Ramsar Information Sheet

Published on 25 March 2025
Update version, previously published on : 1 January 1998

Australia

Roebuck Bay

Designation date	7 June 1990
Site number	479
Coordinates	18°08'51"S 122°15'19"E
Area	34 141,00 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

The Roebuck Bay (Yawuru Nagulagun) Ramsar Site is located at Roebuck Bay near Broome in North Western Australia. Roebuck Bay is a marine tropical embayment, with a very large tidal range which exposes around 160 square kilometres of intertidal mudflats (jalbarl-barl). These extend up to 13 kilometres (km(offshore at the south-western end of the Bay.

Mangrove swamp communities (gundurung) line the eastern and southern edges of the Site and extend up into the linear tidal creeks. They are important nursery areas for marine fishes and crustacea, particularly prawns. The intertidal mud and sand flats support a high abundance of bottom dwelling invertebrates, which are a key food source for waterbirds.

The Site is one of the most important staging sites for migratory shorebirds (gamirda-gamirda) in Australia and globally as well. For many shorebirds, Roebuck Bay is the first Australian landfall they reach on the East Asian Australasian Flyway. The total numbers of waders using the Site each year is estimated at over 300,000. The northern beaches and Bush Point provide important high tide roost sites. Extensive seagrass beds occur in the bay, providing an important feeding ground for Dugong (nganarr). Dolphins and internationally threatened marine turtles (gurlibil) also regularly use the Site. The Site has a high diversity of finfish, sharks and rays.

The Site is used for recreational or tourism activities such as fishing, crabbing, sightseeing and bird watching. Broome Bird Observatory, a small reserve at the northern end of the Site, engages in shorebird research and public education.

Roebuck Bay lies in the traditional country of the Yawuru Indigenous people. The Site was an important area for seasonal meetings, exchanging gifts, arranging marriages and settling disputes. Numerous shellfish middens, marking former camping places, can still be seen along coastal cliffs and dunes. It continues to provide cultural, social, economic and ecological values to Indigenous people. Under the Yawuru native title determinations, the Yawuru people now jointly manage the Site, as part of the Yawuru conservation estate. Most of the Ramsar Site is within the Yawuru Nagulagun/Roebuck Bay Marine Park, while some sections are in the Yawuru Birragun Conservation Park.

The Site meets seven of the nine Ramsar criteria (1, 2, 3, 4, 5, 6 and 8).

2 - Data & location

2.1 - Formal data

2.1.1 - Name and address of the compiler of this RIS

Responsible compiler

Institution/agency	Department of Biodiversity, Conservation and Attractions (DBCA)
Postal address	Department of Biodiversity, Conservation and Attractions Locked Bag 104 BENTLEY DELIVERY CENTRE WA 6983 Australia

National Ramsar Administrative Authority

Institution/agency	Department of Climate Change, Energy, the Environment and Water (DCCEEW)
Postal address	GPO Box 3090 Canberra ACT 2601 Australia

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

From year	1998
To year	2020

2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	Roebuck Bay
Unofficial name (optional)	Yawuru Nagulagun

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 ◉ No ○
(Update) The boundary has been delineated more accurately	☑
(Update) The boundary has been extended	☐
(Update) The boundary has been restricted	☐
(Update) B. Changes to Site area	the area has increased
(Update) The Site area has been calculated more accurately	☑
(Update) The Site has been delineated more accurately	☐
(Update) The Site area has increased because of a boundary extension	☐
(Update) The Site area has decreased because of a boundary restriction	☐
(Update) For secretariat only: This update is an extension	☐

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
(Update) Optional text box to provide further information	

When the Roebuck Bay Site was nominated in 1990, it was considered to meet 3 of the 6 criteria -
• Criterion 1a: It is a particularly good example of a specific type of wetland, characteristic of its region.
• Criterion 3a: It regularly supports 20,000 waterfowl.
• Criterion 3c: It regularly supports 1% of the individuals in a population of one species or a subspecies of waterfowl.

It is now considered to meet current criteria 1, 2, 3, 4, 5, 6 and 8.

In 2010, an assessment was made of possible change in the ecological character of the Site due to decline in the number of migratory birds at Roebuck Bay and Eighty Mile Beach. It concluded that there had been no significant decline in migratory shorebird use of Roebuck Bay. See: https://www.environment.gov.au/water/wetlands/publications/analysis-possible-change-ecological-chara cter-roebuck-bay-and-eighty-mile-beach-ramsar

While there has been no notifiable change in ecological character, the Site has been subject to a changing climate.
Australia has warmed on average by around 1.4 °C (higher than the global average of 1° C) since national records began in 1910, leading to an increased frequency of extreme heat events. Further increase in temperature is projected, with more extremely hot days and fewer extremely cool days over the coming decades under all emissions scenarios. (BOM and CSIRO, State of the Climate 2020). These conditions will affect the critical components, processes and services of the Site. The adaptive capacity and resilience of the site will be tested.

2.2 - Site location

2.2.1 - Defining the Site boundaries

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

Former maps: 0

Boundaries description

The boundary of the Ramsar Site includes the intertidal mudflats and tidal creeks of Roebuck Bay.

The boundary of the Roebuck Bay Ramsar Site is defined by the extent of intertidal mudflats and tidal creeks. The western boundary of the Ramsar Site follows the extent of intertidal mudflat from the south at Point A (Lat 18° 18’ 43.56” Long 122° 7’ 42.24”) northwards to Point B (Lat 18° 5’ 11.04” Long 122° 10’ 41.52”) and then in a south-east direction to Point C (Lat 18° 7’ 29.64” Long 122° 19’ 52.32”). From Point C, the Ramsar boundary follows the extent of intertidal mudflat north to Point D (Lat 17° 58’ 48.72” Long 122° 21’ 6.12”) then west to Point E (Lat 17° 58’ 38.64” Long 122° 18’ 23.04”) and then heads north to Point F (Lat 17° 58’ 11.28” Long 122° 18’ 23.04”). The northern boundary of the Ramsar site heads east to Point G (Lat 17° 58’ 25.68” Long 122° 22’ 41.52”) and the eastern boundary travels south following the indentations of various tidal creeks to the point of commencement in the south.

2.2.2 - General location

a) In which large administrative region does the site lie? Western Australia

b) What is the nearest town or population centre? Broome (population 14,660 in 2021), is 7 km west of the site

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): 34141

Area, in hectares (ha) as calculated from GIS boundaries: 34141.282

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
Other scheme (provide name below)	Tanami-Timor Seacoast - Cape Leveque Coast
Other scheme (provide name below)	Northwest IMCRA Province

Other biogeographic regionalisation scheme

Bureau of Meteorology, 2012. Australian Hydrological Geospatial Fabric (Geofabric). Topographic Drainage Divisions and River Regions, http://www.bom.gov.au/water/geofabric/

Commonwealth of Australia, 2006. Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.

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 ecosystem services provided	The near natural wetland ecosystems of Roebuck Bay support bioregional biodiversity, coastal productivity and global populations of migratory bird species. The soft bottom mudflats along the shores of Roebuck Bay, along with the high tide roosts at Bush and Sandy Points are the most biologically significant parts of the Site (Bennelongia, 2009).
Other reasons	Roebuck Bay is unique in the bioregion for its a large intertidal area and extreme tidal regime. Tides in the vicinity of Broome have a very large range (9.5 m), thus exchange through the Bay is high, tidal velocities are relatively high and large mudflats have developed. The mud and sand flats are among the widest in Western Australia, extending up to 13 km offshore at the south-western end of the Bay where sandbanks are common, offering an important roost for shorebirds (Bennelongia, 2009). The Site is a superb example of a tropical marine embayment within the Northwest (IMCRA) bioregion. Roebuck Bay is the most significant embayment between Cape Leveque at the northern tip of the Dampier Peninsula and Cape Lambert to the south in the Pilbara. It is a unique environment formed by a natural lowland between the northern Dampier Peninsula and the Edgar Ranges and an ancient drainage system. Hydrogeological studies have identified the potential position of an ancient river channel through the intertidal area and have linked it with the now drowned river valley of Roebuck Deeps. Less than 2 km from shore and reaching depths of 100 m, the Roebuck Deeps is a unique geomorphic feature which focuses tidal flows and exerts a strong influence on the nature of Roebuck Bay. The evolution of the intertidal flats of Roebuck Bay (jalbarl-barl) is a function of the broad geological inheritance, a significant rise in sea level (over 100 m in the last 20,000 years) and a unique geomorphic and climate setting that provided little run-off or terrestrial sediment input. As a result, modern day Roebuck Bay is regarded as having one of the most biologically diverse and productive tropical intertidal flats in the world (Bennelongia 2009). Its enormous tidal flats with an abundant and diverse macrozoobenthos fauna result in it being one of only a dozen intertidal flats worldwide where benthic food sources are found in sufficient densities that they regularly support internationally significant numbers of shorebirds (Rogers et al 2011).

☑ Criterion 2 : Rare species and threatened ecological communities

Optional text box to provide further information

The site supports feeding and roosting for a number of migratory bird species which are listed as threatened under the national Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) including the critically endangered curlew sandpiper (Calidris ferruginea) and far eastern curlew (Numenius madagascariensis); the endangered lesser sand plover (Charadrius mongolus), black-tailed godwit (Limosa limosa) and common greenshank (Tringa nebularia); and the vulnerable Asian dowitcher (Limnodromus semipalmatus), ruddy turnstone (Arenaria interpres), red knot (Calidris canutus – also endangered under the IUCN Red list), great knot (Calidris tenuirostris), greater sand plover (Charadrius leschenaultii), grey plover (Pluvialis squatarola) and terek sandpiper (Xenus cinereus).

Other nationally threatened species that use Roebuck Bay include loggerhead turtle (Caretta caretta, nationally endangered) and green turtle (Chelonia mydas, nationally vulnerable). Loggerhead turtles use the Bay as a seasonal feeding area and as a transit area on migration. Flatback turtles (Natator depressus, nationally vulnerable) regularly nest in small numbers on beaches between Cape Villaret and Jacks Creek. Turtle monitoring during 2010, 2011 and 2012 recorded 65, 67 and 55 nests respectively with high hatchling emergence rates (79-87%) (DPW, 2016). Pristis clavata (nationally endangered) regularly use the tidal creeks and mangrove areas for breeding and refuge.

Roebuck Bay supports regionally and nationally significant numbers of Australian snubfin dolphin (Orcaella heinsohni, IUCN - vulnerable, listed as cetacean and migratory under national EPBC Act). Recent surveys of approx. 100 km2 of Roebuck Bay estimated there were around 133 snubfin dolphins (excluding dependent calves) using the area. This is one of the largest reported populations in Australia and is the highest density of snubfin dolphins reported to date (DPAW 2016)

The site is likely to be regionally significant for dugong (Dugong dugon) (nganarr), which are listed as vulnerable globally (IUCN) and as marine and migratory under the national EPBC Act. Survey work in 1984 suggested a population of 50-100 individuals. During survey work in October 2013 for dolphins, they were regularly encountered in small groups throughout the northern third of Roebuck Bay (Brown et al, 2014).

☑ Criterion 3 : Biological diversity

Justification

The site supports a significant component of the regional (Northwest IMCRA bioregion) intertidal and shallow marine biodiversity in terms of the marine vertebrates (dugong, turtles and dolphin), marine invertebrate fauna, and avian fauna across the site.

The total density of macrobenthic animals (1,287 individuals/m2) is high by global standards for a tropical mudflat and species richness is very high (estimated to be between 300 – 500 species). The high biomass of benthic invertebrates is a key characteristic that makes it such an important shorebird habitat.

A total of over 122 waterbird species have been records, including 14 resident shorebirds, 38 migratory shorebirds, 11 gulls and terns, and 19 waterfowl species (DPW, 2016).

Roebuck Bay supports a diverse range of finfish with 352 species from 82 families (2000-2002 survey), and diverse and abundant sharks and rays (DPW, 2016).

☑ Criterion 4 : Support during critical life cycle stage or in adverse conditions

Optional text box to provide further information: The site is one of the most important migration stopover areas for shorebirds both in Australia and globally. It is the arrival and departure point for large proportions of the Australian populations of several shorebird species, notably bar-tailed godwit (Limosa lapponica) and great knot (Calidris tenuirostris). The site provides essential energy replenishment for many migrating species, some of which fly non-stop between continental East Asia and Australia.

☑ Criterion 5 : >20,000 waterbirds

Overall waterbird numbers: 100000

Start year: 1999

End year: 2011

Source of data: Rogers et al 2011

Optional text box to provide further information:

The site regularly supports over 100,000 waterbirds. The highest number of shorebirds counted at the site was 170,915 in October 1983. Over 2 days in December 2008, a total of 199,000 shorebirds and other birds were observed. It regularly hosts at least 100,000 birds per day over the period late October to early March (Rogers et al, 2009).

Maximum counts of 28 coastal migrant species, 3 grassland migrant species and 10 resident shorebird species at Roebuck Bay over the period 2004-2011 totalled 308,964 (Rogers et al 2011).

It is the fourth most important site for shorebirds in Australia in terms of absolute numbers and the most important in terms of the number of species it supports in internationally significant numbers.

Summer counts of shorebirds at Roebuck Bay (Bennelongia, 2010) have been:
Year Count
2004 92,764
2005 81,343
2006 74,664
2007 77,229
2008 94,440
2009 85,007

☑ Criterion 6 : >1% waterbird population

Optional text box to provide further information

The site regularly supports more than 1% of the population of at least 18 shorebird species (16 migratory and 2 resident species):

– greater sand plover (Charadrius leschenaultii)
– oriental plover (Charadrius veredus)
– red-capped plover (Charadrius ruficapillus) (resident species)
– bar-tailed godwit (Limosa lapponica)
– black-tailed godwit (Limosa limosa)
– red knot (Calidris canutus)
– great knot (Calidris tenuirostris)
– red-necked stint (Calidris ruficollis)
– curlew sandpiper (Calidris ferruginea)
– sanderling (Calidris alba)
– far eastern curlew (Numenius madagascariensis)
– little curlew (Numenius minutus)
– whimbrel (Numenius phaeopus)
– grey-tailed tattler (Tringa brevipes)
– terek sandpiper (Xenus cenereus)
– ruddy turnstone (Arenaria interpres)
– Asian dowitcher (Limnodromus semipalmatus)
– pied oystercatcher (Haematopus longirostris) (resident species)

(Rogers et al 2011; Wetlands International 2012, Mundkur and Langendoen 2022).

☑ Criterion 8 : Fish spawning grounds, etc.

Justification

The site is important as a nursery and/or breeding and/or feeding ground for at least five species of fish, including the protected sawfish (Pristis clavata), and also for crustaceans, particularly penaeid prawns and mud crabs (Scylla sp.). The site's mangrove ecosystem is particularly important as a nursery area for marine fishes and prawns.

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 / LILIOPSIDA	*Halodule uninervis*	☐	☑	☐	LC	☐		Supports marine biodiversity including marine mammals, invertebrates and birds
TRACHEOPHYTA / LILIOPSIDA	*Halophila ovalis*	☐	☑	☐	LC	☐		Supports marine biodiversity including marine mammals, invertebrates and birds

The intertidal and shallow marine part of the site includes a variety of benthic plants, including seagrasses (such as Halophila ovalis and Halodule uninervis) and macroalgae, which support a variety of marine mammals, marine invertebrates and avian fauna.

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 / REPTILIA	*Caretta caretta*	☑	☐	☐	☐	☑	☐	☐	☐				VU	☑	☑	EPBC Act - nationally Endangered, Marine and Migratory State listed - Endangered	Feeding
CHORDATA / REPTILIA	*Chelonia mydas*	☑	☐	☐	☐	☑	☐	☐	☐				EN	☑	☑	EPBC Act - nationally Vulnerable, Marine and Migratory State listed - Vulnerable	Feeding
CHORDATA / MAMMALIA	*Dugong dugon*	☑	☐	☐	☐	☑	☐	☐	☐	100	1984		VU	☑	☐	EPBC Act - Marine and Migratory	Feeding
CHORDATA / REPTILIA	*Natator depressus*	☑	☐	☐	☐	☑	☐	☐	☐				DD	☑	☐	EPBC Act - nationally Vulnerable, Marine and Migratory State listed - Vulnerable	Nesting and feeding
CHORDATA / MAMMALIA	*Orcaella heinsohni*	☑	☐	☐	☐	☑	☐	☐	☐				VU	☑	☐	EPBC Act - Cetacean and Migratory State listed - Priority 4 migratory species	Internationally listed threatened species
Fish, Mollusc and Crustacea																	
CHORDATA / ELASMOBRANCHII	*Pristis clavata*	☑	☐	☐	☐	☑	☐	☐	☐				CR	☑	☑	Nationally Vulnerable (EPBC Act) State listed – Priority 1 migratory species	Listed threatened species
Birds																	
CHORDATA / AVES	*Arenaria interpres*	☑	☑	☑	☐	☑	☐	☐	☐	1044	1999-2011	3.48	LC	☐	☐	Nationally Vulnerable and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The Interpres, Pacific & SE Asia (non-breeding) population estimate for this species is 30,000 individuals (EAAFP CSR 1), with a 1% threshold of 300. The site supports 3.48% of the flyway population.
CHORDATA / AVES	*Calidris alba*	☐	☑	☑	☐	☑	☐	☐	☐	3235	1999-2011	10.78	LC	☐	☐	Nationally Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The Rubida E & SE Asia, Australia, New Zealand (non-breeding) population estimate for this species is 30,000 individuals (EAAFP CSR 1), with a 1% threshold of 300. The site supports 10.78% of the flyway population.
CHORDATA / AVES	*Calidris canutus*	☑	☑	☑	☐	☑	☐	☐	☐	2755	1999-2011	4.92	NT	☐	☐	Nationally Vulnerable, Marine and Migratory (EPBC Act) State listed - Endangered	Site count data is based on Rogers et al 2011. The Piersmai population estimate for this species is 50,500 – 62,000 individuals and the Rogersi population 48,500-60,000 individuals (EAAFP CSR 1), with a 1% threshold of 560 and 540. Using the larger Piersmai population, this site supports 4.92% of the flyway population.
CHORDATA / AVES	*Calidris ferruginea*	☑	☑	☑	☐	☑	☐	☐	☐	1601	1999-2011	1.78	NT	☐	☐	Nationally Critically Endangered, Marine and Migratory (EPBC Act) State listed – Critically Endangered	Site count data is based on Rogers et al 2011. The E, SE Asia & Australia (non-breeding) population estimate for this species is 90,000 individuals (EAAFP CSR 1), with a 1% threshold of 900.The site supports 1.78% of the flyway population
CHORDATA / AVES	*Calidris ruficollis*	☐	☑	☑	☐	☑	☐	☐	☐	16397	1999-2011	3.45	NT	☐	☐	Nationally Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The NE Siberia (breeding) population estimate for this species is 475,000 individuals (EAAFP CSR 1), with a 1% threshold of 4800. The site supports 3.45% of the flyway population.
CHORDATA / AVES	*Calidris tenuirostris*	☑	☑	☑	☐	☑	☑	☐	☐	30361	1999-2011	7.14	EN	☐	☑	Nationally Vulnerable, Marine and Migratory (EPBC Act) State listed – Critically Endangered	Site count data is based on Rogers et al 2011. The SE Asia, Australia (non-breeding) population estimate for this species is 425,000 individuals (EAAFP CSR 1), with a 1% threshold of 4300. The site supports 7.14% of the flyway population.

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	*Charadrius leschenaultii*	☑	☑	☑	☐	☑	☑	☐	☐	22318	1999-2011	9.3	LC	☐	☐	Nationally Vulnerable, Marine and Migratory (EPBC Act) State listed - Vulnerable	Site count data is based on Rogers et al 2011. The Leschenaultii, SE Asia, Australia (non-breeding) population estimate for this species is 200,000-300,000 individuals (EAAFP CSR 1), with a 1% threshold of 2400. The site supports 9.3% of the flyway population.
CHORDATA / AVES	*Charadrius mongolus*	☑	☑	☐	☐	☑	☐	☐	☐	71	1999-2011	0.28	EN	☐	☐	Nationally Endangered, Marne and Migratory (EPBC Act) State listed - Endangered	Site count data is based on Rogers et al 2011. The Mongolus population estimate for this species is 25,500 individuals and the Stegmanni population 13,000 individuals (EAAFP CSR 1), with a 1% threshold of 260 and 130 respectively. Using the larger Mongolus population, this site supports 0.28% of the flyway population.
CHORDATA / AVES	*Charadrius ruficapillus*	☐	☐	☑	☐	☑	☐	☐	☐	6531	1999-2011	6.87	LC	☐	☐	Nationally Marine (EPBC Act)	Site count data is based on Rogers et al 2011. The Australia population estimate for this species is 95,000 individuals (WPE 5), with a 1% threshold of 950. The site supports 6.87% of the flyway population.
CHORDATA / AVES	*Charadrius veredus*	☐	☑	☑	☐	☑	☐	☐	☐	6431	1999-2011	2.8	LC	☐	☐	Nationally Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The population estimate for this species is 230,000 individuals (EAAFP CSR 1), with a 1% threshold of 2300. The site supports 2.80% of the flyway population.
CHORDATA / AVES	*Glareola maldivarum*	☐	☑	☐	☐	☑	☑	☐	☐	21041	1999-2011	0.73	LC	☐	☐	Nationally Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The E-SE Asia, Australia population estimate for this species is 288,0000 individuals (EAAFP CSR 1), with a 1% threshold of 28,800. The site supports 0.73% of the flyway population.
CHORDATA / AVES	*Haematopus longirostris*	☐	☐	☑	☐	☑	☐	☐	☐	547	1999-2011	4.97	LC	☐	☐		Site count data is based on Rogers et al 2011. The Australia, S New Guinea, Aru Is population estimate for this species is 11,000 individuals (WPE 5), with a 1% threshold of 110. The site supports 4.97% of the Australian population.
CHORDATA / AVES	*Limnodromus semipalmatus*	☑	☑	☑	☐	☑	☐	☐	☐	414	1999-2011	1.46	NT	☐	☐	Nationally Vulnerable, Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011.The population estimate for this species is 28,400 individuals (EAAFP CSR 1), with a 1% threshold of 280. This site supports 1.46% of the flyway population.
CHORDATA / AVES	*Limosa lapponica*	☐	☑	☑	☐	☑	☑	☐	☐	25821	1999-2011	2.15	NT	☐	☐	Nationally Marine and Migratory (EPBC Act)	Site count data is based on Rogers et al 2011. The Menzbieri population estimate for this species is 100,000-150,000 individuals and the Anadyrensis population 6,300-7,400 individuals (EAAFP CSR 1), with a 1% threshold of 1200 and 70 respectively. Using the larger Menzbieri population, this site supports 2.15% of the flyway population.
CHORDATA / AVES	*Limosa limosa*	☑	☑	☑	☐	☑	☐	☐	☐	6780	1999-2011	4.24	NT	☐	☐	Nationally Endangered, Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011.). The melanuroides population estimate for this species is 160,000 individuals (EAAFP CSR 1), with a 1% threshold of 1600. The site supports 4.24% of the flyway population.
CHORDATA / AVES	*Numenius madagascariensis*	☑	☑	☑	☐	☑	☐	☐	☐	776	1999-2011	2.22	EN	☐	☑	Nationally Critically Endangered, Marine and Migratory (EPBC Act) State listed – Critically Endangered	Site count data is based on Rogers et al 2011. The population estimate for this species is 35,000 individuals (EAAFP CSR 1), with a 1% threshold of 350. The site supports 2.22% of the flyway population.
CHORDATA / AVES	*Numenius minutus*	☐	☑	☑	☐	☑	☐	☐	☐	1297	1999-2011	1.18	LC	☐	☐	Nationally Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The population estimate for this species is 110,000 individuals (EAAFP CSR 1), with a 1% threshold of 1100. The site supports 1.18% of the flyway population.

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	*Numenius phaeopus*	☐	☑	☑	☐	☑	☐	☐	☐	1100	1999-2011	1.69	LC	☐	☐	Nationally Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The Variegatus, E & SE Asia (non-breeding) population estimate for this species is 65,000 individuals (EAAFP CSR 1), with a 1% threshold of 650. The site supports 1.69% of the flyway population.
CHORDATA / AVES	*Pluvialis squatarola*	☑	☑	☐	☐	☑	☐	☐	☐	697	1999-2011	0.87	LC	☐	☐	Nationally Vulnerable, Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The Squatarola, E, SE Asia & Australia (non-breeding) population estimate for this species is 80,000 individuals (EAAFP CSR 1), with a 1% threshold of 800. The site supports 0.87% of the flyway population.
CHORDATA / AVES	*Tringa brevipes*	☐	☑	☑	☐	☑	☐	☐	☐	2173	1999-2011	3.1	NT	☐	☐	Nationally Marine and Migratory (EPBC Act) State listed – priority 4 migratory species	Site count data is based on Rogers et al 2011. The population estimate for this species is 70,000 individuals (EAAFP CSR 1), with a 1% threshold of 700. The site supports 3.1% of the flyway population.
CHORDATA / AVES	*Tringa nebularia*	☑	☑	☐	☐	☑	☐	☐	☐	533	1999-2011	0.48	LC	☐	☐	Nationally Endangered, Marine and Migratory (EPBC Act) State listed - migratory species	Site count data is based on Rogers et al 2011. The E, SE Asia, Australia (non-breeding) population estimate for this species is 110,000 individuals (EAAFP CSR 1), with a 1% threshold of 1100.The site supports 0.48% of the flyway population.
CHORDATA / AVES	*Xenus cinereus*	☑	☑	☑	☐	☑	☑	☐	☐	1522	1999-2011	3.04	LC	☐	☐	Nationally Vulnerable, Marine and Migratory (EPBC Act) State listed – migratory species	Site count data is based on Rogers et al 2011. The E, SE Asia & Australia (non-breeding) population estimate for this species is 50,000 individuals (EAAFP CSR 1), with a 1% threshold of 500. The site supports 3.04% of the flyway population.

1) Percentage of the total biogeographic population at the site

Total migratory shorebird populations are from.
• WPE5 is Wetlands International 2012, or
• EAAFP CSR 1 (Mundkur and Langendoen 2022).

Figures for migratory and resident shorebirds are generally the sum of complete counts between 2004 and 2011 on the northern beaches and BushPoint on the same tide series. Two summer counts (late October to early December) and one winter count (June to July) were carried out annually in this period (Rogers et al 2011). All the migratory shorebirds are listed under the Japan and China Migratory Bird Agreements with Australia (JAMBA and CAMBA) and are protected under the national Environment Protection and Biodiversity Conservation Act (EPBC Act). The State listed status is the WA Biodiversity Conservation Act 2016.

Most shorebirds migrate to temperate or tropical regions during their non-breeding season (Battley et al. 2003). For many shorebirds, Roebuck Bay is the first Australian landfall on the East Asian-Australasian Flyway. Most birds arrive between August and November and disperse to disparate regions of Australia and even New Zealand. The northern migration begins around March for some larger species and continues into May for others (Battley et al. 2003).

The Kimberley coast ranks as the most important non-breeding area for shorebirds known in Australia and the East Asian – Australasian Flyway; it is used by over 649,000 shorebirds which forage in intertidal areas, including 22 species that occur in internationally significant numbers. Within the Kimberley region, the distribution of these birds is patchy, with over 90% of the coastal shorebirds occurring at just two sites: Eighty-mile Beach and Roebuck Bay. Both sites have enormous tidal flats which have been shown to have an abundant and diverse macrozoobenthos fauna, and therefore provide rich feeding grounds for shorebirds (Rogers et al 2011). In Roebuck Bay, the diversity of benthic bivalves provides a platform for a high abundance and diversity of shorebird species, ranging from the world's largest shorebird, the far eastern curlew (Numenius madagascariensis), to one of the smallest, the red-necked stint (Bennelongia 2009).

Roebuck Bay is one of the most important migration stopover areas for shorebirds in Australia and globally, including large proportions of the Australian populations of several shorebird species, notably bar-tailed godwit (Limosa lapponica) and great knot (Calidris tenuirostris) (Bennelongia, 2009). Shorebird numbers are highest in the spring when Palaearctic migrants stop here to feed on their southward migration. The area supports about 30,000 birds during winter, at a time of year when few adults of breeding age remain in Australia, and considerably larger numbers over summer because many migrating birds remain in northern Australia rather than continuing south (Minton et al. 2003). Fewer birds stop on the north-western coast to feed on the northwards migration but, nevertheless, numbers in autumn are very high.

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
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula.	☐	This vegetation type is mainly confined to dunes and other Holocene coastal landforms of the Dampier Peninsula in north-west Western Australia, and is heavily dependent on wet (monsoon) season rainfall.	Listed as endangered under the national EPBC Act.

Optional text box to provide further information

The Threatened Ecological Community, Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula (listed under national legislation, the EPBC Act and also listed as endangered under the BC Act), may occur in the northern part of the site (DAWE, n.d,).

The Dampier Monsoon Vine Thickets occurs as discontinuous patches of dense vegetation and contains approximately 23% of vascular plant species that occur on the Dampier Peninsula. The degree of the ecological community's fragmentation reflects the natural distribution and influences from the surrounding environment. The patches are usually located within the swales on the leeward side of the coastal Holocene dune systems. Patches tend to be larger with increasing dune size. Dampier Monsoon Vine Thickets are considered a rainforest subset ranging from semideciduous vine thickets to closed semi-deciduous vine forest. The ecological community contains deciduous, semi-deciduous and evergreen perennial flora species.

Approved Conservation Advice for Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula is at http://www.environment.gov.au/biodiversity/threatened/communities/pubs/105-conservation-advice.pdf .

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

4.1 - Ecological character

Roebuck Bay is one of less than twenty soft bottomed intertidal mudflats worldwide that support very large numbers of migratory shorebirds and comprise the primary staging and over-wintering areas for Palaearctic shorebirds on their annual southward migrations. Roebuck Bay remains one of the most important sites for shorebird conservation in the East-Asian Australasian Flyway. It is internationally important for at least 20 species of migratory shorebirds with total numbers of waders using the site each year estimated at over 300,000. It supports 300-500 species and a high biomass of benthic invertebrates for a tropical mudflat, including many species believed to be new to science (Bennelongia, 2009).

Vegetation structural formations include: Low closed-forest to open-scrub (mangrove) in the east and south of the Bay; low shrubland (samphire) inland of the mangroves. Surrounding areas support low open woodland (pindan) over grassland.

Nationally endangered loggerhead turtles (Caretta caretta) and the nationally vulnerable green turtle (Chelonia mydas) regularly use the area as a seasonal feeding ground and as a transit area during migration (Lambert and Elix 2006). Flatback turtles (Natator depressus) breed at the site. The site is also a significant nursery area for marine fishes and crustaceans.

Dugong (Dugong dugon) live in the Bay, and the site is likely to be internationally significant for the Australian snubfin dolphin (Orcaella heinsohni) (DPW, 2016).

The site is also of high cultural and social value. The Bay is of cultural, spiritual, social and economic significance to the Yawuru people. The Bay provides the only deep-water port in the Kimberley. It supports tourism, commercial fishing and pearling, and a diversity of recreational activities such as birdwatching, fishing, crabbing, water skiing, kayaking and sight-seeing tours by hovercraft. Dinosaur footprints in the Broome sandstone at Fall Point date from the Cretaceous period and are of considerable scientific interest.

The fundamental drivers of the ecology of Roebuck Bay are climate, geomorphology, hydrology and oceanography, which control wetland type, and biogeography, which controls the pool of available organisms to colonise the Bay. Biogeochemical and biotic features then determine exactly which animals and plants live within the resultant wetland environment and the finer scale distribution of these plants and animals.

Many wetland components and physical, chemical and biological processes are important at Roebuck Bay but it is considered that the most critical are (Bennelongia, 2009):
• Sediment characteristics;
• Benthic plants (seagrass and macroalgae);
• Stands of mangroves;
• Benthic invertebrates on the mudflats;
• Shorebirds.

The soft silty sediments of much of the Bay and the consequential high biomass of benthic invertebrates on the mudflats underpin the critical processes of the site. Maintaining Roebuck Bay in first class condition means ensuring that the physical characteristics of the mudflats and the energy sources driving productivity on the mudflats (mudflat diatoms, planktonic algae brought in by tides, mangrove detritus) continue in their current state. These attributes are critical to maintaining invertebrate biomass and, therefore, Roebuck Bay as an outstanding migratory shorebird site (Bennelongia, 2009).

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
B: Marine subtidal aquatic beds (Underwater vegetation)	Roebuck Bay seagrass beds	2	2700	Representative
E: Sand, shingle or pebble shores		0		
G: Intertidal mud, sand or salt flats	jalbarl-barl	1	6700	Representative
H: Intertidal marshes	Saltmarsh and saline grasslands (bundu)	4		Representative
I: Intertidal forested wetlands	Mangrove swamps at Dampier Creek, Crab Creek and Yardoogarra Creek (gundurung)	3	1900	Representative

(ECD) Habitat connectivity	There is connectivity between the terrestrial and marine ecosystems, with groundwater and surface water flow after monsoonal rain (as well as marine production) supplying the system with energy and nutrients.

4.3 - Biological components

4.3.1 - Plant species

Other noteworthy plant species

Phylum	Scientific name	Position in range / endemism / other
TRACHEOPHYTA/MAGNOLIOPSIDA	*Aegialitis annulata*	Diversity of mangrove species
TRACHEOPHYTA/MAGNOLIOPSIDA	*Aegiceras corniculatum*	Diversity of mangrove species
TRACHEOPHYTA/MAGNOLIOPSIDA	*Avicennia marina*	Diversity of mangrove species
TRACHEOPHYTA/MAGNOLIOPSIDA	*Bruguiera exaristata*	Diversity of mangrove species
TRACHEOPHYTA/MAGNOLIOPSIDA	*Camptostemon schultzii*	Diversity of mangrove species
TRACHEOPHYTA/MAGNOLIOPSIDA	*Ceriops tagal*	Diversity of mangrove species
TRACHEOPHYTA/MAGNOLIOPSIDA	*Osbornia octodonta*	Part of mangrove community
TRACHEOPHYTA/MAGNOLIOPSIDA	*Rhizophora stylosa*	Diversity of mangrove species
TRACHEOPHYTA/LILIOPSIDA	*Sporobolus virginicus*	Stabilises soil, habitat for waterbirds
TRACHEOPHYTA/MAGNOLIOPSIDA	*Tecticornia halocnemoides*	Stabilises soil, habitat for waterbirds

Invasive alien plant species

Phylum	Scientific name	Impacts	Changes at RIS update
TRACHEOPHYTA/LILIOPSIDA	*Cenchrus ciliaris*	Actual (major impacts)	No change
TRACHEOPHYTA/MAGNOLIOPSIDA	*Cryptostegia grandiflora*	Actual (minor impacts)	No change
TRACHEOPHYTA/MAGNOLIOPSIDA	*Leonotis nepetifolia*	Actual (minor impacts)	No change

Optional text box to provide further information

Seagrass Beds: Extensive seagrass beds occur in Roebuck Bay and are dominated by Halophila ovalis and Halodule uninervis (Prince 1986). The most vigorous stands grow in areas that are exposed for less than two hours at low tide. These meadows are important feeding grounds for Dugong (Dugong dugon) and Green Turtle (Chelonia mydas). See Section 3.2.

Mangroves: High diversity and zonation, Northern section comprises low open to closed forest of Avicennia marina, Aegiceras corniculatum, Camptostemon schultzii and Rhizophora stylosa with Aegialitis annulata understorey. The southern section is a mixed woodland (to 5m) of Avicennia marina, Bruguiera exaristata, Osbornia octodonta and Camptostemon schultzii. The mangroves have highest species diversity and tallest trees in Dampier and Crab Creeks and in Yardoogarra Creek, the inlet between Bush Point and Sandy Point. In these areas there is distinct zonation of the mangroves. The typical sequence of species in a landward direction is Avicennia, Rhizophora, Ceriops tagal and samphire or salt flats (Chalmers & Woods 1987).

Samphire Flats: Samphire also occurs landward from the edge of the mangroves and is dominated by species such as: Tecticornia halocnemoides (Chalmers & Woods 1987). These flats may be inundated by some high tides.

Saline Grasslands: The saline grass plains are slightly higher in elevation than the samphire flats and the soil has a lower salinity. The dominant species is Saltwater Couch Sporobolus virginicus, which forms a dense grassland 15-20 cm tall.

“Pindan”: in the north, consisting of a sparse upper story of trees and middle story of dense acacia thickets over dense grasslands.

Weeds: The major weed is Buffel Grass (Cenchrus ciliaris), which was introduced as cattle fodder and has had a significant impact on the native grasses that occurred on the floodplains prior to the introduction of cattle. Small areas of Rubbervine (Cryptostegia grandiflora) is also present around the Ramsar site. One small area of Lion's Tail Grass (Leonotis nepetifolia), which forms dense spiky stands and displaces native vegetation, has also been identified (Bennelongia, 2009).

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/MAMMALIA	*Chaerephon jobensis*				Roosting and/ or feeding site.
CHORDATA/MAMMALIA	*Chalinolobus gouldii*				Roosting and/ or feeding site.
CHORDATA/MAMMALIA	*Macroglossus minimus*				Recorded 6km from NW tip of Roebuck Bay, may use the Ramsar site
CHORDATA/MAMMALIA	*Nyctophilus arnhemensis*				Roosting and/ or feeding site.
CHORDATA/MAMMALIA	*Orcaella brevirostris*	37	1986		Migratory, nationally protected under EPBC Act
CHORDATA/MAMMALIA	*Pipistrellus westralis*				Roosting and/ or feeding site.
CHORDATA/MAMMALIA	*Pteropus alecto*				Roosting
CHORDATA/MAMMALIA	*Pteropus scapulatus*				Roosting
CHORDATA/MAMMALIA	*Saccolaimus flaviventris*				Roosting and/ or feeding site.
CHORDATA/ACTINOPTERYGII	*Eleutheronema tetradactylum*				Nursery site
CHORDATA/ACTINOPTERYGII	*Lates calcarifer*				Nursery site
CHORDATA/ACTINOPTERYGII	*Polydactylus macrochir*				Nursery site
CHORDATA/AVES	*Butorides striata*				Breeding site
CHORDATA/AVES	*Ephippiorhynchus asiaticus*				Breeding site
CHORDATA/AVES	*Haliastur indus*				Breeding site
CHORDATA/AVES	*Pandion haliaetus*				Breeding site

Optional text box to provide further information

Noteworthy fauna:

Birds: Four species of waterbirds have been recorded breeding in mangroves south of Crab Creek:
• striated heron (Butorides striata)
• black-necked stork (Ephippiorhynchus asiaticus)
• osprey (Pandion haliaetus)
• brahminy kite (Haliastur indus)
Bush Point is an important roost site for little tern (Sterna albifrons) and there are records of breeding nearby (C. Hassell, pers. comm.).

Bats: Dampier Creek mangroves are a regular roost for large colonies of fruit bats including Pteropus alecto, Pteropus scapulatus and Macroglossus lagchius. Species of insectivorous bats that have been recorded in the mangroves at Crab Creek include:
• Saccolaimus flaviventris
• Chaerephon jobensis
• Mormopterus loriae
• Chalinolobus gouldii
• Scotorepens greyii
• Pipistrellus westralis
• Nyctophilus arnhemenis
(McKenzie and Rolfe 1986).

Fish: The extensive mangrove swamps are important nursery areas for marine fishes, notably Giant Threadfin Salmon (Polydactylus macrochir), Blue Threadfin Salmon (Eleutheronema tetradactylum). During higher rainfall years, the marshy areas and creeks around the mangroves act as nursery grounds for Barramundi (Lates calcarifer) (Dept. of Fisheries, pers. comm.).

Crustacea: Nine species of fiddler crabs (Uca spp.) have been recorded at Roebuck Bay (Chalmers & Woods 1987). The mangroves provide nursery areas and habitat for mudcrabs (Scylla sp.) and a number of penaeid prawn species including the commercial western king prawn (Penaeus latisulcatus).

Benthic fauna: Total intertidal invertebrate diversity is estimated at between 300 and 500 species – among the richest mudflats known in the world (Piersma et al. 1998). Polychaete worms, especially the families Chaetopteridae and Oweniidae, dominate the fauna in terms of biomass (45%) and abundance (70% of all individuals). In terms of abundance, bivalves comprise 12.5%, crustaceans 8%, brittle stars 4.2% and gastropods 2.5%.

4.4 - Physical components

4.4.1 - Climate

Climatic region	Subregion
B: Dry climate	BSh: Subtropical steppe (Low-latitude dry)

The climate is semi-arid monsoonal with hot, wet summers and warm, dry winters. The site is subject to regular cyclones.

Mean annual rainfall at Bidyadanga (closest weather station - 95 km away) is 513 mm, mostly falling in November to April, when cyclones are common. Mean monthly minimum for July is 14.1 and mean monthly maximum for April is 35.8 degrees C.

According to projections for Australia's NRM Regions - Northern Australia - Monsoonal North West (CSIRO et al, 2016), average temperatures will continue to increase in all seasons (very high confidence) with more hot days and warm spells projected with very high confidence. Changes to rainfall are possible but unclear. There is likely to be Increased intensity of extreme rainfall events (high confidence). With medium confidence, fewer but more intense tropical cyclones are projected. Mean sea level will continue to rise and height of extreme sea-level events will also increase (very high confidence).

4.4.2 - Geomorphic setting

a) Minimum elevation above sea level (in metres): 0

a) Maximum elevation above sea level (in metres): 6

- 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.

Roebuck Bay and Indian Ocean

4.4.3 - Soil

- Mineral ☑
- (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 ◉

Please provide further information on the soil (optional)

Roebuck Bay is a megascale irregular-curved embayment, mostly occupied by intertidal mudflats and indented in the east by microscale linear tidal creeks. The Bay is bounded to the north-west and far south-east by low sand ridges (Bush & Sandy Points), and to the east and far north by coastal flat of Holocene marine sediment. A long red cliff, 2-6 m in height, of pindan soil with occasional patches of brown lateritic gravel, overlying yellowish-red Broome Sandstone of Cretaceous age dominates the northern shore of the Bay. At the base of the cliff, occasional dinosaur footprints are preserved in sandstone (Thulborn et al. 1994).

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
Marine water	☐	No change

Water destination

Presence?	Changes at RIS update
Marine	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:

Roebuck Bay is among the highest tidal range in the country. Roebuck Bay has a very large tidal range which exposes up to 190 km2 of mudflat, approximately 45-50% of the total bay area at low tide. The mud and sand flats are among the widest in Western Australia: the intertidal flats extend up to 13 km offshore at the south-western end of the Bay where sandbanks are common, offering an important roost for shorebirds. Spring tides have an amplitude up to 10 m and can travel at up to 20 cm/sec mid cycle (Hickey et al. 1998; Piersma et al. 2002). Most of the mudflat area is inundated by each high tide and at times, spring tides and/or cyclones may cause the adjoining coastal flats to become inundated. The tidal system is semi-diurnal with an average tidal amplitude of 5.7m. Tidal range varies from ca. 1 m on neap tides to 9.5 m on the highest spring tides. These factors dominate the intertidal ecology.

4.4.5 - Sediment regime

Significant transportation of sediments occurs on or through the site ☑

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

Sediment regime is highly variable, either seasonally or inter-annually ☑

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

Sediment regime unknown ☐

Please provide further information on sediment (optional):

There are 3 main sediment provinces in the intertidal zone of Roebuck Bay (Oldmeadow 2007): Northern Sands, Eastern Silt and Clay, and Southern Sands province.
Erosion from scouring of the tidal channels transports fine carbonate-rich sediments from Roebuck Plains to the intertidal flats, making this a very productive community.

Cyclones and associated storm surge can lead to shore erosion. In 2000 Cyclone Rosita resulted in a storm surge which caused sea water to be driven several kilometres inland along Roebuck Plains. There was severe coastal erosion along the eastern side of Roebuck Bay just south of Broome. Roebuck Bay mangroves and salt marshes bind the soil during periods of flood and also help reduce wind erosion along the coastline (Bennelongia, 2009).

An AGSO report (AGSO 1998) found spring tide currents of up to 2.5 m/s at the Broome Port, scouring sediments from the northern bay and dropping further south.

(ECD) Water turbidity and colour: The Bay waters are relatively turbid due to the area's shallow bathymetry, strong tidal flow, waves and fine sediments.

4.4.6 - Water pH

Circumneutral (pH: 5.5-7.4) ☑

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

Unknown ☐

4.4.7 - Water salinity

Euhaline/Eusaline (30-40 g/l) ☑

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

Unknown ☐

4.4.8 - Dissolved or suspended nutrients in water

Eutrophic ☑

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

Mesotrophic ☑

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

Unknown ☐

Please provide further information on dissolved or suspended nutrients (optional):

Roebuck Plains produces large amounts of sheetwash into the bay after large cyclonic events or prolonged wet season rains. This will be an important vector for nutrients, organic carbon and freshwater into the bay.

Nutrient levels in Roebuck Bay are high in some places. There have been blooms of the cyanobacteria, Lyngbya majuscula recorded since 2005. The source of the nutrients is not clear (Bennelongia, 2009, Estrella, 2013).

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:

Grazing of cattle occurs on pastoral leases (Roebuck Plains and Thangoo Stations). The Broome urban area (residential and industrial) is adjacent to the site, with a growing population. Broome International Airport recorded 365,000 passenger movements in 2016-17. The Tourism Western Australia Report recorded 310,00 visitors to Broome in 2018. There is also commercial fishing, prawning, pearling and industrial use, with deep water port facilities at Broome.

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)	High

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Erosion protection	Soil, sediment and nutrient retention	Medium
Hazard reduction	Coastal shoreline and river bank stabilization and storm protection	High

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
Spiritual and inspirational	Cultural heritage (historical and archaeological)	High
Spiritual and inspirational	Contemporary cultural significance, including for arts and creative inspiration, and including existence values	High
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 microorganizms, the genes they contain, and the ecosystems of which they form a part	High
Nutrient cycling	Storage, recycling, processing and acquisition of nutrients	High
Nutrient cycling	Carbon storage/sequestration	Medium

Optional text box to provide further information

Roebuck Bay is Yawuru sea country, and provides cultural, ecological, social and economic values to the Yawuru people. Yawuru country is a living cultural landscape, with values which arise from the Bugarrigarra (the creative epoch) which gave form to the land and seascape, and gave Yawuru people the responsibility for looking after their country. The Yawuru people have traditional ecological knowledge which is the basis for sustainable use of the abundant marine resources. They use the area for traditional hunting, fishing and harvest. Yawuru country also provides significant sites and places for cultural activities (DPW, 2016)

The pearling industry has been established at Broome since the 1880s, initially for mother-of-pearl, but since 1956 has focused on high value cultured pearls. Broome's pearling history has contributed greatly to its multicultural character, bringing together Aboriginal, European and Asian (notably Japanese, Chinese, Filipino and Malay) peoples. The principal cultural event in the Broome calendar is Shinju Matsuri (Festival of the Pearl), held in July-August.

Broome Bird Observatory near Fall Point was opened in 1988; it is operated by Birds Australia and is used as an educational, research and recreation facility focusing on Roebuck Bay and its environs. Dinosaur footprints in the Broome sandstone at Fall Point date from the Cretaceous period and are of considerable scientific interest (Bennelongia, 2009)

Recreational fishing is important near Broome and the Fall Point coast and there are several boat-launching sites in both areas.

Low cliffs offer a panoramic view across the northern Bay and the contrast of pale blue sea, dark green mangroves and red cliffs is particularly appealing. The cliffs and Crab Creek area offer one of the best places in the world for viewing shorebirds, with accessibility, high species richness and high numbers.

Other ecosystem service(s) not included above:

The site is likely to be a regional driver for ecological productivity (DPW, 2016).

Within the site:	10 000s
Outside the site:	100 000s

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

Where economic studies or assessments of economic valuation have been undertaken at the site, it would be helpful to provide information on where the results of such studies may be located (e.g. website links, citation of published literature):

Yawuru Nagulagun/ Roebuck Bay Marine Park Joint Management Plan 2016: https://www.roebuckbay.org.au/pdfs/RBRSMP-Preliminary-Draft-021209.pdf

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 intertidal areas are benthic driven with high primary production from diatoms on the flats and from mangroves.
(ECD) Nutrient cycling	Nutrient supplies are probably sourced similarly to carbon supplies.
(ECD) Carbon cycling	Carbon supply to the intertidal flats is likely to be from fixation by microalgae, phytoplankton deposits during floods, detritus from mangroves and transport of macroalgae and seagrass.
(ECD) Notable aspects concerning migration	Roebuck Bay is an important staging area for migratory shorebirds travelling south from their Arctic breeding grounds.

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	☑	☑

Other

Category	Within the Ramsar Site	In the surrounding area
Commoners/customary rights	☑	☑

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

For thousands of years Yawuru people have lived along the foreshores of Roebuck Bay, across the pindan plains, as far inland as the Walan-garr (Edgar Ranges). It is a living cultural landscape with which Yawuru people have a dynamic and enduring relationship.

On 28 April 2006, the Federal Court determined that the Yawuru people are the recognised native title holders of the lands and waters in and around Broome. In February 2010, the Yawuru Registered Native Title Body Corporate (RNTBC), the Government of Western Australia, the Broome Shire and other relevant parties signed two Indigenous Land Use Agreements – the Yawuru Prescribed Body Corporate ILUA and the Yawuru Area Agreement ILUA.

The Agreements provided for the establishment of a Yawuru conservation estate, including 3 jointly managed parks. Most of the Ramsar site lies within the Yawuru Nagulagun/ Roebuck Bay Marine Park, which is managed under a joint management plan (DPW, 2016).

5.1.2 - Management authority

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

The site is managed by the Joint Management Body, which comprises 3 Yawuru representatives, appointed by the Yawuru Registered Native Title Body Corporate (RNTBC) and 3 representatives appointed by WA Department of Biodiversity and Conservation.

The contact is the Broome Office, WA Department of Biodiversity Conservation and Attractions (telephone: +61 8 9195 5500).

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

Manager, Kimberley Region. WA Department of Biodiversity, Conservation and Attractions

Postal address:

111 Herbert Street, Broome, WA 6725

or:
PO Box 65
BROOME WA 6725

E-mail address:

broome@dbca.wa.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
Housing and urban areas		unknown impact	☐	No change	☑	increase
Commercial and industrial areas	unknown impact	High impact	☐	No change	☑	increase
Tourism and recreation areas	High impact	High impact	☑	increase	☑	increase

Water regulation

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Water abstraction		unknown impact	☐	No change	☑	unknown

Agriculture and aquaculture

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Livestock farming and ranching	Low impact		☐	No change	☑	No change

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	unknown impact	High impact	☐	No change	☑	No change
Mining and quarrying		unknown impact	☐	No change	☑	No change

Transportation and service corridors

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Shipping lanes		High impact	☑	unknown	☑	unknown

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		High impact	☑	No change	☑	increase

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	High impact	High impact	☑	increase	☑	increase

Natural system modifications

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Vegetation clearance/ land conversion		High impact	☐	No change	☑	increase

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		High impact	☑	unknown	☑	unknown

Pollution

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Household sewage, urban waste water	Medium impact	Medium impact	☑	increase	☑	increase
Agricultural and forestry effluents	Medium impact	Medium impact	☑	increase	☑	increase

Geological events

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Earthquakes/tsunamis		High impact	☑	unknown	☑	unknown

Climate change and severe weather

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Habitat shifting and alteration	Medium impact	High impact	☑	increase	☑	increase
Storms and flooding	Medium impact	High impact	☑	No change	☑	No change

Please describe any other threats (optional):

Conservation of shorebirds along the Kimberley coast depends on protection of a relatively small number of sites, including Roebuck Bay. These sites face relatively few immediate threats and are in good condition. Protected by their isolation, to date they have not been threatened by processes that have caused deterioration or loss of many tidal flat habitats overseas, such as land reclamation, large-scale shorebird hunting, urbanisation or intensive harvesting of shellfish.

Threats to the conservation of Roebuck Bay include:

• General port operations, an increase in port operations, oil and gas activity and infrastructure associated with economic growth in the region has the potential to impact on the values of the Ramsar site (DPW, 2016).

• Increased pressure for coastal development near Broome and increased shipping in the area may become an issue in the future.

• Nutrient enrichment in sections of the bay near to Broome township has resulted in increasingly frequent blooms of cyanobacteria (Lyngbya majascula); there are indications that this has already influenced benthos composition in the tidal flats and foraging behaviour of bar-tailed godwits has changed as a result (DPW 2016).

• Disturbance of shorebirds at roosts on the northern beaches of Roebuck Bay is of concern. Studies from 1997–2000 demonstrated that disturbance levels at roost sites are high, with birds often undertaking energetically costly alarm flights to escape potential danger from birds of prey and humans. Disturbance levels measured in 2005/06 (Rogers et al. 2006e) and 2007/08 (Sitters et al. 2009) indicated that disturbance had increased since 2000, and suggested that shorebird numbers on the northern beaches of Roebuck Bay are declining during the dry season, when disturbance levels are high because of increased numbers of human visitors and birds of prey (especially brahminy, black and whistling kites, whose numbers may be increasing on the northern beaches due to increased availability of fishing scraps from visitors).

• According to projections for Australia's NRM Regions - Northern Australia - Monsoonal North West (CSIRO et al, 2016), average temperatures will continue to increase in all seasons (very high confidence) with more hot days and warm spells projected with very high confidence. Changes to rainfall are possible but unclear. There is likely to be Increased intensity of extreme rainfall events (high confidence). With medium confidence, fewer but more intense tropical cyclones are projected. Mean sea level will continue to rise and height of extreme sea-level events will also increase (very high confidence).

The large tidal ranges of the Kimberley coast may help to buffer the tidal flats from area reduction when global warming results in sea-level rise.

5.2.2 - Legal conservation status

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Conservation Pak	Yawuru Birragun Conservation Park	https://www.dbca.wa.gov.au/management/plans/yawuru-birragun-conservation-park	partly
Marine Park	Yawuru Nagulagun/Roebuck Bay Marine Park	https://www.dbca.wa.gov.au/management/plans/yawuru-nagulagun-roebuck-bay-marine-park	partly

Non-statutory designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Important Bird Area	Roebuck Bay	https://www.birdlife.org.au/documents/OTHPUB-IBA-supp.pdf	partly
Other non-statutory designation	Roebuck Bay East Asian-Australasian Flyway Network Site	https://eaaflyway.net/wp-content/uploads/2017/12/SIS-EAAF111-Roebuck-Bay_v2017.pdf	whole

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

Human Activities

Measures	Status
Research	Implemented
Communication, education, and participation and awareness activities	Implemented
Fisheries management/regulation	Implemented
Harvest controls/poaching enforcement	Implemented
Regulation/management of recreational activities	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 zoning scheme for the Yawuru Nagulagun/ Roebuck Bay Marine Park includes the following zones:
• Kunin special purpose zone (cultural heritage): covers approximately 1,130 ha or 1% of the marine park. The conservation purpose for this zone is to protect critical habitat for high priority fauna such as snubfin dolphins and migratory shorebirds, as well as fossil dinosaur tracks.

• Jangu special purpose zone (cultural heritage): covers approximately 10,720 ha or 14% of the marine park. The conservation purpose for this zone is to protect critical habitat for high priority fauna such as fauna such as sawfish, snubfin dolphins, dugongs, turtles and migratory shorebirds, as well as mangrove communities associated with th3e Yardoogarra and Jacks Creek intertidal creek systems.

• Roebuck Bay special purpose zone (recreation and conservation): covers about 66,250 ha or 84% of the marine park. The conservation purpose of this zone is to protect representative areas of all habitat types found within the marine park including critical habitat for all priority fauna. This zone contains pearling leases and provides for the continuation of the pearling industry.

• Dampier Creek special purpose zone (recreation and conservation): covers about 740 ha or 1% of the marine park. The conservation purpose of this zone is to protect representative areas of mangrove, saltmarsh and intertidal sand and mudflat communities and critical habitat for threatened and priority fauna.

Commercial gillnetting; collection of coral, live rock and live sand; ground disturbing mineral and petroleum exploration and development; pipelines; large-scale dredge spoil dumping; and vessel sewage discharge are considered incompatible with this conservation purposes of the zones listed above.

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 ◉

Please indicate if a Ramsar centre, other educational or visitor facility, or an educational or visitor programme is associated with the site:

Nature-based education programs and tours are run from the Broome Bird Observatory, located at the northern end of Roebuck Bay.

The Yawuru conservation estate offers opportunities for developing cultural heritage and ecotourism businesses. An education and interpretation program is being developed to increase public awareness and understanding of conservation, Yawuru people and their culture, and management issues in the Marine Park (DPW, 2016).

URL of site-related webpage (if relevant): http://www.broomebirdobservatory.com/

5.2.6 - Planning for restoration

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

Further information

The Yawuru Nagulagun/ Roebuck Bay Marine Park Joint Management Plan, 2016 provides for actions to protect and maintain the cultural and natural values of the area.

5.2.7 - Monitoring implemented or proposed

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

The DBCA is implementing a systematic marine monitoring program across its networks of parks and reserves, to improve management effectiveness, and to inform future research, monitoring and decision-making. Monitoring is focusing on determining condition and trends in key ecological, cultural and social values, within a condition-pressure-management-response framework. The program will be undertaken by DBCA, management staff (including Yawuru Rangers), Department of Primary Industries and Regional Development (Fisheries), the CSRO, Australian Institute of Marine Science, universities and community groups.

Monitoring priorities are established within the management plans, monitoring is being undertaken for water quality (nutrients, toxicants, pathogens, debris, algal blooms), and a variety of communities and species (including seagrass, mangroves, shorebirds, marine mammals and turtles) and further monitoring and research programs are proposed (DPW, 2016).

6 - Additional material

6.1 - Additional reports and documents

6.1.1 - Bibliographical references

Information provided in this RIS is predominantly based on the Ecological character description for this site, and on past Ramsar Information Sheets.
Bibliographical references are included as an attachment under Section 6.1.2 vi.

6.1.2 - Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)
<no file available>

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
<1 file(s) uploaded>

v. site management plan
<2 file(s) uploaded>

vi. other published literature
<1 file(s) uploaded>

6.1.3 - Photograph(s) of the Site

Please provide at least one photograph of the site:

Mangroves at Roebuck Bay (*Department of Agriculture, Water and the Environment, 28-07-2005*)

Mangroves at Roebuck Bay (*Department of Agriculture, Water and the Environment, 27-07-2005*)

Black-tailed Godwits at Roebuck Bay (*Brian Furby and Department of Agriculture, Water and the Environment, 02-03-2010*)

Bar-tailed Godwits and Great Knots at Roebuck Bay (*Department of Agriculture, Water and the Environment, 10-06-2006*)

6.1.4 - Designation letter and related data

Designation letter
<2 file(s) uploaded>

Date of Designation: 1990-06-07