyrio</i>)
Intermediate Egret (<i>A. intermedia</i>)	Eurasian Coot (<i>Fulica atra</i>)
White-faced Heron (<i>A. novaehollandiae</i>)	White-headed Stilt (<i>Himantopus leucocephalus</i>)
Little Egret (<i>A. garzetta</i>)	Banded Stilt (<i>Cladorhynchus leucocephalus</i>)
Cattle Egret (<i>A. ibis</i>)	Red-necked Avocet (<i>Recurvirostra novaehollandiae</i>)
Australian Bittern (<i>Botaurus poiciloptilus</i>)	Masked Lapwing (<i>Vanellus miles</i>)
Rufous Night-Heron (<i>Nycticorax caledonicus</i>)	Red-capped Plover (<i>Charadrius ruficapillus</i>)
Australian Ibis (<i>Threskiornis molucca</i>)	Black-fronted Plover (<i>C. melanops</i>)
Straw-necked Ibis (<i>Threskiornis spinicollis</i>)	Red-kneed Dotterel (<i>C. cinctus</i>)
Glossy Ibis (<i>Plegadis falcinellus</i>)	Common Greenshank (<i>Tringa nebularia</i>)
Royal Spoonbill (<i>Platalea regia</i>)	Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)
Yellow-billed Spoonbill (<i>P. Flavipes</i>)	Red-necked Stint (<i>C. ruficollis</i>)
Black Swan (<i>Cygnus atratus</i>)	Curlew Sandpiper (<i>C. ferruginea</i>)
Freckled Duck (<i>Stictonetta naevosa</i>)	Silver Gull (<i>Larus novaehollandiae</i>)
Australian Shelduck (<i>Tadorna tadornoides</i>)	Whiskered Tern (<i>Chlidonias hybridus</i>)
Pink-eared Duck (<i>Malacorhynchus membranaceus</i>)	Gull-billed Tern (<i>Gelochelidon nilotica</i>)
Grey Teal (<i>Anas gibberifrons</i>)	Caspian Tern (<i>Hydroprogne caspia</i>)
Chestnut Teal (<i>A. castanea</i>)	Clamorous Reed Warbler (<i>Acrocephalus stentoreus</i>)
Pacific Black Duck (<i>A. superciliosa</i>)	Golden-headed (<i>Cisticola Cisticola exilis</i>)
Australasian Shoveler (<i>A. rhynchotis</i>)	

Appendix 3



Appendix 4:

The following significant plant species are listed at the State level under the *National Parks and Wildlife Act 1972* and inhabit the site on a permanent or seasonal basis:

Plant Species	Conservation Status
Dainty Maiden-hair <i>Adiantum capillus-veneris</i>	V
Swamp Daisy <i>Brachycome basaltica</i> var. <i>gracilis</i>	R
Black-fruit Daisy <i>Brachycome melanocarpa</i>	V
Coast Daisy <i>Brachycome parvula</i> var. <i>lissocarpa</i>	R
Matted Water Starwort <i>Callitriche sonderi</i>	R
Water Starwort <i>Callitriche umbonata</i>	V
Pale Beauty-heads <i>Calocephalus sonderi</i>	R
Tufted Burr-daisy <i>Calotis scapigera</i>	R
Purple Crassula <i>Crassula peduncularis</i>	R
Pale Flax-lily <i>Dianella porracea</i>	V
Small-flower Beetle-grass <i>Diplachne parviflora</i>	R
Waterwort <i>Elatine gratioloides</i>	R
Barren Cane-grass <i>Eragrostis infecunda</i>	R
Purple Love-grass <i>Eragrostis lacunaria</i>	R
Pale-fruit Cherry <i>Exocarpos strictus</i>	R
Sea-Heath <i>Frankenia cupularis</i>	R
Hooked Needlewood <i>Hakea tephrosperma</i>	R
Nutty Club-rush <i>Isolepis producta</i>	V
Slender Fissure-plant <i>Maireana pentagona</i>	R
Creeping Boobialla <i>Myoporum parvifolium</i>	R
Upright Milfoil <i>Myriophyllum crispatum</i>	V
Robust Milfoil <i>Myriophyllum papillosum</i>	R
Wavy Marshwort <i>Nymphoides crenata</i>	R
Australian Broomrape <i>Orobanche cernua</i> var. <i>australiana</i>	V
Squat Picris <i>Picris squarrosa</i>	R
Jagged Bitter-cress <i>Rorippa laciniata</i>	R
Behr's Swainsona-pea <i>Swainsona behriana</i>	V
<i>Zannichellia palustris</i>	R

Conservation Status – R = Rare, V = Vulnerable

Appendix 5:

The following significant fauna species are listed at a State level and inhabit the site on a permanent or seasonal basis:

Mammal Species	Conservation Status
Feather tailed Glider <i>Acrobates pygmaeus</i>	E

Reptile Species	Conservation Status
Broad-shell Tortoise <i>Chelodina expansa</i>	V
Carpet Python <i>Morelia spilota variegata</i>	R
Lace Monitor <i>Varanus varius</i>	R

Bird Species	Conservation Status
Great Crested Grebe <i>Podiceps cristatus</i>	R
Australian Bittern <i>Botaurus poiciloptilus</i>	V
Musk Duck <i>Biziura lobata</i> ,	R
Blue Billed Duck <i>Oxyura australis</i>	R
Australasian Shoveler <i>Anas rhynchotis</i>	R
Freckled Duck <i>Stictonetta naevosa</i>	V
Intermediate Egret <i>Ardea intermedia</i>	R
Glossy Ibis <i>Plegadis falcinellus</i>	R
Bush Stone-curlew <i>Burhinus grallarius</i>	V
Square-tailed Kite <i>Lophoictinia isura</i>	V
Peregrine Falcon <i>Falco peregrinus</i>	R
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	V
Major Mitchell's Cockatoo <i>Cacatua leadbeateri</i>	V
Redthroat <i>Pyrrholaemus brunneus</i>	R
Blue-faced Honeyeater <i>Entomyzon cyanotis</i>	R
Little Friarbird <i>Philemon citreogularis</i>	R
Striped Honeyeater <i>Plectorhyncha lanceolata</i>	R
Golden-headed Cisticola <i>Cisticola exilis</i>	R

Conservation Status Codes - E = Endangered, R = Rare and V = Vulnerable