

Information Sheet on Ramsar Wetlands

(RIS) – 2009-2012 version

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

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

Compiled by the Western Australian Department of Conservation and Land Management (DCLM; now Department of Parks and Wildlife) in 1990 and Roger Jaensch, Wetlands International - Oceania, on behalf of DCLM in 1998. Updated by DCLM staff in 2000 and 2003. Updated by Department of Parks and Wildlife staff in 2014.

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Designation date

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Site Reference Number

All inquiries should be directed to:
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Principal Coordinator, Wetlands Section
17 Dick Perry Avenue
Kensington, WA, 6151
Australia
Tel: +61-8-9219 9000
Email: wetlands@dpaw.wa.gov.au

2. Date this sheet was completed/updated:

February 2014

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.

Toolibin Lake (also known as Lake Toolibin), Western Australia

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

The Toolibin Lake Ramsar site was designated on 7 June 1990. The previous RIS was dated 2003.

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:

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 Toolibin Lake Ramsar site boundary is the same as Crown Reserve 24556.

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.

Latitude: 32° 55' 00" S; Longitude: 117° 36' 30" E

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.

Toolibin Lake is in the Shire of Wickepin (local government authority) in the State of Western Australia with a population of approximately 2.24 million in 2011 (Australian Bureau of Statistics, 2013). Toolibin Lake is 40 km east of the town of Narrogin, which had a population of 4,219 in 2011 (Australian Bureau of Statistics, 2013).

The Ramsar site as originally nominated in February 1990 comprised Nature Reserve 24556 and part of Game Reserve 9617. It included the entire area of Toolibin Lake and some adjacent land mainly on the north-eastern and eastern sides.

The original site area of 437 ha was extended to 497 ha in 2001 to include land on the northern, western and southern sides of the lake that had been added to Reserve 24556 since the original site nomination. This ensured a reserved buffer zone of at least 100 metres width around most of the lake.

Note that the portion of the Ramsar site that was originally part of Reserve 9617 was added to Reserve 24556. This change has had no effect on the Ramsar site boundary.

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

Approximately 300 metres above mean sea level (Australian Height Datum)

11. Area:(in hectares)

497 ha (Note comments in Section 9 regarding 2001 extension)

12. General overview of the site:

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

Toolibin Lake is a large, intermittently inundated, fresh to brackish wetland located in the inland agricultural region of south-west Western Australia. It is dominated by *Casuarina obesa*, and to a lesser extent *Melaleuca strobophylla*. Wetlands of this type were formerly widespread, but most have been severely degraded by secondary salinisation. This situation led to the nomination of Toolibin Lake for Ramsar listing, to highlight the values of the wetland to assist in gaining resources to address increasing salinisation. Management actions undertaken at the site appear to have met with a degree of success, however, continued low inflows are complicating the issues facing the site. This is elaborated below and in sections 16 and 26.

When full or near full, the lake supports breeding by a large number of waterbird species, including Freckled Duck (*Stictonetta naevosa*), cormorants, egrets, night herons (*Nycticorax caledonicus*) and spoonbills. Toolibin Lake is listed as a threatened ecological community under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999*. The listing is recorded as 'Perched wetlands of the Wheatbelt region with extensive stands of living sheoak and paperbark across the lake floor (Toolibin Lake)'.

The lake has a catchment of approximately 483 square kilometres and is in a low rainfall zone. The median and mean annual rainfall at Wickepin (17 kms northwest of the site) is 401mm and 415mm respectively, mostly falling in May-August. The annual evaporation rate is 1,900 mm. During dry years the lake may not fill, but during wet years the lake may be inundated continuously for several years.

In recent decades, inflows to the lake have been considerably reduced. The reason for this is twofold. Firstly, to combat salinity issues, a diversion channel and separator have been established and saline surface flows from the Arthur River are diverted away from Toolibin Lake. In addition, rainfall in the region has been below average for many years; see Appendix B for an indicative graph. The end result is that the lake has been drier for longer periods than any time since records have been kept. However, it is still considered to be an intermittent wetland. The reduced rainfall across the south-west of Western Australia is due to climate change. Federal and State Departmental officers, along with researchers, are considering how to approach this issue in the long-term.

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



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).

The Ramsar site continues to meet the criteria for which it was originally listed, plus an additional criterion. In 2000, Toolibin Lake was added to the national list of threatened ecological communities and as such also meets Criterion 2.

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Toolibin Lake is the last, large, *Casuarina obesa* dominated wetland, with mostly living trees, in the inland agricultural area of south-west Western Australia (Avon Wheatbelt Bioregion). The *Casuarina obesa* dominated vegetation community has been reduced in area and number of occurrences by at least 90 per cent. Toolibin Lake is the only natural wetland in the bioregion that has not become saline due to rising saline groundwater. The lake's resilience is likely to be a result of the perched nature of the wetland, which has delayed the effect of rising saline groundwater compared with other wetlands in the bioregion.

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

The ecological community of the site 'Perched wetlands of the Wheatbelt region with extensive stands of living sheoak and paperbark across the lake floor (Toolibin Lake)' is identified as endangered under the *Environment Protection and Biodiversity Conservation Act* (1999).

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

As the last substantial remnant of a formerly common wetland type, Toolibin Lake is vital to maintaining the genetic and ecological diversity of the inland agricultural area of south-west Western Australia (Avon Wheatbelt Bioregion). The site supports plants including *Casuarina obesa*, *Melaleuca strobophylla*, *Eucalyptus loxophleba*, *Acacia acuminata*, *Allocasuarina huegeliana* and *Banksia prionotes*. When filled, the site supports waterbirds including Freckled Duck (*Stictonetta naevosa*), Pacific Heron (*Ardea pacifica*), White-faced Heron (*A. novaehollandiae*), Great Egret (*Egretta alba*), Nankeen Night Heron (*Nycticorax caledonicus*), Yellow-billed Spoonbill (*Platalea flavipes*), Great Cormorant (*Phalacrocorax carbo*), Little Black Cormorant (*P. sulcirostris*), Little Pied Cormorant (*P. melanoleucos*) and Blue-billed Duck (*Oxyura australis*), as well as a suite of macroinvertebrate species that provide a major food source for waterbirds.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

When full or near full, Toolibin Lake supports more breeding waterbird species than all other inland wetlands in south-west Western Australia. These include the Freckled Duck *Stictonetta naevosa* which has a very small breeding population in south-west Western Australia (estimated population 500-1,000 Wetlands International 2012). The lake also supports small breeding colonies of cormorants, egrets, night herons and spoonbills which are otherwise scarce or absent in the inland agricultural area of south-west Western Australia.

An extended dry period has resulted in a lack of inundation at Toolibin Lake and few waterbird surveys being able to be conducted. However, in the summer of 2006, a partial fill event occurred and 33 waterbird species were recorded using the Toolibin Lake complexes (Toolibin, Dulbining and Walbyring Lakes) with 12 species breeding (listed below). In the absence of comprehensive data,

opportunistic observations during a partial fill event suggest that if conditions are suitable, substantial numbers of waterbird species will continue to visit and breed at Toolibin Lake and the surrounding wetlands.

Common name	Scientific name	Location
Black Swan	<i>Cygnus atratus</i>	Toolibin, Walbyring, Dulbining
Australian Shelduck	<i>Tadorna tadornoides</i>	Toolibin, Walbyring, Dulbining
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	Toolibin, Walbyring, Dulbining
Grey Teal	<i>Anas gracilis</i>	Toolibin, Walbyring, Dulbining
Pacific Black Duck	<i>Anas superciliosa</i>	Toolibin, Walbyring, Dulbining
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	Toolibin, Walbyring, Dulbining
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	Toolibin, Walbyring, Dulbining
White-necked Heron	<i>Ardea pacifica</i>	Toolibin
Eastern Great Egret	<i>Ardea modesta</i>	Toolibin, Walbyring
White-faced Heron	<i>Egretta novaehollandiae</i>	Toolibin, Walbyring
Australian White Ibis	<i>Threskiornis molucca</i>	Toolibin, Walbyring
Eurasian Coot	<i>Fulica atra</i>	Toolibin, Walbyring, Dulbining

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:

South West Coast drainage division

b) biogeographic regionalisation scheme (include reference citation):

Commonwealth of Australia (Bureau of Meteorology), 2011, Australian Hydrological Geospatial Fabric

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.

Toolibin Lake is a fresh to brackish wetland that is perched above the water table and fills from surface runoff. Toolibin Lake is one of the last, large natural wetlands in the Avon Wheatbelt Bioregion to become impacted by secondary salinity. The median and mean annual rainfall at Wickepin (17 km northwest of the site) is 401 mm and 415 mm respectively, mostly falling in May–August. Annual evaporation is approximately 1,900 mm.

Toolibin Lake is intermittently inundated and generally fills in years when above average rainfall is received. The lake may receive no inflow for several years, and has only partially filled twice since 1996, in 2006 and 2008. The maximum depth of water when Toolibin Lake is fully inundated is approximately 2 metres, after which the lake overflows into other wetlands at the headwaters of the Arthur River. As there have been no complete fill events in the last two decades, water quality data is not available.

Most of the lake bed is covered in thickets or woodlands of watertolerant tree species and there is a large open area on the eastern side. The tree species also require dry periods to allow regeneration

over the long-term. There are pronounced undulations or 'gilgai mounds' on the floor of the lake and the trees tend to occur on the mounds. The lake is surrounded by a woodland of Eucalyptus, Acacia and Allocasuarina, and on the sandy sites, Banksia.

Secondary salinity became evident at Toolibin Lake in the 1970s. A recovery plan was instigated in 1994 and management interventions were implemented to mitigate the impacts of salinisation (see Section 26). Management interventions include: diversion of saline surface water away from the lake, a system of pumps on the lake bed to lower groundwater, a channel system to remove saline surface water, and revegetation within the catchment.

17. Physical features of the catchment area:

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

Toolibin Lake is one of a chain of lakes occupying a palaeodrainage valley that forms part of the Northern Arthur River System. The lake is situated in the Yilgarn Craton, in alluvial and lacustrine valley-fill deposits, surrounded by broadly undulating sandplain. The fluvial plain at Toolibin Lake is about three kilometres wide and is bounded to the east by aeolian dune deposits and to the west by weathered basement overlain by thin colluvium. Toolibin Lake is located at the boundary between these two systems, with its eastern flanks overlying lacustrine sediments, and to the west, alluvial sequences. There is a palaeochannel system 300 m wide and 40 m deep beneath the lake, extending approximately five kilometres in a north-westerly direction (Dogramaci et al., 2002).

The catchment's hydrogeology is affected by several large dolerite dykes which appear to be responsible in part for reducing the effects of secondary salinisation on the lake (Smith and Wallace, 1998).

18. Hydrological values:

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

Toolibin Lake is one of the last wetlands in the bioregion to have been impacted by secondary salinity, largely due to the underlying sediments and perched nature of the lake bed. As a result, it is the only remaining area of brackish wetland habitat suitable for waterbird breeding within the bioregion. Clearing of native vegetation on the surrounding agricultural land has resulted in the saline groundwater table rising to within one metre of the lake bed.

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 (NB: Due to secondary salinisation, which began several decades ago, the water is no longer fresh. The wetland type that would more accurately reflect the present water salinity is R – intermittent brackish lakes, but this does not reflect the wooded character of the wetland which is the dominant feature of the site).

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 tree thickets and woodlands of the lake bed are dominated by *Casuarina obesa* and to a lesser extent *Melaleuca strobophylla*. Two aquatic macrophytes *Potamogeton* sp. and *Lepilaena* sp. have been recorded in the lake when inundated.

The terrestrial vegetation surrounding the lake is dominated by *Allocasuarina huegeliana*, *Acacia acuminata*, *Banksia prionotes* and *Eucalyptus loxophleba*.

The area of the Ramsar site extension (made in 2001) was formerly used for cereal cropping and was largely devoid of native vegetation when acquired for conservation. It has been planted extensively with native vegetation to help control rising saline groundwater.

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.*

Toolibin Lake is the only remaining example in south-west Western Australia of a wetland with extensive areas of living *Casuarina obesa* and to a lesser extent *Melaleuca strobophylla*. This was one of the main types of inland freshwater wetland in the south-west before clearing for agriculture caused most inland wetlands to become saline. As a result, Toolibin Lake is listed as a threatened ecological community under the Australian Government *Environment Protection and Biodiversity Conservation Act* (1999). The listing is recorded as 'Perched wetlands of the Wheatbelt region with extensive stands of living sheoak and paperbark across the lake floor (Toolibin Lake)'.

The lake supports extensive stands of *M. strobophylla*, which has a restricted distribution and further loss of populations of this species would result in state listing as rare.

On deep sands adjoining the main lake are woodlands consisting of co-dominant Acorn banksia (*Banksia prionotes*) and Rock sheoak (*Allocasuarina huegeliana*). This vegetation type is not well represented in the region. The association includes a range of understorey species, including in some parts an attractive display of orchids in spring. Twenty-one species, sixteen per cent of the plants recorded are introduced, a reflection of the surrounding land use.

Dominant invasive flora species include:

Common name	Scientific name
Slender Iceplant	<i>Mesembryanthemum nodiflorum</i>
Bearded Oat	<i>Avena barbata</i>
Veldt Grass	<i>Ehrharta</i> spp
Cape Weed	<i>Arctotheca calendula</i>
Wild Radish	<i>Raphanus raphanistrum</i>

In recent dry years, *Eucalyptus loxophleba* (York Gum) have naturally regenerated on the lake bed. It is expected that these individuals will die when inundated; however, if dry conditions persist they may become more prevalent on the lake bed.

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.*

The site has recorded the highest number of breeding waterbird species (25 species) of any inland wetland in the bioregion (Halse et al. 2000; Northern Arthur River Wetlands Committee 1987), including Freckled Duck (*Stictonetta naevosa*) which is uncommon in south-west Western Australia.

Toolibin Lake also provides breeding habitat for:

Common name	Scientific name
Pacific Heron	<i>Ardea pacifica</i>
White-faced Heron	<i>A. novaehollandiae</i>
Great Egret	<i>Egretta alba</i>
Nankeen Night Heron	<i>Nycticorax caledonicus</i>
Yellow-billed Spoonbill	<i>Platalea flavipes</i>
Great Cormorant	<i>Phalacrocorax carbo</i>
Little Black Cormorant	<i>P. sulcirostris</i>
Little Pied Cormorant	<i>P. melanoleucos</i>
Blue-billed Duck	<i>Oxyura australis</i>

Since 1965, a total of 50 species of waterbird have been recorded at Toolibin Lake, which is a high species richness for inland wetlands in the south-west. The highest number of waterbirds counted at the lake was 1,858 in December 1996 (the previous record was 1,646 in January 1982). The most abundant species was Grey Teal *Anas gracilis* (up to 1,160).

There are no nationally rare, threatened or endemic fauna which are currently known to use the lake, although the nationally endangered Australasian Bittern *Botaurus poiciloptilus* was recorded prior to 1980, when the lake was less saline and rushes persisted.

A total of 52 invertebrate species have been recorded in Toolibin Lake. Insects comprised the largest proportion of the invertebrate fauna (65% of species, of which beetles comprised 28% and chironomids 19%), with crustaceans accounting for another 28% (of which 43% were ostracods), annelids 5%, and molluscs 2%. Rotifers were also present.

Invasive species that require management intervention include:

Common name	Scientific name
European red fox	<i>Vulpes vulpes</i>
Feral pig	<i>Sus scrofa</i>
European rabbit	<i>Oryctolagus cuniculus</i>

Rabbits are baited annually and when required around revegetation sites. Foxes are baited when waterbirds are breeding and feeding, that is when the lake is inundated. Pigs are monitored when the lake is inundated. Small numbers of cats have also been sighted but do not warrant control at this stage.

Western Grey Kangaroos *Macropus fuliginosus* are considered a pest native species as they pose a significant threat to regenerating seedlings through grazing, particularly *Casuarina obesa*. Periodic spotlighting is undertaken and culling is carried out if required.

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:

There is an unregistered Aboriginal Site of Significance listed by the Department of Aboriginal Affairs in the western area of the lake described as artefacts/scatter camp (site no. S02816) (Department of Aboriginal Affairs 2013).

The Heritage Council of Western Australia and State Heritage Office list Toolibin Lake and surrounds as 'Toolibin Lakeside: Heritage Place no. 7312' (Heritage Council of Western Australian and State Heritage Office 2013).

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:

The Nature Reserve is vested in the Conservation Commission (Government of Western Australia). The purpose of Nature Reserve 24556 is 'Conservation of Flora and Fauna'.

b) in the surrounding area:

Surrounding areas include freehold (privately owned) land, and Nature Reserves.

25. Current land (including water) use:

a) within the Ramsar site:

Nature conservation and low intensity nature-based recreation. There is a recreation site at the lake with barbecue and picnic facilities. There is also interpretative material for visitors including a shelter with educational displays and an interactive walk trail. A recreation and interpretation concept plan has also been prepared for the site (Department of Conservation and Land Management, 1999).

b) in the surroundings/catchment:

Dulbin Nature Reserve (R9617 and R27286) is located directly north of the Ramsar site and comprises native vegetation and various small wetlands. Walbyring Nature Reserve (R14398) is located directly south of the Ramsar site and comprises native vegetation and Walbyring Lake. The nature reserves are used for nature conservation. The surrounding land has been largely cleared and is used for agriculture, such as pasture for sheep or cropping.

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:

Secondary salinity was first observed at Toolibin Lake in the mid 1970s when vegetation began to die. Land clearing in the catchment caused salt stored in the soil to mobilise and enter the lake as saline surface run-off and rising saline groundwater. As a result the vegetation community, predominantly *C. obesa* and *M. strobophylla*, was impacted by salt stress. Loss of fringing vegetation, particularly rushes, appears to have reduced the number of secretive fauna species using the lake, notably Australasian Bittern *Botaurus poiciloptilus* and Purple Swamphen *Porphyrio porphyrio*; numbers of Freckled Duck *Stictonetta naevosa* also appear to be declining.

To prevent further vegetation death and the loss of waterbird habitat, management intervention was required. In 1994, a Recovery Plan (Toolibin Lake Recovery Team and Toolibin Lake Technical Advisory Group 1994) was prepared for the lake, which was designated as a 'Natural Diversity Recovery Catchment' (one of six in Western Australia) under the Government of Western Australia's State Salinity Strategy. The Recovery Plan recommended urgent remedial action including diversion of major saline surface flows away from the lake, installation of bores and pumps to lower the groundwater table beneath the lake, and strategic long-term actions including revegetation of farmland within the catchment to reduce regional groundwater levels. The surface water diversion system and groundwater bores were installed by DCLM in 1995, and groundwater pumping began in 1997. Diverted saline surface flows and pumped saline groundwater bypass Lake Walbyring (immediately downstream of Toolibin Lake) and are discharged into Lake Taarblin, a highly salinised wetland further downstream.

By late 1998, the impacts of groundwater pumping were visible: the foliage on *C. obesa* trees around some of the pumps had become dark green and had regrown on trees that had previously appeared dead or severely degraded. *C. obesa* and *M. strobophylla* have recruited on some areas of the lake bed and dense regeneration, particularly of *C. obesa*, has been observed following rainfall events. Groundwater monitoring has revealed that water tables have dropped up to nine metres around some of the bores since 1994 (Smith and Wallace, 1998).

The Toolibin Lake Recovery Plan has guided various management actions, including revegetation and engineering works. Long-term monitoring indicates that these actions have largely halted the decline of the lake bed vegetation since around 2006; however, there has not been wholesale recovery and this prompted an investigation into plant- and hydrological-processes.

The water requirements and tolerances of the two dominant trees on the lake bed – sheoak (*C. obesa*) and paperbark (*M. strobophylla*) – are being studied to help understand the connection between growth and water use by the trees and hydrology.

Below-average rainfall and a lack of natural inflow events meant that understanding of the interactions between surface water, soil properties and plants had to be derived from models. To test these models and understand the dynamics of salt and water movement during inundation, a small flooding trial on the lake bed was conducted in March 2011 (Higbid and Drake, 2011).

The trial confirmed the different rooting depths of the trees and demonstrated that they can rapidly increase water use following flooding, particularly the sheoak. The discovery of different root zone niches used by the two species (sheoak roots are shallower than the paperbark's) helps to explain the sequence of tree deaths that has occurred and the ecological requirements that management must consider. It also showed that surface and groundwater rapidly connect, which is provoking additional research to better guide groundwater management (Higbid and Drake, 2011).

The Toolibin Lake Recovery Project was awarded the Institute of Engineers (Australia) 2002 National Salinity Prize in recognition of the integrated approach to salinity management and strong community support.

Invasive animal and plant species are not severely impacting the ecological character of the Ramsar site. Considerable damage can be done to seedlings by indigenous macropod species; this is monitored and culls are undertaken as required (see Sections 21 and 22).

b) in the surrounding area:

As part of the Toolibin Lake Recovery Plan, the Department of Parks and Wildlife has promoted alley farming and eucalyptus oil plantations in the catchment to reduce regional groundwater levels (Smith and Wallace, 1998) and while initially successful, interest from landholders has waned in recent years. A revegetation and remnant vegetation protection program is also under way in the catchment and is advertised annually; however, few farmers have recently taken up the cost-sharing incentives offered for fencing and revegetation. The Department of Agriculture and Food has produced a comprehensive revegetation manual for the catchment which is designed to encourage revegetation on a farm-scale to favour sustainable agriculture and increase water use on farms throughout the catchment (Baxter, 1996).

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.

The lake is contained in Crown Reserve 24556.

Toolibin Lake is included in the national list of “Ecological Communities that are Endangered” (Threatened Ecological Communities) under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999*.

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?:

The Toolibin Lake Recovery Plan is being implemented by the Department of Parks and Wildlife with the Toolibin Lake Recovery Team providing an advisory role. The Toolibin Lake Recovery Team comprises representatives from Department of Parks and Wildlife, Department of Agriculture and Food, Department of Water, South West Catchments Council, Facey Group, Shire of Wickepin and landholders. A variety of works, including revegetation and engineering interventions have been implemented in accordance with the Recovery Plan. A draft review of the Recovery Plan was completed in 2012 and Department of Parks and Wildlife are currently in the process of revising the plan for the next 20 years.

d) Describe any other current management practices:

Under the Salinity Action Plan for WA (Government of Western Australia 1996; State Salinity Council 2000), Toolibin Lake and associated wetlands have been designated as a ‘Natural Diversity Recovery Catchment’. Through the Natural Diversity Recovery Catchment program, revegetation and other activities have occurred in the catchment to mitigate groundwater rise (see item 26). Surface and groundwater management interventions to protect the Ramsar site include; a levee and channel system to divert saline surface water away from the lake, a system of pumps on the lake bed to lower

groundwater, and a sump and shallow channels on the lake bed to enable surface water to drain before it becomes too saline.

Department of Parks and Wildlife undertake extensive monitoring to determine the effectiveness of the Recovery Plan and guide adaptive management. Monitoring includes; groundwater, surface water, vegetation, waterbirds, invertebrates, and invasive flora and fauna species. Monitoring of waterbirds and invertebrates is dependent on the lake being inundated.

Management of invasive fauna species is guided by monitoring, and control programs are undertaken when required (see Section 22). Control of some invasive plant species has been undertaken from areas close to the lake including Bridal Creeper *Asparagus asparagoides* and Tamarisk *Tamarix aphylla*. There has been little active weed management on the lake bed – inundation events are generally relied on to provide natural control of invasive flora.

28. Conservation measures proposed but not yet implemented:

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

Under the Recovery Plan, further work aimed at lowering of the saline groundwater table, and reducing saline surface runoff, is planned for the upstream surface and groundwater catchments of the lake. This includes identification of priority sites for further revegetation in the catchment, continued implementation of high water-use farming systems including alley farming, and ongoing management of groundwater by pumping and saline surface flows by diversion.

29. Current scientific research and facilities:

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

Toolibin Lake is one of 25 wetlands that have been selected for ongoing monitoring of physico-chemical and biological attributes, including water levels, water chemistry, vegetation composition and health, aquatic invertebrates and use by waterbirds, under the Salinity Action Plan. DPaW Great Southern District staff undertake regular observations of waterbirds when the lake is inundated.

A digital groundwater model for Toolibin Lake is being developed to assist to determine the impact of various regimes of groundwater pumping on the lake bed vegetation.

30. Current communications, education, participation and 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.

An access road, information shelter, interpretive walk, information brochures and other facilities were completed during 2001. The Department of Parks and Wildlife leads primary, secondary and tertiary student groups and community members (including landholders) on field days and educational tours of the lake. The focus of the tours is salinity management in the 'Wheatbelt' region of South-West Western Australia. Information on Toolibin Lake is available from the Department of Parks and Wildlife's website www.dpaw.wa.gov.au/management/salinity.

31. Current recreation and tourism:

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

The site is used for low intensity nature-based recreation.

32. Jurisdiction:

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

Territorial: The State Government of Western Australia.

Functional: The Conservation Commission (vesting) and the Western Australian Department of Parks and Wildlife (management on behalf of the Conservation Commission).

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.

Great Southern District (based in Narrogin) of the Wheatbelt Region, Western Australian Department of Parks and Wildlife.

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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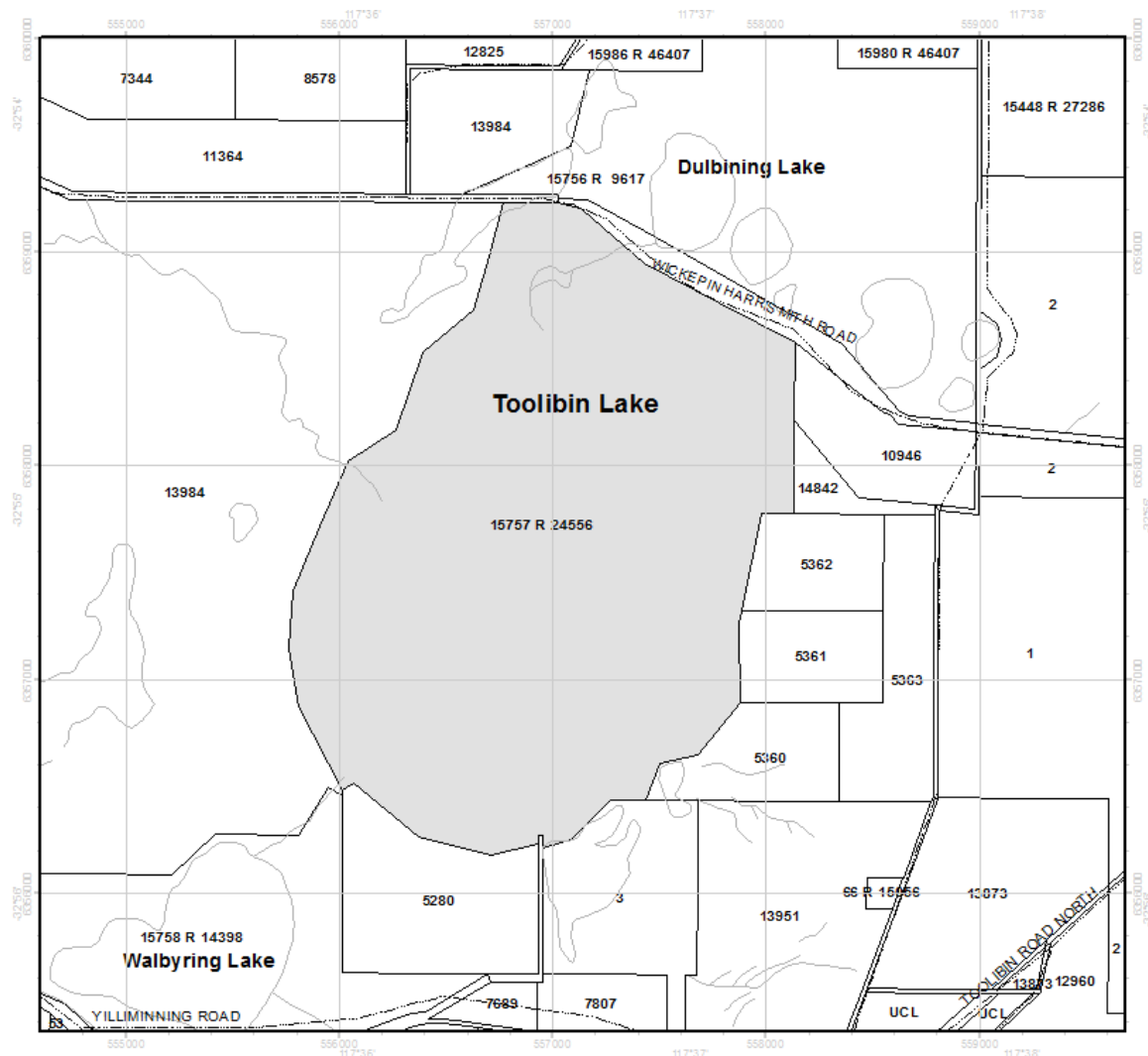
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Wetlands International, 2012, Waterbird Population Estimates, fifth edition.

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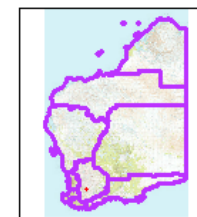
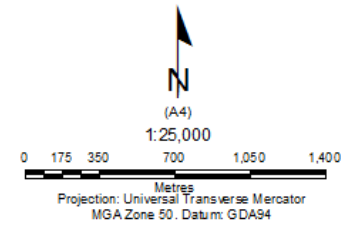
Attachment A: Map of the Toolibin Lake Ramsar site



Toolibin Lake Ramsar site

Legend

- Road
- Hydrography
- Ramsar site
- Cadastre (Land Parcels)



Produced by the
Department of
Parks and Wildlife



Produced at 11:21am, on February 20, 2014

Gridlines shown at 1 minute intervals
GDA shown at 1000 metre intervals

The Dept. of Parks and Wildlife does not guarantee
that this map is without flaw of any kind and disclaims
all liability for any errors, loss or other consequence
which may arise from relying on any information depicted.

Roads and tracks on land managed by DP&W
may contain unmarked hazards and their surface
condition is variable. Exercise caution and drive
to conditions on all roads.

If applicable this map is based on
information provided by and with the
permission of the Western Australian
Land Information Authority (Landgate) (2012)

Appendix B:

Wickepin (010654) Annual rainfall

