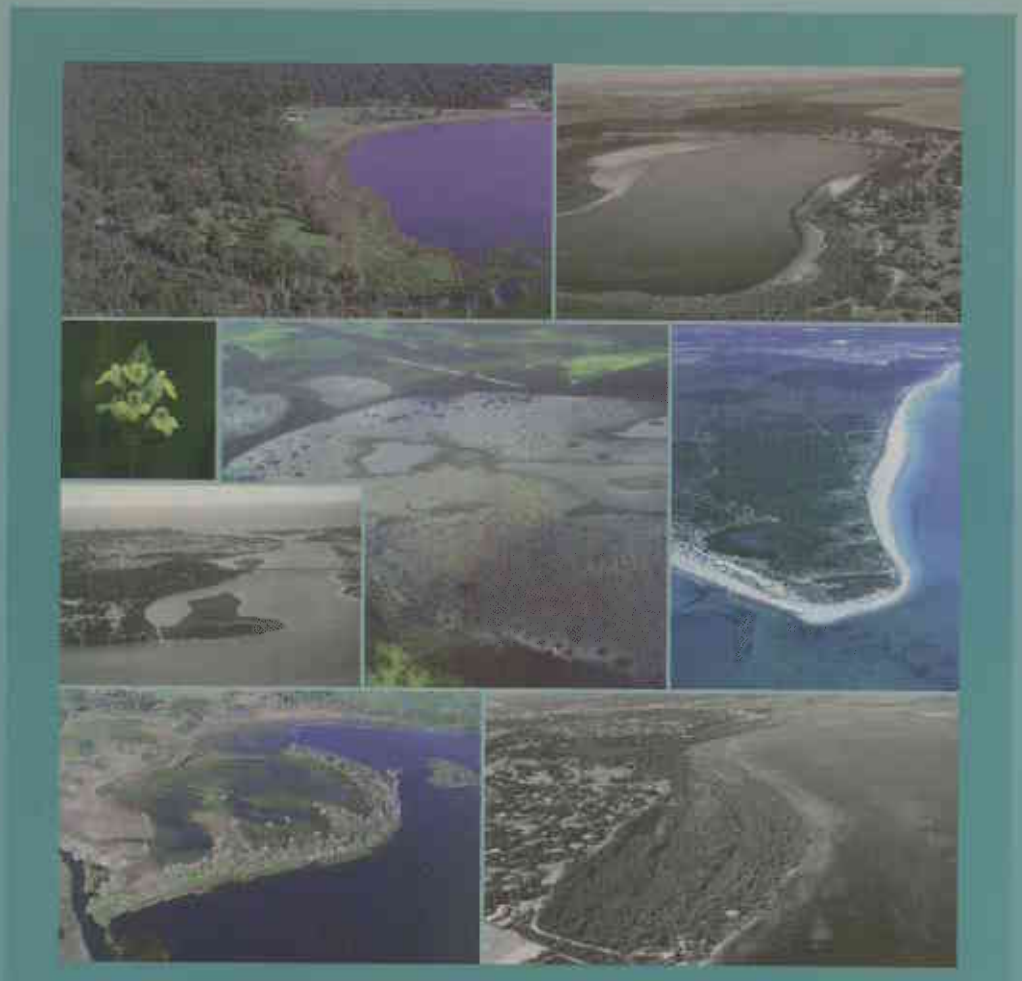
Wetlands nominated by the
Government of Western Australia
for inclusion on the
List of Wetlands of International Importance

RAMSAR CONVENTION

November 2000



DEPARTMENT OF Conservation AND LAND MANAGEMENT

Natural Heritage Trust
Helping Communities Helping Australia

Foreword

The **Convention on Wetlands** is an international treaty aimed at the conservation of wetlands of international importance and the wise use of wetlands generally.

The Convention was adopted in 1971 at a meeting in the Iranian city of Ramsar, hence it is commonly referred to as the 'Ramsar Convention'. It covers many types of wetlands, including permanent, seasonal and ephemeral lakes, swamps, marshes, damplands, rivers and estuaries and shallow marine areas.

The Convention establishes a List of Wetlands of International Importance. These are selected for their international significance in terms of ecology, botany, zoology, or hydrology. More than 120 nations are now Contracting Parties to the Convention and more than 1030 Sites have been listed. The total area of these Sites is 78.2 million hectares.

Australia, one of the first nations to join the Ramsar Convention, has 53 Ramsar Sites covering 5.2 million hectares.

Under a long-standing State-Commonwealth arrangement, State Governments identify and propose wetlands within their jurisdictions for listing under the Convention. In February 1990, the Western Australian Government nominated nine wetland systems – the Ord River Floodplain, Lakes Argyle and Kununurra, Roebuck Bay, Eighty Mile Beach, Forrestdale and Thomsons Lakes, the Peel-Yalgorup System, Toolibin Lake, the Vasse-Wonnerup System and Lake Warden System.

In December 1996, the Government gave a commitment that consideration would be given to nominating additional wetlands such as the Lake Muir complex. Since that time, the Department of Conservation and Land Management (CALM), with specialist advice from Wetlands International-Oceania, has undertaken a lengthy process involving the identification of candidate wetlands, consultations with key stakeholders, and preparation of documentation and maps. This work was largely funded by the National Wetlands Program of the Natural Heritage Trust of the Commonwealth Government, whose assistance is gratefully acknowledged.

Following that process, the Western Australian Government has decided to nominate three new Ramsar Sites and 12 extensions to four existing Sites. The new Sites are the Becher Point Wetlands south of Rockingham, Lake Gore west of Esperance and the Muir-Byenup System east of Manjimup. Extensions are proposed to the Ord River Floodplain, Peel-Yalgorup, Toolibin Lake and Vasse-Wonnerup Ramsar Sites. Detailed information about each Site is provided in this document.

Benefits of nomination to the List include increased local, national and international recognition of Australia's most important wetlands, and heightened management attention by relevant authorities and community groups.

Nomination of these Sites and extensions contributes to implementation of the State Government's Wetlands Conservation Policy for Western Australia (1997). As part of its commitment to this Policy and to the conservation of these Sites, the State Government also has allocated an additional $250,000 a year to CALM for wetland conservation activities.

It is envisaged that more Sites may be listed or extended in the future as relevant studies are completed and land use, tenure and management issues are progressively addressed in consultation with stakeholders.

Richard Court MLA
PREMIER

Cheryl Edwardes MLA
MINISTER FOR THE ENVIRONMENT

Contents

Front cover, clockwise from top left:
Extension 2 of Vasse-Wonerup Ramsar Site; Lake McLarty, Extension 2 of Peel-Yalgorup Ramsar Site; Becher Point Ramsar Site; Erskine Conservation Park, part Extension 6 of Peel-Yalgorup Ramsar Site; Sabina Nature Reserve, Extension 1 of Vasse-Wonerup Ramsar Site; "The Chimneys", part Extension 6 of Peel-Yalgorup Ramsar Site; *Euphrasia scabra*; Byenup Lagoon, Muir-Byenup Ramsar Site.

Euphrasia scabra has been recommended for listing nationally as critically endangered – the largest known populations grow in the Lake Muir Ramsar Site.

Information sheet on Ramsar wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed:

August 2000

2. Country:

Australia

3. Name of wetland:

Becher Point Wetlands

4. Geographical coordinates:

Latitude: 32^0 23' S
Longitude: 115^0 44' E

5. Elevation: (average and/or max. & min.)

A few metres above sea level (Australian Height Datum).

6. Area: (in hectares)

677 ha (of which less than 10% is wetland).

7. Overview: (general summary, in two or three sentences, of the wetland's principal characteristics)

The Site comprises a substantial portion of the system of inter-dunal wetlands associated with Becher Point, on the coast of south-western Australia. The series of wetlands within the Site exhibits a continuum of development in geomorphology, hydrology and vegetation and is considered by researchers to be a unique wetland system in Western Australia and one of the youngest wetland systems on the Swan Coastal Plain. The sedgelands of the Site are included in the national list of threatened ecological communities.

8. Wetland type: (the applicable codes for wetland types as listed in Annex I of the *Ramsar Explanatory Note and Guidelines* document)

Where the type includes options, the relevant options are shown in **bold**.

Ts (**seasonal**/intermittent freshwater **marshes**/pools).
W (shrub-dominated wetlands).

Please now rank these wetland types by listing them from the most to the least dominant:

W, Ts.

9. Ramsar criteria: (the applicable criteria; see point 12)

1 (It contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region).

2 (It supports vulnerable, endangered, or critically endangered species or threatened ecological communities).

Please specify the most significant criterion applicable to the site:

1

10. Map of site included?

Yes

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

Roger Jaensch, Wetlands International - Oceania, GPO Box 636, Canberra ACT 2601, Australia, (Tel: +61-2-6250-0779; Fax: +61-2-6250-0799; email: roger.jaensch@ea.gov.au), on behalf of the Western Australian Department of Conservation & Land Management (CALM), in November 1998. Updated by CALM staff in August 2000. All inquiries should be directed to Jim Lane, CALM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

12. Justification of the criteria selected under point 9: (Please refer to Annex II in the *Ramsar Explanatory Note and Guidelines* document)

1 The Becher Point Wetlands are an example of shrub swamps and seasonal marshes that have formed in an extensive sequence of inter-dunal depressions that have arisen from seaward advancement of the coastline over recent millennia. This type of wetland system is rare in south-western Australia. Examples of this type of geomorphological sequence in equally good condition and within a protected area, are rare world-wide.

2 The sedgelands that occur within linear wetland depressions of the Site are included in the national list of threatened ecological communities.

13. General location: (include the nearest large town and its administrative region)

The Becher Point Wetlands are in the City of Rockingham (local authority) in the State of Western Australia (population ca. 1.9 million). The Becher Point Wetlands are 9 km south of the city of Rockingham (population ca. 70,000 in the local government area).

The Becher Point Wetlands Ramsar Site comprises the entire areas of Nature Reserves 44077 and 45041. It includes a substantial part of the suite of approximately 200 discrete, very small wetlands located between Becher Point (Indian Ocean coast) and the Perth-Mandurah Road.

14. Physical features: (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

The Site is situated in the Perth Basin, in the Quindalup Dunes formation, on the beach ridge plains that form the cuspate foreland at Becher Point. The Site's wetlands are within 0.2-1.5 km of the Indian Ocean. The wetlands comprise chains of microscale linear, ovoid or irregular swamps arranged in about 10 groups roughly parallel to the coast, separated by sand ridges.

The Site's wetlands are seasonal: there is usually no surface water in summer-autumn. The fresh surface water of winter is derived primarily from groundwater flow and direct precipitation and generally is less than 0.3 m deep.

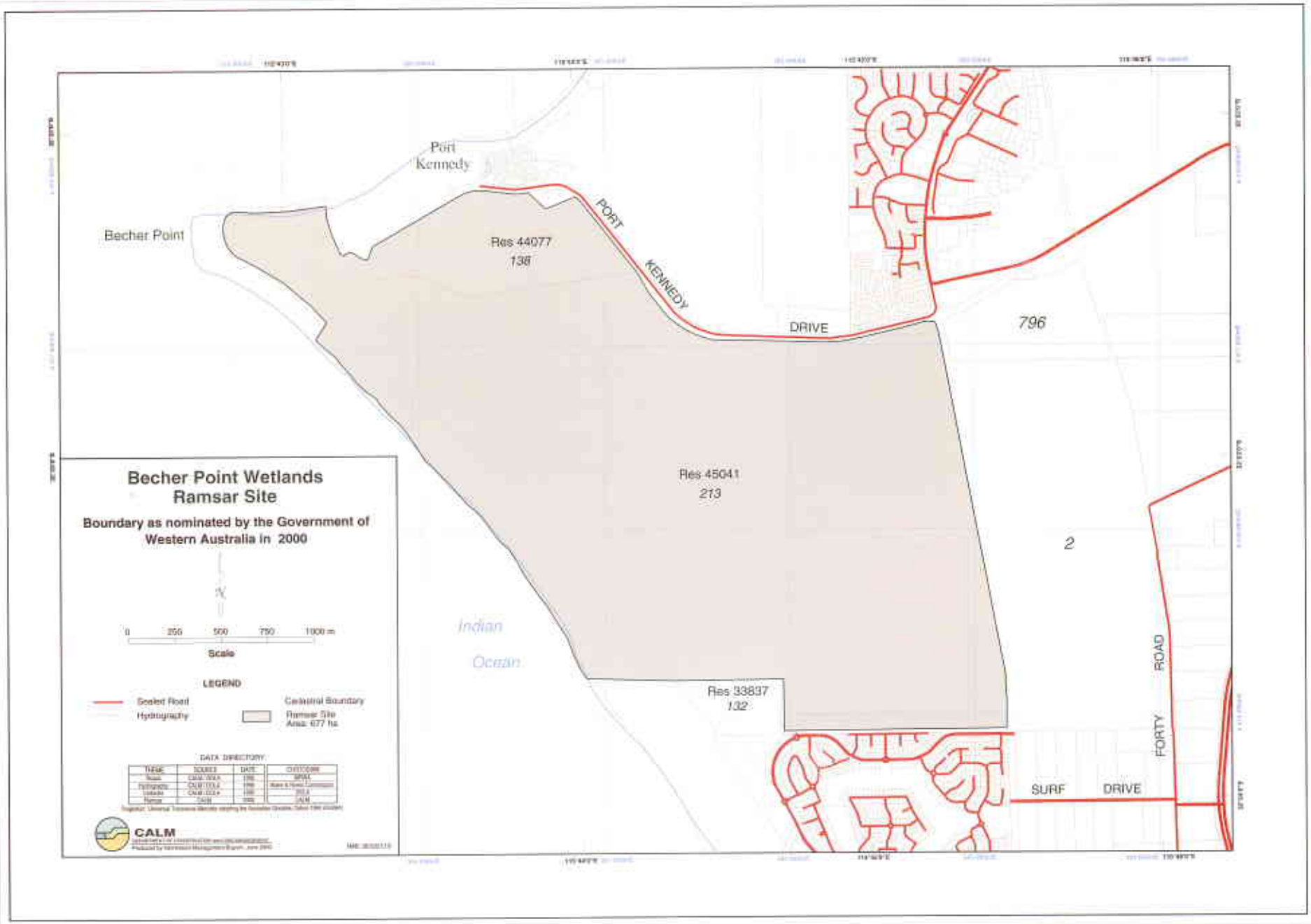
Median and mean annual rainfall at Rockingham are 818 mm and 826 mm respectively, mostly falling in May-August. Annual evaporation is about 1900 mm (Semeniuk 1991).

15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilisation etc.)

The Site's wetlands possibly contribute to maintenance of groundwater in surrounding areas.

16. Ecological features: (main habitats and vegetation types)

The swamps support sedgeland, tall open-shrubland and/or low open-forest in various spatial arrangements. The sedgeland is dominated by *Baumea articulata*, *B. juncea*, *Typha* spp. and


Port
Kennedy
Becher Point
Res 44077
138
PORT
KENNEDY
DRIVE
796
Res 45041
213
2
Indian
Ocean
Res 33837
132
SURF
DRIVE
FORTY
ROAD
Becher Point Wetlands
Ramsar Site
Boundary as nominated by the Government of
Western Australia in 2000
N
0
250
500
750
1000 m
Scale
LEGEND
Sealed Road
Hydrography
Cadastral Boundary
Ramsar Site
Area: 677 ha
DATA DIRECTORY
CALM

Becher Point Ramsar Site. Photo - J. Lane

Lepidosperma spp. *Bolboschoenus caldwellii* and *Juncus kraussii* also occur; the forest/woodland is dominated by *Melaleuca rhaphiophylla* and *M. hamulosa*, *M. cuticularis*, *M. teretifolia* also occur (Semeniuk 1991). Surrounding areas support mainly open-heathland.

17. Noteworthy flora: (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

The sedgelands of the Site are included in the national list of "Ecological Communities that are Endangered" (Threatened Ecological Communities) under the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act 1999.

18. Noteworthy fauna: (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

Noteworthy native fauna of the Site includes the quenda (*Isoodon obesulus fusciventer*), carpet python (*Morelia spilota imbricata*), Perth lined lerista (*Lerista lineata*) and black-striped snake (*Neelaps calanotus*). At least four species of amphibians and 21 species of reptiles have been recorded.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

There is strong community support for protection of the natural history values of the Becher Point wetlands.

20. Land tenure/ownership of: (a) site (b) surrounding area

(a) The entire Ramsar Site is within Nature Reserves 44077 and 45041 vested in the National Parks and Nature Conservation Authority (appointed by the Government of Western Australia) for the purposes of "Conservation of Flora and Fauna".

(b) Surrounding areas include freehold (privately owned) land, Government Reserves (e.g. for recreation), Marine Park, other marine waters and Unallocated Crown Land.

21. Current land use: (a) site (b) surroundings/catchment

(a) There is no land use other than nature conservation within the Ramsar Site. There are no facilities at present for nature-based recreation and this type of recreation is currently negligible within the Ramsar Site. Small numbers of anglers traverse the Site in order to undertake beach fishing.

(b) The dominant land use in the surrounding areas is urban (residential), which is increasing; other uses include recreation and rural smallholdings. Human population in the Site's immediate surrounds is in the order of several hundreds of people and is increasing.

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

(a) Some disturbance of the Site by off-road use of motor vehicles has occurred. Potentially important factors include too frequent burning, and invasion by exotic plants.

(b) Groundwater is extracted in the vicinity, to maintain a nearby golf course. Ongoing monitoring to detect impacts, if any, is required under WA Ministerial conditions of development approval.

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

The Nature Reserves were established in 1996-7. The Site is part of the Rockingham Lakes Regional Park system, which is the subject of a management framework (Tingay and Associates 1997). Preparation of a management plan for the system has begun: consultants have been engaged and a community advisory committee established. Actions undertaken or underway on-site include vermin proof fencing and weed control, fire protection measures and control of public access.

The Water & Rivers Commission has contracted a consultant to develop a groundwater allocation plan that will include the Port Kennedy area (Rockingham Groundwater Area Allocation Plan). As part of this plan, the environmental water requirements of significant wetlands in the area will be assessed.

The Site is listed on the Register of the National Estate.

The sedgelands of the Site are included in the national list of "Ecological Communities that are Endangered" (Threatened Ecological Communities) under the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act 1999.

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

There is potential to extend the Ramsar Site in the future, following proposed changes in land tenure and consultation with land managers, to include adjoining parts of the Rockingham Lakes Regional Park (immediately east, also in the Cooloongup Lake area). This would add later stages (up to 7000 years before present) in the Holocene dune/wetland development to the Ramsar site. The Site as currently defined includes wetlands aged up to 4500 years before present.

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

The Site is of international significance in terms of research interest in the evolution of wetlands; it presents a rare opportunity for investigation of coastal history, biological succession and palaeoclimate during the past 4500 years. (See Semeniuk 1991 & 1995; Semeniuk *et al.* 1988.)

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

No facilities are available at present, however there is considerable potential given the close proximity of urban areas. There are plans to provide information shelters with interpretive signage and also walking paths. An informative brochure has been prepared.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

Low level recreational use of the Site occurs (see items 21 and 26).

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept of Environment etc.)

Territorial: The State Government of Western Australia.
Functional: The National Parks and Nature Conservation Authority (vesting) and the Western Australian Department of Conservation & Land Management (management).

29. Management authority: (name and address of local body directly responsible for managing the wetland)

The Swan Region, Western Australian Department of Conservation & Land Management.

30. Bibliographical references: (scientific/technical only)

Jaensch, R.P. and Watkins, D. 1999. Nomination of additional Ramsar wetlands in Western Australia. Unpublished technical report by Wetlands International – Oceania for the Department of Conservation & Land Management, Perth.

Lane, J., Jaensch, R. and Lynch, R. 1996. Western Australia. In, ANCA. A Directory of Important Wetlands in Australia. Second edition. Australian Nature Conservation Agency, Canberra.

Semeniuk, V. 1995. The Holocene record of climatic, eustatic and tectonic events along the coastal zone of Western Australia - a review. pp 247-59 in Journal of Coastal Research Special Issue No. 17: Holocene Cycles: climate, sea levels and sedimentation.

Semeniuk, V. and C. Research Group 1991. Wetlands of the City of Rockingham - their classification, significance and management. Report to the City of Rockingham and Western Australian Heritage Committee.

Semeniuk, V., Searle, D.J. and Woods, P.J. 1998. The sedimentology and stratigraphy of a cuspate foreland, southwestern Australia. Journal of Coastal Research 4 (4), 551-564.

Tingay, A. and Associates 1997. Proposed Port Kennedy and Rockingham Parks Management Framework. Western Australian Planning Commission, Perth.

Banded Stilts. Photo – Babs & Bert Wells/CALM

Information sheet on Ramsar wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed:

August 2000

2. Country:

Australia

3. Name of wetland:

Lake Gore

4. Geographical coordinates:

Latitude: 33^0 44' S to 33^0 50' S
Longitude: 121^0 26' E to 121^0 32' E

5. Elevation: (average and/or max. & min.)

Approx. 10-20 m (Australian Height Datum).

6. Area: (in hectares)

Approx. 4017 ha of which Lake Gore itself comprises 740 ha.

7. Overview: (general summary, in two or three sentences, of the wetland's principal characteristics)

The Site comprises a near-permanent saline lake and part of a downstream system of inter-connected lakes and swamps of various sizes which are intermittently inundated. Lake Gore itself supports the largest known populations of Hooded Plover *Thinornis rubricollis*, is important for moulting by thousands of Australian Shelduck *Tadorna tadornoides* and for drought refuge by thousands of ducks and shorebirds, and it supports thousands of Banded Stilt *Cladorhynchus leucocephalus*.

8. Wetland type: (please circle the applicable codes for wetland types as listed in Annex I of the *Ramsar Explanatory Note and Guidelines* document)

R (**seasonal**/intermittent **saline**/brackish/alkaline **lakes** and flats)
Ss (**seasonal**/intermittent **saline**/brackish/alkaline **marshes**/pools)

Please now rank these wetland types by listing them from the most to the least dominant:

R, Ss.

9. Ramsar criteria: (please circle the applicable criteria; see point 12, next page)

4 (It supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions).
5 (It regularly supports 20,000 or more waterbirds).
6 (It regularly supports 1% of the individuals in a population of one species or subspecies of waterbird).

Please specify the most significant criterion applicable to the site:

6

10. Map of site included?

Yes

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

Roger Jaensch, Wetlands International - Oceania, GPO Box 636, Canberra ACT 2601, Australia, (Tel: +61-2-6250-0779; Fax: +61-2-6250-0799; email: roger.jaensch@ea.gov.au), on behalf of the Western Australian Department of Conservation & Land Management (CALM), in November 1998. Updated by CALM staff in August 2000. All inquiries should be directed to Jim Lane, CALM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

12. Justification of the criteria selected under point 9: (Please refer to Annex II in the *Ramsar Explanatory Note and Guidelines* document)

4. Lake Gore regularly supports moulting by thousands of Australian Shelducks (see item 18); it is one of the most important moulting sites for shelducks in south-western Australia. The Lake is also used as a drought refuge by large numbers of waterbirds (see criterion 5 and item 18).
5. More than 29,000 waterbirds have been counted at Lake Gore (see item 18). The number of individual waterbirds that use the lake each year probably exceeds 20,000 and the annual data on water depth suggest conditions are suitable for use by 20,000 waterbirds at least several times within a 25 year period; in the context of wetland availability in Western Australia this is considered sufficient evidence of regular use by 20,000 waterbirds.
6. Lake Gore supports up to 1600 Hooded Plovers which constitutes more than 1% (actually almost one third) of the global population. Lake Gore is the single most important wetland for this species. The 1% criterion also is met for Banded Stilt: thousands occur regularly and counts of up to 20,000 (about 10% of the population) have been recorded. See also item 18.

13. General location: (include the nearest large town and its administrative region)

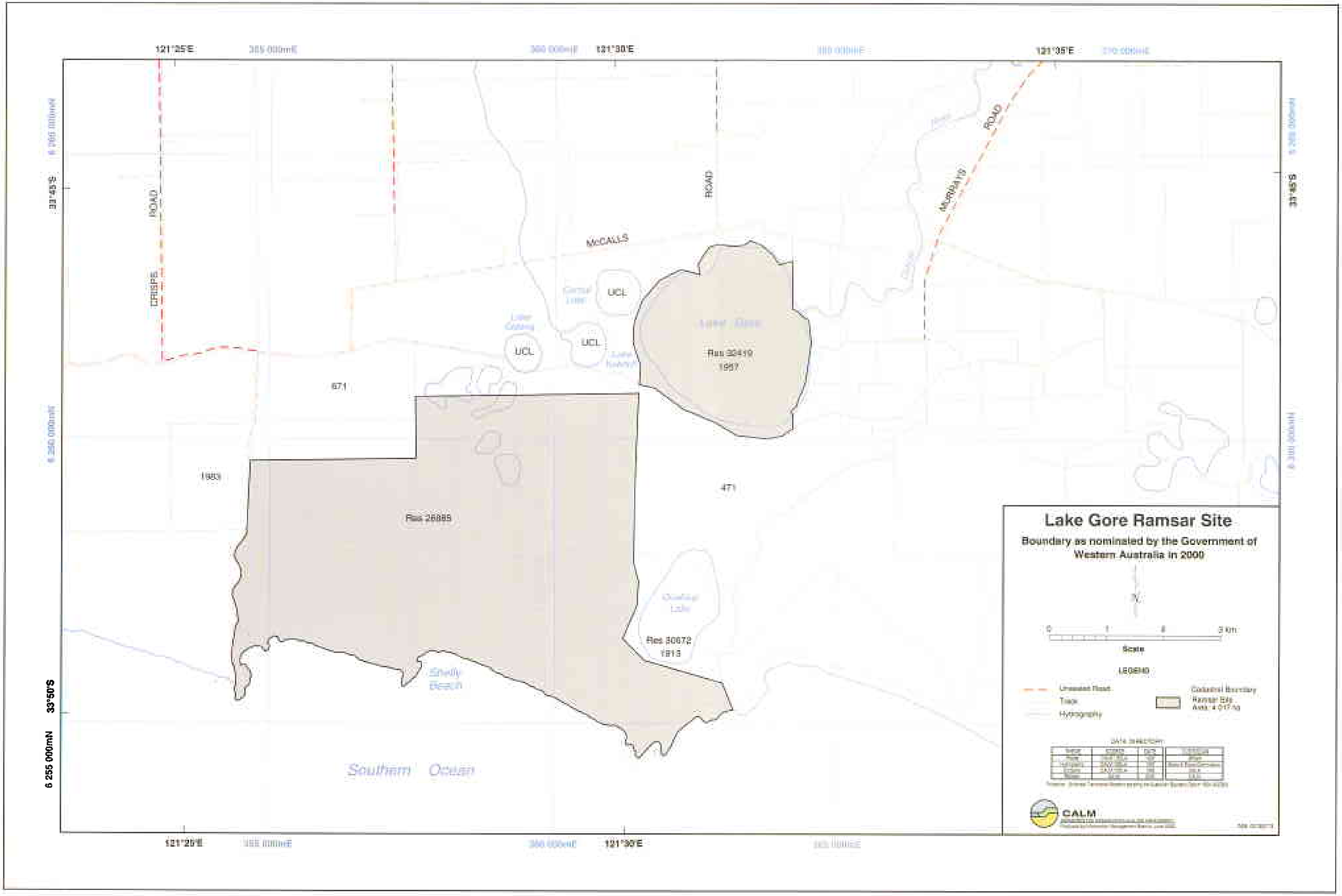
Lake Gore is in the Shire of Esperance (local authority) in the State of Western Australia (population ca. 1.9 million). It is 34 km west-north-west of the town of Esperance (population ca. 13,200).

The Lake Gore Ramsar Site comprises the entire area of Nature Reserve 32419 and the eastern part of Nature Reserve 26885, which are almost contiguous (see map). The western boundary of the Site is the "protected road" (unformed track) that provides vehicular access across Nature Reserve 26885 to Warrinup Beach. Wetlands within the Site include Lake Gore and part of a downstream system of inter-connected lakes and swamps of varied sizes ("the overflow wetlands").

A strip of land oriented east-west and approximately 686 m wide inside the northern boundary of Nature Reserve 26885 is excluded from the Site in anticipation of possible future exchange of this land for freehold land that may be added (subject to negotiation with and voluntary agreement of the present owner) to Nature Reserve 32419, and which would substantially enhance the conservation values and management of the wetlands. Lakes Gidong, Kubitch and Carbul, which are adjacent to Lake Gore, are not in the Ramsar Site; neither are Quallilup Lake or the unreserved overflow wetlands that connect that Lake to the Site. There is potential for addition of these areas of wetland to the Site in the future, subject to resolution of tenure and other issues.

14. Physical features: (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

The Site is situated in the Albany-Fraser Orogen, in alluvial/lacustrine sediments overlying marine limestone and gneiss/sandstone on a sub-coastal plain. It includes a large lake (Lake Gore: 738 ha), and a downstream system of inter-connected small lakes, swamps and creeks ("the overflow wetlands"), all of which are natural wetlands.



Lake Gore Ramsar Site
Boundary as nominated by the Government of Western Australia in 2000
0
1
2
3 km
Scale
LEGEND
Unsealed Road
Track
Hydrography
Cadastral Boundary
Ramsar Site
CALM
121°25'E
121°30'E
121°35'E
33°45'S
33°50'S
6 255 000mN
CRISPS
ROAD
McCALLS
MURRAYS
UCL
Res 30419
1957
Res 26885
Res 30672
1813
671
1983
471
Shelly
Beach
Southern
Ocean

Lake Gore Ramsar Site. Photo - S. Neville

Water is derived from a relatively large surface catchment, mainly from Dalyup River, Coobidge Creek and minor seasonal streams. The total wetland area downstream of Lake Gore and within the Ramsar Site boundary is in the order of 600 ha. The greater part of the surface catchment of the Ramsar Site is cleared of native vegetation.

Lake Gore is a sub-terminal drainage basin. It is seasonal or near-permanent, sometimes being dry in autumn: maximum depth recorded is 2.0 m (September 1996) and the September mean is 1.4 m. In particularly wet years, which have occurred at least four times in the last 25 years, Lake Gore flows out at two points into the overflow wetlands: at times flow may continue for another 1-2 km beyond the Ramsar Site to Lake Quallilup (a terminal basin) and exceptionally also about 10 kilometres westward beyond the Ramsar Site to Barkers Inlet. Water may be more than 1.0 m deep in the overflow wetlands and may persist for more than 12 months before drying out, unless there are further floods.

Water quality, Lake Gore: salinity ranges from saturated salt (e.g. January 1984, when less than 0.5 m deep) to 6.5 parts per thousand (September 1989) with a September mean of 52.1 ppt (n=12); water pH ranges from 7.1 to 9.4; and the water is colourless. The overflow wetlands mainly hold water when the lake has overflowed and are at the lower end of salinities recorded for Lake Gore.

Water data are from monitoring by the Department of Conservation & Land Management.

Median and mean annual rainfall at Esperance (34 km east-south-east of Lake Gore) are 553 mm and 568 mm respectively, mostly falling in May-August. Annual evaporation is about 1800 mm.

15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilisation etc.)

None recognised.

16. Ecological features: (main habitats and vegetation types)

Lake Gore and many of the overflow wetlands support a zone (generally narrow, wide in some overflow swamps) of open-woodland of saltwater paperbark *Melaleuca cuticularis* over understorey of the sedges *Gahnia trifida* and *Schoenus brevifolius* at or near the margins (Halse *et al.* 1993; Lane *et al.* 1996). Areas of low shrubland dominated by the samphires *Suaeda australis* and *Sarcocornia quinqueflora*, the grass *Sporobolus virginicus* and the herb *Samolus repens*, occur in the overflow wetlands.

There is little information on long-term changes to the vegetation though many dead trees in the paperbark woodlands are indicative of prolonged inundation, possibly due in part to increased inflow to the Lake following land clearance in the surface catchment.

Surrounding areas support mainly open-scrub or open-heathland, or are cleared.

17. Noteworthy flora: (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

There are no rare, threatened or endemic plants known at the Site.

18. Noteworthy fauna: (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

Almost one third of the world population (Rose & Scott 1997) of the Hooded Plover occurs regularly at Lake Gore: the maximum count was 1600 in January 1995. The birds often occur in loose groups, sometimes in dense flocks, along the broad north and north-east beaches of Lake Gore. Few if any have been seen in the overflow swamps and there is no evidence of Hooded Plover breeding anywhere in the Site. Although other nearby wetlands, including the Gidong suite of lakes and the Ramsar listed Lake Warden System (at Esperance), also support hundreds of Hooded Plovers, despite many surveys Lake Gore remains clearly the single most important wetland for this species.

Up to almost 10% of the world population of Banded Stilt (20,000 in March 1988) occurs at Lake Gore, usually when the Lake has dried back substantially. This is one of the most important drought refuges for Banded Stilt in south-western Australia.

Lake Gore is used each year in spring-summer for moulting by thousands (up to 12,000, November 1986) of Australian Shelduck. It is one of the most important moulting sites for shelducks in the bioregion.

Use by shelducks and stilts (see above) indicates that Lake Gore is one of the most important drought refuges for waterbirds in the bioregion. The highest number of waterbirds counted was 29,273 in March 1988 and though no other counts have reached 20,000 the number of individual waterbirds that use the lake each year probably exceeds 20,000. The most abundant species at Lake Gore are Banded Stilt, Australian Shelduck, Grey Teal *Anas gracilis* (3500, December 1987) and Hoary-headed Grebe *Poliocephalus poliocephalus* (1000, March 1988).

Other information on waterbirds: Surveys have recorded 48 waterbird species at Lake Gore and about 33 at the overflow wetlands; 14 are migrant shorebirds. Fairy Tern *Sterna nereis* (unusual inland) and Freckled Duck *Stictonetta naevosa* sometimes occur in small numbers. Eight species of waterbirds have been recorded breeding at Lake Gore; several species (e.g. Chestnut Teal *Anas castanea*) breed in the overflow wetlands. Most breeding is in wetter years, mainly in samphire and inundated woodland. The most abundant migrant shorebird is Red-necked Stint *Calidris ruficollis* (625 at Lake Gore). Major roost sites for waterbirds in Lake Gore are at the delta-spit of Dalyup River and on rock outcrops (flightless shelducks).

Other noteworthy fauna: The beaches of Lake Gore have red shell deposits of an ostracod (cf *Australocypris* sp.) that thrives in the lake (S. Halse pers. comm.).

Data are from Jaensch *et al.* 1988, Halse *et al.* 1990, Lane *et al.* 1996 and data sets held by the Western Australian Department of Conservation & Land Management.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

None recognised. (See also item 26.)

20. Land tenure/ownership of: (a) site (b) surrounding area

(a) The Ramsar Site comprises A-Class Nature Reserve 32419 and the eastern part of Nature Reserve 26885, both vested in the National Parks and Nature Conservation Authority (appointed by the Government of Western Australia), for the purposes of "Water and Conservation of Flora and Fauna" (32419), and "Conservation of Flora" (26885). Reserve 26885 has been proposed as an addition to Stokes Inlet National Park (CALM 1991).

(b) Surrounding areas include freehold (privately owned) land, Nature Reserve, Recreation Reserve, Unallocated Crown Land and marine waters.

21. Current land use: (a) site (b) surroundings/catchment

(a) The principal land use within the Ramsar Site is nature conservation. In addition, low level recreational use occurs. There are no developed facilities for nature-based recreation and this type of recreation is negligible within the Ramsar Site.

(b) The most important land uses in the surface catchment are agriculture (cereal, other seed crops) and grazing of sheep. Some adjoining areas are reserved for nature conservation. Some recreational fishing by local residents occurs at or near Warrinup Beach, which is also popular for surfing. Human population in the surface catchment of the Site is in the order of several hundreds of people.

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

(a) Major algal blooms, probably due to use of agricultural fertilisers in the Dalyup River catchment, occur at Lake Gore from time to time and result in deposits of algal mats on the shores. The impact of these blooms/mats on waterbirds including Hooded Plovers is not known. It is thought that the Site's wetlands were naturally saline and that further substantial salinisation probably will not occur. Dead trees in the paperbark woodlands are indicative of prolonged inundation, possibly due in part to increased inflow to the Lake following land clearance in the surface catchment.

(b) Eutrophication and salinisation are significant threats in surrounding farmland and wetlands. Changes in agriculture are possible, e.g. possible establishment of tree plantations, which if extensive may reduce surface and ground water inputs and input of nutrients and salt.

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

Cooperative management of parts of the surface catchment, with substantial community participation (Dalyup Catchment Group), is occurring under the federally funded Landcare program. The Water & Rivers Commission is preparing an Action Plan with the Dalyup Catchment Group to protect the Dalyup River. This work includes foreshore surveys of the Dalyup and West Dalyup Rivers and tributaries and the development of recommendations addressing management issues.

Most of the shoreline of Lake Gore has less than 50 m of buffer zone within protected areas.

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

There is some local interest in the surface catchment becoming designated as a "Key Wetlands and Natural Diversity Catchment" under the Salinity Action Plan for Western Australia and in the Site becoming part of a continuous "macro-corridor" of natural lands, including protected areas, along the South Coast between Albany and Esperance.

There is potential to extend the Ramsar Site in the future, subject to resolution of land tenure and other issues (see item 13).

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

Depth, salinity and other water quality parameters have been measured by the Western Australian Department of Conservation & Land Management at least annually at Lake Gore since 1979. Waterbird usage was surveyed annually during 1981-91, with an emphasis on shorebirds and ducks (e.g. Jaensch *et al.* 1988, Halse *et al.* 1990). Intensive study of the Hooded Plover at Lake Gore and elsewhere in the bioregion has been undertaken by Birds Australia. Murdoch University and the University of Western Australia have undertaken research on classification and management of the Coobidge Creek wetlands. Also see items 21 and 26.

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

No facilities or materials are available at present. Since 1994, depth, salinity and other water quality parameters have been measured at Lake Gore every three months by the Esperance Senior High School as part of a "Ribbons of Blue" community-based water monitoring program. The Site is difficult to access without a 4-wheel-drive vehicle.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

Low level recreation occurs, mainly in Reserve 26885 and associated with the coastline (fishing, swimming). Also see items 21 and 26.

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept of Environment etc.)

Territorial: The State Government of Western Australia.
Functional: The National Parks and Nature Conservation Authority (vesting) and the Western Australian Department of Conservation & Land Management (management).

29. Management authority: (name and address of local body directly responsible for managing the wetland)

The Esperance District (based in Esperance) of the South Coast Region, Western Australian Department of Conservation & Land Management.

30. Bibliographical references: (scientific/technical only)

CALM 1991. South Coast Region, Regional Management Plan 1992-2002. Management Plan No. 24, Department of Conservation & Land Management, Perth, Western Australia.

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Rose, P.M. and Scott, D.A. 1997. Waterfowl population estimates. Second edition. Wetlands International Publication 44, Wageningen, The Netherlands.

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Information sheet on Ramsar wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed:

August 2000

2. Country:

Australia

3. Name of wetland:

Muir-Byenup System

4. Geographical coordinates:

Latitude: 34^0 26' S to 34^0 33' S
Longitude: 116^0 38' E to 116^0 49' E

5. Elevation: (average and/or max. & min.)

170-180 m (Australian Height Datum).

6. Area: (in hectares)

10,631 ha (of which approx. 7000 ha is wetland).

7. Overview: (general summary, in two or three sentences, of the wetland's principal characteristics)

The Site comprises a suite of partly inter-connected lakes and swamps of varied size (up to 4600 ha), salinity (saline to fresh), permanence (permanent to seasonal) and substrate (peat and inorganic), in an internally-draining catchment. The open lakes are used for moulting by thousands of Australian Shelduck *Tadorna tadornoides* and for drought refuge by tens of thousands of other ducks while the sedge/shrub-dominated swamps support an important population of Australasian Bittern *Botaurus poiciloptilus*, and threatened orchids. Vegetation communities of the Site's wet flats are among the few remaining in non-coastal parts of south-western Australia and the Site has some of the largest natural sedgelands in Western Australia.

8. Wetland type: (the applicable codes for wetland types as listed in Annex I of the *Ramsar Explanatory Note and Guidelines* document)

Where the type includes options, the relevant options are shown in **bold**.

O (permanent freshwater lakes).
R (**seasonal**/intermittent **saline**/brackish/alkaline **lakes** and flats).
Tp (permanent freshwater **marshes**/pools).
Ts (**seasonal**/intermittent freshwater **marshes**/pools on inorganic soil).
U (non-forested peatlands).
W (shrub-dominated wetlands).
Xf (freshwater, tree-dominated wetlands).

Please now rank these wetland types by listing them from the most to the least dominant:

R, U, O, Ts, Tp, W, Xf.

9. Ramsar criteria: (the applicable criteria; see point 12)

2 (It supports vulnerable, endangered or critically endangered species or threatened ecological communities).

4 (It supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions).

5 (It regularly supports 20,000 or more waterbirds).

6 (It regularly supports 1% of the individuals in a population of one species or subspecies of waterbird).

Please specify the most significant criterion applicable to the site:

4

10. Map of site included?

Yes

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

Roger Jaensch, Wetlands International - Oceania, GPO Box 636, Canberra ACT 2601, Australia, (Tel: +61-2-6250-0779; Fax: +61-2-6250-0799; email: roger.jaensch@ea.gov.au), on behalf of the Western Australian Department of Conservation & Land Management (CALM), in November 1998. Updated by CALM staff in August 2000. All inquiries should be directed to Jim Lane, CALM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

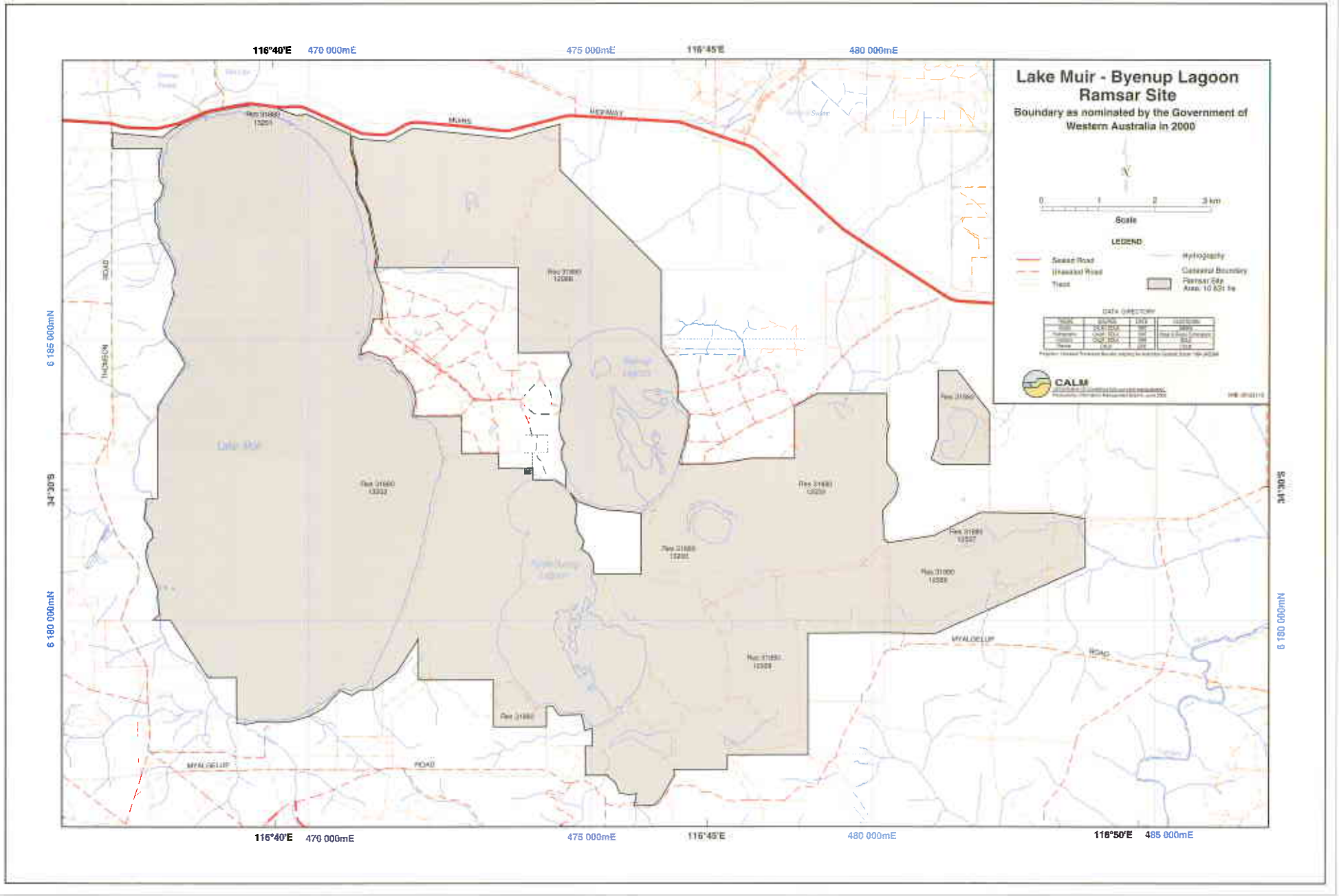
12. Justification of the criteria selected under point 9: (Please refer to Annex II in the *Ramsar Explanatory Note and Guidelines* document)

2. Three wetland-dependent orchids (see item 17) that are formally recognised as nationally vulnerable, and at least one other wetland plant species that may soon be so recognised, occur at the Site in appreciable numbers. These plants mainly occur on seasonally inundated areas or wetland margins, which have been extensively cleared for agriculture elsewhere in south-western Australia.
4. The open lakes of the Site regularly support moulting by thousands of Australian Shelducks (see item 18); this is one of the most important moulting sites for shelducks in south-western Australia. Lake Muir is used as a drought refuge by tens of thousands of waterbirds (see criterion 5 and item 18).
5. Up to 51,000 waterbirds have been counted at the Site (at Lake Muir, when full: see item 18). The annual data on water depth suggest conditions are suitable for use by 20,000 waterbirds at least several times within a 25-year period, which in the context of wetland availability in Western Australia is considered sufficient evidence of regular use by 20,000 waterbirds.
6. At least five, possibly in the order of 10 Australasian Bitterns occur regularly and possibly breed in the sedge swamps of the Site, which constitutes more than 1% of the South-western Australian population. The Site contains the core component of a wider suite of wetlands that constitutes one of the five remaining refuges for the south-western Australian population of this globally threatened species (see item 18).

13. General location: (include the nearest large town and its administrative region)

The Muir-Byenup System is primarily in the Shire of Manjimup and to a lesser extent the Shire of Cranbrook (local authorities) in the State of Western Australia (population ca. 1.9 million). Lake Muir is 55 km east-south-east of the town of Manjimup (population ca. 4300).

The Muir-Byenup System comprises the portion of Nature Reserve 31880 that is south of Muirs Highway. Named wetlands in the Site include Lake Muir, Byenup Lagoon, Tordit-Gurrup Lagoon, Poorginup Swamp, Neeranup Swamp, Coorimup Swamp and Wimbalup Swamp. Freehold land and


Lake Muir - Byenup Lagoon
Ramsar Site
Boundary as nominated by the Government of Western Australia in 2000
N
0 1 2 3 km
Scale
LEGEND
Sealed Road
Unsealed Road
Track
Hydrography
Cadastral Boundary
Ramsar Site
Area: 10 631 ha
DATA DIRECTORY
CALM
116°40'E
470 000mE
475 000mE
116°45'E
480 000mE
116°50'E
485 000mE
6 185 000mN
6 180 000mN
34°30'S
HIGHWAY
MUIRS
ROAD
THOMSON
MYALUP
ROAD

Byenup Lagoon and Lake Muir. Photo - G.Keighery

Byenup Lagoon (northern part). Photo - D.Gardner

Diuris drummondii.
Photo - D.Gardner

Euphrasia scabra.
Photo - G. Keighery

gazetted road reserves enclosed by the Ramsar Site boundary are not part of the Ramsar Site. Parts of the western shoreline of Lake Muir are outside the Reserve and Ramsar Site (but see item 23).

14. Physical features: (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

The Site is situated in the Albany-Fraser Orogen, in alluvial/lacustrine deposits and peat (peat to 4 m thick) overlying granite and gneiss, in broadly undulating country. It includes a large lake (Lake Muir: 4600 ha), smaller lakes and swamps (notably Byenup Lagoon, Tordit-Gurrup Lagoon and Poorginup Swamp: each 140-690 ha), and inter-connected flats, all of which are natural wetlands.

Water is derived from a surface catchment that covers about 38,400 ha, mainly from minor seasonal streams up to about 5 km long. Some of the component wetlands, and a swamp that is outside the Site and is subject to peat mining, drain into Lake Muir. Substantial parts of the surface catchments of most of the component wetlands are cleared. Little is yet known on the interactions between the shallow and deep groundwater systems in the area and the interaction of these with the surface water systems (hence the potential for impacts on conservation values of the wetlands).

Lake Muir and most of the other component wetlands are terminal drainage basins. Lake Muir is seasonal, often dry in autumn: maximum depth recorded since 1978 is 1.3 m (November 1988) and the September mean is 0.78 m. Byenup Lagoon is permanent: maximum depth recorded is 2.6 m (September 1991) and the September mean is 2.3 m. Some of the other component wetlands are permanent or near-permanent, though peaty Poorginup Swamp frequently shows little or no surface water, and the minor swamps and broad flats are inundated or waterlogged only in winter-spring.

Water quality, Lake Muir: salinity ranges from 96 parts per thousand (March 1982) to 0.6 ppt (November 1990) with a September mean of 10.1 ppt (n=12); water pH ranges from 6.2 to 9.7; and the water is colourless. Water quality, Byenup Lagoon: salinity ranges from 42 ppt (March 1988) to 1.4 ppt (November 1988) with a September mean of 3.2 ppt (n=15); and water pH varies from 7.4 to 9.3. Other component wetlands such as Tordit-Gurrup Lagoon and Poorginup Swamp are less saline, or fresh, some are more acidic and some have brown coloured water.

Water data are from monitoring by the Department of Conservation & Land Management.

Median and mean annual rainfall at Rocky Gully (29 km east of Lake Muir) are 723 mm and 715 mm respectively, mostly falling in May-September. Annual evaporation is about 1300 mm.

15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilisation etc.)

The Site's wetlands possibly contribute to maintenance of groundwater in surrounding areas, but little is known on the interactions between the shallow and deep groundwater systems in the area and the interaction of these with the surface water systems.

16. Ecological features: (main habitats and vegetation types)

Lake Muir supports a narrow zone of open-scrub, sedgeland and low shrubland at or near its margins. The dominant low shrubs are the samphires *Sarcocornia quinqueflora* and *Halosarcia lepidosperma*, the wetland scrub is dominated by the tall shrubs *Melaleuca halmaturorum* and *M. cuticularis* and there is some *M. rhaphiophylla* and *M. viminea*. Other wetland plants near the lake margins include *Lepidosperma effusum*, *Gahnia trifida*, *Schoenus submicrostachyus* and *Wilsonia backhousei*.

Most of the other component lakes and swamps support extensive sedgeland and fringing or scattered areas of low closed-forest or closed-scrub, while open-heathland over open-sedgeland occurs on the wet flats. Major areas of sedgeland are dominated by *Baumea articulata*; commonly associated species are *Baumea* spp. and *Triglochin hueglii*, and at Poorginup Swamp *Leptocarpus scariosus*, *B. vaginalis* and *Gahnia. trifida* also occur. The dominant wetland tree is *Melaleuca rhaphiophylla*. *Melaleuca lateritia*, *Astartea fascicularis* and *Agonis juniperina* occur in some wetlands. (Halse *et al.* 1993; Lane *et al.* 1996; N. Gibson pers. comm.).

Surrounding areas mainly support open-forest dominated by eucalypts, or are cleared.

Since the above description was prepared, the flora and vegetation units of Lake Muir Nature Reserve, and other nearby Nature Reserves, have been extensively surveyed and mapped. 649 indigenous flora taxa were recorded in the Reserve and it has been estimated (N. Gibson pers. comm.) that at least 600 taxa occur within the Ramsar Site. This is a rich flora for such a small area. The reasons for such diversity probably relate to complexes of soil types and hydrological patterns found over short distances. The complex of vegetation patterning is related to these patterns, particularly period of inundation and quality of groundwater, and also to fire history. Structural vegetation mapping showed a complex mosaic of almost 30 vegetation types within the Site (Gibson & Keighery 1999).

17. Noteworthy flora: (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

Three species of wetland-dependent orchids *Caladenia christineae* ms, *Caladenia harringtoniae* ms and *Diuris drummondii* that occur in appreciable numbers at the margins of Lake Muir and elsewhere in the Site (Halse *et al.* 1993; Lane *et al.* 1996, R.W. Hearn pers. comm.) are listed as "Species that are Vulnerable" (Threatened Species) under the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act 1999.

Other notable plants that occur in winter-wet swamps at the Site include several species that currently are poorly known and that soon may be declared rare at a State level: *Stylidium ripidium, Wurmbea sp.* Cranbrook, and *Caladenia starteorum* ms.

Vegetation communities of the wet flats are well represented at the Site and are among the few remaining in non-coastal parts of south-western Australia. The Site has some of the largest natural sedgelands in Western Australia.

Since the above was prepared, the flora of Lake Muir Nature Reserve has been extensively surveyed and described (Gibson & Keighery 1999. See item 16 above). Among the 649 indigenous flora taxa they recorded on this Reserve were three species declared rare (threatened) under the Western Australian Wildlife Conservation Act (*Caladenia christineae* ms, *Caladenia harringtoniae* ms and *Diuris drummondii*) and 19 "priority taxa" (State supplementarty listing of poorly known, or rare but not threatened, taxa). One of these, *Eryngium* sp. Lake Muir, appears to be an endemic taxon to winter-wet clay flats of the Lake Muir area, and currently is only known from the Ramsar Site. The two large populations of *Euphrasia scabra* are the only known extant populations for this taxon in Western Australia; it has been recommended for listing nationally as critically endangered, based on severe population declines in eastern Australia. During recent surveys of the *Euphrasia scabra* populations a new population of the orchid *Caladenia lodgeana* was found. This species was previously known only from a few restricted populations in the Augusta area, some 150 km to the west (N. Gibson pers. comm.).

The shrublands and forests surrounding Lake Muir contain the only known populations of *Lilaeopsis polyantha* in WA. The aquatic sedge *Schoenus natans* has recently been de-listed as Declared Rare Flora based on the large population of this taxon in the Ramsar Site and several nearby Nature Reserves; it was previously believed to be restricted to the Swan Coastal Plain. *Tribonanthes* sp. Lake Muir, which appears to be a previously unrecognised taxon, also appears to be endemic to winter-wet clay flats of the Ramsar Site and other nearby Nature Reserves.

Of the above-mentioned plants, only *Eryngium* sp. Lake Muir is endemic (based on current knowledge) to the Muir-Byenup Ramsar Site.

18. Noteworthy fauna: (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

Lake Muir is regularly used in spring for moulting by thousands of Australian Shelduck. Moulting also occurs on the smaller open lakes, an exceptional concentration of 12,000 shelduck being recorded at Tordit-Gurrup Lagoon in December 1982. Muir-Byenup System is one of the most important moulting sites for shelduck in south-western Australia.

The same lakes are also used as drought refuges by large numbers of waterbirds. The highest number of waterbirds counted at Lake Muir was 51,600 in March 1989, an unusually high total

following a wet winter in the surrounding district but, together with depth data, indicative of occurrence by more than 20,000 waterbirds from time to time.

The Australasian Bittern has been recorded in four of the component sedge-dominated wetlands and probably also occurs elsewhere in the Site. The Site possibly supports in the order of ten pairs of Australasian Bittern and behaviour suggests that some pairs breed there. This number constitutes more than 1% of the south-western Australian population: the 1% level is 3 birds (Rose & Scott 1997). The Site contains the core component of a wider suite of wetlands that constitutes one of the five remaining refuges for the South-western Australian population of this globally threatened (Collar *et al.* 1994) species. The Australasian Bittern is specially protected under State legislation as a species that is "rare or likely to become extinct".

Other information on waterbirds: Surveys have recorded 23 waterbird species at Lake Muir and 41 at Byenup Lagoon: most are non-migrants. The most abundant species at Lake Muir are Pacific Black Duck *Anas superciliosa* (up to 18,450), Grey Teal *Anas gracilis* (16,000) and Eurasian Coot *Fulica atra* (9630) (all counts in March 1989). Lake Muir is a migration stop-over site for small numbers of shorebirds, notably Red-necked Stint *Calidris ruficollis* (up to 517 in November 1985). A breeding colony of up to 40 pairs of Silver Gull *Larus novaehollandiae* occurs on rock outcrops in Lake Muir; up to 700 birds have been counted. Little Bittern *Ixobrychus minutus* and Spotless Crake *Porzana tabuensis* are among the several waterbirds recorded breeding in the sedge-dominated wetlands.

Other noteworthy fauna: fishes. Recent surveys (Storey 1998) of 27 wetlands (including eight in the Muir-Byenup Ramsar Site) in the adjoining catchments of Lake Muir and Lake Unicup have revealed a total of seven fish species, with six being endemic to South-western Australia and one introduced. Of the 27 wetlands surveyed, Poorginup Swamp had the greatest number (five) of native species. Mulgarnup Swamp, also within the Site, had four native species. The two least-frequently encountered native species, *Galaxiella nigrostriata* and *G. munda*, were found only at Poorginup Swamp and one other wetland outside the Site. All seven fish species occurred within the Ramsar Site; no species was restricted to it.

Other noteworthy fauna: invertebrates. A survey of macroinvertebrates by DeHaan (1987) revealed 97 invertebrate taxa in the suite comprising Tordit-Gurrup Lagoon, Byenup Lagoon and Poorginup Swamp. These included 11 water mites Hydracarina, six of which (found at Poorginup Swamp) have restricted distributions (e.g. *Pseudohydryphantes doegi*, *Acercella poorginup*) and are of considerable zoogeographic interest. One species, *Huitfeldtia* sp. nov., is the second known species in its genus; the other species occurs in northern Europe and Canada. The crustaceans *Cherax preissii* and *C. quinquecarinatus* occur at the site.

More recently, Storey (1998) has surveyed the macroinvertebate communities of 27 wetlands (including eight in the Muir-Byenup Ramsar Site) in the adjoining catchments of Lakes Muir and Unicup. A total of 219 taxa was recorded; with 32 endemic to South-western Australia. Poorginup Swamp had the greatest number (16) of south-western Australian endemics. Two new species of dytiscid water beetle *Sternopriscus* sp. nov. and *Antiporus pennifoldae* (*Antiporus* Sp. 1 of Storey, 1998) were recorded, the former was widespread in the catchments, the latter from Poorginup and another location. Storey also recorded a possible new species of ceinid amphipod *Austrochiltonia* sp.

Another new species of dytiscid *Antiporus mcraeae* has recently been found (Watts and Pinder in press) in the Muir-Unicup area (Kodjinup Swamp, outside the Site) during a biological survey funded under the State Salinity Action Plan.

Preliminary identification of microinvertebrates collected during Storey's (1998) survey has revealed a rich and diverse fauna. At least 78 species of ostracods and copepods were recorded. Of these, six ostracods and one cyclopoid copepod are to date only known from the Muir-Unicup area, with two of the ostracods and the cyclopoid being found within the Site (S. Halse pers. comm.). Within the Rotifera there were 11 new records for Western Australia, one new record for Australia and one new species, yet to be described. Within the Cladocera there were two new species and the second record of new, undescribed genus. It is considered likely that much-needed taxonomic revision will reveal that the Muir-Unicup collection contains other new cladoceran taxa. South-western Australia has been shown to have more endemic species and genera of cladocerans than any other region of Australia (R. Shiel pers. comm.)

Unless otherwise indicated, data above are from Jaensch & Vervest 1988, Jaensch *et al.* 1988, Halse *et al.* 1990, Lane *et al.* 1996, R. Hearn pers. comm. and data sets held by the Western Australian Department of Conservation & Land Management.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

No information.

20. Land tenure/ownership of: (a) site (b) surrounding area

(a) The Ramsar Site is the portion of A-Class Nature Reserve 31880 that is south of Muirs Highway. This reserve is vested in the National Parks and Nature Conservation Authority (appointed by the Government of Western Australia) for the purposes of "Conservation of Flora and Fauna" and "Water".

(b) Surrounding areas include freehold (privately owned) land, Nature Reserve, special leases for mining, and State Forest. An area of freehold land is enclosed within, but is not part of, the Ramsar Site (see map).

21. Current land use: (a) site (b) surroundings/catchment

(a) There is no land use other than nature conservation within the Ramsar Site. There are no facilities for nature-based recreation and this type of recreation is limited within the Ramsar Site.

(b) Freehold land enclosed by and adjoining the Ramsar Site is used for agriculture, notably grazing of domestic sheep and cattle and tree plantations. The special leases are for extraction of peat. They expire in 2003 and 2004 though mining may finish earlier than this. Timber is extracted from the State Forests. The most important land uses in the catchment are agriculture and forestry (plantations and native forest). Human population in the Site's surface catchment is in the order of about 20, with a further eight absentee owners.

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

(a) Recently pigs *Sus scrofa* were unlawfully released on the Site. They are causing considerable damage to vegetation and soil. Determined efforts are being made to reduce feral pig numbers by trapping, shooting and poisoning but eradication may be impossible without new technology. Also, exotic plants such as *Typha orientalis* are appearing in some of the wetlands. Some unlawful disturbance of dry lake bed by motor vehicles occurs at Lake Muir.

Potentially important factors include: eutrophication (algal blooms caused by agricultural fertilisers); salinisation (particularly smaller wetlands adjacent to cleared land), too frequent and/or inappropriate fires (destruction of peat and retardation of regeneration of wetland shrub thickets, especially those used by breeding waterbirds), and drainage works.

These and other present and potential disturbances and threats have been described in CALM (1998), Storey (1998) and Gibson & Keighery (1999).

(b) Factors operating in the Site's catchments which potentially may affect the Site's ecological character include salinisation, past catchment drainage and future drainage proposals, and too frequent and/or inappropriate fires. See also CALM (1998), Storey (1998), Gibson & Keighery (1999).

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

The Nature Reserve was established in 1973. In the past, proposed commercial extraction of peat from Tordit-Gurrup Lagoon was opposed by the Western Australian Department of Conservation & Land Management and others and was not approved. The entire Site is included on the Register of the National Estate.

Under the Salinity Action Plan for WA, Lake Muir and associated wetlands have been designated as a "Key Wetlands and Natural Diversity Catchment". Cooperative management of the catchment, with

substantial community participation, is occurring. Besides commercial tree crops (both hardwood and softwood), non commercial plantings of recharge and discharge areas has been undertaken as joint operations between the Western Australian Department of Conservation & Land Management and landowners on private lands to improve water quality impacting downstream on wetlands. Stream flow and water quality monitoring is in place in several locations.

A Draft Management Plan for the Reserve (and nearby Perup and Unicup Reserves) was released for public comment late in 1998.

Large parts of the shoreline of Lake Muir and Byenup Lagoon have no protected area buffer zones whereas other wetlands within the Ramsar Site have protected buffers more than 100 m wide.

An area of lake and shoreline (Nelson Location 2198) on the south-western side of Lake Muir has recently been purchased by the Department of Conservation & Land Management and is proposed for addition to the Lake Muir Nature Reserve.

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

Measures proposed under the Salinity Action Plan include further planting of trees (including commercial plantations) on freehold land as a strategy to reduce dryland salinity in the Lake Muir catchment. Proposals to divert high salt water flows away from freshwater systems at critical times are being investigated. A Recovery Catchment Management Plan is being prepared.

There is potential to extend the Ramsar Site in the future, following consultation with land managers, to include Nature Reserves and possibly other government land (e.g. some Water & Rivers Commission land) to the north of Muirs Highway. The area of lake and shoreline on the south-western side of Lake Muir that has recently been purchased and is proposed for addition to the Nature Reserve (see item 23) could also potentially be added to the Site in the future.

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

Depth, salinity and other water quality parameters of Lake Muir, Byenup Lagoon, Tordit-Gurrup Lagoon and Poorginup Swamp have been measured by the Department of Conservation & Land Management at least twice each year since the late 1970s.

Waterbird usage was surveyed annually during 1981-91, with an emphasis on bitterns and ducks (Jaensch *et al.* 1988, Jaensch and Vervest 1988, Halse *et al.* 1990).

Intensive surveys of flora and fauna within the Site have recently been conducted with funding from Environment Australia Biodiversity Group (Natural Heritage Trust) and the State Government (Salinity Action Plan). Reports on the Site's fish, aquatic macroinvertebrates, physico-chemistry, flora and vegetation have been prepared (Storey 1998 and Gibson & Keighery 1999).

During the past three years, vegetation monitoring plots and/or transects have been established at Tordit-Gurrup, Mulgarnup, Byenup, North Byenup and Geordinup Lagoons, Poorginup Swamp, Lake Muir and two other locations within the Ramsar Site (Gibson & Keighery 1999; J. Lane pers. comm.).

Magnetic and radiometric survey data have been collected to improve knowledge of the geology of the area. Hydrogeological and limnological surveys, analysis and mapping will follow with a view to improving knowledge of groundwater and surface water systems. "Salt mapping" will allow synthesis into a model to facilitate planning of future management of the area, particularly (high water use) tree and agricultural crops on adjoining lands, to maintain conservation values of the wetland system.

The Ramsar Site is of interest for scientific research of past climatic regimes (peat record).

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

No facilities or materials are available at present. Construction of an information bay and interpretive facility at the northern end of Lake Muir is proposed for completion during 2001. An informative

brochure will be prepared. The area is likely to become a target of education through the Perup Ecology Centre, located in the adjacent Perup Nature Reserve.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

There is low level, irregular use for birdwatching from the few public access points, e.g. Muirs Highway adjacent to Lake Muir. Also see items 21 and 26.

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept of Environment etc.)

Territorial: The State Government of Western Australia.
Functional: The National Parks and Nature Conservation Authority (vesting) and the Western Australian Department of Conservation & Land Management (management).

29. Management authority: (name and address of local body directly responsible for managing the wetland)

The Manjimup District (based in Manjimup) of the Southern Forests Region, Western Australian Department of Conservation & Land Management.

30. Bibliographical references: (scientific/technical only)

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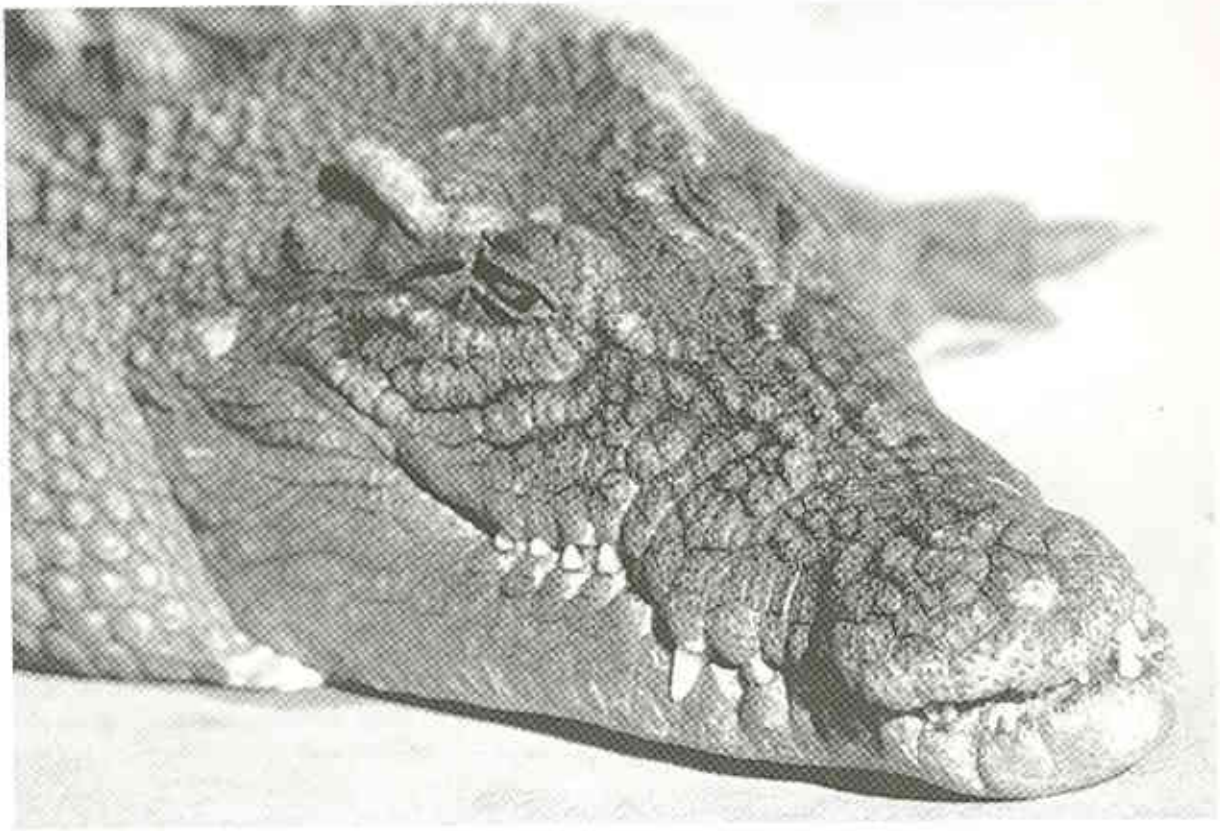
Storey, A.W. 1998. Assessment of the nature conservation values of the Byenup-Muir peat swamp system, south western Australia: physico-chemistry, aquatic macroinvertebrates and fishes. Unpublished report for the WA Department of Conservation & Land Management and Environment Australia.

Watts, C.H.S and Pinder, A. (in press). Two new species of *Antiporus* from Western Australia (Coleoptera; Dytiscidae). Records of the South Australian Museum.



Saltwater Crocodile. Photo – Babs & Bert Wells/CALM

Information sheet on Ramsar wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed:

August 2000

Note: this Information sheet documents extensions to an existing Ramsar Site.

2. Country:

Australia

3. Name of wetland:

Ord River Floodplain

4. Geographical coordinates:

Latitude: 14^0 51' S to 15^0 46' S
Longitude: 128^0 12' E to 128^0 33' E

5. Elevation: (average and/or max. & min.)

Approx. at sea level (Australian Height Datum).

6. Area: (in hectares)

The area (re-calculated) of the original Site nomination in February 1990 was 124,370 ha, the total area of the extension is 17,083 ha, thus the total area of the Ramsar Site is now 141,453 ha.

7. Overview: (general summary, in two or three sentences, of the wetland's principal characteristics)

A large system of river, seasonal creek, tidal mudflat and floodplain wetlands that supports extensive stands of mangroves important for salt-water crocodiles, and a large number and diversity of waterbirds.

8. Wetland type: (please circle the applicable codes for wetland types as listed in Annex I of the *Ramsar Explanatory Note and Guidelines* document)

Where types include options, the relevant options are shown in **bold**.

F (estuarine waters).
G (intertidal **mud**, **sand** or salt flats).
H (intertidal marshes).
I (intertidal forested wetlands).
J (coastal **brackish**/saline lagoons).
N (**seasonal**/intermittent/irregular rivers/streams/**creeks**).
Tp (permanent freshwater **marshes**/pools).
Ts (**seasonal**/intermittent freshwater **marshes**/pools).
W (shrub-dominated wetlands).
Xf (freshwater, tree-dominated wetlands).
Y (**freshwater springs**; oases).

The extension (see item 13) does not contribute additional wetland types, though it adds substantially to the area of seasonal creek in the Site. The creeks include permanent waterholes.

Please now rank these wetland types by listing them from the most to the least dominant:

Ts, G, I, H, F, N, Xf, Tp, J, W, Y.

9. Ramsar criteria: (please circle the applicable criteria; see point 12, next page)

The Criteria under which Ord River Floodplain was originally nominated as a Ramsar Site were:

1 (It is a particularly good example of a specific type of wetland, characteristic of its region).

2a (It supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant or animal, or an appreciable number of individuals of any one or more of these species).

2b (It is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna).

3b (It regularly supports substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity).

Since that time, the Criteria have been further developed and re-numbered by Ramsar Conferences of Contracting Parties. The Criteria now applicable to the Site as originally nominated are:

1 (It contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region).

2 (It supports vulnerable, endangered or critically endangered species or threatened ecological communities).

3 (It supports populations of a plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

The extension (see item 13) does not cause additional Criteria to be met.

Please specify the most significant criterion applicable to the site:

3 (formerly 2b)

10. Map of site included?

Yes, the maps show the original Ramsar Site and the extension.

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

Roger Jaensch, Wetlands International - Oceania, GPO Box 636, Canberra ACT 2601, Australia, (Tel: +61-2-6250-0779; Fax: +61-2-6250-0799; email: roger.jaensch@ea.gov.au), on behalf of the Western Australian Department of Conservation & Land Management (CALM), in November 1998. Updated by CALM staff in August 2000. All inquiries should be directed to Jim Lane, CALM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

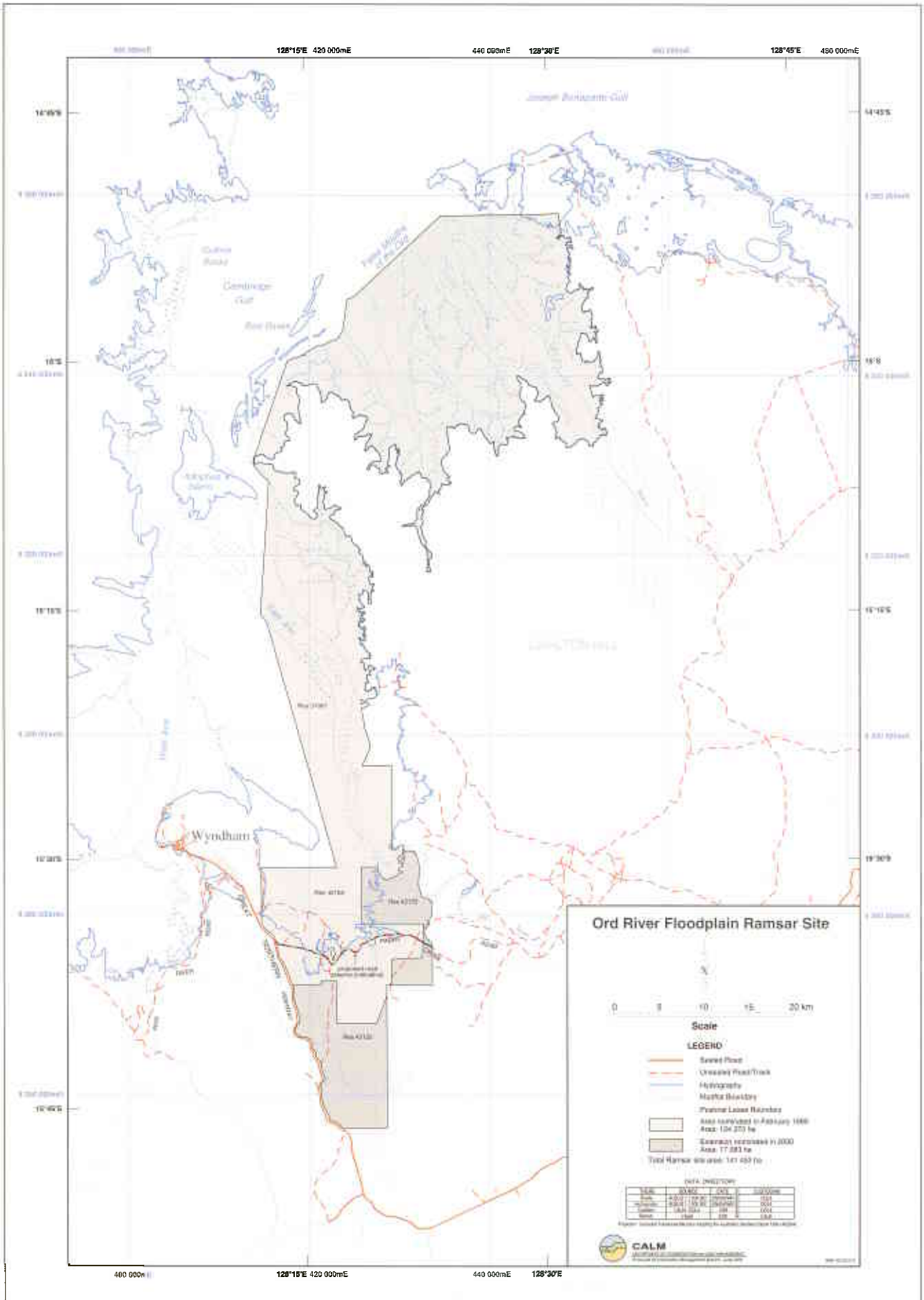
12. Justification of the criteria selected under point 9: (Please refer to Annex II in the *Ramsar Explanatory Note and Guidelines* document)

(Based on information provided in the original nomination document)

1 (formerly 1): The Site is the best example in Western Australia of an extensive system of wetlands (e.g. grass-dominated wetland) associated with the floodplain and estuary of a major tropical river.

2 (formerly 2a): The Site supports a viable population of the globally threatened saltwater crocodile *Crocodylus porosus*.

3 (formerly 2b): The Site includes the most biologically diverse, contiguous floodplain and mangroves system in Western Australia.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Joseph Bonaparte Gulf
Cambridge Gulf
Wyndham
Ord River Floodplain Ramsar Site
N
0 5 10 15 20 km
Scale
LEGEND
Sealed Road
Unsealed Road/Track
Hydrography
Pastoral Lease Boundary
Area nominated in February 1990
Area: 124 273 ha
Extension nominated in 2000
Area: 17 083 ha
Total Ramsar site area: 141 453 ha
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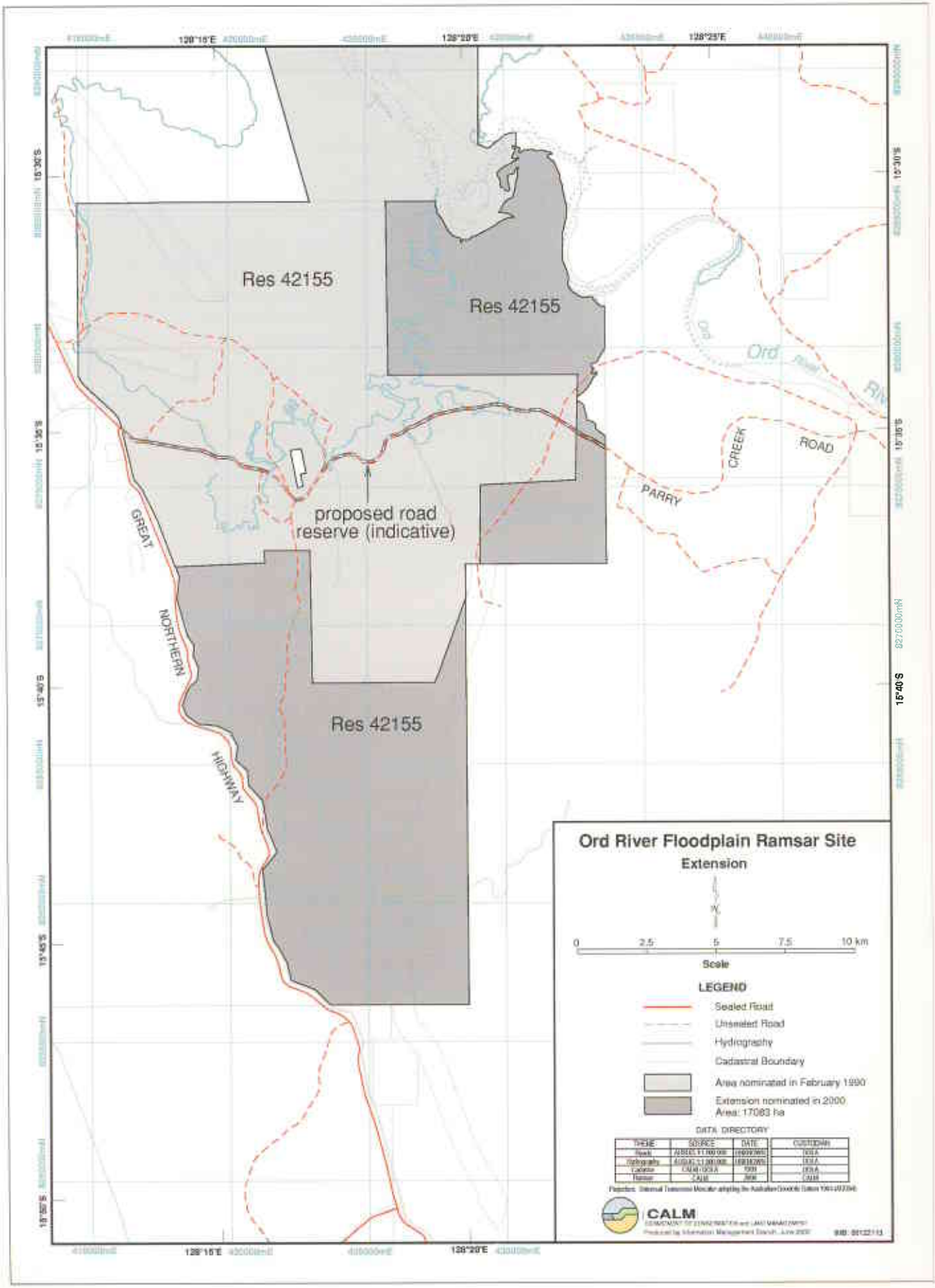
CALM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Res 42155
Res 42155
Res 42155
proposed road reserve (indicative)
GREAT NORTHERN HIGHWAY
PARRY CREEK ROAD
Ord River Floodplain Ramsar Site
Extension
0 2.5 5 7.5 10 km
Scale
LEGEND
Sealed Road
Unsealed Road
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 17083 ha
DATA DIRECTORY
THEME
SOURCE
DATE
CUSTODIAN
Roads
Hydrography
Cadastre
Relief
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3 (formerly 3b): The Site supports substantial numbers of individuals from most waterbird families, but especially those (herons, ducks, shorebirds) typically associated with tropical floodplains.

13. General location: (include the nearest large town and its administrative region)

Ord River Floodplain is in the Shire of Wyndham-East Kimberley (local authority) in the State of Western Australia (population ca. 1.9 million). It is 8 km east of the town of Wyndham (population ca. 1000).

The Ramsar Site as originally nominated in February 1990 comprised: former Nature Reserves 30866, I058, I059, 31636 (now amalgamated as Nature Reserve 42155) and 31967; areas that at the time were proposed for reservation and have since been added to Nature Reserve 31967; and some adjacent marine and estuarine waters and tidal land of Cambridge Gulf and the lower Ord River. The main wetland features of the Site therefore were (and are) the floodplain and associated wetlands of the lower Ord River and of Parry Creek as well as the intertidal wetlands associated with the East Arm of Cambridge Gulf and the "False Mouths of the Ord".

The Site has now been extended (see maps) to include areas that have been added to Nature Reserve 42155 since the original Site nomination. The extension comprises most of the land between the former eastern/southern boundary of the Site and the present eastern/southern boundary of Nature Reserve 42155. Two small areas of the Nature Reserve (totalling approximately 120 hectares on the eastern boundary) have not been included in the Site extension because these are subject to a proposal for changes to the Reserve boundary, involving a combination of excisions and additions to the Reserve. A proposed road reserve, intended to accommodate Parry Creek Road (which is currently within Nature Reserve), is also not included in the Site.

The extension brings more of the wetlands associated with Goose Creek (e.g. part of Wild Goose Lagoon) and upper Parry Creek (waterholes and gorge wetlands) into the Ramsar Site.

14. Physical features: (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

As indicated in the original nomination document and subsequent Ramsar Information Sheet (RIS).

The extension is briefly described in item 13.

15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilisation etc.)

None recognised.

16. Ecological features: (main habitats and vegetation types)

As indicated in the original nomination document and subsequent RIS. Vegetation of the extension is similar to that of relevant wetlands described in the original nomination document and RIS.

17. Noteworthy flora: (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

There are no nationally rare, threatened or endemic plants known at the Site. However, several species that are under consideration for declaration as "rare flora" at State level occur at the Site, notably *Utricularia aurea.*

18. Noteworthy fauna: (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

As indicated in the original nomination document and subsequent RIS.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

As indicated in the original nomination document and subsequent RIS.

20. Land tenure/ownership of: (a) site (b) surrounding area

(a) See item 13. The Nature Reserves are vested in the National Parks and Nature Conservation Authority of Western Australia (appointed by the State Government). The purpose of the Nature Reserves is "Conservation of Flora and Fauna". Marine areas within the site are largely non-reserved.

(b) Surrounding areas are mostly pastoral leasehold land (notably Carlton Hill and Ivanhoe leases), government reserves (e.g. Reserve 20623), and non-reserved marine and estuarine areas.

21. Current land use: (a) site (b) surroundings/catchment

(a) As indicated in the original nomination document and subsequent RIS. The extension is used for nature conservation.

(b) As indicated in the original nomination document and subsequent RIS.

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

(a) As indicated in the original nomination document and subsequent RIS.

(b) As indicated in the original nomination document and subsequent RIS. Also, the Ord River Area Stage 2 expansion may see irrigated agriculture in close proximity to the Extension. The Water & Rivers Commission has commenced a project to consider environmental water requirements for the Lower Ord. The intent of the project is to provide a basis for the determination of a flow management strategy that takes account of economic, social and ecological requirements. Water allocations for agriculture and other purposes would be considered in the light of any possible impacts on the Ramsar Site.

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

As indicated in the original nomination document and subsequent RIS.

In addition, since the Site was originally nominated in 1990, changes to the extent, vesting and purpose of the component Nature Reserves have been achieved (see item 13).

Preliminary management planning work for the Ramsar Site in 1997 was followed by production of a draft "Management Report" by the Western Australian Department of Conservation & Land Management in 1998. With the approval of the National Parks and Nature Conservation Authority, this document will now be progressed to the status of a formal management plan for the area.

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

As indicated in the original nomination document and subsequent RIS.

In addition, a number of measures have been proposed (CALM 1998), notably: declaration of a Cambridge Gulf Marine Park; management zoning; formation of a management council; further biological surveys; preparation of a fire master plan; and management of recreational use.

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

As indicated in the original nomination document and subsequent RIS.

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

As indicated in the original nomination document and subsequent RIS. Walkways and bird viewing platforms have been constructed at Marlgu Lagoon. Interpretive signs about the Site are proposed to be put in place during 1998-9.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

As indicated in the original nomination document and subsequent RIS.

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept of Environment etc.)

Territorial: The State Government of Western Australia.
Functional: The National Parks and Nature Conservation Authority (vesting) and the Western Australian Department of Conservation & Land Management (management).

29. Management authority: (name and address of local body directly responsible for managing the wetland)

The Kimberley Region (based in Kununurra) of the Western Australian Department of Conservation & Land Management.

30. Bibliographical references: (scientific/technical only)

As indicated in the original nomination document and subsequent RIS, plus the following:

CALM 1998. Lower Ord Ramsar Site Draft Management Report June 1998. Western Australian Department of Conservation & Land Management, Kununurra.

Jaensch, R.P. and Watkins, D. 1999. Nomination of additional Ramsar wetlands in Western Australia. Unpublished technical report by Wetlands International – Oceania for the Department of Conservation & Land Management, Perth.

Watkins, D., Brennan, K., Lange, C., Jaensch, R. and Finlayson, M. 1997. Management planning for Ramsar sites in the Kimberley Region of Western Australia. Report prepared by Wetlands International – Oceania for the Department of Conservation & Land Management

Lake McLarty, Extension 2 of Peel-Yalgorup Ramsar Site. Photo – G. Pearson

Lake Clifton, Extension 4 of Peel-Yalgorup Ramsar Site. Photo – G. Pearson

Information sheet on Ramsar wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed:

August 2000

Note: this Information sheet documents extensions to an existing Ramsar Site.

2. Country:

Australia

3. Name of wetland:

Peel-Yalgorup System

4. Geographical coordinates:

Latitude: 32^0 32' S to 33^0 06' S
Longitude: 115^0 37' E to 115^0 47' E

5. Elevation: (average and/or max. & min.)

Approx. at sea level (Australian Height Datum).

6. Area: (in hectares)

The area (re-calculated) of the original Site nomination in February 1990 was 24,370 ha, the total area of the seven extensions is 2160 ha, thus the total area of the Ramsar Site is now 26,530 ha.

7. Overview: (general summary, in two or three sentences, of the wetland's principal characteristics)

A large system of shallow estuary and saline, brackish and freshwater lakes. Many tens of thousands of waterbirds, including large numbers of migrant shorebirds from the northern hemisphere, use the estuary and lakes each year. There is also a particularly unusual occurrence of thrombolites, a primitive life form superficially resembling stromatolites.

8. Wetland type: (please circle the applicable codes for wetland types as listed in Annex I of the *Ramsar Explanatory Note and Guidelines* document)

Where types include options, the relevant options are shown in **bold**.

F (estuarine waters).
G (intertidal **mud**, **sand** or salt flats).
H (intertidal marshes).
Q (permanent **saline**/brackish/alkaline lakes).
Tp (permanent freshwater **marshes**/pools).
Ts (**seasonal**/intermittent freshwater **marshes**/pools).
W (shrub-dominated wetlands).
Xf (freshwater, tree-dominated wetlands).

The extensions (see item 13) do not contribute additional wetland types.

Please now rank these wetland types by listing them from the most to the least dominant:

F, Q, Ts, G, H, W, Xf, Tp.

9. Ramsar criteria: (please circle the applicable criteria; see point 12, next page)

The Criteria under which Peel-Yalgorup System was originally nominated as a Ramsar Site were:

1 (It is a particularly good example of a specific type of wetland, characteristic of its region).

2d (It is of special value for its endemic plant or animal species or communities).

3a (It regularly supports 20,000 waterfowl).

3c (Where data on populations are available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl).

Since that time, the Criteria have been further developed and re-numbered by Ramsar Conferences of Contracting Parties. The Criteria now applicable to the Site as originally nominated are:

1 (It contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region).

3 (It supports populations of a plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

5 (It regularly supports 20,000 or more waterbirds).

6 (It regularly supports 1% of the individuals in a population of one species or subspecies of waterbird).

The extensions (see item 13) do not cause additional Criteria to be met.

Please specify the most significant criterion applicable to the site: 3 (formerly 2d) and 5 (3a)

10. Map of site included?

Yes, the maps show the original Ramsar Site and the extensions.

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

Roger Jaensch, Wetlands International - Oceania, GPO Box 636, Canberra ACT 2601, Australia, (Tel: +61-2-6250-0779; Fax: +61-2-6250-0799; email: roger.jaensch@ea.gov.au), on behalf of the Western Australian Department of Conservation & Land Management (CALM), in November 1998. Updated by CALM staff in August 2000. All inquiries should be directed to Jim Lane, CALM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

12. Justification of the criteria selected under point 9: (Please refer to Annex II in the *Ramsar Explanatory Note and Guidelines* document)

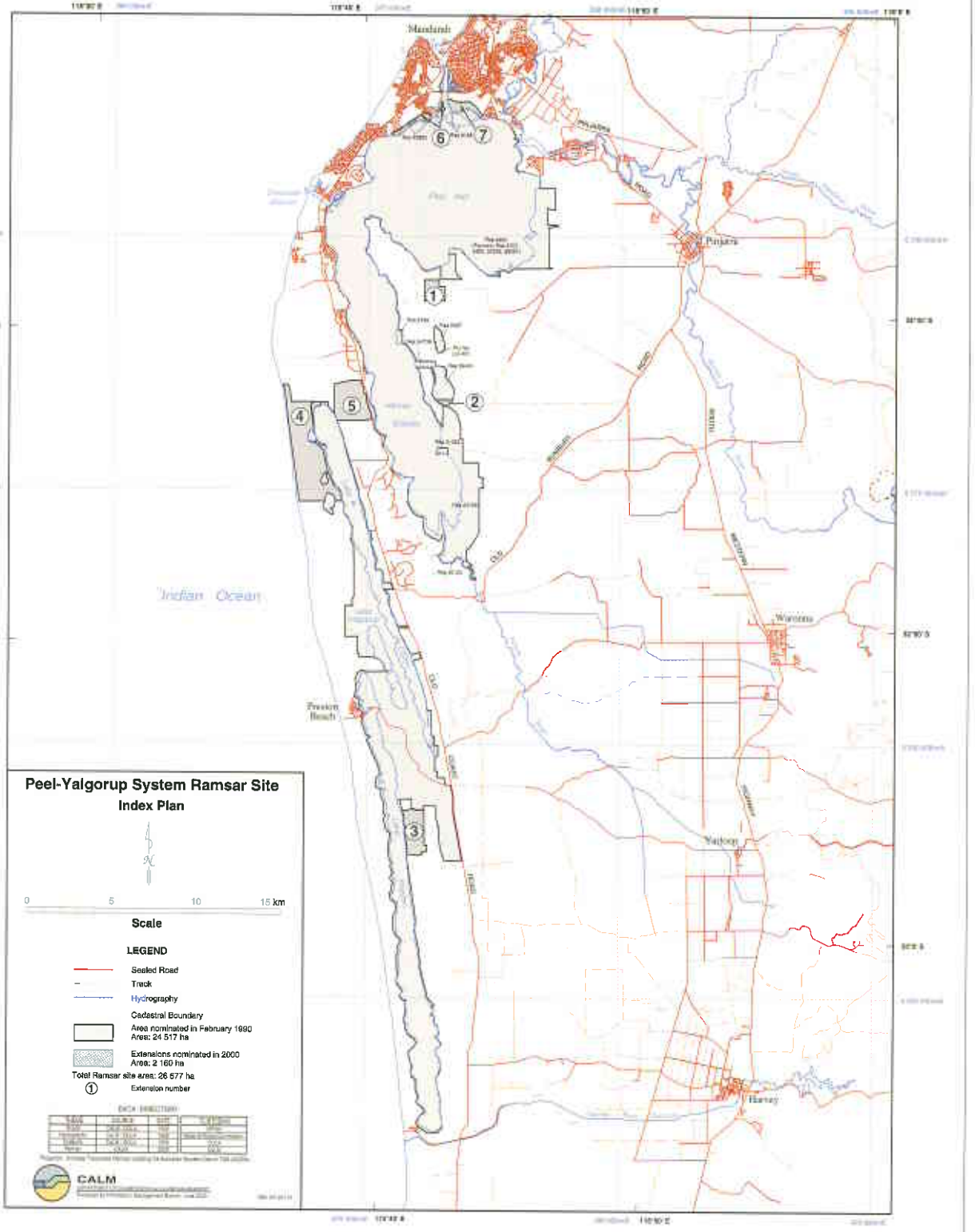
(Based on information provided in the original nomination document.)

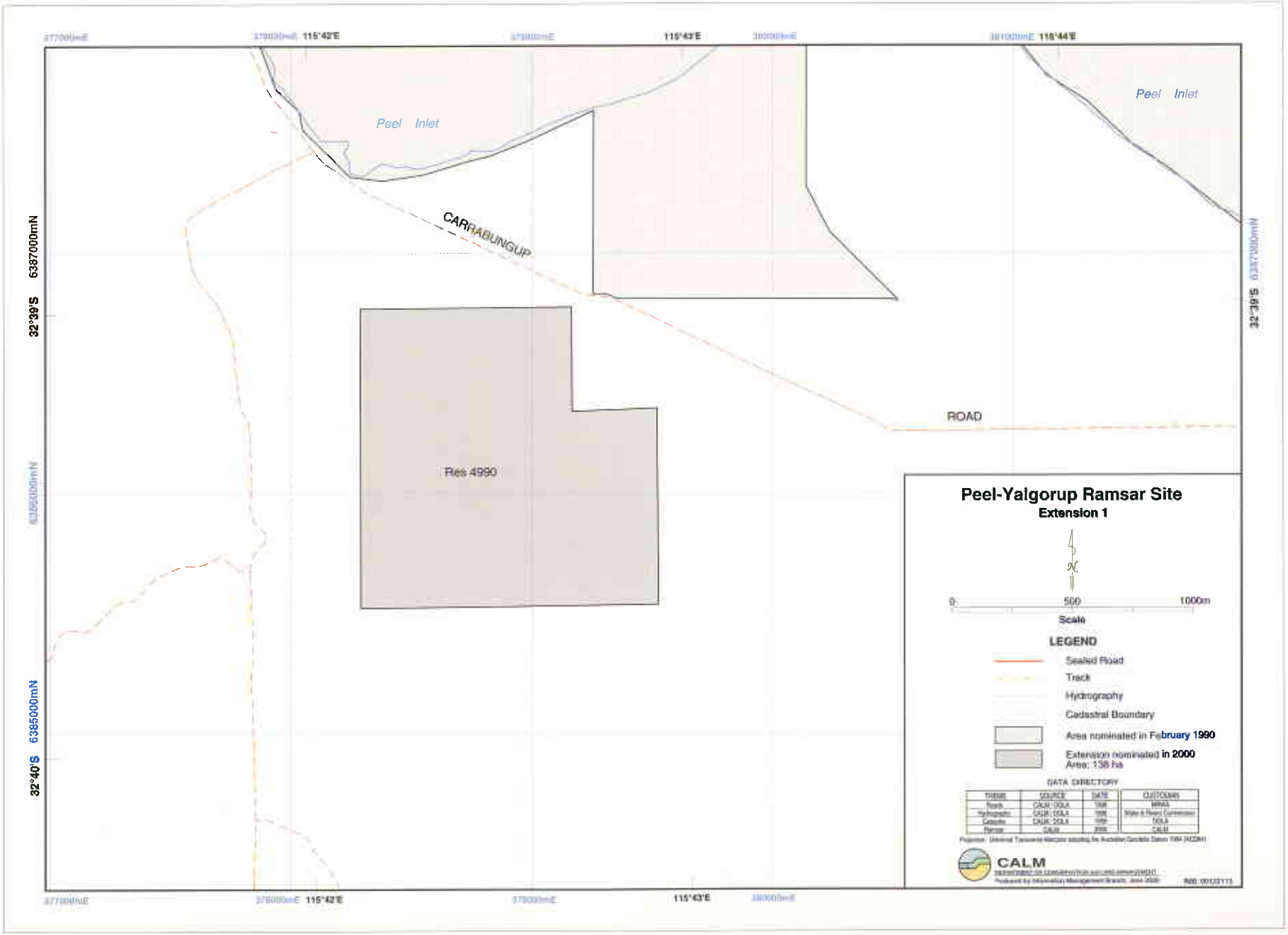
1 (formerly 1): The Site includes the largest and most diverse estuarine complex in south-western Australia and also particularly good examples of coastal saline lakes and freshwater marshes.

3 (formerly 2d): The Site is one of only two locations in south-western Australia and one of very few in the world where living thrombolites (a type of microbialite, superficially similar in appearance to stromatolites) occur in hyposaline water.

5 (formerly 3a); The Site supports in excess of 20,000 (up to 150,000) waterbirds annually.

6 (formerly 3c): The Site regularly supports 1% of the population of at least 7 waterbird species.


Mandurah
Pinjarra
Warrenup
Preston Beach
Yalgorup
Harvey
Indian Ocean
1
2
3
4
5
6
7
Peel-Yalgorup System Ramsar Site
Index Plan
0
5
10
15 km
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Area: 24 517 ha
Extensions nominated in 2000
Area: 2 160 ha
Total Ramsar site area: 26 677 ha
Extension number
CALM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Peel-Yalgorup Ramsar Site
Extension 1
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Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 138 ha
DATA DIRECTORY
THEME
SOURCE
DATE
CUSTODIAN
Roads
CALM / DOLA
1998
MRWA
Hydrography
CALM / DOLA
1998
Water & Rivers Commission
Cadastre
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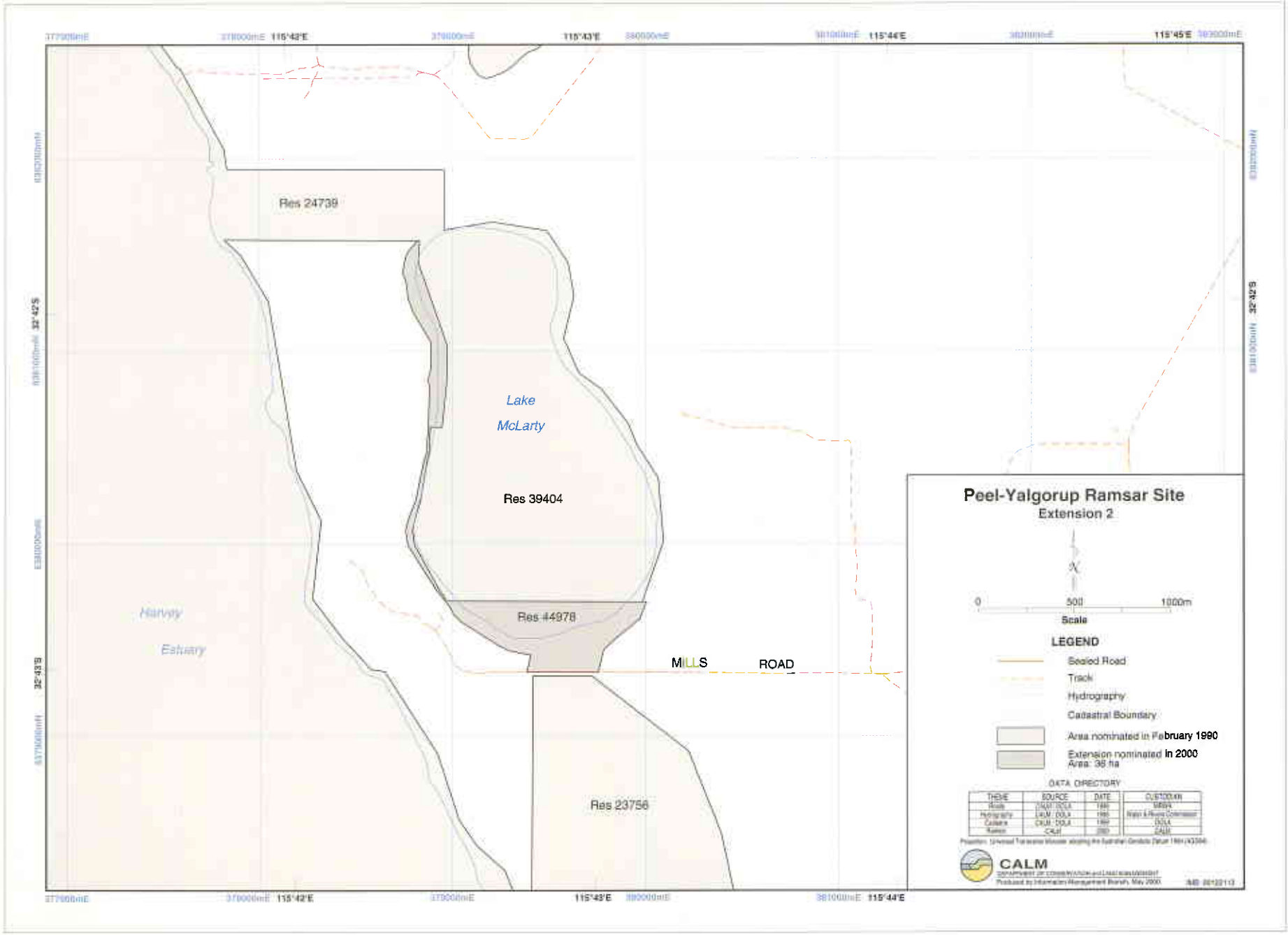
Produced by Information Management Branch, June 2000.
IMB: 00122113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Harvey
Estuary
MILLS
ROAD
Res 23756
Peel-Yalgorup Ramsar Site
Extension 2
N
0
500
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Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 38 ha
DATA DIRECTORY
THEME
SOURCE
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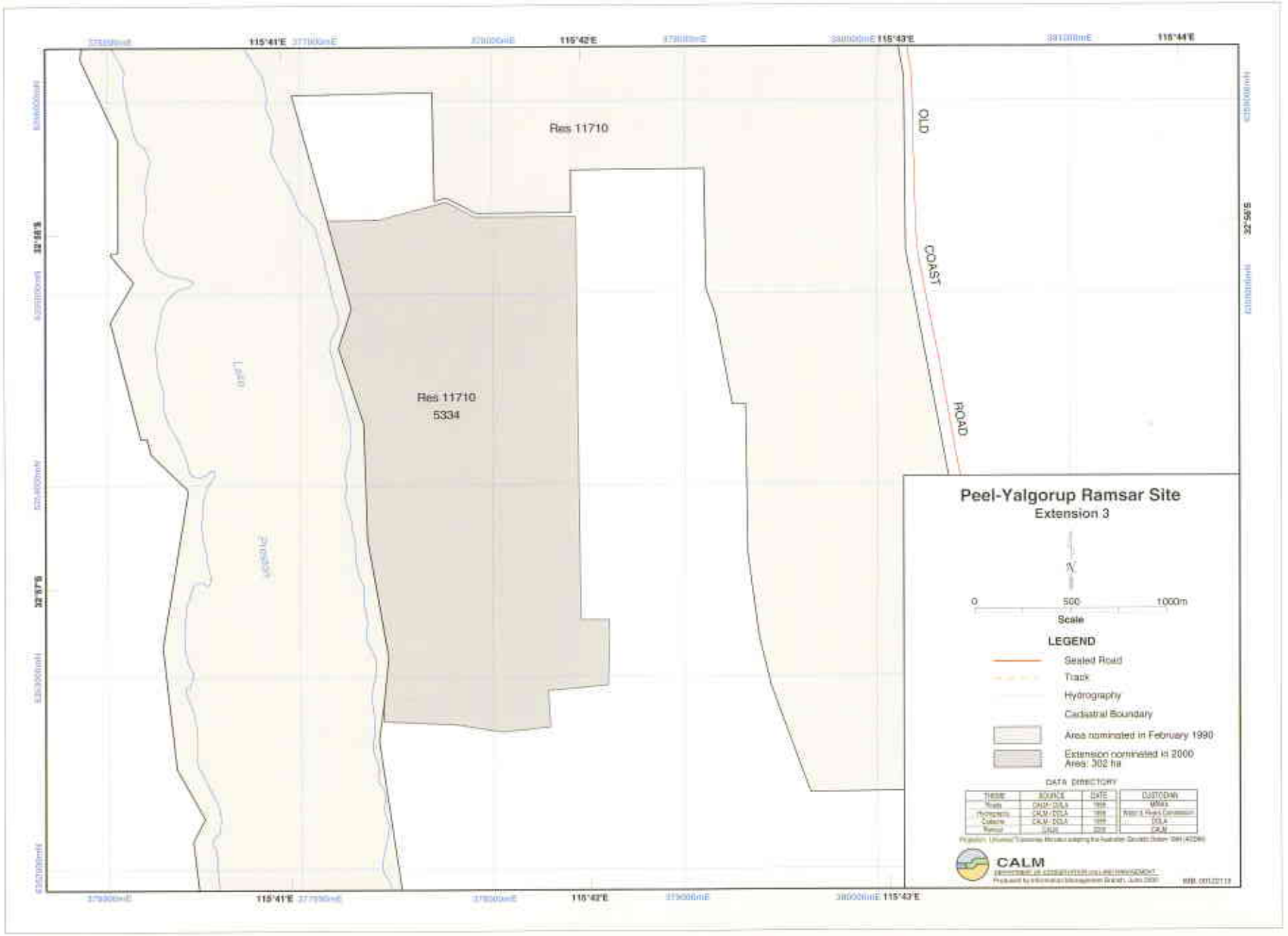
CUSTODIAN
CALM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Res 11710
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OLD
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Peel Inlet
Peel-Yalgorup Ramsar Site
Extension 3
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0
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1000m
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 302 ha
DATA DIRECTORY
THEME
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DATE
CUSTODIAN
Roads
CALM - DOLA
1998
MRWA
Hydrography
CALM - DOLA
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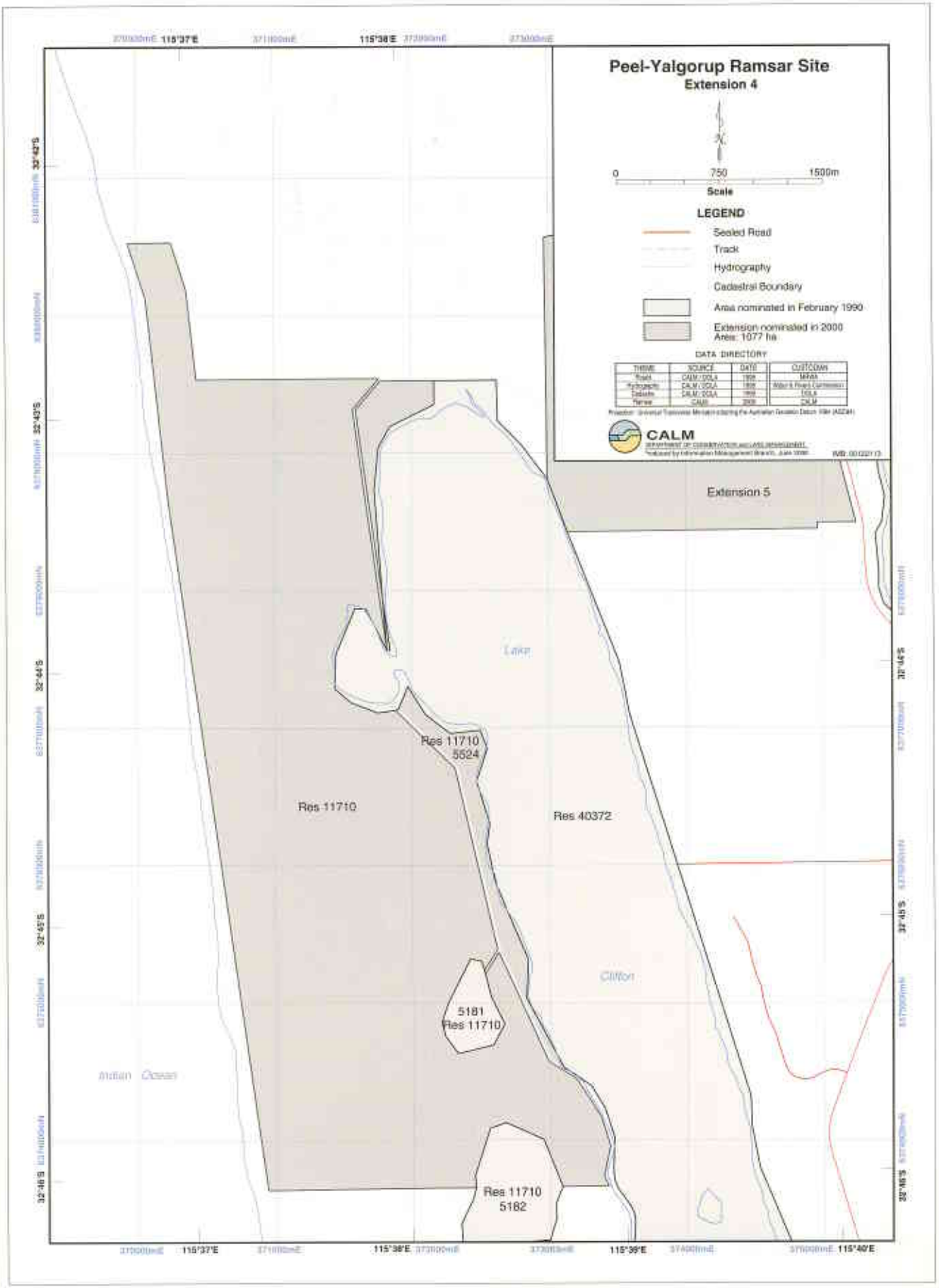
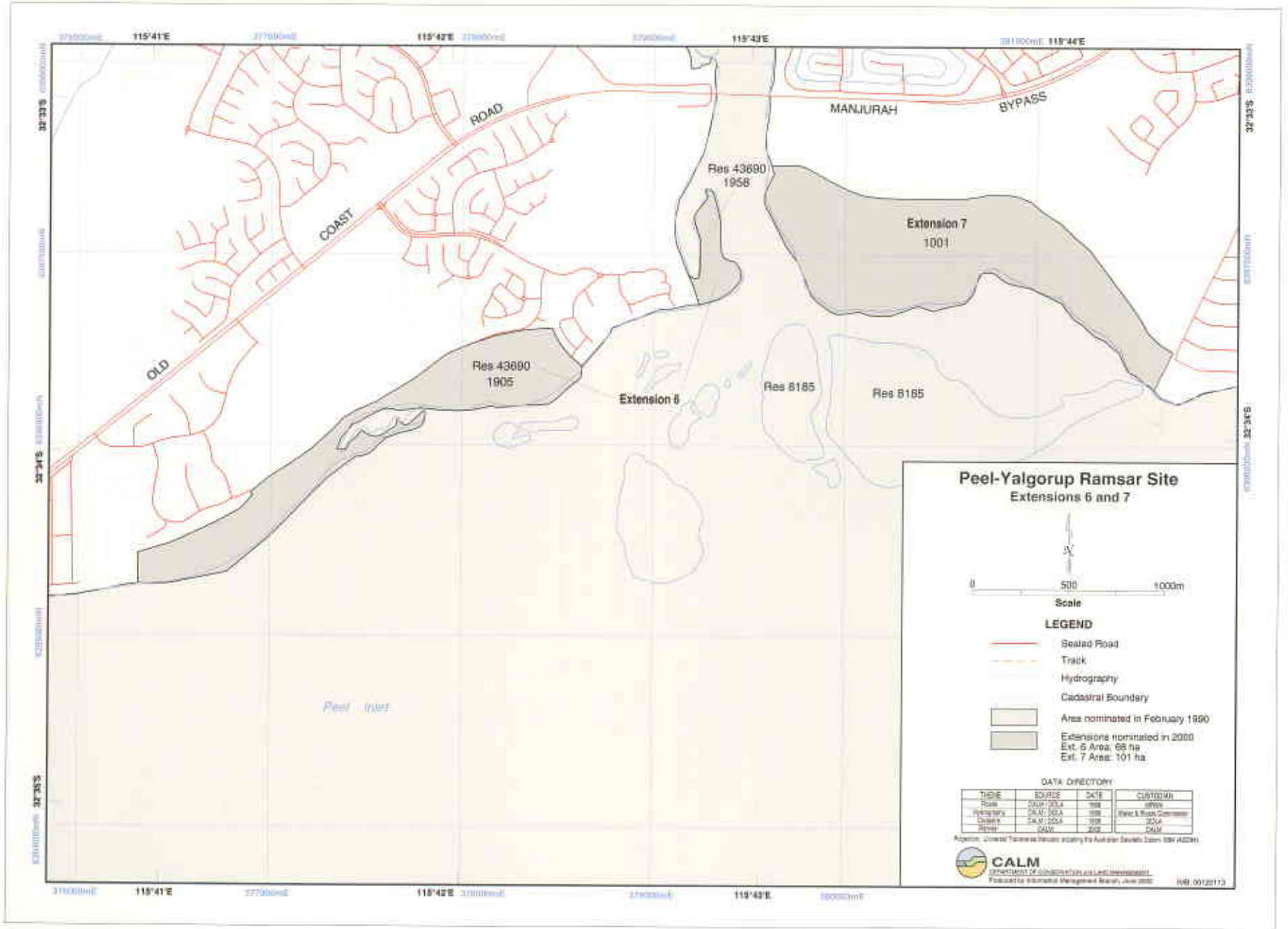
Water & Rivers Commission
Cadastre
CALM - DOLA
1998
DOLA
Ramsar
CALM
2000
CALM
CALM


Peel-Yalgorup Ramsar Site
Extension 4
0
750
1500m
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 1077 ha
DATA DIRECTORY
THEME
SOURCE
DATE
CUSTODIAN
Roads
CALM / DOLA
1998
MRWA
Hydrography
CALM / DOLA
1998
Water & Rivers Commission
Cadastre
CALM / DOLA
1998
DOLA
Ramsar
CALM
2000
CALM
CALM
Extension 5
Lake
Res 11710
5524
Res 11710
Res 40372
Clifton
5181
Res 11710
Indian Ocean
Res 11710
5182
115°37'E
115°38'E
115°39'E
115°40'E
32°42'S
32°43'S
32°44'S
32°45'S
32°46'S


115°38'E
115°39'E
115°40'E
115°41'E
32°42'S
32°43'S
32°44'S
OLD
COAST
ROAD
Res 12189
Res 40372
Extension 4
Harvey
Estuary
Lake
Clifton
Peel-Yalgorup Ramsar Site
Extension 5
N
0
500
1000m
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 438 ha
DATA DIRECTORY
THEME
SOURCE
DATE
CUSTODIAN
Roads
CALM / DOLA
1998
MRWA
Hydrography
CALM / DOLA
1998
Water & Rivers Commission
Cadastre
CALM / DOLA
1998
DOLA
Ramsar
CALM
2000
CALM
CALM


115°41'E
115°42'E
115°43'E
115°44'E
32°33'S
32°34'S
32°35'S
MANJURAH
BYPASS
ROAD
COAST
OLD
Res 43690
1958
Extension 7
1001
Res 43690
1905
Extension 6
Res 8185
Res 8185
Peel Inlet
Peel-Yalgorup Ramsar Site
Extensions 6 and 7
N
0
500
1000m
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extensions nominated in 2000
Ext. 6 Area: 68 ha
Ext. 7 Area: 101 ha
DATA DIRECTORY
THEME
SOURCE
DATE
CUSTODIAN
Roads
DOLA / DOLA
1998
MRWA
Hydrography
CALM / DOLA
1998
Water & Rivers Commission
Cadastre
CALM / DOLA
1998
DOLA
Ramsar
CALM
2000
CALM
CALM
DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
Produced by Information Management Branch, June 2000
IMB 00120113

Erskine Conservation Park, part extension 6 of Peel-Yalgorup Ramsar Site. Photo - G.Pearsons

"The Chimneys", part extension 6 of Peel-Yalgorup Ramsar Site. Photo - G.Pearsons

13. General location: (include the nearest large town and its administrative region)

Peel-Yalgorup System is in the Shires of Murray, Mandurah, Waroona and Harvey (local authorities) in the State of Western Australia (population ca. 1.9 million). It is immediately south of the city of Mandurah (population ca. 44,000).

The Ramsar Site as originally nominated in February 1990 comprised: Peel Inlet (south of the old Mandurah Estuary Bridge) and Harvey Estuary; Nature Reserves (4990, 24036, 28087 and 2707) adjoining the eastern and southern sides of Peel Inlet; Nature Reserves (2738, 24739, 23756 and 36126) adjoining the eastern and southern sides of Harvey Estuary; most of Lake McLarty (Nature Reserve 39404, which is contiguous with 24739); Lake Mealup (partly in Nature Reserve 6627 and partly freehold owned by the Lake Mealup Preservation Society); and the waters (principally Lakes Clifton, Preston, Boundary, Pollard, Martins Tank, Yalgorup, Hayward and Newnham) and lands of Yalgorup National Park.

The Site has now been extended to include seven additional areas, most of which are recent additions to the conservation reserve system (see maps):

- Extension 1: an addition to Nature Reserve 4990 which includes brackish-saline marsh and shrub-swamp connected by a drain to Peel Inlet at Robert Bay;
- Extension 2: the new Nature Reserve 44978 which comprises the western margins and southern part of Lake McLarty;
- Extension 3: an addition to Reserve 11710 (part of Yalgorup National Park) which is dryland that widens the buffer zone for part of the eastern side of Lake Preston;
- Extension 4: an addition to Reserve 11710 (part of Yalgorup National Park) which includes some of the north-western shore of Lake Clifton and also dryland that widens the buffer zone for the north-western side of Lake Clifton;
- Extension 5: the south-eastern part of Reserve 12189 (also part of Yalgorup National Park) which widens the buffer zone for part of the north-eastern side of Lake Clifton;
- Extension 6: Erskine Conservation Park (Nature Reserve 43690), which has two parts and includes shore and associated marshes on the north-western side of Peel Inlet near "The Chimneys".
- Extension 7: an area of salt marsh north of Creery Island ceded to the Crown (and subsequently to be made a conservation reserve) by Cedar Woods Properties Limited as part of the Mariners Cove Development at Mandurah.

Of these components, Extensions 1, 2, 6 and 7 include substantial areas of wetland. The others include shoreline at the edge of the Ramsar Site as originally nominated and/or dryland that provides a buffer zone for the wetlands. See also item 24.

14. Physical features: (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

As indicated in the original nomination document and subsequent RIS.

The extensions are briefly described in item 13.

15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilisation etc.)

None recognised.

16. Ecological features: (main habitats and vegetation types)

As indicated in the original nomination document and subsequent RIS. This information also applies to the extensions.

17. Noteworthy flora: (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

There are no nationally rare, threatened or endemic wetland plants known at the Site. At least one species (*Schoenus natans*) that is of conservation concern ("Priority 4") at State level is found at the Site.

18. Noteworthy fauna: (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

As indicated in the original nomination document and subsequent RIS.

Areas now added to the Site enhance the conservation values of the Site through inclusion of shorebird feeding habitat (Extensions 1, 6 and 7), inclusion of the remainder of Lake McLarty (the southern part is used consistently by large numbers of waterbirds including migratory shorebirds), and provision/widening of protected buffer zones for the Site's wetlands.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

As indicated in the original nomination document and subsequent RIS.

The southern end of Lake McLarty is a popular birdwatching site.

20. Land tenure/ownership of: (a) site (b) surrounding area

(a) See item 13. The Nature Reserves and National Park are all vested in the National Parks and Nature Conservation Authority of Western Australia (appointed by the State Government). The purpose of most of the Nature Reserves is "Conservation of Flora and Fauna": an exception is Reserve 43690 which is "Conservation Park". The purpose of the Reserves that comprise Yalgorup National Park is "National Park".

(b) Surrounding areas are mostly freehold (privately owned) land or Unallocated Crown Land and there are some other local/State Government reserves.

21. Current land use: (a) site (b) surroundings/catchment

(a) As indicated in the original nomination document and subsequent RIS. The extensions are used for nature conservation.

(b) As indicated in the original nomination document and subsequent RIS.

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

(a) As indicated in the original nomination document and subsequent RIS. Changes to the hydrology of Peel Inlet and Harvey Estuary have occurred since the Dawesville Channel was opened in April 1994, effectively creating a more marine environment in the Inlet (greater tidal exchange/range within Peel Inlet and Harvey Estuary). These hydrological changes were designed to alleviate eutrophication problems referred to in the original nomination document and are considered largely beneficial.

(b) As indicated in the original nomination document and subsequent RIS. In addition, urban (housing, including canal estate) development has continued to expand in the immediate vicinity of the Site. The already substantial urban population adjacent to many parts of the Ramsar Site is expected to increase markedly.

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

As indicated in the original nomination document and subsequent RIS. In addition, since the Site was originally nominated, several new Nature Reserves (included in the extensions: see item 13) on or near the edge of Peel Inlet or Harvey Estuary have been declared and Yalgorup National Park has

been extended (some of this is included in the Site extensions). A management plan exists for Yalgorup National Park (CALM 1995).

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

As indicated in the original nomination document and subsequent RIS.

The conservation value of the "Creery Marshes" (salt marsh immediately north of Creery Island) has been recognised. Wetlands of the Creery Marshes have been ceded to the Crown and will be reserved for conservation. This is the area of Extension 7.

Subject to consultation with stakeholders and, where necessary, resolution of land tenure, it may be possible to add other areas to the Ramsar Site in the future, for example the reserve, vested in the Shire of Murray, which comprises the deltaic islands situated where the Murray River enters Peel Inlet.

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

As indicated in the original nomination document and subsequent RIS.

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

As indicated in the original nomination document and subsequent RIS.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

As indicated in the original nomination document and subsequent RIS.

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept of Environment etc.)

With respect to the Nature Reserves and Yalgorup National Park:

Territorial: The State Government of Western Australia.
Functional: The National Parks and Nature Conservation Authority (vesting) and the Western Australian Department of Conservation & Land Management (management).

With respect to the waters and shores of Peel-Harvey Estuary: The Peel Inlet Management Authority.

29. Management authority: (name and address of local body directly responsible for managing the wetland)

The Dwellingup District (based in Dwellingup and with an office also in Mandurah town) of the Swan Region, Western Australian Department of Conservation & Land Management, and the Mandurah office of the Peel Inlet Management Authority.

30. Bibliographical references: (scientific/technical only)

As indicated in the original nomination document and subsequent RIS, plus the following:

Burbidge, A.H. and Craig, M. 1996. Lake McLarty: an important Ramsar wetland. WA Bird Notes 78, 10-13.

CALM 1995. Yalgorup National Park Management Plan 1995-2005. Management Plan No. 29, Western Australian Department of Conservation & Land Management, Perth.

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Davies, P.M. and Lane, J.A.K. 1996. The impact of vegetated buffer zones on water and nutrient flow into Lake Clifton. J. Roy. Soc. West. Aust. 79,155-160.

EPA 1997. Final criteria of environmental acceptability for land use proposals within the catchment of Lake Clifton. Environmental Protection Authority, Perth. Bulletin 864.

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Lavery, P. 1999. Ecological effects of macroalgal harvesting on beaches in the Peel-Harvey estuary, Western Australia. In: Estuarine Coastal & Shelf Science 49 (2).

McComb, A.J., Kobryn, H.T. and Latchford, J.A. 1995. Samphire marshes of the Peel-Harvey estuarine system. Peel-Preservation Group, Mandurah.

Monks, L. and Gibson, N. 2000. Changes in peripheral vegetation of the Peel-Harvey Estuary 1994-1998. Unpublished report for the Department of Conservation & Land Management.

Moore, L.S. and Burne, R.V. 1994. The modern thrombolites of Lake Clifton, Western Australia. In: J. Bertrand-Sarfati and C. Monty (eds) *Phanerozoic Stromatolites II*, 3-29. Kluwer.

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Rosen, M.R., Coshell, L., Turner, J.V. and Woodbury, R.J. 1996. Hydrochemistry and nutrient cycling in Yalgorup National Park. Journal of Hydrology 185, 241-274.

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Shams, R. 1999. Assessment of hydrogeology and water quality inputs to Yalgorup lakes. Water & Rivers Commission Hydrogeology Report HR90.

Singor, M. 1997. Eastern Curlews near Mandurah. WA Bird Notes 83, 1-2.

Singor, M. 1998. Hooded Plovers at Yalgorup National Park. WA Bird Notes 85, 10-13.

Summers, R.N. 1999. The phosphorus content in the run-off from the coastal catchment of the Peel Inlet and Harvey Estuary and its associations with land characteristics. In: Agriculture, Ecosystems& Environment 73 (3).

Wilson, C., Hale, J. and Paling, E.I. 1997. Water quality of the Peel-Harvey Estuary, comparisons before and after the opening of the Dawesville Channel (July 1991 to April 1997). Marine & Freshwater Research Laboratory, Murdoch University. Report MAFRA 97/6.

Wilson, C., Latchford, J. and Paling, E.I. 1997. Peel-Harvey intensive water survey July 1996 – March 1997. Marine & Freshwater Research Laboratory, Murdoch University. Report MAFRA 97/3

Wilson, C., Latchford, J. and Paling, E.I. 1997. Macrophyte abundance and composition in the Peel-

Harvey Estuary from July 1996 to June 1997, with biomass comparisons before and after the construction of the Dawesville Channel. Marine & Freshwater Research Laboratory, Murdoch University. Report MAFRA 97/5.

Information sheet on Ramsar wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed:

August 2000

Note: this Information sheet documents extensions to an existing Ramsar Site.

2. Country:

Australia

3. Name of wetland:

Toolibin Lake (also known as Lake Toolibin)

4. Geographical coordinates:

Latitude: 32^0 55' 00" S
Longitude: 117^0 36' 30" E.

5. Elevation: (average and/or max. & min.)

Approx. 300 m (Australian Height Datum).

6. Area: (in hectares)

The area (re-calculated) of the original Site nomination in February 1990 was 441 ha, the extension is 52 ha, thus the total area of the Ramsar Site is now 493 ha.

7. Overview: (general summary, in two or three sentences, of the wetland's principal characteristics)

Toolibin Lake is the last, large, *Casuarina obesa* - dominated wetland, with mostly living trees, in the inland agricultural area of south-western Australia. Wetlands of this type were formerly widespread, but most have been severely degraded by secondary salinisation. The lake supports breeding by a large number of waterbird species, including the Freckled Duck, cormorants, egrets, night herons and spoonbills. Toolibin Lake is included in the national list of threatened ecological communities.

8. Wetland type: (please circle the applicable codes for wetland types as listed in Annex I of the *Ramsar Explanatory Note and Guidelines* document)

Where types include options, the relevant options are shown in **bold**.

Xf (freshwater, tree-dominated wetlands)

This describes the original wetland type. Due to salinisation, which began several decades ago, the water is no longer fresh (see item 14). The wetland type that would more accurately reflect the present water salinity is R (**seasonal**/intermittent saline/**brackish**/alkaline **lakes** and flats) but this does not reflect the wooded character of the wetland, which is the dominant feature.

The extension (see item 13) does not contribute additional wetland types.

Please now rank these wetland types by listing them from the most to the least dominant:

Xf

9. Ramsar criteria: (please circle the applicable criteria; see point 12, next page)

The Criteria under which Toolibin Lake was originally nominated as a Ramsar Site were:

1a (It is a particularly good example of a specific type of wetland, characteristic of its region).

2b (It is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna).

2c (It is of special value as the habitat of plants or animals at a critical stage of their biological cycles).

Since that time, the Criteria have been further developed and re-numbered by Ramsar Conferences of Contracting Parties. The Criteria now applicable to the Site as originally nominated are:

1 (It contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region).

3 (It supports populations of a plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

4 (It supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions).

Toolibin Lake has recently been added to the national list of threatened ecological communities (see items 17 & 23 below). The Site now meets an additional Criterion:

2 (It supports vulnerable, endangered, or critically endangered species or threatened ecological communities).

The extension (see item 13) does not cause additional Criteria to be met.

Please specify the most significant criterion applicable to the site:

The criteria are equally significant.

10. Map of site included?

Yes, the map shows the original Ramsar Site and the extension.

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

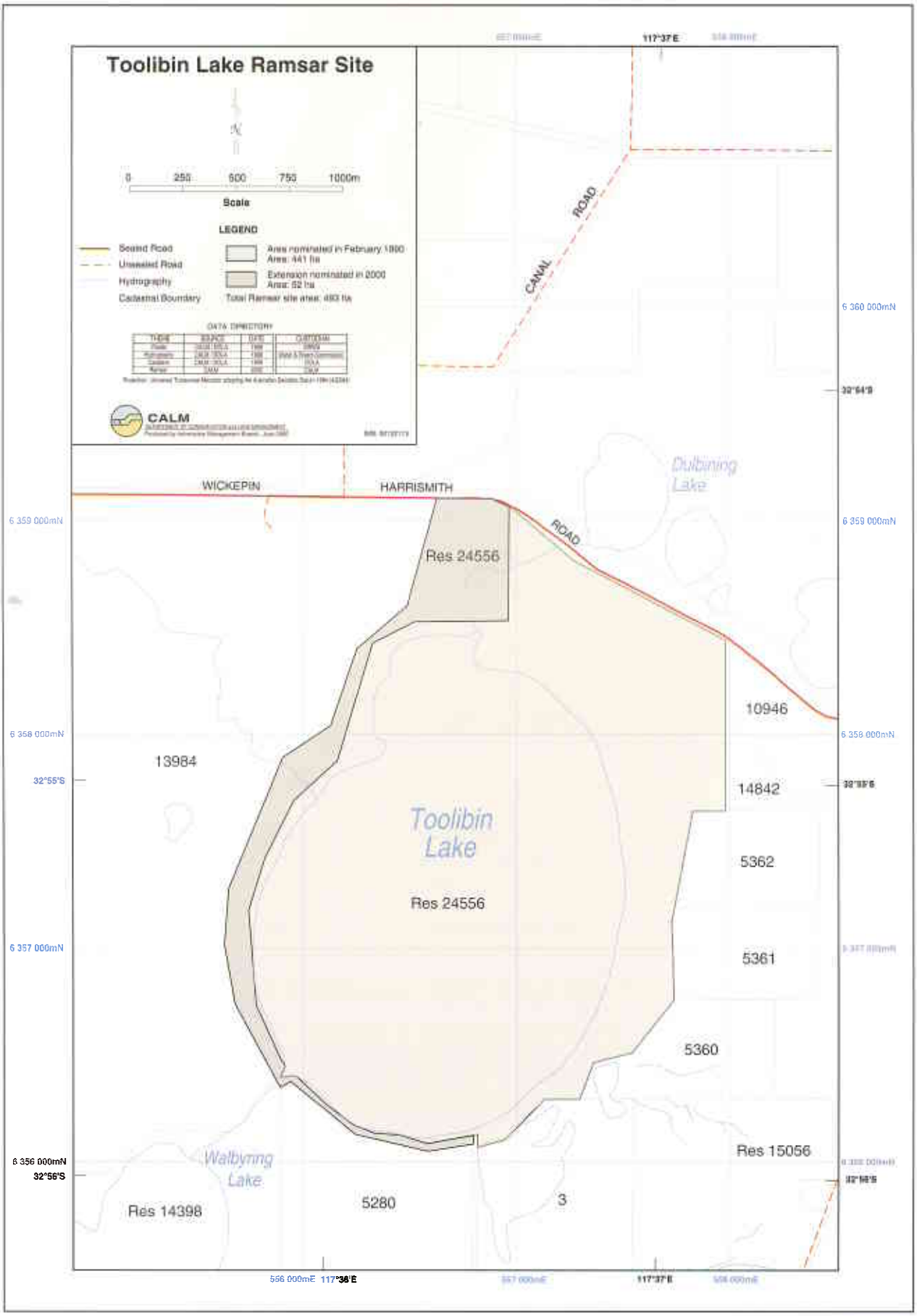
Roger Jaensch, Wetlands International - Oceania, GPO Box 636, Canberra ACT 2601, Australia, (Tel: +61-2-6250-0779; Fax: +61-2-6250-0799; email: roger.jaensch@ea.gov.au), on behalf of the Western Australian Department of Conservation & Land Management (CALM), in November 1998. Updated by CALM staff in August 2000. All inquiries should be directed to Jim Lane, CALM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

12. Justification of the criteria selected under point 9: (Please refer to Annex II in the *Ramsar Explanatory Note and Guidelines* document)

(Based on information provided in the original nomination document, plus the recent national listing of Toolibin Lake as a threatened ecological community.)

1 (formerly 1): Toolibin Lake is the last, large, *Casuarina obesa* - dominated wetland, with mostly living trees, in the inland agricultural area of south-western Australia. Whereas wetlands of this type formerly were widespread, the woodland in most of these wetlands has been degraded or lost due to salinisation associated with agricultural development of catchments.

2: 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 included in the national list of threatened ecological communities.


Toolibin Lake Ramsar Site
0 250 500 750 1000m
Scale
LEGEND
Sealed Road
Unsealed Road
Hydrography
Cadastral Boundary
Area nominated in February 1990 Area: 441 ha
Extension nominated in 2000 Area: 52 ha
Total Ramsar site area: 493 ha
CALM
117°37'E
CANAL
ROAD
6 360 000mN
32°54'S
WICKEPIN
HARRISMITH
Dulbining Lake
6 359 000mN
Res 24556
ROAD
10946
6 358 000mN
13984
32°55'S
14842
Toolibin Lake
5362
Res 24556
6 357 000mN
5361
5360
Walbyring Lake
6 356 000mN
32°56'S
Res 15056
Res 14398
5280
3
556 000mE
117°36'E
117°37'E

Great Egret. Photo - Babs & Bert Wells/CALM

3 (formerly 2b): 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-western Australia.

4 (formerly 2c): Toolibin Lake supports more breeding waterbird species than most if not all other wetlands in south-western Australia. These include the Freckled Duck *Stictonetta naevosa* which has a very small breeding population in south-western Australia. 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-western Australia.

13. General location: (include the nearest large town and its administrative region)

Toolibin Lake is in the Shire of Wickepin (local authority) in the State of Western Australia (population ca. 1.9 million). It is 40 km east of the town of Narrogin (population ca. 5000).

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 Site has now been extended (see map) to include land on the northern, western and southern sides of the Lake that has been added to Reserve 24556 since the original Site nomination. This ensures a reserved buffer zone of at least 100 m width around most of the Lake.

Note that the portion of the Ramsar Site that was originally part of Res 9617 has since been added to Res 24556. This change has had no effect on the Ramsar Site.

14. Physical features: (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

As indicated in the original nomination document and subsequent RIS.

15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilisation etc.)

As indicated in the original nomination document and subsequent RIS. See also item 23.

16. Ecological features: (main habitats and vegetation types)

As indicated in the original nomination document and subsequent RIS.

The extension formerly was mostly agricultural land 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.

17. Noteworthy flora: (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

There are no rare, threatened or endemic plant species known at the Site.

Toolibin Lake is included in the national list of "Ecological Communities that are Endangered" (Threatened Ecological Communities) under the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act 1999. Its inclusion is based in large part upon the persistence of extensive stands of living sheoak (*Casuarina obesa*) and paperbark (*Melaleuca strobophylla*) across the lake floor.

18. Noteworthy fauna: (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

As indicated in the original nomination document and subsequent RIS.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

None recognised.

20. Land tenure/ownership of: (a) site (b) surrounding area

(a) The Ramsar Site as originally nominated in February 1990 comprised two adjoining areas of reserved land that were subsequently amalgamated into one (Nature Reserve 24556; see Section 13). The land now added to the Site is land that has since been added to Nature Reserve 24556. The Nature Reserve is vested in the National Parks and Nature Conservation Authority of Western Australia (appointed by the State Government). The purpose of Nature Reserve 24556 is "Conservation of Flora and Fauna".

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

21. Current land use: (a) site (b) surroundings/catchment

(a) Nature conservation and low intensity nature-based recreation.

(b) As indicated in the original nomination document and subsequent RIS.

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

(a) As indicated in the original nomination document and subsequent RIS.

(b) As indicated in the original nomination document and subsequent RIS.

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

As indicated in the original nomination document and subsequent RIS.

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". Coordinated management of the catchment, with substantial community participation, is occurring. Specific actions at the Lake have included diversion of highly saline, surface flows (generally the first autumn-winter runoff) away from the Lake and pumping to lower the saline groundwater table under the Lake. Revegetation and other activities are occurring in the catchment to control groundwater rise.

Toolibin Lake is included in the national list of "Ecological Communities that are Endangered" (Threatened Ecological Communities) under the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act 1999.

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

Under the Toolibin Lake Recovery Plan (1994), it is proposed to install additional pumps that will contribute further to lowering of the saline groundwater under the Lake and in the immediate vicinity. Further work aimed at lowering of the saline groundwater, and reducing saline surface runoff, is planned for the upstream surface and groundwater catchments of the Lake.

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

As indicated in the original nomination document and subsequent RIS. See also item 30.

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.

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

As indicated in the original nomination document and subsequent RIS. In addition, an access road, information shelter, interpretive walk and other facilities are proposed for construction during 2000.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

As indicated in the original nomination document and subsequent RIS.

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept of Environment etc.)

Territorial: The State Government of Western Australia.
Functional: The National Parks and Nature Conservation Authority (vesting) and the Western Australian Department of Conservation & Land Management (management).

29. Management authority: (name and address of local body directly responsible for managing the wetland)

The Narrogin District (based in Narrogin) of the Wheatbelt Region, Western Australian Department of Conservation & Land Management.

30. Bibliographical references: (scientific/technical only)

As indicated in the original nomination document and subsequent RIS, plus the following:

Baxter, A. 1996. Toolibin Catchment Revegetation Manual. Agriculture Western Australia, Perth.

CALM 1999. Toolibin Lake recreation and interpretation masterplan. Unpublished report of the Department of Conservation & Land Management.

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Red-necked Avocet. Photo – Babs & Bert Wells/CALM

Sabina Nature Reserve, Extension 1 of Vasse-Wonnerup Ramsar Site. Photo – J. Lane

Information sheet on Ramsar wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed:

August 2000

Note: this Information sheet documents extensions to an existing Ramsar Site.

2. Country:

Australia

3. Name of wetland:

Vasse-Wonnerup System

4. Geographical coordinates:

Latitude: 33^0 35' S to 33^0 39' S
Longitude: 115^0 22' E to 115^0 28' E

5. Elevation: (average and/or max. & min.)

Approx. 0-6 m (Australian Height Datum).

6. Area: (in hectares)

The area (re-calculated) of the original Site nomination in February 1990 was 750 ha, the total area of the extensions is 365 ha, thus the total area of the Ramsar Site is now approx. 1115 ha.

7. Overview: (general summary, in two or three sentences, of the wetland's principal characteristics)

An extensive, shallow, nutrient-enriched, wetland system with widely varying salinities. Water levels in its two principal components, the Vasse and Wonnerup lagoons (former estuaries), are managed with the aim of minimising flooding of adjoining lands and largely excluding seawater. The Site supports tens of thousands of resident and migrant waterbirds of a wide variety of species and the largest regular breeding colony of Black Swan in South-western Australia. The Site's close proximity to residential, farming and tourism areas presents a range of management issues and opportunities.

8. Wetland type: (please circle the applicable codes for wetland types as listed in Annex I of the *Ramsar Explanatory Note and Guidelines* document)

Where types include options, the relevant options are shown in **bold**.

J (coastal **brackish**/saline lagoons)
Ss (**seasonal**/intermittent saline/**brackish**/alkaline **marshes**/pools)

The extensions (see item 13) add the following wetland types:

N (**seasonal**/intermittent/irregular rivers/**streams**/creeks)
Xf (freshwater, tree-dominated wetlands)

Please now rank these wetland types by listing them from the most to the least dominant:

J, Ss, N, Xf.

9. Ramsar criteria: (please circle the applicable criteria; see point 12, next page)

The Criteria under which Vasse-Wonnerup System was originally nominated as a Ramsar Site were:

3a (It regularly supports 20,000 waterfowl).

3c (Where data on populations are available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl).

Since that time, the Criteria have been further developed and re-numbered by Ramsar Conferences of Contracting Parties. The Criteria now applicable to the Site as originally nominated are:

5 (It regularly supports 20,000 or more waterbirds).

6 (It regularly supports 1% of the individuals in a population of one species or subspecies of waterbird).

The extensions (see item 13) do not cause additional Criteria to be met.

Please specify the most significant criterion applicable to the site:

5 (formerly 3a)

10. Map of site included?

Yes, the maps show the original Ramsar Site and the extensions.

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

Roger Jaensch, Wetlands International - Oceania, GPO Box 636, Canberra ACT 2601, Australia, (Tel: +61-2-6250-0779; Fax: +61-2-6250-0799; email: roger.jaensch@ea.gov.au), on behalf of the Western Australian Department of Conservation & Land Management (CALM), in November 1998. Updated by CALM staff in August 2000. All inquiries should be directed to Jim Lane, CALM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-8-9752-1677; Fax: +61-8-9752-1432; email: jiml@calm.wa.gov.au).

12. Justification of the criteria selected under point 9: (Please refer to Annex II in the *Ramsar Explanatory Note and Guidelines* document)

(Based on information provided in the original nomination document.)

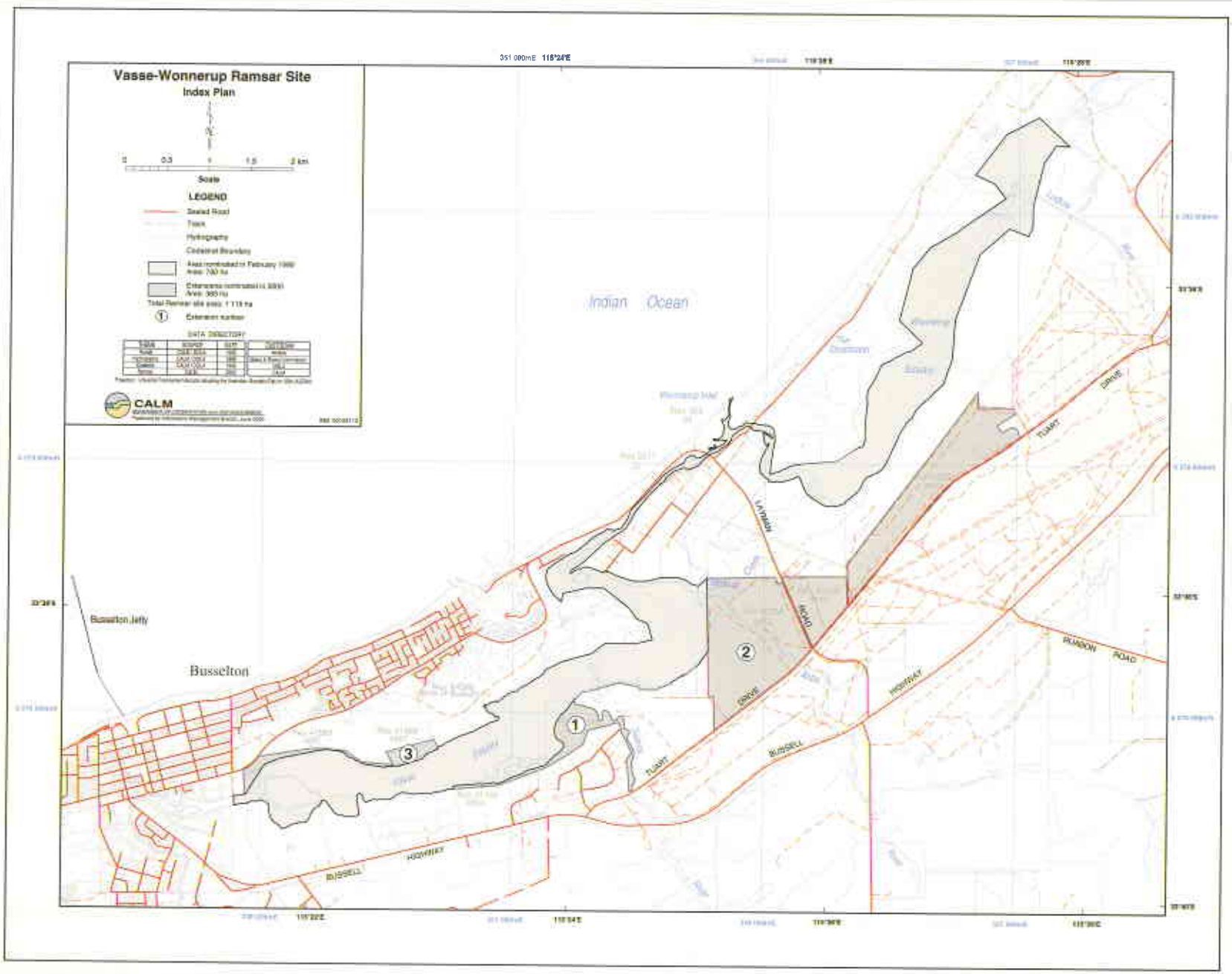
5 (formerly 3a): More than 33,000 waterbirds have been counted (January 1986) at Vasse-Wonnerup System. Waterbird data indicate that more than 20,000 waterbirds use the Site each year. Thus the Site "regularly supports 20,000 waterfowl".

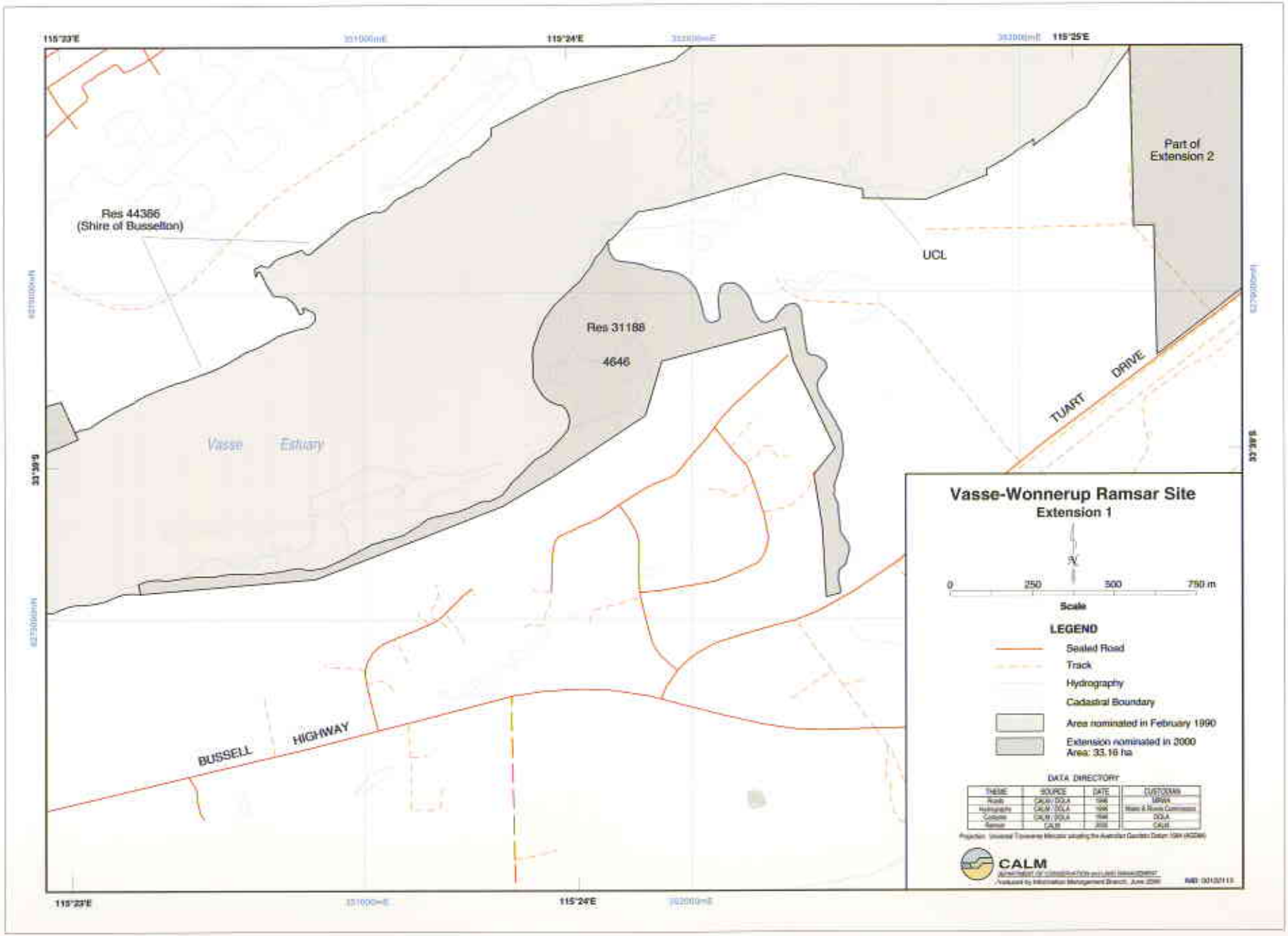
6 (formerly 3c): At least 1% of the Australian population of Black-winged Stilt *Himantopus himantopus* and at least 1% of the world population of Red-necked Avocet *Recurvirostra novaehollandiae* use Vasse-Wonnerup System in most years.

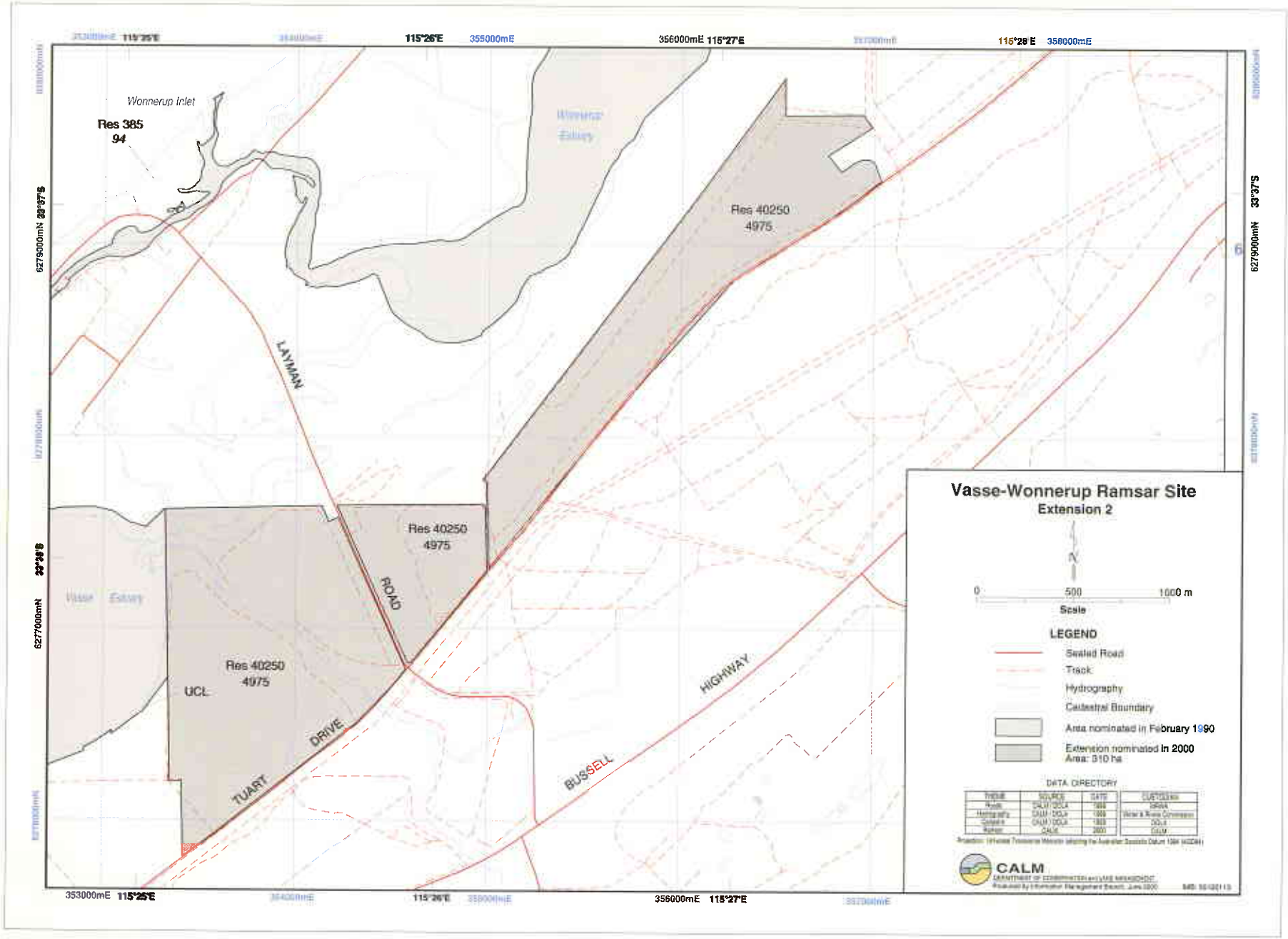
13. General location: (include the nearest large town and its administrative region)

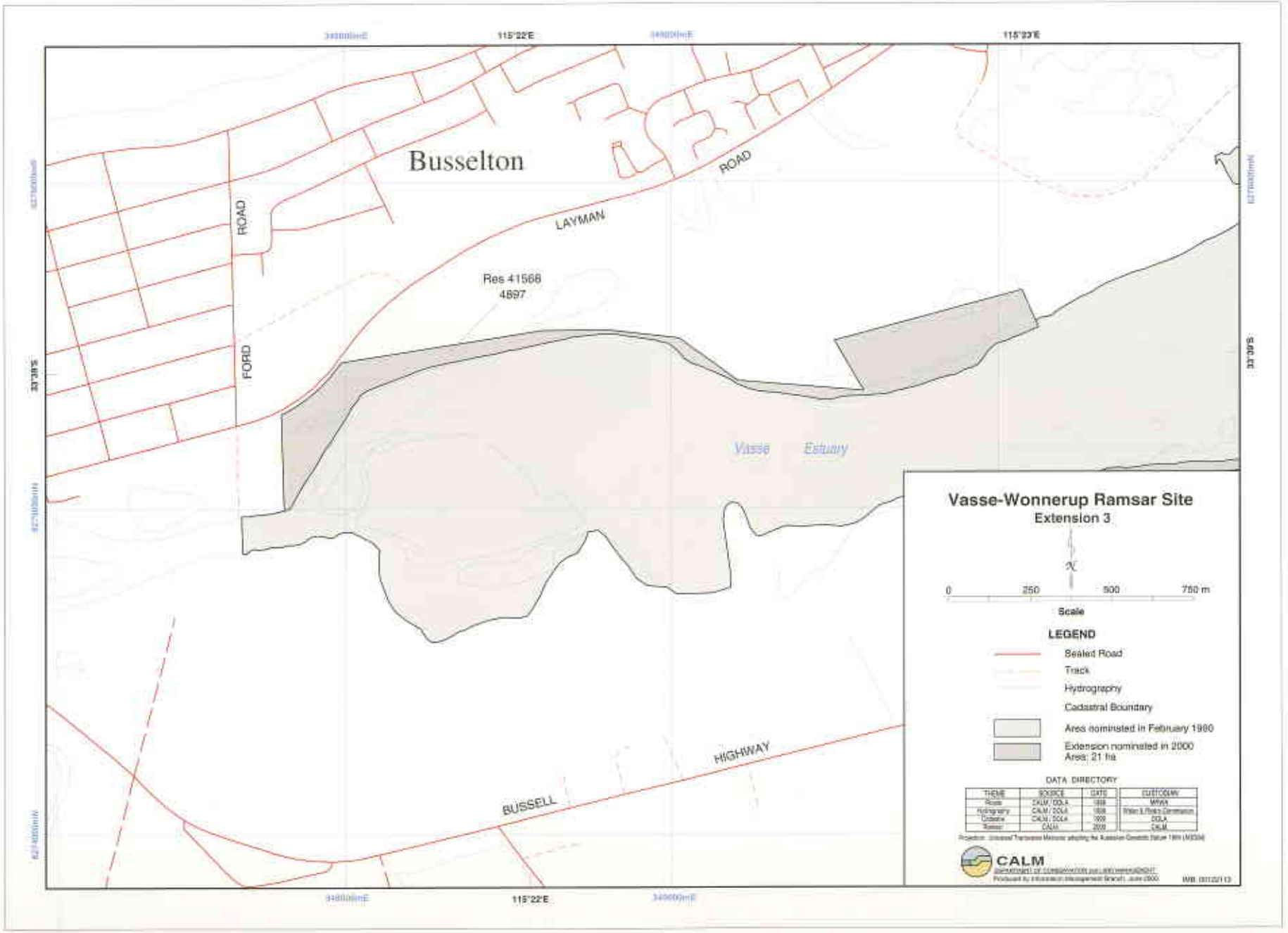
Vasse-Wonnerup System is in the Shire of Busselton (local authority) in the State of Western Australia (population ca. 1.9 million). It is immediately east of the town of Busselton (population ca. 22,000).

The Ramsar Site as originally nominated in February 1990 consisted of non-freehold wetland (including the Vasse estuary portion of Reserve 31188) within the boundaries of the Vasse and Wonnerup estuaries and Wonnerup Inlet, and an adjoining area of non-freehold wetland (formerly part of Wonnerup estuary) between Wonnerup Estuary and Forrest Beach Road.


Vasse-Wonnerup Ramsar Site
Index Plan
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Extension number
DATA DIRECTORY
CALM
351 000mE
115°24'E
115°30'E
115°36'E
33°30'S
33°36'S
Indian Ocean
Busselton Jetty
Busselton
LAYMAN ROAD
TUART DRIVE
PUNSON ROAD
BUSSELL HIGHWAY
1
2
3


115°23'E
115°24'E
115°25'E
Part of
Extension 2
Res 44386
(Shire of Busselton)
UCL
Res 31188
4646
Vasse Estuary
TUART DRIVE
BUSSELL HIGHWAY
33°39'S
Vasse-Wonnerup Ramsar Site
Extension 1
0 250 500 750 m
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 33.16 ha
DATA DIRECTORY
CALM


115°25'E
115°26'E
355000mE
356000mE
115°27'E
115°28'E
356000mE
Wonnerup Inlet
Res 385
94
Wonnerup Estuary
Res 40250
4975
LAYMAN
ROAD
Res 40250
4975
Vasse Estuary
Res 40250
4975
UCL
DRIVE
TUART
HIGHWAY
BUSSELL
6279000mN
33°37'S
6278000mN
33°38'S
6277000mN
353000mE
115°25'E
115°26'E
356000mE
115°27'E
Vasse-Wonnerup Ramsar Site
Extension 2
N
0
500
1000 m
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 510 ha
DATA DIRECTORY
CALM


115°22'E
115°23'E
33°38'S
Busselton
ROAD
LAYMAN
ROAD
FORD
Res 41568
4897
Vasse Estuary
HIGHWAY
BUSSELL
Vasse-Wonnerup Ramsar Site
Extension 3
0 250 500 750 m
Scale
LEGEND
Sealed Road
Track
Hydrography
Cadastral Boundary
Area nominated in February 1990
Extension nominated in 2000
Area: 21 ha
DATA DIRECTORY
THEME SOURCE DATE CUSTODIAN
Roads CALM / DOLA 1998 MRWA
Hydrography CALM / DOLA 1998 Water & Rivers Commission
Cadastre CALM / DOLA 1998 DOLA
Reserves CALM 2000 CALM
CALM

Malbup Creek (foreground) and Tuart Forest National Park, Extension 2 of Vasse-Wonnerup Ramsar Site. Photo – J. Lane

Black-winged Stilt. Photo – Babs & Bert Wells/CALM

The Vasse, Sabina, Abba and Ludlow Rivers and the Deadwater were not included in the Site. Dryland parts of Sabina Nature Reserve (Res 31188) and dryland parts of Unallocated Crown Lands that extended into the estuaries were also not included.

The Site has now been extended to include (see maps):

- Extension 1: the remainder of Reserve 31188, which includes a part of the Sabina River;
- Extension 2: those parts of Tuart Forest National Park (Reserve 40250) that are between the Vasse-Wonnerup Ramsar Site as originally nominated and Tuart Drive. This extension includes a length of the Abba River. Road reserves are not included.
- Extension 3: Nature Reserve 41568, which includes a substantial part of the northern shore of Vasse Estuary.

14. Physical features: (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

As indicated in the original nomination document and subsequent RIS.

15. Hydrological values: (groundwater recharge, flood control, sediment trapping, shoreline stabilisation etc.)

The Vasse and Wonnerup estuaries have an important role in flood mitigation.

16. Ecological features: (main habitats and vegetation types)

As indicated in the original nomination document and subsequent RIS.

In addition, the vegetation of Tuart Forest National Park is dominated by open-forest of mature tuart *Eucalyptus gomphocephala*. Tall shrubs and small trees of Western Australian peppermint *Agonis flexuosa* occur as understorey in the forest. There are also some very small areas (< 1ha) of seasonal freshwater *Melaleuca* swamp.

The vegetation of the Nature Reserves that are now added to the Site includes low shrubland dominated by samphires and sedges and small areas of tall shrubs mainly *Melaleuca* spp. *Eucalyptus rudis* trees and some sedges occur along the Sabina and Abba Rivers.

17. Noteworthy flora: (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

There are no nationally rare, threatened or endemic wetland plants known at the Site.

18. Noteworthy fauna: (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

As indicated in the original nomination document and subsequent RIS.

In addition, the tuart forest is considered to contribute substantially to the conservation values of the Ramsar Site in providing breeding sites (tree hollows) for Australian Wood Duck *Chenonetta jubata*, Australian Shelduck *Tadorna tadornoides* and possibly other duck species. Adult ducks have been observed moving their young from the forest to the wetlands. This extension also provides a protected buffer zone for some of the Site's wetlands.

Land within Nature Reserves that are now added to the Site adds to the conservation values of the Site by providing protected buffer zones for the Site's wetlands and some seasonal feeding habitat for the Site's waterbirds.

The native water rat *Hydromys chrysogaster* has been recorded at the Site.

The Site supports the largest regular breeding colony of Black Swan *Cygnus atratus* in south-western Australia. More than 150 pairs of swans nest in most years. Breeding is often successful.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

As indicated in the original nomination document and subsequent RIS.

In addition, the (Ludlow) tuart forest is of historical interest because it was among the first areas to be gazetted as State Forest in Western Australia and the first formal training school for forest land managers in the State was located here.

20. Land tenure/ownership of: (a) site (b) surrounding area

(a) The Site as originally nominated included the Vasse estuary wetland portion of Sabina Nature Reserve (Res 31188); an area of Crown leasehold land at the north-eastern end of the Site, and wetland portions of some Unallocated Crown Lands. Areas of freehold land that extended into the estuaries were not included.

Land now added to the Site comprises Nature Reserve (the remainder of Sabina Nature Reserve; and all of Reserve 41568) and National Park (part of Tuart Forest National Park: Reserve 40252). The Nature Reserves and National Park are vested in the National Parks and Nature Conservation Authority of Western Australia (appointed by the State Government). The purpose of Reserves 31188 and 41568 is "Conservation of Flora and Fauna" and the purpose of Reserve 40250 is "National Park".

(b) Surrounding areas include freehold (privately owned) land, Unallocated Crown Land and Crown Reserves for purposes other than conservation.

21. Current land use: (a) site (b) surroundings/catchment

(a) The principal land use at the Site is nature conservation and education (see item 26).

(b) As indicated in the original nomination document and subsequent RIS.

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

(a) As indicated in the original nomination document and subsequent RIS. In addition, changes to the operation of the flood gates on Vasse Estuary have occurred. Waterbird usage of the Site following these changes is the subject of investigation by the Western Australian Department of Conservation & Land Management. Exotic plants including bulrush *Typha orientalis* and arum lily *Zanteschina aethiopica* are established in and around the Sabina and Abba Rivers. An arum lily control program is in place.

(b) As indicated in the original nomination document and subsequent RIS. In addition, urban (housing estate) development has continued to expand in the immediate vicinity of the Site.

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

As indicated in the original nomination document and subsequent RIS. In addition, since the Site was originally nominated in February 1990, one new Nature Reserve (41568) on the edge of Vasse Estuary has been declared and additional reserves are in the process of being gazetted or are planned. Activities to control feral animals (foxes and rabbits) are undertaken regularly, notably monthly fox baiting in Tuart Forest National Park and Reserve 31188 to reduce fox predation on ducks that nest in the tuart forest and walk their young to the wetlands.

No management plan or interim management guidelines currently exist for Reserves 41568 and 31188.

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

As indicated in the original nomination document and subsequent RIS.

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

As indicated in the original nomination document and subsequent RIS. See also item 22.

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

A bird hide has been constructed at Malbup Creek and a self-guided interpretive walk-trail commencing from Layman Picnic Area runs parallel to Malbup Creek and partially along the lower reaches of the Abba River within the Tuart Forest National Park. A schools-based education program, led by the Western Australian Department of Conservation & Land Management (CALM), exploring - among other things - the forest/wetland interface, has been in place for seven years. CALM has also conducted waterbird identification and "Frog Watch" activities at the Site.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

As indicated in the original nomination document and subsequent RIS. See also item 26.

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept of Environment etc.)

With respect to the Nature Reserves and National Park:

Territorial: The State Government of Western Australia.
Functional: The National Parks and Nature Conservation Authority (vesting) and the Western Australian Department of Conservation & Land Management (management).

29. Management authority: (name and address of local body directly responsible for managing the wetland)

The South West Capes District (based in Busselton) of the Central Forest Region, Western Australian Department of Conservation & Land Management.

30. Bibliographical references: (scientific/technical only)

As indicated in the original nomination document and subsequent RIS, plus the following:

Elscot, S.V. 2000. Monitoring of fish behaviour in the lower reaches of the Vasse-Wonnerup wetland system during the summer of 1999/2000. Unpublished technical report for the Department of Conservation & Land Management and the Geographe Catchment Council, Busselton.

EPA 1999. Proposal to construct a road across Vasse Estuary (Ford Road), Shire of Busselton: Report and recommendations of the Environmental Protection Authority, Bulletin 940.

EPA 2000. Proposal to construct a road across Vasse Estuary (Ford Road), Shire of Busselton: Advice to the Minister for the Environment from the Environmental Protection Authority under Section 44 of the Environmental Protection Act 1986, Bulletin 975.

Froend, R.H. 1999. Wetland vegetation monitoring program for the Vasse-Wonnerup wetland system: Monitoring design and recommendations. Unpublished technical report for the Department of Conservation & Land Management, Busselton.

Froend, R.H., Pettit, N. and Franke, B. (in prep). Vegetation monitoring and mapping of the Vasse estuary. Unpublished technical report for the Geographe Catchment Council, Ministry for Planning and Department of Conservation & Land Management, Busselton.

Jaensch, R.P. and Watkins, D. 1999. Nomination of additional Ramsar wetlands in Western Australia. Unpublished technical report by Wetlands International – Oceania for the Department of Conservation & Land Management, Perth.

Lane, J.A.K., Hardcastle, K.A., Tregonning, R.J. and Holtfreter, S. 1997. Management of the Vasse-Wonnerup wetland system in relation to sudden, mass fish deaths. Unpublished technical report prepared on behalf of the Vasse Estuary Technical Working Group, Busselton.

White, K.S. 1999. Monitoring of fish behaviour in the lower Vasse-Wonnerup wetlands during the summer of 1998-99. Unpublished technical report for the Department of Conservation & Land Management and the Geographe Catchment Council, Busselton.