



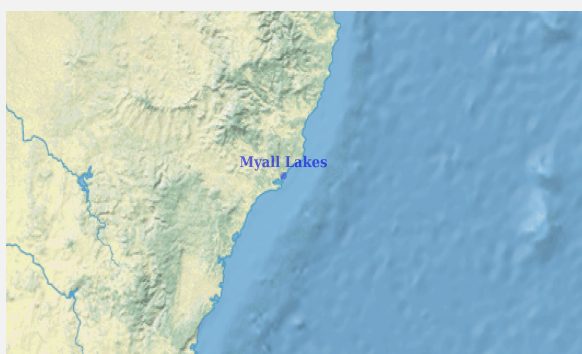
Ramsar Information Sheet

Published on 1 July 2022

Update version, previously published on : 1 January 2012

Australia

Myall Lakes



Designation date	14 June 1999
Site number	994
Coordinates	32°37'41"S 152°13'29"E
Area	44 612,00 ha

Color codes

Fields back-shaded in light blue relate to data and information required only for RIS updates.

Note that some fields concerning aspects of Part 3, the Ecological Character Description of the RIS (tinted in purple), are not expected to be completed as part of a standard RIS, but are included for completeness so as to provide the requested consistency between the RIS and the format of a 'full' Ecological Character Description, as adopted in Resolution X.15 (2008). If a Contracting Party does have information available that is relevant to these fields (for example from a national format Ecological Character Description) it may, if it wishes to, include information in these additional fields.

1 - Summary

Summary

Myall Lakes Ramsar site is approximately 75 km north-east of Newcastle and 30 km south of Forster on the lower north coast of NSW. The 44,612 ha site sits between the coastal sand barrier and the hills around the township of Bulahdelah. It is one of the few coastal wetlands systems in NSW that has not been greatly impacted by human activities and is in a relatively healthy condition. It is renowned for its rich biodiversity and complex variety of habitats.

The site meets three of the nine Ramsar criteria; 1, 2 and 3.

The site supports a wide variety of near-natural wetlands, ranging from fresh through to saline and is one of the largest brackish-freshwater barrier estuaries in the South East Coast Drainage Division. It contains the only remaining example of a large coastal brackish lake system on the NSW coast that has not been greatly modified by human activity. The site spans a range of vegetation communities ranging from rainforest and wet sclerophyll vegetation to heathland and sand dunes. As such, the site contains a diversity of habitats, with some of the lakes containing a unique co-existence of deep and shallow water macrophytes and the organic lake-floor muds known as gyttja.

Myall Lakes Ramsar site supports: twenty-two migratory bird species listed under international agreements, including breeding of four of these species; ten nationally threatened and eight internationally threatened fauna species; eight nationally threatened flora species; and two nationally threatened ecological communities.

Because of the extensive waterways, dune systems and beaches, Myall Lakes Ramsar site is one of the most frequently visited national parks in NSW.

The critical components and processes that define the ecological character of the site are: mosaic of natural or near-natural wetlands, water quality, salinity regime, diversity and abundance of wetland vegetation and habitats, presence and functioning of gyttja community of cyanobacteria. The critical services for the site include supporting services for waterbirds and threatened plant and animal species and recreational services.

2 - Data & location

2.1 - Formal data

2.1.1 - Name and address of the compiler of this RIS

Responsible compiler

Institution/agency	New South Wales Department of Planning, Industry and Environment
Postal address	PO Box A290 Sydney South, NSW 1232 Australia

National Ramsar Administrative Authority

Institution/agency	Department of Agriculture, Water and the Environment
Postal address	GPO Box 858 Canberra ACT 2601 Australia

2.1.2 - Period of collection of data and information used to compile the RIS

From year	<input type="text" value="2009"/>
To year	<input type="text" value="2019"/>

2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	Myall Lakes
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2.1.4 - Changes to the boundaries and area of the Site since its designation or earlier update

(Update) A. Changes to Site boundary	Yes <input type="radio"/> No <input checked="" type="radio"/>
(Update) B. Changes to Site area	No change to area <input type="checkbox"/>
(Update) For secretariat only: This update is an extension	<input type="checkbox"/>

2.1.5 - Changes to the ecological character of the Site

(Update) 6b i. Has the ecological character of the Ramsar Site (including applicable Criteria) changed since the previous RIS?	No <input checked="" type="radio"/>
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(Update) Optional text box to provide further information

While there has been no notifiable change in ecological character, the site has been subject to a changing climate. Australia has warmed by (on average) 1 °C since 1910, with most of the warming since 1950 (BoM State of Climate, 2018). Australia is projected to experience further increases in temperature, with more extremely hot days and fewer extremely cool days over the coming decades. Warming over Australia is expected to be slightly higher than the global average (BOM, State of the Climate 2018).

According to the BOM Regional Weather and Climate Guide 2019 for the Hunter Region (BOM, 2019) the region has, over the last 30 years, seen changes to the climate and weather including:

- Rainfall has decreased in most months, but is relatively stable on an annual basis.
- Summer rainfall has been reliable, winter has been unreliable
- Spring frosts have been more common and have been occurring later
- There have been more hot days, with more consecutive days above 35 °C

Based on the Climate Change in Australia sub clusters (CSIRO, 2018), the East Coast South will experience:

- Temperature increases of 0.5 to 1.3 °C above 1996-200 levels by 2030 and at least 1.3 to 2.5 °C by 2090
- Continued increases in number of hot days and warm spells and reduction in frosts in line with increases in mean temperature
- Increased intensity of extreme rainfall events
- Sea level rise of at least 0.30 to 0.65 m by 2090
- Sea surface temperature increases of between 2.8 and 5.7 °C by 2090
- Increase in acidification of sea
- A harsher fire-weather climate

2.2 - Site location

2.2.1 - Defining the Site boundaries

b) Digital map/image
<1 file(s) uploaded>

Former maps

Boundaries description

Part of the Myall Lakes Ramsar site is conserved within the boundaries of Myall Lakes National Park, and part of the Ramsar site is also protected within the Port Stephens – Great Lakes Marine Park.

The Myall Lakes Ramsar site is situated approximately 75 kilometres north of Newcastle. It is located between Hawks Nest to the south and Forster to the north, on the central coast of New South Wales.

The Ramsar site includes Myall Lakes National Park, Corrie Island Nature Reserve, Little Broughton Island Nature Reserve and the Fame Cove section of Gir-um-bit National Park.

The Ramsar site boundary is the Myall Lakes National Park boundary as gazetted on 28 April 1972, including additions gazetted up to and including 1 January 1999; the Little Broughton Island Nature Reserve boundary as gazetted on 19 May 1961; the Corrie Island Nature Reserve boundary as gazetted on 5 March 1999; and the Gir-um-bit National Park (Fame Cove section) boundary as gazetted on 1 July 2007 (originally gazetted as part of Myall Lakes National Park).

2.2.2 - General location

- a) In which large administrative region does the site lie?
- b) What is the nearest town or population centre?

2.2.3 - For wetlands on national boundaries only

- a) Does the wetland extend onto the territory of one or more other countries? Yes No
- b) Is the site adjacent to another designated Ramsar Site on the territory of another Contracting Party? Yes No

2.2.4 - Area of the Site

Official area, in hectares (ha):

Area, in hectares (ha) as calculated from GIS boundaries

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
Marine Ecoregions of the World (MEOW)	Southeast Australian shelf
Other scheme (provide name below)	Australian Drainage Divisions

Other biogeographic regionalisation scheme

Manning Shelf Bioregion under the Interim Marine and Coastal Regionalisation of Australia (Environment Australia 1998).

Australian Hydrological Geospatial Fabric (Geofabric): Topographic Drainage Divisions and River Regions (BOM 2012) – South East Coast Drainage Division, Karuah River.

3 - Why is the Site important?

3.1 - Ramsar Criteria and their justification

- Criterion 1: Representative, rare or unique natural or near-natural wetland types

Other reasons

The Myall Lakes are a relatively unmodified large coastal brackish lake system. The main streams flowing into the lakes (Myall River and Boolambayte Creek) are free of dams and mostly free of weirs. Consequently the water regime in the lakes are considered to be close to natural and represent a rare example of a brackish-freshwater barrier estuary in the South East Coast Drainage Division. The coastal wetland types in the Ramsar site are representative of near-natural wetlands in the Manning Shelf Bioregion, and include marine subtidal aquatic beds, intertidal marshes, and intertidal forested wetlands (mangroves). The range of wetlands, combined with the adjoining near natural terrestrial ecosystem, provide a complex variety of habitats and a rich biodiversity.

The Myall Lakes are significant because:

1. They represent a unique association of at least 18 Ramsar wetland types, ranging from fresh to marine waters, with the entire association covering an extensive area, with minimal structural and hydrological disturbance and supporting ecosystems and processes in near-natural condition;
2. They are one of the two largest brackish-freshwater barrier estuaries in the South East Coast Drainage Division and are an excellent representative example of this wetland type within the bioregion.
3. They contain a unique co-existence of deep and shallow water macrophytes and the organic lake-floor muds known as gyttja.

- Criterion 2 : Rare species and threatened ecological communities

- Criterion 3 : Biological diversity

Justification

The Ramsar site's large area of 44,612 ha supports a rich biodiversity, containing a range of undisturbed terrestrial vegetation communities and wetland types. As a consequence it supports a high diversity of terrestrial plants and animals in the South East Coast Drainage Division and aquatic plants and animals in the Manning Shelf Bioregion.

Many groups of wetland bird species are represented in the Ramsar site such as pelicans (Pelicanidae), cormorants (Phalacrocoracidae), grebes (Podicipedidae), swans and ducks (Anatidae), herons, egrets, bitterns, ibises and spoonbills (Ciconiiformes), and plovers and lapwings (Charadriidae), and wetlands-related raptors (Accipitridae and Falconidae).

The site provides a wide range of intertidal habitats for shorebirds such as the pied oystercatcher (*Haematopus longirostris*), crested tern (*Sterna bergii*), eastern curlew (*Numenius madagascariensis*), red-necked stint (*Calidris ruficollis*) and bar-tailed godwit (*Limosa lapponica*). The intertidal habitats include coastal mudflats, sandy beaches, saltmarshes, brackish marshes, mangroves and swamp forests, and provide roosting, nesting, breeding, and feeding sites for the site's shorebirds (Lane 1987). The site is important for providing habitat for migratory birds, with 22 species listed in agreements between Australia and Japan (JAMBA), China (CAMBA) and the Republic of South Korea (ROKAMBA) recorded from the site.

Migratory species listed under international agreements which breed in the Ramsar site include little tern (*Sterna albifrons*), sooty shearwater (*Puffinus griseus*), short-tailed shearwater (*Puffinus tenuirostris*) and wedge-tailed shearwater (*Puffinus pacificus*).

The site's vegetation is particularly diverse, with 946 species of terrestrial flora, two mangrove species (*Avicennia marina* and *Aegiceras corniculatum*), 10 species of submerged aquatic flora recorded including *Vallisneria gigantea*, *Ruppia megacarpa*, *Myriophyllum salsugineum* and *Najas marina*, and saltmarsh species such as *Sarcocornia quinqueflora*, *Suaeda australis*, *Baumea juncea* and *Juncus kraussii*. The terrestrial species occur in a wide range of vegetation communities, from rainforest and wet sclerophyll vegetation to heathland and sand dune vegetation.

There is also a high diversity of animal species, with 298 birds, 58 mammals, 44 fish species, 37 reptiles and 29 amphibians recorded from the Ramsar site (NSW Wildlife Atlas). Many of the site's animals are found in a wide range of wetland types, including estuarine waters; intertidal forested wetlands; coastal freshwater lagoons; permanent rivers, streams or creeks; freshwater tree dominated wetlands; and shrub dominated wetlands.

3.2 - Plant species whose presence relates to the international importance of the site

Phylum	Scientific name	Criterion 2	Criterion 3	Criterion 4	IUCN Red List	CITES Appendix I	Other status	Justification
Plantae								
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Aegiceras corniculatum</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	LC	<input type="checkbox"/>		Filters nutrients and runoff, provides habitat and breeding site ground for fish and crabs.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Allocauarina simulans</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	Vulnerable (EPBC Act)	
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Asperula asthenes</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	Vulnerable (EPBC Act)	Also vulnerable under NSW Biodiversity Conservation Act.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Avicennia marina</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	LC	<input type="checkbox"/>		Filters nutrients and runoff, provides habitat and breeding site ground for fish and crabs.
TRACHEOPHYTA/ LILIOPSIDA	<i>Diuris pedunculata</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	Endangered (EPBC Act)	Also endangered under NSW Biodiversity Conservation Act.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Eucalyptus parramattensis</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NT	<input type="checkbox"/>	Subsp Decodens Vulnerable (EPBC Act)	Also vulnerable under NSW Biodiversity Conservation Act.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Grevillea guthrieana</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	EN	<input type="checkbox"/>	Endangered (EPBC Act)	Also endangered under NSW Biodiversity Conservation Act.
TRACHEOPHYTA/ LILIOPSIDA	<i>Juncus kraussii</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.
TRACHEOPHYTA/ LILIOPSIDA	<i>Machaerina juncea</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Melaleuca quinquenervia</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	LC	<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Myriophyllum salsugineum</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.
TRACHEOPHYTA/ LILIOPSIDA	<i>Najas marina</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	LC	<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.
TRACHEOPHYTA/ LILIOPSIDA	<i>Ruppia megacarpa</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	LC	<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Sarcocornia quinqueflora</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Suaeda australis</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Syzygium paniculatum</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	Vulnerable (EPBC Act)	Also endangered under NSW Biodiversity Conservation Act.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Tetradlea juncea</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	Vulnerable (EPBC Act)	Also vulnerable under NSW Biodiversity Conservation Act.
TRACHEOPHYTA/ LILIOPSIDA	<i>Vallisneria nana</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		Habitat for fish, crabs, birds and other animals.

The wetlands also support *Cynanchum elegans* (white-flowered wax plant), which contributes to Criterion 2 and is listed as Endangered under the EPBC Act. *Vallisneria gigantea* (ribbon weed) provides important habitat for fish, crabs, birds and other animals and is important for Criterion 3.

The wetlands support a range of vegetation types which are important for defining the ecological character and wetland habitats of the Myall lakes:

- submerged aquatic vegetation (SAV) – includes macrophytes, macroalgae, charophytes and seagrasses, and is the basis of gyttja; SAV reflects a range of salinity in lakes, with marine seagrasses in areas with higher salinities, and macrophytes and algae in freshwater lakes.
- mangroves and saltmarsh – mangroves provide habitats for fish, crabs, birds and other animals, and maintain water quality by filtering silt from runoff and recycling nutrients; saltmarshes provide habitat for juvenile fish such as bream and mullet, for fish such as common galaxias to deposit eggs, and for crabs.
- seagrasses – valuable as nursery, feeding and shelter areas for many aquatic animals, including fish, mollusc and crustacean species.
- wet heaths – consist of several wetland vegetation types.

Other wetland types important to the ecological character (as per section 2.5 of the ecological character description) include:

- forested wetlands
- swamp oak and swamp sclerophyll forests
- marine coast

There are 8 threatened plants species listed under the national EPBC Act known or believed to occur within the Ramsar site.

3.3 - Animal species whose presence relates to the international importance of the site

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence ¹⁾	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
Others																	
CHORDATA/ MAMMALIA	<i>Dasyurus maculatus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				NT	<input type="checkbox"/>	<input type="checkbox"/>	Nationally endangered (EPBC)	Threatened, site supports critical habitat.
CHORDATA/ AMPHIBIA	<i>Litoria aurea</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				VU	<input type="checkbox"/>	<input type="checkbox"/>	Nationally vulnerable	Broughton Island provides habitat for this nationally and internationally vulnerable species.
CHORDATA/ AMPHIBIA	<i>Litoria brevipalmata</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				EN	<input type="checkbox"/>	<input type="checkbox"/>		Broughton Island provides habitat for this species that is also listed as endangered in NSW.
CHORDATA/ AMPHIBIA	<i>Litoria freycineti</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				VU	<input type="checkbox"/>	<input type="checkbox"/>		Broughton Island provides habitat for this species that is also listed as vulnerable in NSW.
CHORDATA/ AMPHIBIA	<i>Mixophyes balbus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				VU	<input type="checkbox"/>	<input type="checkbox"/>	Nationally vulnerable	Broughton Island provides habitat for this nationally and internationally vulnerable species.
CHORDATA/ AMPHIBIA	<i>Mixophyes iteratus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				EN	<input type="checkbox"/>	<input type="checkbox"/>	Nationally endangered (EPBC) NSW Endangered (BCA)	
CHORDATA/ MAMMALIA	<i>Pteropus poliocephalus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				VU	<input type="checkbox"/>	<input type="checkbox"/>	Nationally vulnerable (EPBC)	Threatened, site supports critical habitat.
Birds																	
CHORDATA/ AVES	<i>Arenaria interpres</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Provides important habitat for migratory species listed under JAMBA, CAMBA, ROKAMBA international agreements.
CHORDATA/ AVES	<i>Botaurus poiciloptilus</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				EN	<input type="checkbox"/>	<input type="checkbox"/>	Nationally endangered (EPBC) NSW Endangered (BCA)	
CHORDATA/ AVES	<i>Calidris ruficollis</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				NT	<input type="checkbox"/>	<input type="checkbox"/>		Provides important roosting and feeding habitat for migratory species listed under JAMBA, CAMBA, ROKAMBA international agreements.

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
CHORDATA/AVES	<i>Charadrius veredus</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Provides important roosting and feeding habitat for migratory species listed under ROKAMBA international agreements.
CHORDATA/AVES	<i>Gallinago hardwickii</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Provides important roosting and feeding habitat for migratory species listed under JAMBA, CAMBA, ROKAMBA international agreements.
CHORDATA/AVES	<i>Haematopus fuliginosus</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Roosting and feeding habitat for NSW vulnerable species.
CHORDATA/AVES	<i>Haematopus longirostris</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Roosting and feeding habitat. roost in beaches and sand dunes.
CHORDATA/AVES	<i>Haliaeetus leucogaster</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Provides important habitat for migratory species listed under CAMBA international agreement.
CHORDATA/AVES	<i>Hirundapus caudacutus</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Provides important habitat for migratory species listed under JAMBA, CAMBA, ROKAMBA international agreements.
CHORDATA/AVES	<i>Lathamus discolor</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				CR	<input type="checkbox"/>	<input type="checkbox"/>	Nationally endangered (EPBC)	Threatened and occurs within the site.
CHORDATA/AVES	<i>Limosa lapponica</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				NT	<input type="checkbox"/>	<input type="checkbox"/>		Provides important habitat for migratory species listed under JAMBA CAMBA and ROKAMBA international agreements.
CHORDATA/AVES	<i>Numenius madagascariensis</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				EN	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Critically Endangered (EPBC Act)	Roosting and feeding habitat.
CHORDATA/AVES	<i>Pterodroma leucoptera leucoptera</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>	Nationally endangered (EPBC) NSW Vulnerable (BCA)	Site supports breeding population at Broughton Island.
CHORDATA/AVES	<i>Puffinus griseus</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				NT	<input type="checkbox"/>	<input type="checkbox"/>		Breeding site at Little Broughton/Broughton Island. provides important habitat for migratory species listed under JAMBA CAMBA and ROKAMBA international agreements.
CHORDATA/AVES	<i>Puffinus pacificus</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Breeding site at Little Broughton/Broughton Island. provides important habitat for migratory species listed under JAMBA international agreements.
CHORDATA/AVES	<i>Puffinus tenuirostris</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Breeding site at Little Broughton/Broughton Island provides important habitat for migratory species listed under JAMBA and ROKAMBA international agreement.
CHORDATA/AVES	<i>Sterna hirundo</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Provides important habitat for migratory species listed under JAMBA, CAMBA, ROKAMBA international agreements.
CHORDATA/AVES	<i>Sternula albifrons</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Provides important habitat for migratory species listed under JAMBA, CAMBA, ROKAMBA international agreements.
CHORDATA/AVES	<i>Thalasseus bergii</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		Roost in beaches and sand dunes. provides important habitat for migratory species listed under JAMBA international agreement.

1) Percentage of the total biogeographic population at the site

The grey-tailed tattler (*Heteroscelus brevipes*), eastern reef egret (*Egretta sacra*) and cattle egret (*Ardea ibis*) are also internationally significant and contribute to the site's biodiversity, with the grey-tailed tattler being recognised in JAMBA, CAMBA and ROKAMBA bilateral agreements, eastern reef egret being recognised in CAMBA agreements and the cattle egret being represented in JAMBA and CAMBA agreements.

The regent honeyeater (*Anthochaera phrygia*) is also internationally significant under Criterion 2 as it is listed as Critically Endangered under the national Environment Protection and Biodiversity Conservation Act (EPBC). It is also listed as Critically Endangered under the NSW Biodiversity Conservation Act. The Ramsar site hosts a breeding population of this species and birds from this population have been used in a captive breeding program for this species.

Gould's petrel has recently been detected breeding on Broughton Island within the Ramsar site (NPWS, pers comm). This breeding success has been attributed to the recent complete eradication of the rats and rabbits from the island. The process of eradication commenced in 2009, with the island being declared pest free in 2013 following extensive monitoring.

3.4 - Ecological communities whose presence relates to the international importance of the site

Name of ecological community	Community qualifies under Criterion 2?	Description	Justification
Littoral rainforest and coastal vine thickets of eastern Australia.	<input checked="" type="checkbox"/>	Small stands scattered on coastal sand dunes and headlands. Suitable substrates include deep sand dunes, rainforests, basalts and rhyolites.	Nationally listed as critically endangered under the EPBC Act. Within the Ramsar site.
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	<input type="checkbox"/>	Restricted to poorly drained depressions associated with swales on coastal sand sheets or the headwater of creeks on coastal sandstone plateaus e.g. The Moors.	Endangered at the State level (TSC Act)
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	<input type="checkbox"/>	Occurs around the lake fringes. Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains	Endangered at the State level (TSC Act)
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South-East Corner Bioregions	<input type="checkbox"/>	Occurs in the intertidal zone on the shores of estuaries and lagoons including when they are intermittently closed along the NSW coast. These mudflats are exposed to intermittent tidal inundation.	Endangered at the State level (TSC Act)
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner	<input checked="" type="checkbox"/>	It is associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins. It is scattered around the margins of lakes and lagoons.	Nationally listed as endangered under the EPBC Act.
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions.	<input type="checkbox"/>	Small stands scattered on coastal sand dunes and headlands. Suitable substrates include deep sand dunes, rainforests basalts and rhyolites.	Endangered at the State level (TSC Act)
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner bioregion	<input type="checkbox"/>	Found on on sea cliffs and coastal headland. The structure of the community is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs.	Endangered at the State level (TSC Act)

Optional text box to provide further information

All of the ecological communities listed above are listed as endangered in NSW under the NSW Biodiversity Conservation Act (BCA). Themeda grassy headlands were not listed under the BCA until 2015, so they were not in the previous RIS.

Monitoring of the littoral rainforest critically endangered ecological community was established under the NSW Saving our Species Program. Initial surveys have now been completed to assess the distribution and condition and follow-up surveys are planned. A permanent plot has been established to detect changes in rainforest floristics over time. This ecological community is also regularly monitored as part of the site's weed management program.

A vegetation map of the site, including threatened ecological communities, is currently being prepared for the site. This will include mapping of different Ramsar wetland types to provide an accurate assessment of the extent of each type of important ecosystem.

4 - What is the Site like? (Ecological character description)

4.1 - Ecological character

The critical components, processes and services of the Ramsar site are outlined below.

1. Mosaic of natural and/or near natural wetlands

The lakes 18 different wetland types form an interconnected mosaic of fresh to brackish and saline habitats, including; freshwater and fringing wetlands – coastal heath, swamps, coastal swamp forests, and paperbark and she-oak forests on lake margins, brackish waters – characterised by submerged and emergent aquatic vegetation mangroves and intertidal flats, rivers, creeks, streams and marine coast.

2. Water Quality

Oligotrophic clear waters - Clear waters with low nutrient levels in the lakes are critical for ecosystem function and primary production. Good water quality of the lakes is maintained through effective retention, recycling and removal of suspended solids, organic and inorganic nutrients, and other pollutants from water that flows through the lakes.

External nutrient loads - Maintaining the right balance of nutrients imported into the lakes is critical for the site's ecological character. The intensification of land use and removal of native vegetation in catchments leads to increases in the amount of nutrients and sediments entering the lakes. Excessive nutrients stimulate the growth of phytoplankton and increased sediment loads reduce water clarity.

3. Salinity regime and salinity levels

The mosaic of open-water, fringing and tidal wetlands is dependent on the lakes' salinity regime, which ranges from near fresh through brackish to estuarine/marine. Salinity levels are also an important determinant of many of the lakes' aquatic biotic structures and processes.

4. Wetland vegetation

The wetlands support a range of vegetation types which are important for defining the ecological character including:

- submerged aquatic vegetation – e.g. macrophytes, macroalgae, charophytes and seagrasses. This is the basis of gytja; It reflects a range of salinity, with marine seagrasses in areas with higher salinities, and macrophytes and algae in freshwater lakes.
- mangroves and saltmarsh – mangroves provide habitats for fish, crabs, birds and other animals, and maintain water quality by filtering silt from runoff and recycling nutrients; saltmarshes provide habitat for juvenile fish such as bream and mullet, for spawning (e.g. common galaxias), and for crabs.
- seagrasses – valuable as nursery, feeding and shelter areas for many aquatic animals, including fish, mollusc and crustacean species.
- wet heaths – several wetland vegetation communities on The Moors, principally dry heath forest, wet heath forest, swamp forest, swamp, dry heath and wet heath.
- freshwater fringing vegetation – occurs on higher sandy soils along margins of freshwater lakes, and is dominated by broad-leaved paperbark and swamp she-oak.
- emergent vegetation – grows in the shallow waters of the lakes, and is dominated by cumbungi, common reed, sedge, leptocarpus.

5. Significant biodiversity and habitats

The Myall lakes support 1174 terrestrial plant, 22 aquatic plant, 244 bird, 80 mammal, 44 fish, 40 reptile and 37 amphibian species (Bionet Atlas, 2019). They provide a wide range of intertidal habitats for resident and migratory shorebirds including coastal mudflats, sandy beaches, saltmarshes, brackish marshes, mangroves and swamp forests, used for roosting, nesting, breeding, and feeding. The Myall lakes also provide drought refuge for waterbirds.

6. Wetland dependent threatened species

The Ramsar site supports five wetland-dependent species listed as threatened under the EPBC Act and in the IUCN Red List, including; Australasian bittern (*Botaurus poiciloptilus*), Freycinet's frog (*Litoria freycineti*), green and golden bell frog (*Litoria aurea*), green-thighed frog (*Litoria brevipalmata*) and the stuttering frog (*Mixophyes balbus*).

7. Special ecological features – gytja

Myall Lake, Boolambayte Lake and Two-Mile Lake support gytja which determines the distribution of macrophytes in the upper lakes

4.2 - What wetland type(s) are in the site?

Marine or coastal wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
A: Permanent shallow marine waters	Marine coast	3	730	Representative
B: Marine subtidal aquatic beds (Underwater vegetation)	Marine coast	3		Representative
D: Rocky marine shores	Marine coast	3		Representative
E: Sand, shingle or pebble shores	Marine coast	3		Representative
F: Estuarine waters	Mangroves and intertidal flats	4	200	Representative
G: Intertidal mud, sand or salt flats	Mangroves and intertidal flats	4		Representative
H: Intertidal marshes	Mangroves and intertidal flats	4		Representative
I: Intertidal forested wetlands	Mangroves and intertidal flats	4		Representative
J: Coastal brackish / saline lagoons	Brackish waters	1	10300	Representative
K: Coastal freshwater lagoons	Brackish waters	1		

Inland wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
Fresh water > Flowing water >> M: Permanent rivers/ streams/ creeks	Rivers, creeks and streams	4	500	Representative
Fresh water > Flowing water >> N: Seasonal/ intermittent/ irregular rivers/ streams/ creeks	Rivers, creeks and streams	4		Representative
Fresh water > Lakes and pools >> Tp: Permanent freshwater marshes/ pools	Freshwater and fringing wetlands	2	6000	Representative
Fresh water > Marshes on inorganic soils >> Ts: Seasonal/ intermittent freshwater marshes/ pools on inorganic soils	Freshwater and fringing wetlands	2		Representative
Fresh water > Marshes on inorganic soils >> W: Shrub-dominated wetlands	Freshwater and fringing wetlands	2		Representative
Fresh water > Marshes on inorganic soils >> Xf: Freshwater, tree-dominated wetlands	Freshwater and fringing wetlands	2		Representative

Human-made wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type
7: Excavations			
9: Canals and drainage channels or ditches			

Other non-wetland habitat

Other non-wetland habitats within the site	Area (ha) if known
Dry sclerophyll forest	
Coastal valley grassy woodlands	
Maritime grasslands	
Two classes of heath	
Two classes of rainforest	
Two classes of wet sclerophyll forest	

(ECD) Habitat connectivity

The Ramsar site provides important connectivity between terrestrial and wetland ecosystems, and between the lakes and other wetland ecosystems, both within and outside the Ramsar site.

4.3 - Biological components

4.3.1 - Plant species

Other noteworthy plant species

Phylum	Scientific name	Position in range / endemism / other
TRACHEOPHYTA/MAGNOLIOPSIDA	<i>Euphorbia psammogeton</i>	Listed as endangered in NSW. This species is also known as Chamaesyce psammogeton.
TRACHEOPHYTA/MAGNOLIOPSIDA	<i>Melaleuca groveana</i>	Listed as vulnerable in NSW
TRACHEOPHYTA/MAGNOLIOPSIDA	<i>Prostanthera densa</i>	Listed as vulnerable in NSW
TRACHEOPHYTA/MAGNOLIOPSIDA	<i>Senecio spathulatus</i>	Listed as endangered in NSW

Invasive alien plant species

Phylum	Scientific name	Impacts	Changes at RIS update
TRACHEOPHYTA/LILIOPSIDA	<i>Asparagus africanus</i>	Actual (minor impacts)	No change
TRACHEOPHYTA/LILIOPSIDA	<i>Asparagus aphyllus</i>	Actual (minor impacts)	No change
TRACHEOPHYTA/MAGNOLIOPSIDA	<i>Lantana camara</i>	Actual (minor impacts)	No change
TRACHEOPHYTA/MAGNOLIOPSIDA	<i>Myriophyllum aquaticum</i>	Actual (minor impacts)	decrease
TRACHEOPHYTA/LILIOPSIDA	<i>Sagittaria graminea</i>	Actual (minor impacts)	No change
TRACHEOPHYTA/POLYPODIOPSIDA	<i>Salvinia molesta</i>	Actual (minor impacts)	decrease

Optional text box to provide further information

Weeds have been monitored for over a decade by National Parks and Wildlife Services and are reducing across the landscape.

Aquatic and semi-aquatic weeds are a key threat to the Ramsar site. Since 2012, parrots feather (*Myriophyllum aquaticum*) has been actively monitored and controlled within the Ramsar site and surrounding catchment resulting in a significant reduction in density. Cabomba and salvinia, both highly invasive aquatics weeds were found in farm dams in the surrounding catchment several years ago and have been eradicated. *Sagittaria graminea* is known to occur in the upper Myall River catchment and is being actively monitored in conjunction with the local government. Long-leaved willow primrose is a highly invasive weed that has been found in other state reserves in NSW and was recently detected in urban drains close to the Ramsar site. The site manager is working with the local government to treat this infestation and reduce the risk of transmission into the Ramsar site.

Encroachment and competition from aggressive introduced weeds is the main threat to existing terrestrial vegetation. The main concerns are bitou bush (*Chrysanthemoides monilifera*) and slash pine (*Pinus elliotii*). Bitou bush occurs in the eastern part of the Ramsar site along much of the coastline dune systems, on headlands, around the river and lake edges and is encroaching into the Eurunderee sand mass between the lakes and coastline. It has the potential to spread further into native vegetation communities growing on sands, particularly after fire or other types of disturbance. Slash pine occurs in the southern part of the Ramsar site around the lower Myall River and beach areas. A relic plantation remnant adjacent to the river has generated pine wildlings which are spreading into native vegetation communities. Active treatment of infestations of both these species is occurring with densities significantly reduced (NPWS, pers comm. 2020).

Other weeds of concern include lantana (*Lantana camara*), climbing asparagus and prickly asparagus (*Protasparagus* spp.). Myrtle rust (*Uredo rangeii*), an introduced fungus known to infect plants in the Myrtaceae family, is widespread along the east coast of mainland Australia (I&I NSW 2010). If left untreated, it could affect genetic diversity of highly susceptible species.

4.3.2 - Animal species

Other noteworthy animal species

Phylum	Scientific name	Pop. size	Period of pop. est.	% occurrence	Position in range /endemism/other
CHORDATA/REPTILIA	<i>Hoplocephalus stephensii</i>				Listed as Vulnerable in NSW

Invasive alien animal species

Phylum	Scientific name	Impacts	Changes at RIS update
CHORDATA/MAMMALIA	<i>Equus ferus</i>	Actual (minor impacts)	No change
CHORDATA/MAMMALIA	<i>Felis catus</i>	Actual (minor impacts)	No change
CHORDATA/MAMMALIA	<i>Oryctolagus cuniculus</i>	Actual (minor impacts)	decrease
CHORDATA/MAMMALIA	<i>Rattus rattus</i>	Actual (minor impacts)	decrease
CHORDATA/MAMMALIA	<i>Sus scrofa</i>	Actual (minor impacts)	No change
CHORDATA/MAMMALIA	<i>Vulpes vulpes</i>	Actual (minor impacts)	No change

Optional text box to provide further information

Refer to Appendix 2, 3, 5 and 6 of the attached Ecological Character Description (ECD) for lists of other animal species that occur within and around the Ramsar site.

Foxes are a threat to ground-dwelling mammals, amphibians and shore birds, including the pied oystercatcher (*Haematopus longirostris*), which breeds in dunes on the beaches of the Ramsar site, and migratory birds such as the little tern (*Sterna albibronis*), which is predated on by foxes. Fox control in NSW is managed under a threat abatement program that focuses on implementation at sites for threatened species where the benefits are deemed to be greatest (OEH, 2011). There is no broad scale fox control within the Ramsar site.

Feral cats and introduced rats are also threats to migratory birds and other ground-dwelling animals. Rabbits cause changes in the abundance and diversity of vegetation which impacts on habitat for birds and terrestrial species.

A control program for feral cats in NSW is currently being developed. Rats and rabbits have recently been eradicated from Broughton Island resulting in a resurgence of beach nesting birds and active breeding.

Pigs are a threat to amphibians through their disturbance to swamps and other wetland areas which provide habitat for several threatened frogs. Pigs also cause freshwater streams to become muddy, resulting in reduced water quality in some areas of the site's wetlands due to increased turbidity. Pigs are controlled in the Ramsar site on an as needs basis if regular monitoring shows increasing activity (NPWS pers comm, 2020).

There are 2 pest species that could be considered "emerging threats" – they are not yet in the Ramsar site, but if they invade could be a major impact to wetlands:

1. Cane Toad is expanding its range. Current southern range is to Grafton NSW with an outlying population at Port Macquarie NSW. Competition and predation impacting amphibians and other native fauna and food webs. There is no effective treatment/control method for this pest.
2. Rusa Deer has greatly expanded its range and population size in recent years and now occurs at Bulahdelah, only a few kilometres from the park. Deer have the potential to browse and trample sensitive wetlands and surrounding catchment. As they are widespread in the landscape treatment would require co-operation with public and private land managers.

4.4 - Physical components

4.4.1 - Climate

Climatic region	Subregion
C: Moist Mid-Latitude climate with mild winters	Cfb: Marine west coast (Mild with no dry season, warm summer)

The prevailing climate in this region is warm and temperate with a maritime influence. Summers are warm to hot and humid. Winters are cool to mild. The mean annual rainfall is 1328 mm at Bulahdelah. The wettest months are in late summer and early autumn.

Climate change will be a threat to the site. The expected regional climatic changes are:

- temperatures are almost certain to rise
- rainfall is likely to decrease in winter and increase in summer
- evaporation is likely to increase in all seasons
- the impacts of El Niño - Southern Oscillation is likely to become more extreme.

As a result:

- sea levels are almost certain to rise
- coastal dune erosion and soil decline are likely to continue
- seawater intrusion is likely to affect subsoils on coastal plains
- increased sheet, rill and gully erosion due to higher rainfall is likely to induce sediment inundation in coastal floodplains. (OEH, 2012).

4.4.2 - Geomorphic setting

a) Minimum elevation above sea level (in metres)

a) Maximum elevation above sea level (in metres)

Entire river basin

Upper part of river basin

Middle part of river basin

Lower part of river basin

More than one river basin

Not in river basin

Coastal

Please name the river basin or basins. If the site lies in a sub-basin, please also name the larger river basin. For a coastal/marine site, please name the sea or ocean.

The river catchment originates in the hills to the north-west of Bulahdelah and runs south and east to Bombah Broadwater. It is composed of two major subcatchments – the Myall and the Crawford. Gradients are steep in the headwaters but become much more moderate in the lowlands near Bulahdelah. The site is also influenced by tides from the Pacific Ocean.

There are three main geomorphological features of the Ramsar site: the Myall River catchment, the lakes system and the coastal sand deposits.

4.4.3 - Soil

Mineral

(Update) Changes at RIS update No change Increase Decrease Unknown

Organic

(Update) Changes at RIS update No change Increase Decrease Unknown

No available information

Are soil types subject to change as a result of changing hydrological conditions (e.g., increased salinity or acidification)? Yes No

4.4.4 - Water regime

Water permanence

Presence?	Changes at RIS update
Usually permanent water present	

Source of water that maintains character of the site

Presence?	Predominant water source	Changes at RIS update
Water inputs from precipitation	<input type="checkbox"/>	No change
Water inputs from groundwater	<input type="checkbox"/>	No change
Water inputs from surface water	<input checked="" type="checkbox"/>	No change

Water destination

Presence?	Changes at RIS update
Feeds groundwater	No change

Stability of water regime

Presence?	Changes at RIS update
Water levels fluctuating (including tidal)	No change

Please add any comments on the water regime and its determinants (if relevant). Use this box to explain sites with complex hydrology:

Myall Lakes Ramsar site is centred around the large open-water fresh to brackish lakes system, with other wetland types either directly connected (such as fringing wetlands around lakes, riverine wetlands upstream of lakes, tidal wetlands downstream of lakes) or located nearby (perched dune wetlands). The marine coast of Myall Lakes National Park is part of the Ramsar site.

(ECD) Connectivity of surface waters and of groundwater	Most of the groundwater inflow to the lakes comes from sand aquifers, with inflows estimated at 285ML/day from sand aquifers and 2 ML/day from fractured rock aquifers (MHL 1999). The annual maximum estimated groundwater inflow is 104.7GL (MHL 1999)
(ECD) Stratification and mixing regime	No information available

4.4.5 - Sediment regime

Sediment regime unknown

Please provide further information on sediment (optional):

Sediments in the waterways are caused by erosion and overland transport of soil particles. In Myall lakes, sediment sources are derived from sheet or surface erosion, or from deeper erosion.

The volumes of sediment likely to enter the lakes by surface erosion were modelled (Great Lakes Council 2009). This showed that overall agricultural land and gravel roads were the largest sources of sediments in the catchment, contributing 79% of the total suspended solids entering the lakes.

Areas in the Ramsar site where there is contemporary sediment accumulation are floodplains adjacent to the Myall River, and the Myall River delta in Bombah Broadwater. There are also catchment sediment sinks with very old deposits in the site, which formed via the deposition of sediment at the edges of the valley on the old floodplain during the Holocene period upstream of Bulahdelah (Thom 1965).

Generally the sediments in and around Myall Lakes are stable.

(ECD) Water turbidity and colour	Water turbidity is generally low, with concentrations not exceeding 2.6 NTU from 2010-2018.
(ECD) Light - reaching wetland	The acceptable annual median Secchi depth has been set at not less than 1.75m at key locations.
(ECD) Water temperature	No information available

4.4.6 - Water pH

Circumneutral (pH: 5.5-7.4)

(Update) Changes at RIS update No change Increase Decrease Unknown

Alkaline (pH>7.4)

(Update) Changes at RIS update No change Increase Decrease Unknown

Unknown

4.4.7 - Water salinity

Fresh (<0.5 g/l)

(Update) Changes at RIS update No change Increase Decrease Unknown

Mixohaline (brackish)/Mixosaline (0.5-30 g/l)

(Update) Changes at RIS update No change Increase Decrease Unknown

Euhaline/Eusaline (30-40 g/l)

(Update) Changes at RIS update No change Increase Decrease Unknown

Unknown

Please provide further information on salinity (optional):

The mosaic of open-water, fringing and tidal wetlands is dependent on the lakes' salinity regime, which ranges from near fresh in Myall Lake and Boolambayte Lake, through brackish in Bombah Broadwater to estuarine/marine in the lower Myall River. The existing salinity regime is maintained by changing lake levels in response to variable rainfall and by sufficient inflow from rainfall to keep salinity levels low. Varying water levels are essential to the maintenance of the fringing wetlands, and low salinity in the lakes is necessary for the macrophyte beds and fringing wetlands. The presence of intertidal flats and maintenance of intertidal wetlands (mangrove and saltmarsh) depends on the current sea level remaining constant.

(ECD) Dissolved gases in water

No information available.

4.4.8 - Dissolved or suspended nutrients in water

Oligotrophic

(Update) Changes at RIS update No change Increase Decrease Unknown

Unknown

(ECD) Dissolved organic carbon No information available

(ECD) Redox potential of water and sediments No information available

(ECD) Water conductivity Salinity levels range from 0.4 to 50.6 mS/cm across the site.

4.4.9 - Features of the surrounding area which may affect the Site

Please describe whether, and if so how, the landscape and ecological characteristics in the area surrounding the Ramsar Site differ from the site itself: i) broadly similar ii) significantly different

Surrounding area has greater urbanisation or development

Surrounding area has higher human population density

Surrounding area has more intensive agricultural use

Surrounding area has significantly different land cover or habitat types

Please describe other ways in which the surrounding area is different:

The Myall Lakes catchment covers 440 square kilometres. Its major tributary is the Myall River, whose headwaters extend to Craven Nature Reserve and the Kyle Range.

The catchment is largely occupied by agricultural land, with forestry and protected vegetation in the steeper areas and a small amount of urban land in the townships of Bulahdelah and the well-known tourist destinations of Tea Gardens-Hawks Nest.

The Myall Lakes and Myall River in particular are part of a large tourism and recreation industry which includes Myall Lakes National Park, one of New South Wales' most visited National Parks with estimated annual visitor numbers of 250,000.

Major issues for the Myall Lakes system include the impacts of rural runoff on water quality including nutrients, noxious weeds and other pathogens. Urban runoff and the impacts from tourism and recreation uses of the lakes and estuaries are more prevalent in the lower reaches of the catchment.

4.5 - Ecosystem services

4.5.1 - Ecosystem services/benefits

Provisioning Services

Ecosystem service	Examples	Importance/Extent/Significance
Food for humans	Sustenance for humans (e.g., fish, molluscs, grains)	Medium

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Maintenance of hydrological regimes	Storage and delivery of water as part of water supply systems for agriculture and industry	Medium
Erosion protection	Soil, sediment and nutrient retention	Medium
Pollution control and detoxification	Water purification/waste treatment or dilution	Medium

Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Recreational hunting and fishing	Medium
Recreation and tourism	Nature observation and nature-based tourism	Medium
Recreation and tourism	Water sports and activities	Medium
Spiritual and inspirational	Cultural heritage (historical and archaeological)	Medium
Scientific and educational	Educational activities and opportunities	Medium
Scientific and educational	Important knowledge systems, importance for research (scientific reference area or site)	Medium

Supporting Services

Ecosystem service	Examples	Importance/Extent/Significance
Biodiversity	Supports a variety of all life forms including plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part	Medium

Other ecosystem service(s) not included above:

The site supports a mosaic of largely unmodified coastal lakes systems ranging from fresh to estuarine.

The Myall Lakes provide important connectivity between terrestrial and wetland ecosystems, both within and outside the Ramsar site. The wetlands primary production and food webs support significant biodiversity and habitat for fish, shorebirds, migratory birds, terrestrial fauna and invertebrates.

Within the site:

Outside the site:

Have studies or assessments been made of the economic valuation of ecosystem services provided by this Ramsar Site? Yes No Unknown

4.5.2 - Social and cultural values

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

<no data available>

4.6 - Ecological processes

(ECD) Primary production	The wetlands in the Myall lakes support a diverse and apparently healthy aquatic ecosystem, indicating that fundamental ecosystem processes such as primary production and food webs are still functioning in a near-natural state.
(ECD) Nutrient cycling	The lakes maintain high water quality by effectively retaining, recycling and removing suspended solids, organic and inorganic nutrients, and other pollutants from water that flows through. They act as a sink for nutrients, organic matter and sediments.
(ECD) Carbon cycling	No information available

(ECD) Animal reproductive productivity	No information available
(ECD) Vegetational productivity, pollination, regeneration processes, succession, role of fire, etc.	Fire plays an important role in determining the diversity, distribution and abundance of flora and fauna in Myall Lakes Ramsar site (NPWS 2002).
(ECD) Notable species interactions, including grazing, predation, competition, diseases and pathogens	Predation by introduced species including foxes, feral cats and rats is a key threat to breeding success of beach-nesting resident and migratory birds.
(ECD) Notable aspects concerning animal and plant dispersal	The site's estuarine and brackish waters provide a spawning ground and nursery for many common fish species that then disperse through the freshwater or marine environments.
(ECD) Notable aspects concerning migration	The Myall lakes system provides habitat for many of the flyways migratory bird species at the terminus of their migration. Most of the available information suggests that intertidal habitats are the most important for the majority of shorebird species
(ECD) Pressures and trends concerning any of the above, and/or concerning ecosystem integrity	Climate change is expected to impact on the above ecological processes (Refer to section 5.2.1 and 2.1.5). Excessive nutrient inputs caused by increased urbanisation or poor agricultural practices are also a key threat to the functioning of the ecosystem.

5 - How is the Site managed? (Conservation and management)

5.1 - Land tenure and responsibilities (Managers)

5.1.1 - Land tenure/ownership

Public ownership

Category	Within the Ramsar Site	In the surrounding area
Provincial/region/state government	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Private ownership

Category	Within the Ramsar Site	In the surrounding area
Other types of private/individual owner(s)	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Provide further information on the land tenure / ownership regime (optional):

Myall Lakes Ramsar site is comprised of national park (Myall Lakes National Park and part of Gir-um-bit National Park) and nature reserve (Little Broughton Island Nature Reserve and Corrie Island Nature Reserve), which are protected under the NSW National Parks and Wildlife Act and managed by the NSW Department of Planning Industry and the Environment (DPIE). The waterways of the Ramsar site are included within the Port Stephens – Great Lakes Marine Park, protected under the NSW Marine Parks Act.

5.1.2 - Management authority

Please list the local office / offices of any agency or organization responsible for managing the site:

NSW National Parks and Wildlife Service (part of DPIE) Hunter Central Coast Branch, Manning Great Lakes Area

NSW Marine Parks Authority

Provide the name and/or title of the person or people with responsibility for the wetland:

NPWS Park Operations Branch - Hunter Central Coast

Postal address:

NSW National Parks and Wildlife Service
Manning Great Lakes Area
The Ruins Campground
The Lakes Way, Pacific Palms, NSW 2428

Marine Parks Authority
Manager, Port Stephens-Great Lakes Marine Park
Locked Bag 800
Nelson Bay NSW 2315

E-mail address:

npws.westdarling@environment.nsw.gov.au

5.2 - Ecological character threats and responses (Management)

5.2.1 - Factors (actual or likely) adversely affecting the Site's ecological character

Human settlements (non agricultural)

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Tourism and recreation areas	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input type="checkbox"/>	No change
Housing and urban areas	Low impact	Medium impact	<input type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Agriculture and aquaculture

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Livestock farming and ranching	Medium impact	High impact	<input type="checkbox"/>	No change	<input checked="" type="checkbox"/>	decrease

Energy production and mining

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Oil and gas drilling	Low impact	Medium impact	<input type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Biological resource use

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Fishing and harvesting aquatic resources	unknown impact	unknown impact	<input checked="" type="checkbox"/>	No change	<input type="checkbox"/>	No change

Human intrusions and disturbance

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Recreational and tourism activities	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input type="checkbox"/>	No change

Natural system modifications

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Fire and fire suppression	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input type="checkbox"/>	No change
Vegetation clearance/land conversion	Medium impact	Medium impact	<input type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Invasive and other problematic species and genes

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Invasive non-native/alien species	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Pollution

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Agricultural and forestry effluents	Medium impact	Medium impact	<input type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Climate change and severe weather

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Temperature extremes	Low impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input type="checkbox"/>	No change
Storms and flooding	Low impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change
Habitat shifting and alteration	Low impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Please describe any other threats (optional):

The impacts of inappropriate fire regimes (frequent, severe fires) across the Ramsar site include:

- changes to vegetation communities and therefore fauna habitats
- reductions in abundance or local extinction of endemic species
- extinction of threatened species from the site
- increased runoff and sediments and nutrients into the lakes
- invasion of introduced species.

There is a fire management strategy in place for the site (OEH, 2014).

Inappropriate fire regimes are a significant threat to native vegetation communities, and high frequency fire is listed as a key threatening process under the TSC Act. Vegetation communities can be altered and species eliminated if the frequency of fire is too great to enable species to maintain their life cycles. The alteration of vegetation communities by frequent fire also has an impact on animals that depend on habitats in those vegetation communities for their survival.

Frequent fires as the result of arson, particularly in parts of the Ramsar site accessible by vehicle, are a threat to vegetation communities, reducing species abundance and diversity (for example, in heathland) and impacting on fauna habitats (for example, for birds and ground dwelling mammals).

The range of potential impacts associated with sea level rise is unknown. It is possible that sea level rise may impact the coastal hydrology causing freshwater systems to increase in salinity.

5.2.2 - Legal conservation status

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Marine Park	Great Lakes Marine Park	https://www.dpi.nsw.gov.au/fishing/marine-protected-areas/marine-parks/port-stephens-marine-park	partly
State Protected Area	Corrie Island Nature Reserve	http://www.nationalparks.nsw.gov.au/visit-a-park/parks/corrie-island-nature-reserve	partly
State Protected Area	Gir-um-bit National Park	http://www.nationalparks.nsw.gov.au/visit-a-park/parks/girumbit-national-park	partly
State Protected Area	Little Broughton Island Nature Reserve	http://www.nationalparks.nsw.gov.au/visit-a-park/parks/little-broughton-island-nature-reserve	partly
State Protected Area	Myall Lakes National Park	http://www.nationalparks.nsw.gov.au/visit-a-park/parks/myall-lakes-national-park	partly

5.2.3 - IUCN protected areas categories (2008)

- Ia Strict Nature Reserve
- Ib Wilderness Area: protected area managed mainly for wilderness protection
- II National Park: protected area managed mainly for ecosystem protection and recreation
- III Natural Monument: protected area managed mainly for conservation of specific natural features
- IV Habitat/Species Management Area: protected area managed mainly for conservation through management intervention
- V Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation
- VI Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems

5.2.4 - Key conservation measures

Legal protection

Measures	Status
Legal protection	Implemented

Habitat

Measures	Status
Catchment management initiatives/controls	Partially implemented

Species

Measures	Status
Control of invasive alien plants	Implemented
Control of invasive alien animals	Implemented

Human Activities

Measures	Status
Regulation/management of recreational activities	Implemented
Harvest controls/poaching enforcement	Implemented

Other:

In Australia, the ecological character of a designated Ramsar site is protected as a Matter of National Environmental Significance (MNES) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The Department of Planning, Industry and Environment (DPIE) develops and implements management strategies for invasive species on more than 7 million ha (approximately 9% of the State) of lands managed under the National Parks and Wildlife Act 1974. DPIE works collaboratively with stakeholders including Local Land Services and Regional Weeds Committees. DPIE also develops, coordinates and reports on state-wide initiatives to reduce the impacts of invasive species on biodiversity. Initiatives such as the Saving our Species (SOS) program identify specific pest management actions to protect threatened species, ecological communities and other important biodiversity assets. The SOS program also includes specific strategies to address Key Threatening Processes, many of which are invasive species. DPIE undertakes research into new invasive species control tools and monitors the effectiveness of invasive species management on lands it manages. DPIE also has an advisory role on environmental invasive species management across NSW and sits on the National Biosecurity Committee (DPIE 2018).

In this Ramsar site, weeds are controlled under the provisions of the Hunter Regional Strategic Weed Management Plan 2017-2022 and pest animals under the Hunter Regional Strategic Pest Animal Management Plan 2018-2023 (Hunter LLS, 2017, 2018).

The site manager, DPIE, has an ongoing program of pest and weed control throughout the Ramsar site. A pest and weed information system is used to record maps of areas treated for weeds and pest species treated. It also provides an estimate of pest species density. The site is also actively managed for tourism and recreation. Recreational activities are carefully monitored and access restricted if monitoring indicates that recreational impacts are having an unacceptable impact. For instance, a road was closed in 2009 to limit vehicle access to the Moors, a highly valuable wetland ecosystem within the site. This has resulted in the protection and rejuvenation of highly sensitive high conservation value areas (NPWS, pers comm 2020.)

One of the key threats to the site is runoff from agricultural / forestry areas outside of the site. DPIE work with the local government agency and other catchment management agencies to monitor and respond to reduce these threats. An example was the development, of the Water Quality Improvement Plan in 2009 (Great Lakes Council, 2009) and its ongoing implementation.

Control of fishing activities is regulated and actively managed in the marine park part of the Ramsar site.

5.2.5 - Management planning

Is there a site-specific management plan for the site? Yes

Has a management effectiveness assessment been undertaken for the site? Yes No

If the site is a formal transboundary site as indicated in section Data and location > Site location, are there shared management planning processes with another Contracting Party? Yes No

5.2.6 - Planning for restoration

Is there a site-specific restoration plan? No need identified

5.2.7 - Monitoring implemented or proposed

Monitoring	Status
Water quality	Implemented
Plant species	Implemented
Animal species (please specify)	Implemented
Plant community	Proposed

Water quality: Chlorophyll-a and turbidity is monitored 6 times over summer between November and March each year, with the monitoring results generally within the natural variability (Mid Coast Council, 2019).

There was one unexpectedly high result for chlorophyll-a, which was assessed to be due to high levels of nutrients being washed from agricultural land in the catchment following storms. The excessive nutrients stimulate algal growth to unacceptable levels and sometimes cause toxic blue green algal blooms. This did occur in Jan, Feb 2012 and again in 2016. (http://www.water.nsw.gov.au/__data/assets/pdf_file/0019/548101/hunter_racc_blue_green_algal_blooms_myall_lakes.pdf)

There has been a decline in chlorophyll-a over time in Bombah Broadwater part of the site. Government agencies are working in the catchment, together with the community, to implement the actions in the Water Quality Improvement Plan for the region, to improve the water quality of the Myall Lakes (http://www.water.nsw.gov.au/__data/assets/pdf_file/0007/548224/hunter_racc_great_lakes_water_quality_improvement_.pdf)

Monitoring and control of pest plants and animals is ongoing and there are several permanent transects that have been put in place to monitor weeds (NPWS, pers. comm, 2020). There is some existing monitoring of the littoral rainforest threatened ecological community and the proposed vegetation map will assist with monitoring changes to this community and the casuarina glauca threatened ecological community over time.

6 - Additional material

6.1 - Additional reports and documents

6.1.1 - Bibliographical references

See Attachment 1 under other published literature.

6.1.2 - Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)

<1 file(s) uploaded>

ii. a detailed Ecological Character Description (ECD) (in a national format)

<1 file(s) uploaded>

iii. a description of the site in a national or regional wetland inventory

<no file available>

iv. relevant Article 3.2 reports

<no file available>

v. site management plan

<1 file(s) uploaded>

vi. other published literature

<3 file(s) uploaded>

6.1.3 - Photograph(s) of the Site

Please provide at least one photograph of the site:



Bombah Broadwater (*Fiona Miller (OEH), 16-04-2009*)



Swamp Webs, Myall Lakes NP (*Fiona Miller (OEH), 21-05-2008*)



Myall Lakes National Park (*Fiona Miller (OEH), 16-04-2009*)



View south from Dark Point, Myall Lakes National Park (*Neal Foster (DAWE), 30-04-2019*)



View of Broughton Island, Myall Lakes National Park (*Neal Foster (DAWE), 30-04-2019*)

6.1.4 - Designation letter and related data

Designation letter

<1 file(s) uploaded>

Date of Designation