Ramsar Information Sheet

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

Australia

Eighty-mile Beach

Designation date	7 June 1990
Site number	480
Coordinates	19°45'49"S 121°14'36"E
Area	175 487,00 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

Eighty-mile Beach is a remote, undisturbed environment in north Western Australia. It comprises 2 areas: 220 kilometres (km) of beach with associated intertidal mudflats (from Cape Missiessy to Cape Keraudren); and Mandora Salt Marsh (40km to the east of the beach). The beach portion includes extensive intertidal mudflats, supporting abundant macroinvertebrates, which are food for very large numbers of shorebirds. It is also an important nesting site for marine turtles (DEC 2008). The Site is considered as one of the most important wetlands in Australia for the numbers of shorebirds supported. It is also a significant staging area along the East Asian-Australian flyway (Bamford et al. 2008).

Mandora Salt Marsh comprises a series of floodplain depressions dominated by two large seasonal wetlands (Lake Walyarta and East Lake) and a series of small permanent mound springs. The Site contains one of only two occurrences of inland mangroves in Australia. Following episodic cyclonic rainfall, the marshes become inundated and support continental scale waterbird populations (Halse et al. 2005).

Eighty-mile Beach meets Ramsar criteria 1, 2, 3, 4, 5 and 6:

1: It represents an unmodified ecosystem with the greatest continuous intertidal mudflat in northwest Western Australia. Mandora Salt Marsh contains important and rare wetlands (including peat springs) within an arid bioregion.

2: The Site provides habitat for threatened species listed nationally (under the EPBC Act) and/ or internationally (under the IUCN Redlist), including migratory shorebirds and turtles.

3: It supports a diversity of wetland habitats which support a diversity of species. Eighty-mile Beach supports an abundance of migratory and non-migratory shorebird species. The mudflats support a range of macroinvertebrate species.

4: Eighty-mile Beach is considered one of the most important stop-over sites for migratory shorebirds moving through the East Asian-Australasian flyway. Mandora Marsh provides breeding habitat for at least 13 species of waterbirds. The beach provides important nesting habitat for the flatback turtle, and the surrounding waters are likely to be important foraging habitat for this and other turtle species.

5: The Site regularly supports very large numbers of shorebirds, with up to 500,000 birds using the Site in most years.

6: The Site supports over 1% of the flyway population of 17 species of migratory shorebirds, and over 1% of the Australian population of 2 species.

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
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
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	2009
To year	2021

2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	Eighty-mile Beach

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) 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

In 2010, the Site was assessed for a possible change of ecological character due to a potential decline in the number of migratory birds at Eighty-mile Beach. Similar concerns had been raised for Roebuck Bay. The assessment concluded that there may have been a decline in the numbers of some species of migratory shorebirds using Eighty-mile Beach during the summer months. However, no significant anthropogenic changes at the Site have been reported and the area remains secluded. The shorebird decline may reflect a reduced flyway population, rather than a deterioration in habitat at the Site. The lack of change in the numbers of resident shorebird species supports this theory. See: https://www.dcceew.gov.au/water/wetlands/publications/analysis-possible-change-ecological-character- 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 by an average of 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 increases in temperature are projected, with most extremely hot days and fewer extremely cool days under all emissions scenarios (BoM and CSIRO 2020). These conditions will affect the critical components, processes, and services of the Site and will test the Site's resilience.

Climate projections and the information available to guide wetland management under a changing climate is continually evolving, This and other relevant sections of the RIS will be reviewed and updated as significant advances are made.

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 Eighty-mile Beach Ramsar Site is comprised of two discrete units – Eighty Mile Beach (220 km of intertidal mudflats and coast) and Mandora Salt Marsh (seasonal wetlands and mound springs located 40 km to the east).

Eighty-mile Beach
The boundary of the Eighty-mile Beach section of the Site is defined by the tidal extent. The western boundary of the Site follows the extent of Mean Low Water from the southwest corner (Lat 19° 57' 57.24", Long 119° 44' 48.48") to the northeast corner (Lat 19° 1'41.88", Long 121° 32' 8.16"). The eastern boundary heads south, encompassing 40m above Mean High Water, to the point of commencement in the southwest.

Mandora Salt Marsh
The boundary of the Mandora Salt Marsh section of the Site follows the southern extent of wetland areas, east from Great Northern Highway (Lat 19° 46' 58.08", Long 121° 3' 30.96") to the southeast corner of the Site (Lat 19° 55' 24.96", Long 121° 55' 39.36") and heads north to the northeast corner of the Site (Lat 19° 48' 34.56", Long 121° 53' 53.52"). The boundary then follows the northern extent of wetland areas, west to the Great Northern Highway at the northwest corner of the Site (Lat 19° 42' 0.72", Long 121° 14' 4.20") and heads south along the Great Northern Highway, to the point of commencement in the southwest.

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) lies 142 km north of the northernmost extent of the Ramsar 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): 175487

Area, in hectares (ha) as calculated from GIS boundaries: 175464.39

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
Other scheme (provide name below)	Northwest Sandy Desert, North Western Plateau
Other scheme (provide name below)	Eighty-mile Beach, Northwest IMCRA province
Other scheme (provide name below)	Pindanland, Dampierland

Other biogeographic regionalisation scheme

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

Commonwealth of Australia (2012). Interim Biogeographic Regionalisation for Australia, Version 7 - Pindanland, Dampierland. (https://www.environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps).

Commonwealth of Australia (2006). Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4 - Eighty-mile Beach mesoscale bioregion, Northwest IMCRA province (https://parksaustralia.gov.au/marine/management/resources/scientific-publications/guide-integrated- marine-and-coastal-regionalisation-australia-version-40-june-2006-imcra/)

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

Hydrological services provided	Eighty-mile Beach lies within a macro-tidal region with a tide ranging from an average of 6m to as much as 8m during Spring tides. Tidal regime is likely to be important for intertidal mudflat ecology. The tidal regime is not monitored and remains a knowledge gap for the Site. Currently there are no structures to impede tidal flows across the Site. Unrestricted tidal flows are a critical process for the Site and therefore part of its ecological character. The hydrology of Mandora Salt Marsh is not well understood and has not been quantified. Walyarta, East Lake and the Melaleuca wetlands are filled predominantly from rainfall and runoff during the wet season in January – March. Walyarta probably fills seasonally to a depth of less than 0.5 m (Storey et al 2011) while East Lake to a lower depth, and although seasonal flooding of the Melaleuca stands does not occur, the clay soils are likely to be seasonally waterlogged. Freshwater mound springs within the Mandora Salt Marsh provide a permanent source of freshwater, which is extremely important to biodiversity within the arid environment. They provide habitat for aquatic flora and fauna and a source of drinking water for terrestrial animals. These springs are reliant on good quality alkaline groundwater. Groundwater interactions are a knowledge gap for the Site (Hale and Butcher 2009).
Other ecosystem services provided	The Site includes mangroves and saltmarsh, which are recognised as blue carbon ecosystems. Blue carbon ecosystems sequester significant amounts of carbon dioxide from the atmosphere and oceans, contributing to climate change mitigation. They also protect the coastline from storms and sea level rise, prevent shoreline erosion and regulate coastal water quality (Conservation International 2019).

Other reasons	Eighty-mile Beach represents an unmodified ecosystem with the greatest extent of continuous intertidal mudflat in excellent condition within the northwest (IMCRA) bioregion. The peat mound springs in the Mandora Marsh date from the Holocene and can be considered bioregionally rare and outstanding examples of this wetland type in Western Australia. Eighty-mile Beach contains 8 wetland types: • Intertidal mudflats (G): 220 km of coastline within the Ramsar Site consists of extensive intertidal mudflats, ranging in width from 1-4 km and comprised of fine silt/ clay sediments. • Sand shores (E): along the landward edge of the intertidal mudflats is a sand beach, much of which is also intertidal in nature. • Intertidal forested wetlands (I): there are small patches of grey mangrove lining two tidal creeks along the coastal section of the Ramsar Site. These are the only areas of mangrove on the coast within the Ramsar Site and cover approximately 100 ha. Salt Creek contains the most inland mangroves (40 km from the coast) in Western Australia. • Seasonal/ intermittent saline/ lakes and flats (R): Mandora Salt Marsh contains two large seasonal/ intermittent wetlands: Walyarta and East Lake. These wetlands are seasonally inundated, predominantly by direct precipitation and local runoff following heavy rainfall. When full, they are fresh, but become saline as water evaporates and salts concentrate, until only a dry saltpan remains. The area immediately surrounding these is dominated by saltmarsh and is included within this wetland type. • Permanent saline/ brackish/ alkaline marshes/ pools (Sp): between the 2 lakes is Salt Creek, a permanent waterbody, which is groundwater fed and flows from east to west into Walyarta after heavy rain. At times, Salt Creek exists as a series of isolated pools, with water disappearing into the sands to the east of Walyarta. It is thought that it may be connected to the coast via an aquifer. • Freshwater, tree dominated wetlands (Xf): to the south and north of Walyarta and East Lake are areas of clay soil that retain surface water for longer than the surrounding landscape. These support stands and thickets of saltwater paperbark (Melaleuca alsophilia) and could be considered temporary, tree-dominated freshwater wetlands. • Forested peatlands (Xp) and Freshwater springs; oases (Y): to the south of Walyarta are freshwater mound springs, including Eil Eil (Mandora Spring), Saunders and Fern Springs. These are mostly raised peat bogs consisting of a central mound of saturated peat 2-3 m in elevation. The mound is typically surrounded by an inundated moat, which may contain aquatic or emergent vegetation. There are both freshwater and saline springs, which support paperbarks (freshwater springs) and mangroves (saline springs).

☑ Criterion 2 : Rare species and threatened ecological communities

Optional text box to provide further information

The Site provides habitat for 2 species of turtle and 12 species of migratory shorebirds that are listed as threatened either nationally (under the EPBC Act) and/ or internationally (under the IUCN Red List):

Turtles:
• flatback turtle (EPBC – vulnerable, IUCN - data deficient) has been recorded nesting at Eighty-mile Beach (Spotila 2004).
• green turtle (EPBC – vulnerable, IUCN - endangered) has been recorded foraging (Pendoley 2005) and potentially nesting (Pendoley 1997) at Eighty-mile Beach.
• The adjoining Eighty-mile Beach Marine Park may provide habitat for threatened turtle species. These species could also use habitat within the Ramsar Site from time to time. The importance of Eighty-mile beach for turtle species (other than the flatback turtle) is a knowledge gap.

Migratory shorebirds:
• far eastern curlew (EPBC – critically endangered, IUCN – endangered)
• red knot (EPBC – vulnerable, IUCN – near threatened)
• great knot (EPBC – vulnerable, IUCN – endangered)
• curlew sandpiper (EPBC – critically endangered, IUCN – near threatened)
• greater sand plover (EPBC – vulnerable)
• bar-tailed godwit (EPBC –endangered, IUCN – near threatened)
• ruddy turnstone (EPBC – vulnerable)
• sharp-tailed sandpiper (EPBC – vulnerable, IUCN – vulnerable)
• asian dowitcher (EPBC – vulnerable, IUCN – near threatened)
• black-tailed godwit (EPBC – endangered, IUCN– near threatened)
• common greenshank (EPBC – endangered)
• terek sandpiper (EPBC – vulnerable)

Other:
The greater bilby (Macrotis lagotis) (EPBC & IUCN – vulnerable), has been recorded at Mandora Salt Marsh (Graham 1999). However, this marsupial is an arid zone specialist that obtains its moisture requirement from its diet and does not drink water. As such it is not wetland dependent, and the Site is unlikely to provide critical habitat.

A threatened bird species: Nordmann's greenshank (Tringa guttifer) (IUCN – endangered) has been recorded at the Site once but is likely to be a vagrant. The Australian painted snipe (Rostratula australis) (EPBC – endangered) has also only been recorded at the site only once, however, the site likely provides breeding habitat under suitable conditions.

☑ Criterion 3 : Biological diversity

Justification

The Site supports a diversity of wetland types, including mudflats, mound springs and mangroves, which in turn support a diversity of species.

Eighty-mile Beach includes 220 km of beach and associated intertidal mudflats, which support a high number and diversity of shorebirds. A total of 97 wetland bird species have been recorded within the beach portion of the Site. This includes up to 42 species listed as migratory under international agreements (JAMBA, CAMBA, ROKAMBA and CMS). Six of these species are listed as threatened under the EPBC Act and/ or IUCN Redlist.

The mudflats support a diversity and abundance of invertebrates with over 200 taxa recorded (Lavaleye et al. 2005). The most abundant taxa collected included a brittle star (Amphiura tenuis), a bivalve mollusc (Siliqua pulchella), polychaete worms (Oweniidae), mud shrimp (Coropiidae, Amphipoda), and sandhoppers (Oedicerotidae, Amphipoda) (Hale and Butcher 2009). These invertebrates provide an important food source for large numbers of shorebirds.

The Mandora Salt Marsh portion of the Site contains temporary and permanent wetlands in an arid bioregion (Western Plateau) and has been recognised as important refugia for biological diversity in arid Australia (Morton et al. 1995). A total of 269 species of vascular plants from 55 families have been collected from Mandora Marsh. 22 mammal species, 49 reptile species, 6 amphibian species and 110 bird species have been recorded from the marsh.

The inland grey mangroves (Avicennia marina) lining Salt Creek represent the most inland occurrence of this species (Seminiuk and Seminiuk 2000) and the only occurrence in the Great Sandy Desert bioregion. In 1999 a new species of goby (Acentrogobius sp. nov.) was collected from Salt Creek in Mandora Marshes (A. Storey pers. comm.). The specimen has yet to be officially identified and catalogued.

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

Optional text box to provide further information

Eighty-mile Beach is considered one of the most important sites for stop-over and feeding by migratory shorebirds in Australia. It is second only to Roebuck Bay in the total number of migratory species for which it is considered internationally important. The coast of north Western Australia is the most important non-breeding area for migratory shorebirds in the entire East Asian-Australasian Flyway. It supports the largest numbers and greatest diversity of non-breeding shorebirds in the flyway, and is the first landfall for birds on their southward migration from Asia.

Mandora Salt Marsh provides breeding habitat for at least 13 waterbird species, including large numbers of Australian pelicans and black swans (Birds Australia 2008).

The Ramsar Site provides nesting habitat for flatback turtle (Natator depressus), and may provide foraging and nesting habitat for green turtle (Chelonia mydas). Other turtle species may use the waters within the Site, but this is a knowledge gap.

☑ Criterion 5 : >20,000 waterbirds

Overall waterbird numbers	275,188
Start year	2015
End year	2015
Source of data:	Rogers et al 2020.

Optional text box to provide further information

Eighty-Mile Beach is considered to regularly support over 500,000 birds each year (Wade and Hickey 2008). Total summer counts for a small portion of the 220km intertidal site are generally greater than 200,000 (Shorebirds 2020 unpublished data).

Due to the great length of the beach, there have been relatively few total ground counts of shorebirds in the non-breeding season. These occurred in:
• October 1998 – 465,890
• November 2001 – 472,418
• December 2008 – 311,638.
(Rogers et al 2009).

The total number of coastal shorebirds recorded in complete counts of Eighty Mile Beach in November 2015 totaled 275,188 individuals (269,995 migratory shorebirds and 5,193 non-migratory shorebirds) (Rogers et al 2020).

These counts represent the highest number of shorebirds for any site in Australia and among the highest counts in the East Asian-Australasian flyway.

In 2010, record numbers of grasshopper-eating waders (514,900 oriental pratincole, 144,300 oriental plover, 14,200 little curlew) were counted on Eighty-mile Beach (Piersma and Hassell 2010). In February 2004, 2.88 million oriental pratincoles were recorded on Eighty-mile Beach (Sitters et al. 2004).

The Site is important in terms of total number of waterbirds during both summer and winter periods. Winter counts from a sub-site within the Ramsar Site consistently record over 20,000 birds. Populations of resident birds use the site year-round, as well as immature migratory birds that remain in Australia for up to three years after their first southward migration (including the great knot, bar-tailed godwit, and eastern curlew).

☑ Criterion 6 : >1% waterbird population

Optional text box to provide further information

Eighty-mile Beach supports more than 1% of the population of 19 waterbird species, including 17 migratory species and 2 Australian residents.

Migratory species:
• greater sand plover (Charadrius leschenaultii)
• oriental plover (Charadrius veredus)
• grey plover (Pluvialis squatarola)
• bar-tailed godwit (Limosa lapponica)
• red knot (Calidris canutus)
• great knot (Calidris tenuirostris)
• red-necked stint (Calidris ruficollis)
• sanderling (Calidris alba)
• curlew sandpiper (Calidris ferruginea)
• eastern curlew (Numenius madagascariensis)
• little curlew (Numenius minutus)
• whimbrel (Numenius phaeopus)
• common greenshank (Tringa nebularia)
• grey tailed tattler (Tringa brevipes)
• terek sandpiper (Xenus cinereus)
• ruddy turnstone (Arenaria interpres)
• oriental pratincole (Glareola maldivarum)

Resident species:
- red capped plover (Charadrius ruficapillus)
- pied oystercatcher (Haematopus longirostris)

Surveys of the entire and vast marshes system behind the coast, including Mandora Salt Marsh, revealed high numbers (over 1%) for several other waterbirds after cyclonic flooding in 1999-2000 (Halse et al. 2005). Similar flooding has occurred previously, e.g. early 1980s and it is likely that large numbers of waterbirds occur in this part of the Site during flood events.

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	*Avicennia marina*	☐	☑	☐	LC	☐		Represents the most inland occurrence of this species (Seminiuk and Seminiuk 2000) and the only occurrence in the Great Sandy Desert bioregion. This species contributes to the biodiversity of the site.

Vascular plants are not a significant feature of the beach portion of the Site. However, a total of 269 species of vascular plants, from 55 families, have been collected from Mandora Salt Marsh. This includes 37 species from the family Poaceae, and nine introduced weeds (Willing and Handasyde 1999).

The Site does not contain any threatened flora species. However, in 1999 a new species of bush tomato (Solanum oligandrum) was recorded at Mandora Salt Marsh (Willing and Handasyde 1999).

There are 4 groups of vegetation that could be considered critical components of Eighty Mile Beach:
• mangroves: it has been suggested that the grey mangrove formation at Salt Creek is a relic from the time that sea levels were higher, and the Marsh was a mangrove-lined estuary.
• paperbark thickets: low paperbark thickets dominated by Melaleuca alsophila cover much of the clay soils to the south and east of Walyarta within the Ramsar boundary. They occur in areas that become seasonally waterlogged and occasionally inundated.
• samphire: the shores of Lake Walyarta and much of the area surrounding East Lake are covered in samphire dominated by Tecticornia spp. These areas are seasonally inundated/ waterlogged and grade into salt tolerant grasslands of Sporobolus sp.
• freshwater aquatic vegetation: when flooded, Walyarta contains a mix of submerged aquatic species including ribbon weed (Vallisneria spiralis) and the freshwater macroalgae Chara sp. It is likely these species only occur following significant inundation. At times when the lake only partially fills, salinity may be too high for these species. The salinity characteristics of this wetland remain a knowledge gap.

The freshwater mound springs contain a complex mosaic of vegetation associations (Graham 1999).

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	*Chelonia mydas*	☑	☐	☐	☐	☑	☐	☐	☐	20000	2005		EN	☑	☑	Nationally listed (EPBC Act) – vulnerable, migratory, and marine	Nationally listed threatened species (EPBC). Internationally listed threatened species (IUCN). The species uses the waters along the coast for foraging and may nest on the beach within the Ramsar Site (Pendoley 1997 & 2005).
CHORDATA / REPTILIA	*Natator depressus*	☑	☐	☐	☐	☑	☐	☐	☐				DD	☑	☐	Nationally listed (EPBC Act) – vulnerable, migratory, and marine	Nationally listed threatened species (EPBC). Flatback turtles nest on Eighty-mile Beach and use the nearby waters for foraging (Spotila 2004, DPW 2014).
Birds																	
CHORDATA / AVES	*Anas gracilis*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in tree hollows or on the ground in swamp vegetation, and contributes to the biodiversity of the Site.
CHORDATA / AVES	*Anas superciliosa*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in tree hollows or on the ground in swamp vegetation, and contributes to the biodiversity of the Site.
CHORDATA / AVES	*Anhinga melanogaster*	☐	☑	☐	☐	☑	☐	☐	☐				NT	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests (in pairs or in small colonies) in tree forks and horizontal branches over water, and contributes to the biodiversity of the Site.
CHORDATA / AVES	*Ardea modesta*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests (in colonies with other species) in trees above standing water in the wet season, and contributes to the biodiversity of the Site. Note: This species may meet criterion 6, however current population estimates are not available.

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	*Ardea pacifica*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in horizontal branches over water, and contributes to the biodiversity of the Site.
CHORDATA / AVES	*Arenaria interpres*	☑	☑	☑	☐	☑	☐	☐	☐	1676	2015	5.58	LC	☐	☐	Nationally listed (EPBC Act) – vulnerable and migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 6: 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 5.58% of the flyway population.
CHORDATA / AVES	*Aythya australis*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in dense vegetation, and contributes to the biodiversity of the Site.
CHORDATA / AVES	*Calidris acuminata*	☑	☑	☐	☐	☑	☑	☐	☐	213	2015	0.25	VU	☐	☐	Nationally listed (EPBC Act) – vulnerable and migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit 5 contributes to 2015 count.
CHORDATA / AVES	*Calidris alba*	☐	☑	☑	☐	☑	☑	☐	☐	3455	2015	11.52	LC	☐	☐		Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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 11.52% of the flyway population.
CHORDATA / AVES	*Calidris canutus*	☑	☑	☑	☐	☑	☑	☐	☐	26336	2015	47	NT	☐	☐	Nationally listed (EPBC Act) – vulnerable and migratory	Crit. 3, 4: Nationally listed threatened species (EPBC). Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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 47% of the flyway population.
CHORDATA / AVES	*Calidris ferruginea*	☑	☑	☑	☐	☐	☑	☐	☐	3734	2015	4.15	NT	☐	☐	Nationally listed (EPBC Act) – critically endangered and migratory	Crit. 3, 4: Nationally listed threatened species (EPBC). Uses the site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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 4.15% of the flyway population.
CHORDATA / AVES	*Calidris melanotos*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Calidris ruficollis*	☐	☑	☑	☐	☐	☑	☐	☐	20576	2015	4.33	NT	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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 4.33% 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	*Calidris subminuta*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit 3, 4 Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Calidris tenuirostris*	☑	☑	☑	☐	☐	☑	☐	☐	103276	2015	24.3	EN	☐	☑	Nationally listed (EPBC Act) – vulnerable and migratory	Crit. 2, 3, 4: Nationally listed threatened species (EPBC). Internationally listed threatened species (IUCN). Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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 24.3% of the flyway population.
CHORDATA / AVES	*Charadrius dubius*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit 3, 4 Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Charadrius leschenaultii*	☑	☑	☑	☐	☐	☑	☐	☐	37757	2015	15.73	LC	☐	☐	Nationally listed (EPBC Act) – vulnerable, and migratory	Crit. 3, 4: Nationally listed threatened species (EPBC). Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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 15.73% of the flyway population.
CHORDATA / AVES	*Charadrius ruficapillus*	☐	☑	☑	☐	☐	☑	☐	☐	4280	2015	4.51	LC	☐	☐		Crit. 3, 4: Breeds at Eighty-mile Beach and Mandora Marsh. Nests in sand/mud scrapes, and contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: The Australia population estimate for this species is 95,000 individuals (WPE 5), with a 1% threshold of 950. The site supports 4.51% of the flyway population.
CHORDATA / AVES	*Charadrius veredus*	☐	☑	☑	☐	☐	☑	☐	☐	144300	2010	62.74	LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration, and contributes to the biodiversity of the Site. Crit. 5 contributes to 2010 count. Crit. 6: The population estimate for this species is 230,000 individuals (EAAFP CSR 1), with a 1% threshold of 2300. The site supports 62.74% of the flyway population.
CHORDATA / AVES	*Chlidonias hybrida*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests in floating rafts of vegetation on inundated temporary wetlands. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Chlidonias leucopterus*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Migratory species that uses the Site for non-breeding habitat and as a stopover point on southward and northward migration.
CHORDATA / AVES	*Cygnus atratus*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests on mounds in open water or on islands. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Dendrocygna arcuata*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Eighty-mile Beach. Nests in a scrape in tall grassland, or shrubland on dry ground, typically at the end of the wet season. This species contributes to the biodiversity 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								
CHORDATA / AVES	*Dendrocygna eytoni*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests in tall grasslands in or near vegetation cover, typically at the end of the wet season. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Egretta intermedia*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests (in colonies with other species) high in trees above standing water in mangroves and wooded swamps. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Egretta novaehollandiae*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests in tree forks and horizontal branches, not necessarily in a wetland. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Elseyornis melanops*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests in a scrape on the ground close to water. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Erythrogonys cinctus*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests in a scrape in mud on an island, ridge, or elevated position often sheltered by vegetation. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Fulica atra*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests in or over water in vegetation (shrubs, trees, sedges). This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Glareola maldivarum*	☐	☑	☑	☐	☑	☑	☐	☐	514000	2010	17.88	LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2010 count. Crit. 6: The E-SE Asia, Australia population estimate for this species is 2,880,000 individuals (EAAFP CSR 1), with a 1% threshold of 28,800. This site supports 17.88% of the flyway population. The Site has supported up to 100% of the flyway population of this species in the past.
CHORDATA / AVES	*Haematopus longirostris*	☐	☐	☑	☐	☑	☑	☐	☐	866	2015	7.87	LC	☐	☐	Nationally listed (EPBC Act) – critically endangered and migratory	Crit. 3: Nationally listed threatened species (EPBC). Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: The Australia, S New Guinea, Aru Is population estimate for this species is 11,000 individuals (WPE 5). The site supports 7.87% of the Australian population.
CHORDATA / AVES	*Himantopus himantopus*	☐	☑	☐	☐	☑	☐	☐	☐	10	2008		LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in small mounds in saltmarsh or swamp or in a scrape in the substrate of an island or spit. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Hydroprogne caspia*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Listed migratory under the bilateral Japan-Australia Migratory Bird Agreement (JAMBA).
CHORDATA / AVES	*Limicola falcinellus*	☐	☑	☐	☐	☑	☑	☐	☐	71	2015	0.24		☐	☐	Nationally listed (EPBC Act) – migratory	Crit 3, 4. Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count.

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	*Limnodromus semipalmatus*	☑	☑	☐	☐	☑	☐	☐	☐	3	2016	0.02	NT	☐	☐	Nationally listed (EPBC Act) – vulnerable and migratory	Crit. 2, 3, 4. Nationally listed threatened species (EPBC). Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Limosa lapponica*	☑	☑	☑	☐	☐	☑	☐	☐	51720	2015	43.1	NT	☐	☐	Nationally listed (EPBC Act) – endangered and migratory	Crit. 2, 3, 4: Nationally listed threatened species (EPBC). Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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. Using the larger Menzbieri population, this site supports 43.1% of the flyway population.
CHORDATA / AVES	*Limosa limosa*	☑	☑	☐	☐	☑	☐	☐	☐	99	2015	0.06	NT	☐	☐	Nationally listed (EPBC Act) – endangered and migratory	Crit 2, 3. Nationally listed threatened species (EPBC). Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count.
CHORDATA / AVES	*Malacorhynchus membranaceus*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds opportunistically at Mandora Marsh. Crit. 3: Uses vegetation over water, including old nests of other waterbirds. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Numenius madagascariensis*	☑	☐	☑	☐	☑	☑	☐	☐	930	2015	2.66	EN	☐	☑	Nationally listed (EPBC Act) – critically endangered and migratory	Crit. 2 Nationally listed threatened species (EPBC). Internationally listed threatened species (IUCN). Crit 3. Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: The population estimate for this species is 35,000 individuals (EAAFP CSR 1), with a 1% threshold of 350. The site supports 2.66% of the flyway population.
CHORDATA / AVES	*Numenius minutus*	☐	☐	☑	☐	☑	☑	☐	☐	14200	2010	12.9	LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3 Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the site. Crit. 5 contributes to 2010 count. Crit 6: The population estimate for this species is 110,000 individuals (EAAFP CSR 1), with a 1% threshold of 1,100. The site supports 12.9% of the flyway population.
CHORDATA / AVES	*Numenius phaeopus*	☐	☑	☑	☐	☑	☑	☐	☐	694	2015	1.07	LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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 1.07% of the flyway population.
CHORDATA / AVES	*Nycticorax caledonicus*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests (often in loose association with herons and egrets) in trees or shrubs in standing water. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Pelecanus conspicillatus*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in colonies on islands with little/ no vegetation. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Pluvialis fulva*	☐	☑	☐	☐	☑	☑	☐	☐	154	2015	0.13	LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit 3, 4. Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the site. Crit. 5 contributes to 2015 count.

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	*Pluvialis squatarola*	☐	☑	☑	☐	☑	☑	☐	☐	1289	2015	1.61	LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit., 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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. This site supports 1.61% of the flyway population.
CHORDATA / AVES	*Poliocephalus poliocephalus*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests on floating mound of aquatic vegetation anchored to emergent vegetation. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Recurvirostra novaehollandiae*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in a scrape in mud on an island, ridge, or elevated position. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Rostratula australis*	☑	☐	☐	☐	☑	☐	☐	☐				EN	☐	☐	Nationally listed (EPBC Act) – endangered	Crit. 2 Nationally listed threatened species (EPBC), and Crit 4 this species contributes to the biodiversity of the Site. Whilst it has only been recorded at the site only once, the site is likely to provide breeding habitat under suitable conditions.
CHORDATA / AVES	*Sterna dougallii*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Listed migratory species under the bilateral Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA). Note: The species recorded at the Site is likely to be the subspecies Sterna dougalii gracillis, (this is a knowledge gap).
CHORDATA / AVES	*Sterna hirundo hirundo*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration.
CHORDATA / AVES	*Sterna nilotica*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in a range of habitats, including on inundated samphire and on low bare islets. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Sternula albifrons*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Listed migratory species under the bilateral Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Crit. 3, 4: Bird Agreement (CAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).
CHORDATA / AVES	*Tachybaptus novaehollandiae*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests in deep open water on floating aquatic vegetation. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Threskiornis spinicollis*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 4: Breeds at Mandora Marsh. Crit. 3: Nests (in colonies with other species) in shrubs over water, sometimes on islands. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Tringa brevipes*	☐	☑	☑	☐	☑	☑	☐	☐	10375	2015	14.82	NT	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the site. Crit. 5 contributes to 2015 count. Crit. 6: The population estimate for this species is 70,000 individuals (EAAFP CSR 1), with a 1% threshold of 700. The site supports 14.82% 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	*Tringa glareola*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration.
CHORDATA / AVES	*Tringa guttifer*	☑	☑	☐	☐	☑	☐	☐	☐				EN	☑	☑	Nationally listed (EPBC Act) – migratory Internationally listed (IUCN) - endangered	Crit. 2 Internationally listed threatened species (IUCN). Crit. 3, 4: uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Species may be a vagrant.
CHORDATA / AVES	*Tringa nebularia*	☑	☑	☑	☐	☑	☑	☐	☐	2735	2015	2.49	LC	☐	☐	Nationally listed (EPBC Act) – endangered and migratory	Crit. 2 Nationally listed threatened species (EPBC). Crit. 3, 4: Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: The E, SE Asia, Australia (non-breeding) population estimate for this species is 110,000 individuals (EAAFP CSR 1), with a 1% threshold of 1,100. The site supports 2.49% of the flyway population.
CHORDATA / AVES	*Tringa stagnatilis*	☐	☑	☐	☐	☑	☑	☐	☐	50	2015	0.12	LC	☐	☐	Nationally listed (EPBC Act) – migratory	Crit 3, 4. Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count.
CHORDATA / AVES	*Tringa totanus*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐	Nationally listed (EPBC Act) – migratory	Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Vanellus miles*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Crit. 3, 4: Breeds at Mandora Marsh. Nests in short grass or bare ground. This species contributes to the biodiversity of the Site.
CHORDATA / AVES	*Xenus cinereus*	☑	☑	☑	☐	☐	☑	☐	☐	4769	2015	9.54	LC	☐	☐	Nationally listed (EPBC Act) – vulnerable and migratory	Crit. 2 Nationally listed threatened species (EPBC). Crit. 3, 4 Uses the Site for non-breeding habitat and as a stopover point on southward and northward migration. This species contributes to the biodiversity of the Site. Crit. 5 contributes to 2015 count. Crit. 6: 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 9.54% of the flyway population.

1) Percentage of the total biogeographic population at the site

Eighty-mile Beach is renowned for large numbers of shorebirds and the beach is one of the most important sites for migratory shorebirds in the East Asian-Australasian Flyway (EAAF) (Bamford et al. 2008). Its location makes Eighty-Mile Beach a primary staging area for many migratory shorebirds on their way to and from Alaska and eastern Siberia (Wade and Hickey 2008).
Mandora Marsh is considered a significant site for wetland birds, particularly in years of significant inundation (Halse et al. 2005). Surveys in 1997 and 1999 recorded over 20,000 waterbirds within the Ramsar boundary at Mandora Salt Marsh (Graham 1999). Following the extensive inundation of the area in 1999 and 2000, 480,000 – 490,000 waterbirds were recorded from aerial surveys, although the area surveyed included larger areas of inundated land outside the Ramsar boundary (Halse et al. 2005).

Turtles: The beach portion of the Ramsar Site is considered an important rookery for the threatened flatback turtle. It is estimated that hundreds of females nest on the beaches. Peak nesting is from November to December, and peak hatching from January to March (Pendoley 2005, Spotila 2004, DBCA 2019). Comprehensive data on numbers and locations, but the WA marine turtle database suggests that areas near Mandora station and the Eighty-mile Beach caravan park have the highest density of nesting sites. In November 2008, 331 nests and 54 false tracks were recorded in a 6 km stretch of beach adjacent to the access track from the caravan park (DEC 2009).
Unlike other marine turtles, flatback turtle hatchlings are not pelagic and remain within 10 – 100 km of their natal beaches, feeding in low energy, shallow environments, on benthic invertebrates (DEC 2008). Eighty-mile beach may provide foraging habitat for juveniles of this species. Research suggests that the flatback population at Eighty-mile beach may be genetically different to populations further west in the Pilbara and north along the Kimberley coast (Pittard 2010).

Other marine turtles may frequent the waters of the adjacent marine park (and may occur within the Ramsar Site). These species include:
• green turtle (Chelonia mydas) – vulnerable (EPBC), endangered (IUCN),
• hawksbill turtle (Eretmochelys imbricata) – vulnerable (EPBC), critically endangered (IUCN)
• loggerhead turtle (Caretta caretta) – endangered (EPBC), vulnerable (IUCN)
• olive ridley turtle (Lepidochelys olivacea) – endangered (EPBC), vulnerable (IUCN)
• leatherback turtle (Dermochelys coriacea) – endangered (EPBC), vulnerable (IUCN)

Waterbirds: Shorebird population counts for the site in the table are based on surveys from 2015 as documented in Rogers et al (2020) or 2010 as in Piersma and Hassell (2010).

WPE5 is Waterbird Population Estimates, Fifth Edition (Wetlands International 2012).

EAAFP CSR 1 is Report on the Conservation Status of Migratory Waterbirds of the East Asian – Australasian Flyway. First Edition (Mundkur and Langendoen 2022).

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

<no data available>

Optional text box to provide further information

Whilst not listed as threatened ecological communities under Australian national legislation, the following vegetation communities are considered critical components of the ecological character of the Site:
• grey mangroves
• paperbark thickets dominated by Melaleuca alsophila
• samphire dominated by Tecticornia spp.
• freshwater aquatic vegetation, including Cumbungi (Typha domingensis) and sedges (Eleocharis sp.).
(from Graham 1999, cited in Hale and Butcher 2009).

Coastal habitats such as mangroves and saltmarsh/ samphire are blue carbon ecosystems and play an important role in sequestering carbon.

Assemblages of the organic springs and mound springs of Mandora Marsh area' are listed as critically endangered under the Western Australian Biodiversity Conservation Act 2016.

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

4.1 - Ecological character

Critical components, processes and services have been identified separately for the beach/ mudflats and marsh components of the Site as outlined below.

Overarching CPS:
• The Site contains exceptionally large examples of wetland types and includes rare wetland types of special scientific interest The interactions between hydrology and geomorphology provide a physical template for diverse vegetation and wetland habitats.
• The Site is one of the most important migratory shorebird sites in the East Asian-Australasian flyway.
• The Site supports waterbird breeding with 26 species recorded breeding within the Site, utilising different habitats across the system.

Beach and mudflats CPS:
• hydrology: this area has a macro-tidal regime that provides habitat and productivity for the mudflats. There are no structures impeding tidal movement within the site. A small number of tidal creeks dissect the beach (but not the mudflats) in southern section. There are no significant surface water flows into the mudflats. Groundwater interactions are unknown.
• geomorphology and soils: the extensive intertidal mudflats are comprised of fine-grained sediments. The Site is backed by steep dunes of calcareous sand.
• primary production: organic material deposited from ocean currents drives the intertidal system through bacterial or microphytobenthos driven primary production (data deficient).
• invertebrates: there are a large number and diversity of invertebrates within the intertidal mudflats.
• fish: anecdotal evidence of marine fish using inundated mudflats (data deficient).
• waterbirds: the site is a significant stop-over and feeding location for significant numbers of migratory shorebirds. It regularly supports over 200,000 shorebirds during summer and over 20,000 during winter. There is high species diversity with over 85 species of waterbird recorded. It regularly supports 1% or more of the flyway population of 20 species. Breeding has been recorded for at least 2 species.
• marine turtles: the Site provides significant nesting (and potentially foraging) habitat for the flatback turtle. Green, hawksbill, loggerhead, olive ridley and leatherback turtles may frequent the waters of the adjacent marine park and use the Ramsar Site (DPW 2014).

Marsh CPS:
• hydrology: Walyarta, East Lake and surrounding intermittently inundated paperbark thickets are inundated by rainfall and local runoff. Extensive inundation occurs following large cyclonic events Salt Creek and the Mound springs are groundwater fed systems from the Broome Sandstone Aquifer.
• geomorphology and soils: Wetland formation is dominated by alluvial processes. Wetlands were once a part of an ancient estuary. Freshwater springs have been dated at 7,000 years old.
• water quality (salinity, pH and nutrients): Most wetlands are alkaline reflecting the influence of soils and groundwater. Salinity is variable, the mound springs are fresh, Salt Creek hyper-saline and Walyarta variable with inundation. Nutrient concentrations in groundwater and groundwater fed systems are high.
• phytoplankton and primary production: There is evidence of boom and bust cycle at Walyarta with seasonal inundation (data deficient).
• vegetation: Inland mangroves line Salt Creek and are one of only two occurrences of inland mangroves in Australia. Paperbark thickets dominated by saltwater paperbark extend across the Site on clay soils which retain moisture longer than the surrounding landscape. Samphire occurs around the margins of the large lakes. Freshwater aquatic vegetation occurs at Walyarta when inundated and at the mound spring sites year-round.
• invertebrates: Data limited, but potentially unique species occur at the Site.
• waterbirds: Significant for waterbirds and waterbird breeding events, particularly during extensive inundation events. 66 species have been recorded, with breeding recorded for at least 24 species.

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
E: Sand, shingle or pebble shores	Eighty Mile Beach	0		Representative
G: Intertidal mud, sand or salt flats	Eighty Mile Beach	1	88000	Representative
I: Intertidal forested wetlands	Salt Creek	0	1000	Rare

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
Saline, brackish or alkaline water > Lakes >> R: Seasonal/ intermittent saline/ brackish/ alkaline lakes and flats	Mandora Marsh: Walyarta and East Lake	0		Rare
Saline, brackish or alkaline water > Marshes & pools >> Sp: Permanent saline/ brackish/ alkaline marshes/ pools	Mandora Marsh: Walyarta and East Lake	0		Rare
Fresh water > Marshes on inorganic soils >> Xf: Freshwater, tree-dominated wetlands	Mandora Marsh: south and north of Walyarta and East Lake	0		Rare
Fresh water > Marshes on peat soils >> Xp: Permanent Forested peatlands	Eil Eil, Saunders and Fern Springs (south of Walyarta)	0		Rare
Fresh water > Flowing water >> Y: Permanent Freshwater springs; oases	Eil Eil, Saunders and Fern Springs (south of Walyarta	0		Rare

4.3 - Biological components

4.3.1 - Plant species

Other noteworthy plant species

Phylum	Scientific name	Position in range / endemism / other
TRACHEOPHYTA/MAGNOLIOPSIDA	*Acacia ampliceps*	Endemic to north west Australia. Component of state listed critically endangered ecological community.
TRACHEOPHYTA/POLYPODIOPSIDA	*Acrostichum speciosum*	Refugia. Key understory component of state listed critically endangered ecological community.
CHAROPHYTA/CHAROPHYCEAE	*Chara canescens*	Submerged macroalgae that provides food for fauna when site is inundated.
TRACHEOPHYTA/LILIOPSIDA	*Eleocharis sphacelata*	Component of state listed critically endangered ecological community.
TRACHEOPHYTA/MAGNOLIOPSIDA	*Melaleuca alsophila*	Endemic to WA
TRACHEOPHYTA/MAGNOLIOPSIDA	*Melaleuca leucadendra*	Refugia. Key component of state listed critically endangered ecological community.
TRACHEOPHYTA/MAGNOLIOPSIDA	*Sesbania formosa*	Refugia. Key component of state listed critically endangered ecological community..
TRACHEOPHYTA/LILIOPSIDA	*Typha domingensis*	Key component of state listed critically endangered ecological community..
TRACHEOPHYTA/LILIOPSIDA	*Vallisneria spiralis*	Submerged aquatic species that provides food for fauna when site is inundated.

Invasive alien plant species

Phylum	Scientific name	Impacts	Changes at RIS update
TRACHEOPHYTA/LILIOPSIDA	*Cenchrus ciliaris*	Potential	unknown

Optional text box to provide further information

Noteworthy flora
• grey mangroves occur at Salt Creek in Mandora marsh. These may be a relic from a time when sea levels were higher, and the Marsh was a mangrove-lined estuary. Mangroves line both sides of Salt Creek in a mono-specific stand with trees to 5 m high. Grey mangroves also occur at other locations within the Ramsar site, including in linear stands parallel to the southern shore at Walyarta and at the Stockyard Springs to the east. In spring 1999, large numbers of germinating seedlings of grey mangrove were recorded within the Ramsar Site and extending as far west as the Great Northern Highway.
• low paperbark thickets dominated by Melaleuca alsophila cover much of the clay soils to the south and east of Walyarta within the Ramsar Site. They occur in areas that become seasonally waterlogged and occasionally inundated
• samphire covers the shores of Lake Walyarta and much of the area surrounding East Lake, with Tecticornia spp dominant. These areas as seasonally waterlogged/ inundated and grade into salt tolerant grasslands of Sporobolus sp
• freshwater aquatic vegetation: when flooded, Walyarta contains a mix of submerged aquatic species including ribbon weed (Vallisneria spiralis) and freshwater macroalgae (Chara sp.). It is likely these species only occur following significant inundation. At other times, when the lake only partially fills, salinity may remain too high for these freshwater aquatic species.
The freshwater mound springs contain a complex mosaic of vegetation associations, such as those seen at Saunders Spring, which includes:
• A tall stand of paperbark (Melaleuca leucadendra) and dragon tree (Sesbania formosa), on top of the peat mound. With trees up to 20 m high, it towers over the surrounding low paperbark thickets. Under this canopy is a dense groundcover of mangrove fern (Acrostichum speciosum).
• Cumbungi (Typha domingensis) groves in the moat surrounding the peat mound
• Outside the moat, the vegetation is more terrestrial, with dense Acacia ampliceps shrubland grading into salt marsh. Patches of sedges (Eleocharis sp.) occur on wetter soils
(from Graham 1999, cited in Hale and Butcher 2009)
Invasive species:
Weeds do not appear to be a significant issue at the Site and the percentage of exotic species in the survey at Mandora Marsh was very low (Willing and Handasyde 1999). There is anecdotal evidence of buffel grass invading the dunes on the beach portion of the Site and the wetlands at Mandora Marsh during dry periods.

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/ACTINOPTERYGII	*Mugil cephalus*				This detrivore species is an important component of intertidal mudflat ecosystems.

Invasive alien animal species

Phylum	Scientific name	Impacts	Changes at RIS update
CHORDATA/MAMMALIA	*Camelus dromedarius*	Actual (minor impacts)	unknown
CHORDATA/MAMMALIA	*Felis catus*	Actual (major impacts)	unknown
CHORDATA/MAMMALIA	*Vulpes vulpes*	Actual (major impacts)	unknown

Optional text box to provide further information

Other noteworthy fauna

Fish: There is no published information on fish species present or their use of the Site. This remains a significant knowledge gap. It is likely that a range of tropical fish use the inundated mudflats during high tide cycles. Detrivores such as mullet (Mugil cephalus) are important components of intertidal mudflat systems. They feed on the surface of the sediment, ingesting benthic algae, bacteria, and small invertebrates, and contribute significantly to secondary production.
There is anecdotal evidence that elasmobranchs such as stingrays feed in the inundated intertidal mudflats on a range of invertebrates such as brittle stars, crabs and molluscs. There are also observations of sharks, sawfish and other large predators feeding on fish and other prey within the mudflats at high tide.

Turtles: Various marine turtles frequent the waters of the adjacent marine park and may occur within the Ramsar Site. Whether these species use Site is a knowledge gap. Species include: the green, hawksbill, loggerhead, olive ridley, and leatherback turtle (Dermochelys coriacea).

Invertebrates: The macrozoobenthos of Eighty-mile Beach contains over 200 taxa, contributing to the diversity of the Site (Lavaleye et al 2005). The most abundant taxa collected included brittle stars (Amphiura tenuis), bivalve molluscs (Siliqua pulchella), polychaete worms (Oweniidae), mud shrimp (Coropiidae, Amphipoda) and sandhoppers (Oedicerotidae, Amphipoda).

Within Mandora Marsh, one endemic species has been recorded: a gastropod (Assiminea sp.). This genus is considered marine and the presence of a “new” species may relate to the wetlands having once been an estuary, with their subsequent isolation at the start of the Holocene leading to genetic and morphological divergence (Storey, unpublished).
Seasonal variation in species composition and species diversity remains a knowledge gap. The rarity of aquatic habitat within the bioregion would suggest Mandora marsh is significant for aquatic invertebrate diversity.

Invasive species
Camels occur at Mandora marsh in moderate numbers, causing similar impacts to cattle. Unlike domestic stock grazing, however, this threat will remain after the pastoral leases expire. Feral cats are a significant problem at the marsh, causing impacts to waterbirds and other native animals.

Foxes and feral cats have also been reported at Eighty-mile Beach and are considered a serious threat to turtle hatchlings and other native fauna.

4.4 - Physical components

4.4.1 - Climate

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

The Site lies within the dry tropics of northern Australia. Climate is semi-arid, monsoonal, with a prolonged dry season. It is subject to regular cyclones. Rain falls almost exclusively in the wet season (November to April), with highest monthly average in January and February (80–100 mm). There is considerable variability in rainfall, both within and between years. Most rain falls during cyclonic events, over relatively short periods of time.

According to BoM and CSIRO (2020a) projections for Australia's NRM Regions (Northern Australia: Monsoonal North West), average temperatures will continue to increase in all seasons with more hot days and warm spells projected. Changes to rainfall are possible but unclear. There is likely to be increased intensity of extreme rainfall events. 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.

4.4.2 - Geomorphic setting

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

a) Maximum elevation above sea level (in metres): 50

- 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 Site lies on the coastline, extending into the intertidal zone of the Indian Ocean.
There are a small number of tidal creeks that dissect the beach within the Ramsar Site, along the southern sections. The most significant of these is the paleo-channel of Salt Creek.

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 ◉

Please provide further information on the soil (optional)

The Ramsar Site lies within the Canning Basin and is comprised of predominantly Quaternary age sediments.

The beach contains black organic sediments of marine origin in the wide flat expanse of the intertidal zone. The south flowing Leeuwin Current carries carbonate rich sediments to the shoreline where the loss of current velocity causes the sediments to settle out, forming the intertidal mudflats (Pearson et al. 2005).

The geology of Mandora Salt Marsh reflects alluvial and inland water processes. The floor of the two large wetlands comprises sand, silt and clay of alluvial origin. The areas south of these wetlands that retain water and support paperbark communities are comprised of clay. There are pockets of peat soils (in the mound springs) and the entire wetland area is surrounded by red quartz sand (Geoscience Australia 2008). Soil samples collected from the wetlands indicate that the majority of the Site is covered by clay with a salt crust (Graham 1999).

4.4.4 - Water regime

Water permanence

Presence?	Changes at RIS update
Usually seasonal, ephemeral or intermittent water present	unknown
Usually permanent water present	No change

Source of water that maintains character of the site

Presence?	Predominant water source	Changes at RIS update
Water inputs from groundwater	☐	unknown
Marine water	☐	No change

Water destination

Presence?	Changes at RIS update
Marine	unknown

Stability of water regime

Presence?	Changes at RIS update
Water levels fluctuating (including tidal)	unknown

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

Eighty-mile Beach is subject to macro tides. As there is no tidal gauge at the Site, this a significant knowledge gap given the importance of tidal regime on intertidal mudflat ecology. Despite the magnitude of the tide, the tidal regime has been described as gentle, ranging from an average of 6 m, up to 8 m during Spring tides. Tides are unrestricted along the beach and is not impacted by any artificial structures. Uninterrupted flows are a critical component of the Site.

The hydrology of Mandora Marsh is not well understood. Walyarta, East Lake and the Melaleuca wetlands are predominantly filled by rainfall and runoff during the wet season (January to March). Walyarta fills seasonally to a depth of < 0.5 m, East Lake less. Although seasonal flooding of the Melaleuca stands does not occur, the clay soils are likely to be seasonally waterlogged. In most years, Walyarta and East Lake are either dry or partially inundated, after which they dry back to bare clay beds.

Episodic cyclones result in more extensive rainfall. Inundation can extend beyond the Ramsar site boundary and west across the Northern Highway. During such events, the depth of water in Walyarta may exceed 2 m.

Groundwater is a significant component of the hydrology of the Site, in particular Mandora Marsh. The mound springs are probably the expression of upwelling from deep within the Broome Sandstone aquifer through fractures in the rock (Seminiuk and Seminiuk 2000). This results in permanent surface water in these springs despite the low rainfall and high evaporation in the area.

Salt Creek is fed from groundwater and has areas of permanent standing water. This system, however, is not connected to the springs. The groundwater aquifer that feeds Salt Creek is shallow and the exposure to the air concentrates the salinity (Seminiuk and Seminiuk 2000; Graham 1999).

(ECD) Connectivity of surface waters and of groundwater	The hydrological connections and ecological water requirements are a knowledge gap. It is in the La Grange groundwater management area and the Broome sandstone aquifer is thought to be the most important aquifer for the Site.
(ECD) Stratification and mixing regime	At the beach portion of the Site, macro-tides exchange large volumes of water twice daily, minimising potential water quality changes. Detailed water quality information is not available for this part of the Site.

4.4.5 - Sediment regime

Sediment regime unknown ☐

Please provide further information on sediment (optional):

The sediments that make up the mudflats are of marine origin, predominantly fine silts and clays with a grain size <63 µm. The interaction between the tide and the fine sediments acts in a cyclic way to maintain habitat, with the soft sediments decreasing the energy of incoming waves and resulting in a low energy, depositional environment where fine sediments accumulate (Honkoop et al 2006).

This grades into coarser calcareous sand at the eastern edge of the intertidal mudflats, where there is a steep 0.5 m incline (step). The step is formed by the incoming tide and backwash colliding with the aeolian deposited coarse sand of the dunes. This strip of sandy beach is approximately 100 m wide, bordered to the east by dunes comprised of quartz sand.

At Mandora Marsh, most of the site is covered by clay with a salt crust. The wetlands comprise sand, silt and clay of alluvial origin. Areas to the south are comprised of clay. There are pockets of peat soils in the mound springs.

(ECD) Water temperature	Daytime water temperatures were: 34°C at Lake Walyarta; 34-35°C at Salt Creek; and 19- 36°C at the mound springs

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 ☐

Please provide further information on pH (optional):

Water was alkaline at Lake Walyarta (pH 8.8) and Salt Creek (pH 8.4 – 7.8); and neutral to alkaline at the mound springs (7.5 – 9.6). Groundwater at Mandora Marsh was neutral (pH 7.1).

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):

Water at Lake Walyarta was brackish to saline (27 ppt).
At Salt Creek, water was saline to hypersaline (> 60 ppt), probably reflecting concentration effects as water evaporates. The salinity of the spring at Salt Creek was 38.5 ppt.
Salinity at the mound springs ranged from 0.5-5.8 ppt. Salinity was lowest at Top spring (0.5) and Linear Spring (0.6); increasing at Little Eil Eil spring (1.2), Saunders spring (1.3) and Eil Eil spring (1.4); and highest at Melaleuca spring (4.7) and Fern spring (5.8 ppt).
Groundwater at Mandora Marsh was fresh to brackish (1.3 to 1.5 ppt).

(ECD) Dissolved gases in water

Dissolved oxygen at Melaleuca and Saunders springs was higher than other springs when sampled in 1999.

4.4.8 - Dissolved or suspended nutrients in water

Unknown ☑

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

Very little is known about nutrient cycling and primary productivity and is a knowledge gap.

Studies elsewhere suggest that microorganisms drive primary production and nutrient cycling in intertidal systems (Decho 2000). Organic matter is probably carried to the site by ocean currents and deposited in the intertidal zone where heterotrophic bacteria play a key role in re-mineralising organic carbon, nitrogen and other nutrients. Microphytobenthos typically drive primary productivity in these unvegetated habitats. While this may apply to Eighty-mile Beach, there is no data to characterise or quantify it.

At Mandora Marsh, nutrient concentrations were variable across the springs. In 1999 sampling at Melaleuca spring showed high total nitrogen (17,000 µg/L) and total phosphorus concentrations (2,000 µg/L) compared to the other springs. These elevated nutrient and dissolved oxygen concentrations indicate that primary productivity may be high following extended inundation.

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 surrounding landscape is relatively unpopulated, with minimal disturbance. Future proposals in the surrounding area for industries such as mining, shipping and energy generation, is likely to pose a significant risk to the ecological character of the Site.

Land use in the surrounding area is primarily pastoral. Pastoral leases occupy the land from 40 m above the high tide mark along the coast.

There is a mining tenement at the southern end of Eighty-mile Beach; and exploration permits over lands at the northern end of Eighty-mile Beach and the eastern half of Mandora Marsh.

The Nyangumarta, Ngarla and Karajarri people are the traditional owners and hold native titles over a large portion of the Ramsar Site, including sections of the beach and all of Mandora Marsh (National Native Title Tribunal 2009).

4.5 - Ecosystem services

4.5.1 - Ecosystem services/benefits

Provisioning Services

Ecosystem service	Examples	Importance/Extent/Significance
Fresh water	Drinking water for humans and/or livestock	Medium
Wetland non-food products	Livestock fodder	Medium

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Maintenance of hydrological regimes	Groundwater recharge and discharge	High
Biological control of pests and disease	Support of predators of agricultural pests (e.g., birds feeding on locusts)	Medium

Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Recreational hunting and fishing	Medium
Recreation and tourism	Picnics, outings, touring	Medium
Spiritual and inspirational	Contemporary cultural significance, including for arts and creative inspiration, and including existence values	Medium
Spiritual and inspirational	Spiritual and religious values	Medium
Scientific and educational	Major scientific study site	High

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	Carbon storage/sequestration	High
Nutrient cycling	Storage, recycling, processing and acquisition of nutrients	High

Other ecosystem service(s) not included above:

Ecosystem services:
• Maintenance of hydrological regimes in terms of unrestricted tidal flows are of high importance for the ecological character of the mudflats.
• Fresh water: the springs at Mandora Marsh provide drinking water for livestock.

• Biological control of pests: there is evidence that many of the waterbirds feed on adjacent pastoral land and that the record of 2.88 million oriental pratincole coincided with locusts in almost plague proportions, on which the birds fed (Sitters et al 2004).

• recreation: the Site contains a small camping area, with people engaging in fishing, 4WD and shell collecting. Though permission is required to enter Mandora Marshes, it is popular for passive recreation and bird watching.

• spiritual: the wetlands and beach areas are spiritually significant for the Karajarri and Nyangumarta and contain a number of culturally significant sites. The Site has aspirational, aesthetic and existence values at regional, state and national levels.

• scientific and educational: Mandora Marsh and Eighty-mile Beach have been the Site of a number of significant scientific investigations. Eighty-mile Beach is a significant site for migratory shorebirds and is part of the Australian Shorebirds Monitoring program.

• Biodiversity: the Site contains a diversity of wetland types; supports significant numbers of migratory shorebirds; supports significant wetland bird breeding; and supports flatback turtle breeding.

• Nutrient cycling: the Site may be important for nutrient cycling and carbon sequestration, but these are knowledge gaps.

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	Primary productivity in the mudflats is key to the provision of food sources for migratory shorebirds. Little is known about primary production in this system.

(ECD) Nutrient cycling	Primary production and nutrient cycling are critical processes to the ecological character of the site but are knowledge gaps.
(ECD) Carbon cycling	This is a knowledge gap.
(ECD) Animal reproductive productivity	The Site is important for turtle and waterbird breeding.
(ECD) Vegetational productivity, pollination, regeneration processes, succession, role of fire, etc.	178 plant species have been recorded from Mandora Marsh. The Site is important for biodiversity.
(ECD) Notable species interactions, including grazing, predation, competition, diseases and pathogens	The abundance of macroinvertebrates in the intertidal mudflats are critical food sources for large numbers of migratory and resident shorebirds.
(ECD) Notable aspects concerning migration	The Site is one of the most important sites for migratory shorebirds in the EAA flyway and is a key staging area for birds travelling from Alaska and eastern Siberia to Australia.
(ECD) Pressures and trends concerning any of the above, and/or concerning ecosystem integrity	The Site is remote and relatively undisturbed. Due to its relatively pristine nature, future development pressures will have significant impacts on the character of the Site.

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
National/Federal government	☐	☑
Provincial/region/state government	☑	☐

Private ownership

Category	Within the Ramsar Site	In the surrounding area
Other types of private/individual owner(s)	☐	☑

Other

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

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

The beach is unallocated crown land with limited public access. The area immediately inland is pastoral lease with a few public roads connecting the northern highway to the coast. The main access is at the Eighty-mile Beach caravan park, approximately 120 km south of Cape Missiessy.

The adjacent waters are part of the Eighty Mile Beach State Marine Park (extending 12 nautical miles offshore), which is managed by the WA Government. Adjacent to the State Marine Park is the Commonwealth managed Marine Park (extending a further 20 nautical miles offshore).

Mandora Marsh is predominantly on leasehold land and has been subject to cattle grazing for many years.

There are 3 indigenous groups with native title rights over parts of the Ramsar Site and the surrounding area:
• Karajarri in the north;
• Nyangumarta in the middle (including Mandora Marsh); and
• Ngarla in the south.

5.1.2 - Management authority

Please list the local office / offices of any agency or organization responsible for managing the site:
Kimberley Region, Parks and Wildlife Service,
Government of Western Australia

Postal address:
Department of Biodiversity Conservation and Attractions
PO Box 65
Broome WA 6725

E-mail address: enquiries@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
Tourism and recreation areas	unknown impact	unknown impact	☐	No change	☑	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	Medium 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	☐	No change	☑	No change
Mining and quarrying	unknown impact	unknown impact	☐	No change	☑	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	☐	No change	☑	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	unknown impact	unknown impact	☑	No change	☑	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	unknown impact	unknown impact	☑	No change	☑	No change

Climate change and severe weather

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Storms and flooding	Medium impact	unknown impact	☑	increase	☑	increase

Please describe any other threats (optional):

Threats:
• Recreation: vehicles can access the beach, impacting sand dunes, intertidal habitat, disturbing migratory shorebirds and disturbing/ damaging nesting areas of local shorebirds and turtles.
The area is well known for large shells, prized by recreational and commercial collectors, the removal of which reduces habitat for fauna.

• Agriculture: cattle grazing occurs within areas of Mandora Marsh, trampling vegetation, eroding wetland shores and increasing nutrient loads. The extraction of groundwater for irrigation may alter the hydrology of groundwater dependent wetlands.

• Introduced species: camels occur at Mandora Marsh, causing similar impacts to cattle. Feral cats are a problem at the marsh, impacting waterbirds and other native animals. Foxes and feral cats have been reported at Eighty-mile Beach and are considered a serious threat to turtle hatchlings and other native fauna.

• Mining: tenements or exploration licenses cover areas within and around Eighty-mile Beach. Although it is unlikely that mining would be permitted within the Ramsar Site, mining in adjoining areas may impact the Site. Increased groundwater extraction from mining is likely, which may impact groundwater dependent ecosystems at Mandora Marsh.

• Shipping and offshore petroleum/ gas exploration are a potential threat. A major oil spill could have a catastrophic impact on biota using Eighty-mile Beach, impacting migratory species such as shorebirds and marine turtles. Construction activities associated with offshore mining could change water quality and sediment transfer, which may impact the intertidal habitat and fish species.

• Commercial fishing: in the waters adjacent to the beach includes gillnetting for blue and king threadfin salmon and trapping of demersal fish in inshore waters. Bycatch of sharks and illegal take of sharks is of concern. The impact of fishing on the Ramsar Site is unknown as the composition and importance of fish communities is a knowledge gap. The waters off Eighty-mile Beach are the most significant for wild pearl oyster harvesting in Western Australia. Over 450,000 South Sea Pearls (Pinctada maxima) are hand collected each year by divers in the area adjacent to the Ramsar Site.

• Climate change: according to projections for the Monsoonal North West (BoM & CSIRO 2020a), average temperatures are projected to increase in all seasons with more hot days and warm spells. Increased intensity of extreme rainfall events is likely, with fewer but more intense tropical cyclones projected. Mean sea level will rise and height of extreme sea-level events will increase.

• Future development: due to the remote and relatively undisturbed nature of the Ramsar Site, any future development has the potential to threaten the Site's ecological character. Large developments involving industrial/ manufacturing elements with associated changes to hydrology, topography and pollutants/ contaminants are of particular concern.

5.2.2 - Legal conservation status

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Indigenous Protected Area	Karajarri Indigenous Protected Area		partly
Indigenous Protected Area	Nyangymarta Warran Indigenous Protected Area		partly
State Conservation Area	Jarrkaunpungu Nature Reserve (R 52365)		partly
State Conservation Area	Jinmarnkur Conservation Park (R 52367)		partly
State Conservation Area	Jinmarnkur Kulja Nature Reserve (R 52364)		partly
State Conservation Area	Kujungurru Warrarn Conservation Park (R 52362)		partly
State Conservation Area	Kujungurru Warrarn Nature Reserve (R 52363)		partly
State Conservation Area	Unnamed Nature Reserve (R 53015)		partly
State Conservation Area	Walyarta Conservation Park (R 53017, 52387)		partly
State Conservation Area (Marine Park)	Eighty Mile Beach Marine Park		partly

Non-statutory designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Important Bird Area	Eighty-Mile Beach, Western Australia	http://datazone.birdlife.org/site/factsheet/eighty-mile-beach-ib a-australia	whole
Other non-statutory designation	[EAAF110] Eighty-Mile Beach, Western Australia	https://eaaflyway.net/wp-content/uploads/2017/12/SIS-EAAF110-Eig hty-Mile-Beach_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

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 State Marine Park includes the following zones:
• Sanctuary zones: managed solely for nature conservation and low impact recreation and tourism. They provide the highest level of protection for vulnerable or specially protected species and protect representative habitats and communities from human disturbance. Passive recreation activities are permitted.

• Special purpose zones: managed for a particular conservation purpose and/or priority use, such as the protection of cultural heritage, a seasonal event (e.g. wildlife breeding) or a particular type of activity (e.g. pearling). Uses that are incompatible with the specified conservation purpose are not permitted.

• Recreation zones: provide for conservation and compatible recreational activities, including wildlife viewing and recreational fishing. Commercial fishing, pearling, aquaculture and petroleum development are not permitted.

• General use zones: areas where activities such as sustainable commercial and recreational fishing, aquaculture, pearling and petroleum exploration and production are permitted where is it considered that they do not compromise the cultural and ecological values of the marine park.

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

The DBCA undertakes ecological monitoring for key variables of marine parks and conservation estate through the Marine Science Program and Nature Conservation Program. The DBCA works with Rangelands NRM to undertake surveys where there are knowledge gaps.

6 - Additional material

6.1 - Additional reports and documents

6.1.1 - Bibliographical references

This RIS has been prepared based on information from the Ecological character description of the Eighty-mile Beach Ramsar Site; management plans for Eighty-mile Beach marine park and parks and reserves of the south-west Kimberley and north-west Pilbara; and past Ramsar Information Sheets. Additional references are included in 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>

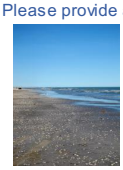
iv. relevant Article 3.2 reports
<no file available>

v. site management plan
<1 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:



Shells on Eighty-mile Beach (*DAWE, 18-06-2021*)

Tidal shelf on Eighty-mile Beach (*DAWE, 18-06-2021*)

Tidal stream at Eighty-mile Beach (*DAWE, 18-06-2021*)

Sand dunes behind Eighty-mile Beach (*DAWE, 18-06-2021*)

Eighty-mile Beach - mangroves at low tide (*DAWE, 18-06-2021*)

6.1.4 - Designation letter and related data

Designation letter
<1 file(s) uploaded>

Date of Designation	1990-06-07