



Parks and reserves of the south-west Kimberley and north-west Pilbara

joint management plan 2019

Management plan 91



Conservation and Parks Commission
Department of Biodiversity, Conservation and Attractions



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Top left: Dragon trees over bulrush at Dragon Tree Soak, Kurriji Pa Yajula Nature Reserve. Photo – Stephen Reynolds/Envirocons Kimberley

Top right: Saunders Spring, Walyarta Conservation Park. Photo – Jan van de Kam

Bottom right: Kujungurru-Warrarn Nature Reserve looking south from Waru Creek. Photo – DBCA

Bottom left: Salt Creek, Walyarta Conservation Park. Photo – Jan van de Kam

Main: Greater bilby (*Macrotis lagotis*). Photo – Bert and Babs Wells/DBCA

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Conservation and Parks Commission
Department of Biodiversity, Conservation and Attractions
Karajarri Traditional Lands Association
Nyangumarta-Karajarri Aboriginal Corporation
Nyangumarta Warrarn Aboriginal Corporation
Wanparta Aboriginal Corporation

Summary

This management plan provides direction for the joint management of parks and reserves in the south-west Kimberley and north-west Pilbara regions; a coastal strip of conservation estate comprising nature reserves and conservation parks (Eighty Mile Beach coastal reserves), Walyarta Conservation Park and Kurriji Pa Yajula Nature Reserve.

The creation of new parks and reserves in the south-west Kimberley and north-west Pilbara and the subsequent preparation and implementation of this plan are key features of Indigenous Land Use Agreements (ILUAs) negotiated with the Karajarri, Nyangumarta and Ngarla people. Each traditional owner group has a special connection with, and responsibility for, the lands and waters within their native title determination areas.

The plan describes the cultural heritage, natural, recreation, tourism, community and resource use values of the planning area and analyses management issues. It identifies objectives, strategies and key performance indicators (KPIs), to provide a robust framework to protect and manage the area's values and support adaptive management.

The purpose of the plan is to ensure:

- the planning area is managed in an ecologically sustainable and a culturally appropriate manner
- management of relevant parts of the planning area is consistent with and complements management of the Eighty Mile Beach Marine Park
- management of relevant parts of the planning area is consistent with Australia's obligations under the Ramsar Convention.

Management needs to ensure that access to culturally sensitive and significant areas is appropriate. Access restrictions to a number of cultural sites will be given effect through the implementation of the plan. Traditional owners can continue to enjoy and maintain their customary activities in the planning area. Joint management of the planning area will also result in better integration of traditional knowledge with contemporary science and land practices.

Maintaining the integrity of hydrological systems that provide critical ecosystem services, and maintaining the condition and extent of wetland habitats, are high priorities for management, along with the conservation of threatened species and communities.

Over the next 10 years, visitation is likely to remain focused on existing nodes along the coast and just outside of the planning area, such as Eighty Mile Beach Caravan Park and Cape Keraudren. These provide access to the adjacent Eighty Mile Beach Marine Park and offer the best options for managing visitor risk and safety. New cultural ecotourism opportunities may also be investigated.

The key management issues are introduced herbivores (including domestic stock) and inappropriate fire regimes. Walyarta Conservation Park and the Eighty Mile Beach coastal reserves have a long history of pastoralism. Destocking and fencing are important strategies to allow these areas to recover from grazing and to prevent adverse impacts on sensitive sites. Other land uses in the vicinity of the planning area have the potential to affect the hydrology and functioning of significant wetlands. These issues occur at a landscape-scale and, when considered with the fragmented nature of the planning area, it is essential to adopt a cooperative, integrated management approach involving all neighbouring land managers.

Developing an understanding of the key values of the planning area and collecting the relevant baseline data will be a strong focus in the early stages of implementation. It is a priority to increase understanding of the water requirements and regimes that are needed to sustain the groundwater-dependent ecosystems of the planning area. It is essential to establish a long-term monitoring program to evaluate management effectiveness and inform adaptive management.

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1. Introduction

1.1. The reserves and their values

The parks and reserves of the south-west Kimberley and north-west Pilbara regions (the planning area) include the lands and waters of the Karajarri, Nyangumarta and Ngarla people, who have continuing rights and responsibilities for these areas. The region's geomorphology and hydrology give rise to a spectacular and complex array of landscape features and habitats including the coastal dunes along Eighty Mile Beach, the freshwater mound springs and inland mangroves of Mandora Marsh and the striking red sand dunes and sandplains of the Great Sandy Desert.

The planning area comprises the Eighty Mile Beach coastal reserves (Jinmarnkur Conservation Park, Jinmarnkur Kulja Nature Reserve, an unnamed nature reserve, Kujungurru-Warrarn Nature Reserve, Kujungurru-Warrarn Conservation Park, unnamed 'Gap' nature reserve and Jarrkunpungu Nature Reserve), Walyarta Conservation Park and Kurriji Pa Yajula Nature Reserve.

Key values of the planning area and/or their management are grouped under four headings:

Cultural heritage – the reserves are living cultural landscapes which include sacred sites, stories and songlines that cross the broader region, linking places and people. Many sites are believed to be created and inhabited by *pulany* (powerful mythical water snakes) and must be respected and approached in the right way. These sites and the associated knowledge and traditions, demonstrate the long and ongoing connection traditional owners have with this area.

Natural – the planning area encompasses a range of wetland types and part of the internationally significant Eighty Mile Beach Ramsar site. The reserves support large numbers of wildlife, as well as populations of threatened species, and provide breeding habitat for waterbirds, particularly when flooded. Mound springs and permanent water sources maintain unique vegetation associations and have important refugia value for biodiversity. The planning area contains several threatened and priority ecological communities. Weeds, introduced animals, inappropriate fire regimes and a changing climate are all factors that can impact on key values.



Walyarta Conservation Park. Photo – Chris Nutt/DBCA

Recreation, tourism and community – Eighty Mile Beach Marine Park is adjacent to the planning area, and accessible locations along the coast will be the focus for visitation. They provide opportunities for nature-based tourism and recreation for travellers between the Pilbara and the Kimberley. Access is limited within the planning area and public visitation to the inland reserves, particularly Kurriji Pa Yajula Nature Reserve, is considered a safety risk. Traditional owners have expressed interest in developing new cultural ecotourism ventures.

Resource use – pastoralism, horticulture and resource exploration and development are all existing or potential activities of the surrounding area that can and do have impacts on key values, particularly in relation to grazing and water abstraction. Permanent removal of livestock from the reserves, determining the hydrological regimes and ongoing monitoring of groundwater dependent wetlands, springs and communities, will be critical in ensuring such resource use is sustainable.

Names of the reserves

The Karajarri, Nyangumarta and Ngarla people have chosen the names of the reserves of the planning area. The origin and meaning of the names are listed below.

Table 1 Reserve names, origins and meanings

Reserve name	Origin and meaning
Kurriji Pa Yajula	A <i>pukarrikarra</i> (Dreaming) site for Karajarri people. Contains two <i>jila</i> (permanent water sources), namely <i>Kurriji</i> and <i>Yajula</i> .
Walyarta	Nyangumarta place name associated with the salt and freshwater marshlands that stretch from the desert to the coast. <i>Walyarta</i> is a common name for the area used by both the Nyangumarta and the Karajarri people.
Jinmarnkur	Karajarri place name for the area known as Cape Missiessy, the northern point of Eighty Mile Beach. Karajarri people visited <i>Jinmarnkur</i> to use a fish trap called <i>kunjunku</i> and often caught <i>pirala</i> (whiskered salmon).
Jinmarnkur Kulja	<i>Jinmarnkur</i> (jin-marn-goor) is the traditional Karajarri place name for the area known as Cape Missiessy. <i>Kulja</i> means 'south' in Karajarri language.
Kujungurru Warrarn	Nyangumarta place name meaning 'country around the ocean or sea around the country'.
Jarrkumpungu	Ngarla place name for Solitary Island. The origin for <i>Jarrkumpungu</i> is a Dreaming story: <i>Marnmulkura</i> , an Ancestral Being (an octopus) attempted to steal a firestick from the people. When <i>Marnmulkura</i> was descending into the ocean, <i>Winti-Winti</i> the nankeen kestrel intercepted him and snatched the firestick from him. <i>Marnmulkura</i> instantly turned to stone, becoming Solitary Island (J. Brown Snr <i>pers. comm.</i> 2016).

1.2. Management context

Joint management partners

The lands and waters of the planning area are highly significant to the culture and heritage of the Karajarri, Nyangumarta and Ngarla people, who are the determined native title holders over the planning area. The Nyangumarta and Karajarri people also have a shared native title determination within the planning area.

Joint management will provide the opportunity for the Department of Biodiversity, Conservation and Attractions (DBCA; the department) to work in partnership with the area's traditional owners, to achieve the objectives set out in this plan. Each traditional owner group has joint management responsibility for the reserves (or parts of the reserves) located within their native title determination areas (see Table 2).

The CEO of the department will jointly manage the relevant parts of the planning area with the Karajarri Traditional Lands Association (KTLA), the Nyangumarta–Karajarri Aboriginal Corporation (NKAC), the Nyangumarta Warrarn Aboriginal Corporation (NWAC) and the Wanparta Aboriginal Corporation (WAC) in accordance with Joint Management Agreements (JMAs) pursuant to section 56A of the *Conservation and Land Management Act 1984* (CALM Act). Joint management will formally commence upon execution of the JMAs (to be attached to this joint management plan and signed as soon as practicable following its approval). Department of Parks and Wildlife (2015a) provides further guidance on joint management with traditional owners.

Planning and decision making

The JMAs will establish Joint Management Bodies (JMBs) to oversee management of the planning area in accordance with the agreements and the CALM Act. The JMBs will make management decisions, provide strategic input into how management strategies are implemented, and strategically monitor the implementation of the plan.

Administration

Under the guidance of the JMBs, the West Kimberley District of the department will be responsible for coordinating the operational management of the planning area. The regional office in Kununurra and a number of other specialist branches will provide support, direction and assistance. It may be beneficial for all joint management partners to come together on an annual basis to share experiences, celebrate achievements and participate in operational planning.



Ngarla and Nyangumarta rangers Augustine Badal, Jeffrey Brown, Nathan Hunter and Stephen Brown. Traditional owner rangers will play an important role in implementing this plan. *Photo – Miecha Bradshaw/DBCA*

Legislative and policy framework

The Karajarri, Nyangumarta and Ngarla people hold native title rights and interests over the planning area. These rights and interests are recognised by the common law of Australia and protected through the *Native Title Act 1993* (Cth). This is discussed further in the section **Connection to country**.

The planning area will be managed in accordance with the CALM Act, which provides for the protection of native flora and fauna and Aboriginal culture and heritage on lands and waters to which the Act applies, and the *Biodiversity Conservation Act 2016* (Biodiversity Conservation Act), which provides for the conservation and protection of biodiversity on all lands within the State.

The Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) relates to the protection of nationally listed species and ecological communities, Ramsar wetlands, heritage and migratory species protected under international agreements. The EPBC Act also establishes a framework for managing Ramsar sites, in the form of the [Australian Ramsar management principles](#).

These and other legislation applicable to the planning area, for example heritage protection and bushfire management, are available from the Western Australian Legislation [website](#). Numerous departmental [policies](#) are also relevant to this plan.

International conservation agreements

The Convention on Wetlands (known as the Ramsar Convention) is an international treaty concerned with the conservation and wise use of wetlands. Walyarta Conservation Park and the Eighty Mile Beach coastal reserves protect portions of the Eighty Mile Beach Ramsar site¹, which was listed as a wetland of international importance in June 1990 (see **Appendix I**). Under the Convention, Contracting Parties accept a number of responsibilities, including a commitment to prevent changes to the ecological character of listed wetlands. The [Ecological Character Description of the Eighty Mile Beach Ramsar Site](#) (Hale and Butcher 2009) is an important guiding document for the planning area.

In addition to the Ramsar Convention, Australia is a signatory to bilateral agreements with China (China–Australia Migratory Bird Agreement), Japan (Japan–Australia Migratory Bird Agreement) and the Republic of Korea (Republic of Korea–Australia Migratory Bird Agreement) to provide a collaborative framework for the protection of habitats of migratory birds within the East Asian–Australasian Flyway. A number of species listed in these agreements occur in the planning area and some are also listed under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

1.3. Planning area

Location

The planning area (Map 1) is located in north-western Australia approximately 1700km from Perth and falls within both the Shire of East Pilbara and Shire of Broome.

Covering an area of 11,943ha, the Eighty Mile Beach coastal reserves (Map 2) run parallel to the Eighty Mile Beach Marine Park stretching almost 220km from Cape Missiessy in the north to Cootenbrand Creek in the south. Under the classification scheme provided in the Interim Biogeographic Regionalisation of Australia (IBRA7), the Eighty Mile Beach coastal reserves are located within the Dampierland (Pindanland subregion) bioregion.

Walyarta Conservation Park (Map 3) is on the western edge of the Great Sandy Desert and covers an area of 231,814ha. It extends east-west for approximately 95km. It is located at the junction of the Dampierland (Pindanland subregion) and Great Sandy Desert (McLarty subregion) bioregions, however, the latter contains the main body of the reserve.

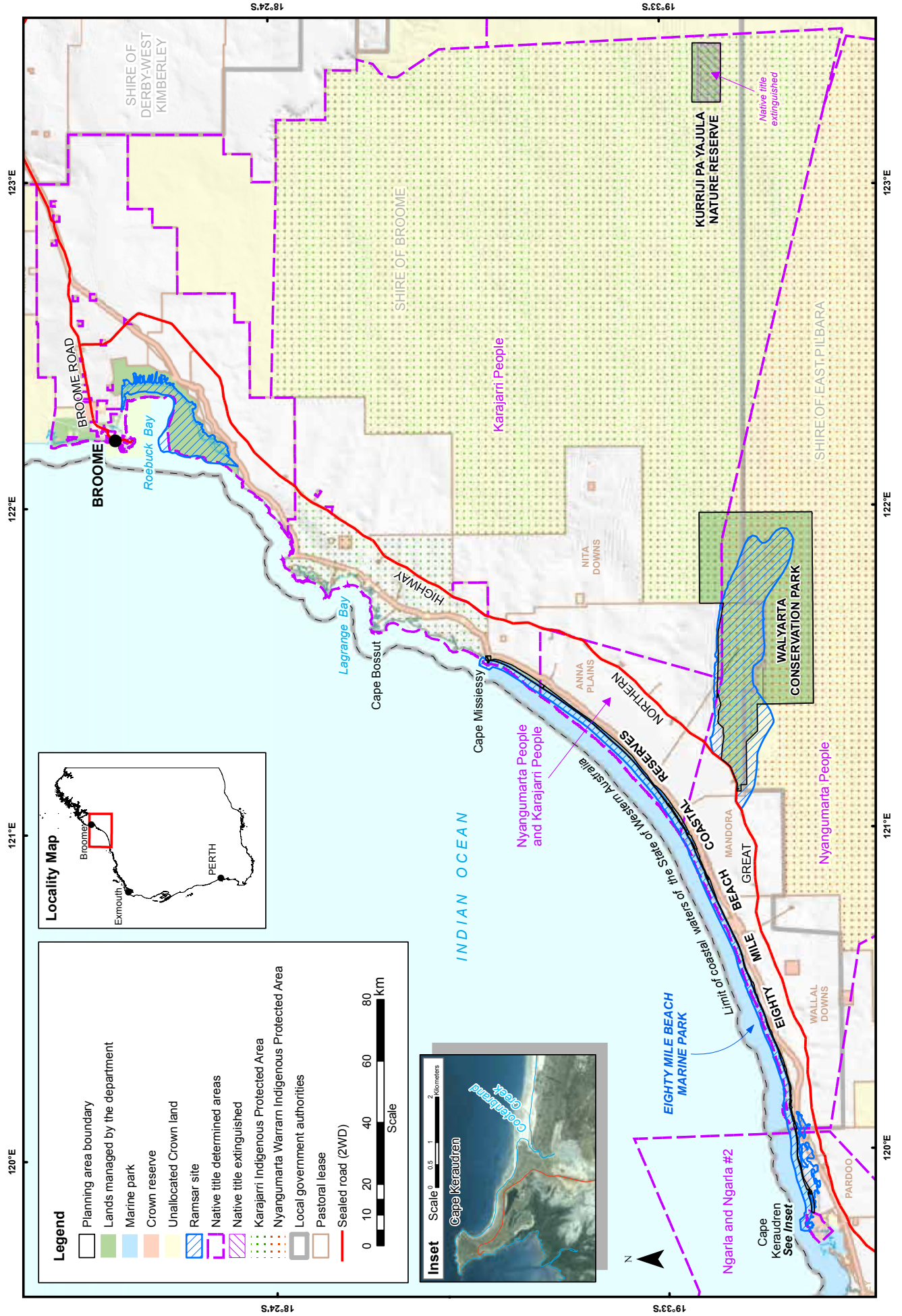
Kurriji Pa Yajula Nature Reserve (Map 4) is located a further 140km to the east-north-east, covering an area of 17,729ha. It is situated completely within the Great Sandy Desert bioregion (McLarty subregion).



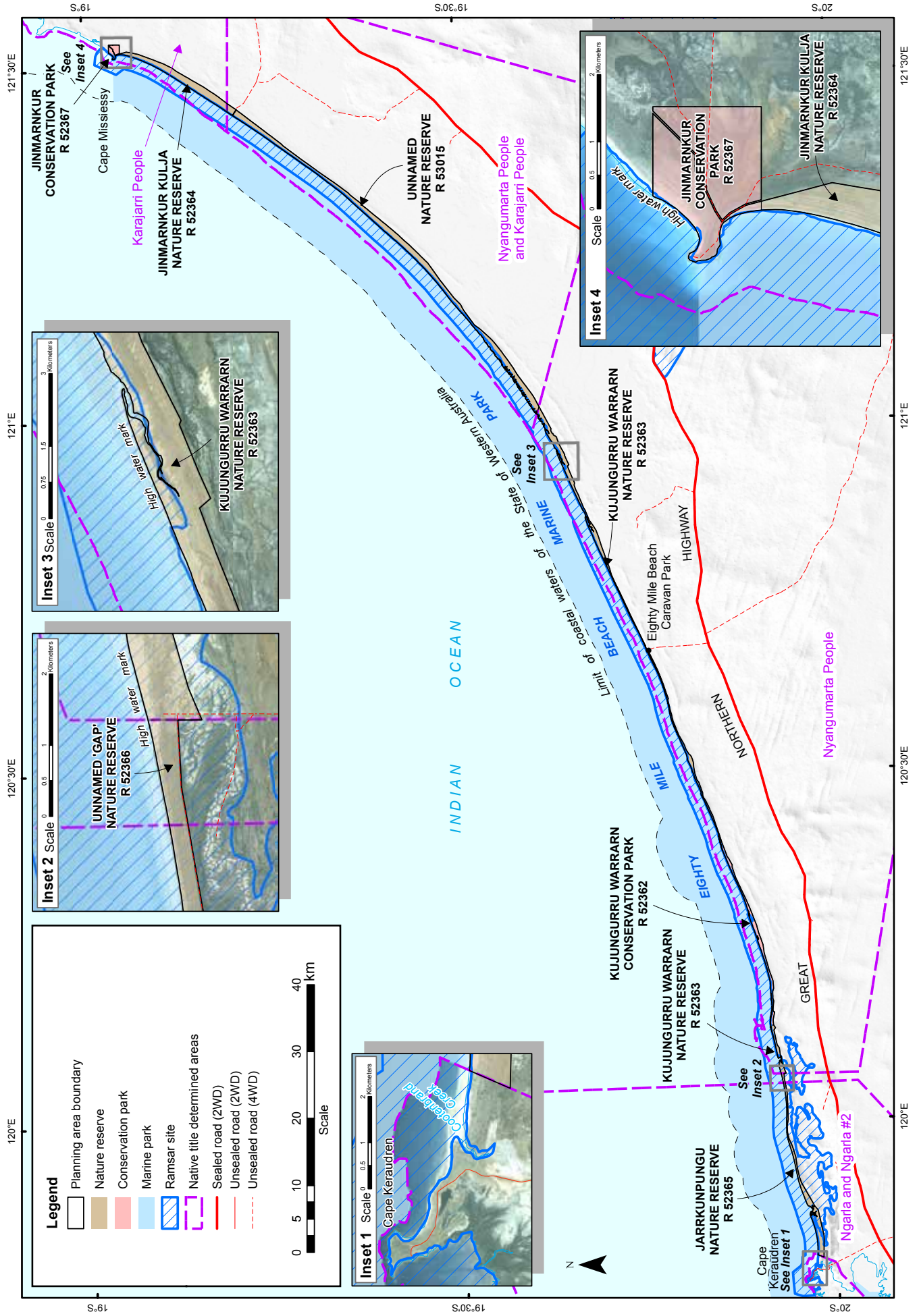
Eighty Mile Beach coastal reserves and adjacent marine park. *Photo - DBCA*

¹ The rest of the Ramsar site is largely covered by Eighty Mile Beach Marine Park and managed in accordance with the CALM Act, with smaller areas also occurring on unallocated Crown land and pastoral lease on surrounding lands.

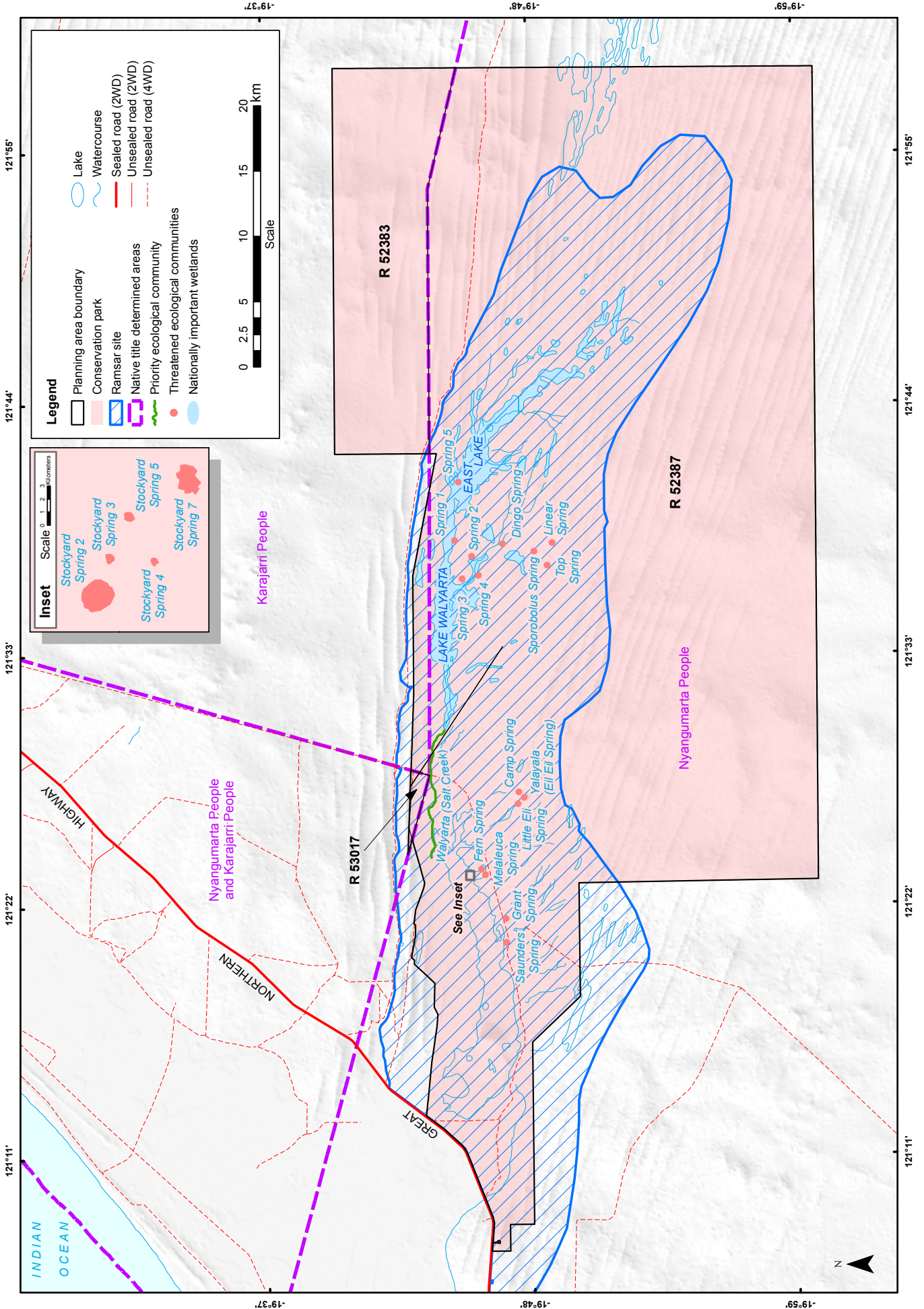
Map 1 Overview of the planning area



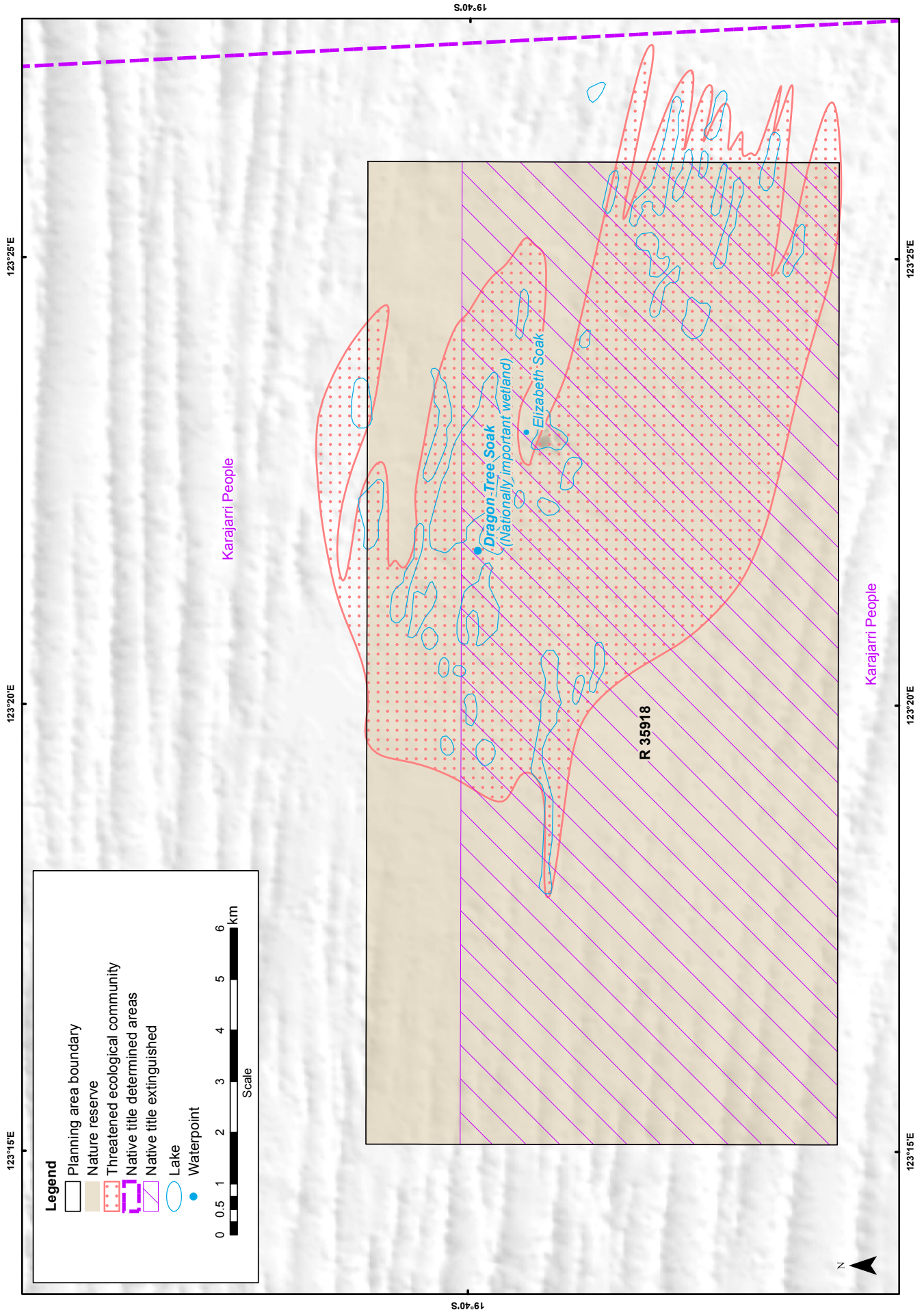
Map 2 Eighty Mile Beach coastal reserves



Map 3 Walyarta Conservation Park



Map 4 Kurriji Pa Yajula Nature Reserve



Tenure

Kurriji Pa Yajula (formerly Dragon Tree Soak) Nature Reserve was first gazetted in March 1979 with an area of 14,182ha. An additional 3,547ha were added to the reserve in December 1994.

Walyarta Conservation Park and the Eighty Mile Beach coastal reserves listed in Table 2 are new additions to the conservation reserve system. Since 2003, the coastal strip of land that was part of Anna Plains Station was jointly managed with the lessee in accordance with a section 16A agreement under the CALM Act for the protection of migratory shorebirds. It resulted in the facilitation of a number of conservation and research projects to assist with the protection of the Eighty Mile Beach component of the Ramsar site and the pastoralist's involvement in this is acknowledged. Other portions of these lands were held under pastoral lease until 30 June 2015, when they were excised as a result of long-standing arrangements with the respective pastoral lessees. These lands remained as unallocated Crown land until the reserves were created in September 2016 (within the Karajarri, Nyangumarta and Ngarla determination areas) and October 2017 (within the Nyangumarta-Karajarri joint determination area).

Table 2 Tenure of the planning area

Reserve name	Tenure	Class	Reserve number	Area (ha)	Traditional owners	Vested
Kurriji Pa Yajula	Nature reserve	A	35918	17,729	Karajarri	Jointly with Conservation and Parks Commission and KTLA
Walyarta	Conservation park	Unclassified	52383	24,731	Karajarri	Jointly with Conservation and Parks Commission and KTLA
			53017	456	Nyangumarta-Karajarri	Jointly with Conservation and Parks Commission and NKAC
			52387	206,627	Nyangumarta	Jointly with Conservation and Parks Commission and NWAC
Eighty Mile Beach coastal reserves (from north to south)						
Jinmarnkur	Conservation park	Unclassified	52367	268	Karajarri	Jointly with Conservation and Parks Commission and KTLA
Jinmarnkur Kulja	Nature reserve*	A	52364	1,727		
Unnamed	Nature reserve*	A	53015	4,838	Nyangumarta-Karajarri	Jointly with Conservation and Parks Commission and NKAC
Kujungurru Warrarn	Nature reserve*	A	52363	2,555	Nyangumarta	Jointly with Conservation and Parks Commission and NWAC
Kujungurru Warrarn	Conservation park	Unclassified	52362	1,139		
Unnamed 'Gap'	Nature reserve*	A	52366	44	Undetermined	Conservation and Parks Commission
Jarrkumpungu	Nature reserve*	A	52365	1,372	Ngarla	Jointly with Conservation and Parks Commission and WAC

* To a depth limit of 200m.

Native title rights exist over all tenure in the planning area except the southern portion of Kurriji Pa Yajula Nature Reserve where native title has been determined to be extinguished. The unnamed 'Gap' nature reserve is located between the Nyangumarta and Ngarla determination areas and is subject to native title applications from both of these traditional owner groups. It is solely vested with the Conservation and Parks Commission until the native title applications above are resolved.

Adjacent lands and off-reserve management

Key values and management issues occur, and are influenced by land use activities, beyond the boundary of the planning area. The high perimeter to area ratio of the Eighty Mile Beach coastal reserves make them particularly vulnerable. The planning area is bordered by pastoral leases, unallocated Crown land and Eighty Mile Beach Marine Park (see Map 1).

A road reserve, the De Grey Stock Route and some smaller reserves of varying purpose also occur in the vicinity. Mining and petroleum interests exist over parts of the planning area, particularly Walyarta Conservation Park (see **Using resources from country**), and Eighty Mile Beach Caravan Park, Reserve 39135 at Cape Keraudren (Cape Keraudren Coastal Reserve) and Pardoo Station are important recreational nodes with caravan and camping facilities available (see **People on country**).

Effective management cannot be achieved in isolation, but must be integrated with management across the broader landscape. The department and its joint management partners will need to work collaboratively with adjacent land managers (e.g. shires of Broome and East Pilbara, pastoralists and caravan park owners) to maintain an appropriate level of access and ensure cross-boundary issues such as weeds, feral animals, fire and water abstraction are considered and addressed. These management issues are further discussed in the relevant sections of this plan. Lessons from other regional works programs (e.g. North Kimberley Landscape Conservation Initiative) may also be applicable.

Several government agencies have responsibility for, and provide advice on, landscape-scale management issues such as declared pest animals and plants (Department of Primary Industries and Regional Development; DPIRD), water resource use (Department of Water and Environmental Regulation; DWER) and fire management (Department of Fire and Emergency Services; DFES).

A close working relationship must also be maintained with the Commonwealth Department of the Environment with regard to management of key values relevant to the EPBC Act, including the Eighty Mile Beach Ramsar site.

Other lands may be considered for addition to the conservation reserve system, if they become available for reservation, and subject to the usual government process. Tenure proposals may include new areas identified as having conservation significance, amendments to reserve boundaries to improve protective coverage of key values (for example, Eighty Mile Beach Ramsar site, threatened ecological communities or occurrences of conservation significant species or habitats) and strengthening reserve connectivity, particularly where broader landscape features and functions such as drainage, facilitate improved protection and management of existing key values.

Other protected areas

Several other protected areas are relevant to the management of the planning area.

Eighty Mile Beach Marine Park abuts the Eighty Mile Beach coastal reserves. It was gazetted in January 2013 and covers an area of approximately 200,000ha, including all of the State waters within the Eighty Mile Beach meso-scale bioregion and a small portion of the Pilbara Nearshore meso-scale bioregion. The marine park is a Class A reserve jointly managed with the Karajarri, Nyangumarta and Ngarla traditional owners. [Eighty Mile Beach Marine Park Management Plan No. 80 2014-2024](#) outlines the values and management arrangements for the marine park (Department of Parks and Wildlife 2014a).

In 2014, the Karajarri people declared an Indigenous Protected Area (IPA) across 24,797km² (more than 2.4 million ha) of Karajarri country. It includes Kurriji Pa Yajula Nature Reserve and the Karajarri portion of Walyarta Conservation Park. The *pirra* (inland desert area) of the IPA is an IUCN Category VI protected area, with the primary objectives of nature conservation and sustainable resource use. The Karajarri traditional owners would like to increase the area of their IPA to include sea country adjacent to and north of the planning area. [Karajarri Healthy Country Plan 2013-2023](#) sets out the long-term conservation targets and management strategies (KTLA 2014).



Karajarri elders Philip Wildridge and Joe Edgar at *Jinmarnkur* (Cape Missiessy). Lands north-east are part of Frazier Downs pastoral lease and managed as the Karajarri IPA while coastal waters to the west are part of Eighty Mile Beach Marine Park.
Photo – Matt Fossey/DBCA

The Nyangumarta traditional owners declared the Nyangumarta Warran IPA in 2015 across 28,675km² (more than 2.8 million ha) of their country. The IPA is listed as IUCN Category VI and includes the Nyangumarta portion of Walyarta Conservation Park, Kujungurru Warrarn Nature Reserve, Kujungurru Warrarn Conservation Park and Eighty Mile Beach Marine Park (Nyangumarta Part). *Nyangumarta Warrarn Indigenous Protected Area Plan of Management 2015-2020* provides strategic direction for management of the IPA (NWAC and YMAC 2015).

While the various reserves across the landscape have been planned and established independently of each other, the result is a mosaic of protected areas extending from the Great Sandy Desert to the coastal waters of Eighty Mile Beach.

1.4. Term of the plan

The joint management plan will guide management of the planning area for 10 years. If the plan is not reviewed and replaced by the end of the 10-year period, it will remain in force until a new plan is approved. Amendments to the plan may be made in accordance with the CALM Act and the ILUAs relevant to the planning area.

Summary of management directions for joint management, legislative and policy framework, tenure arrangements and adjacent lands

Key points and considerations	
<ul style="list-style-type: none"> The planning area and proposed additions comprise a number of nature reserves and conservation parks collectively referred to as the Eighty Mile Beach coastal reserves; the Walyarta Conservation Park; and the Kurriji Pa Yajula Nature Reserve. The CEO of the department will jointly manage the relevant parts of the planning area with the KTLA, NKAC, NWAC and WAC and will formalise this arrangement under the CALM Act through section 56A JMAs. The JMAs will establish JMBs to oversee management of the planning area in accordance with the agreements and the CALM Act. Operational management will be coordinated by the department's West Kimberley District. Large portions of the planning area were held under pastoral lease until 30 June 2015. A landscape-scale management approach is needed for the planning area, involving adjacent land managers, other agencies and the wider community. The Eighty Mile Beach coastal reserves in particular have a very high perimeter to area ratio which makes management challenging and will require a coordinated approach from neighbouring land managers. A variety of Acts, Regulations, policies, agreements (e.g. Ramsar Convention, migratory bird agreements, ILUAs and JMAs) and management documents apply to, or have relevance to, this plan and the planning area. 	
Management objectives	Strategies
1. Consider tenure opportunities to improve management and/or increase formal protection of the planning area.	Facilitate joint vesting of the unnamed 'Gap' nature reserve if native title is determined for this reserve.
	If other lands become available, consider them for addition to the planning area where they provide a benefit to the management of key values.
2. Ensure legislative requirements and other commitments are met during plan implementation.	Implement joint management of the relevant parts of the planning area between the CEO of the department and the KTLA, NKAC, NWAC and WAC in accordance with the CALM Act section 56A JMAs attached to this joint management plan.
	Conduct the minimum number of meetings required for each JMB, though two or more meetings per year are encouraged.
3. Maintain close working relationships and regular and open communication with traditional owners.	Provide opportunities for training and mentoring traditional owner rangers and continue to provide equitable support to the Karajarri Ranger group on a fee-for-service basis.
	Assess joint management effectiveness of the planning area (i.e. how joint management arrangements work for the department and traditional owners and whether the arrangements themselves are functioning effectively).
4. Promote effective coordinated cross-boundary management of landscape-scale influences.	Facilitate the transfer of information from research and monitoring to the joint management partners (e.g. through research licence or other approval conditions).
	Liaise with, and provide advice and support to, relevant agencies, stakeholders and neighbouring landholders with management and monitoring responsibilities (e.g. DPIRD, DWER, DFES, Shire of Broome and pastoralists) across the planning area and on surrounding lands, including portions of the Eighty Mile Beach Ramsar site that occur outside the formal conservation reserve system.
	Ensure that research and monitoring in the planning area is integrated with that being undertaken in adjacent protected areas.
	Adhere to and/or maintain consistency with relevant legislative and other key documents as outlined above.

2. Vision and strategic goals

2.1. Vision

“The living cultural landscapes, significant wetlands, and unique plant and animal communities of the planning area are protected and looked after for future generations, jointly with the Karajarri, Nyangumarta and Ngarla traditional owners and with neighbouring land managers and the wider community.”



Karajarri traditional owners at Elizabeth Soak, Kurriji Pa Yajula Nature Reserve. *Photo – Ilse Pickerd/Environs Kimberley*

2.2. Strategic goals

A set of strategic goals has been developed for the planning area that provides a link between the vision statement and the desired outcomes expressed through the objectives identified in this plan. The strategic goals are to:

- uphold and respect the culture and traditional knowledge of the Karajarri, Nyangumarta and Ngarla traditional owners
- protect and conserve the value of the land to the culture and heritage of Aboriginal people
- provide for sustainable traditional and customary Aboriginal use and enjoyment
- conserve and restore wetlands of international and national significance
- conserve biodiversity and maintain ecosystem processes and function
- increase understanding of the cultural heritage, natural values, and management issues to support adaptive management
- provide for recreation, tourism and resource use that is compatible with and respectful to the area’s cultural heritage and natural values.



Spinifex sandplain and melaleuca thicket, Walyarta Conservation Park. *Photo – Jan van de Kam*

3. Connection to country (cultural heritage values)

Protecting and conserving the value of the land to the culture and heritage of Aboriginal people is a priority for all joint management partners of the planning area, as well as an objective under section 56(2) of the CALM Act.

3.1 Dreamtime and traditional law

The traditional owners of the planning area believe the landscape, its features and all forms of life were created by supernatural Ancestral Beings during the Dreamtime (*Pukarrikarra* or *Pukarrikarrajangka*). These Ancestral Beings also created the social and cultural norms and different regional languages and inscribed the country with meaning (KTLA 2014; NWAC and YMAC 2015).

Traditional law is a set of rules that guides the area's traditional owners in all aspects of their life. The physical environment, plants and animals have been inseparable from traditional law, culture, language and knowledge since Creation Time and this is integral to the maintenance and protection of country. Under traditional law, the Karajarri, Nyangumarta and Ngarla people have a binding responsibility to care for country and keep culture strong. Country is the source of spirit, culture and language and is where spirits return when they die.

3.2 Traditional knowledge

Traditional owners, especially the elders, collectively hold an extensive body of cultural and ecological knowledge that has been developed over millennia. In accordance with traditional law, they are responsible and obliged to transfer knowledge to the younger generation. This is typically undertaken while spending time on country camping, telling stories, performing song and dance, participating in ceremonies and rituals, making spears, fishing, hunting, learning about bush tucker and natural medicine, and generally through everyday life (KTLA 2014; NWAC and YMAC 2015). Traditional ecological knowledge is underpinned by seasonal calendars and the life cycles of individual species, as well as a deep spiritual attachment to country (Willing 2014).

Traditional owners are increasingly concerned about the difficulties in being able to pass on their traditional knowledge because of limited opportunities to spend time on country due to distance, costs, access and health conditions; the younger generation being distracted by modern influences and becoming less interested in learning about their own culture and heritage; and elders passing away before all their knowledge can be passed on (NWAC and YMAC 2015). The Karajarri people are particularly keen to use modern technology to document, and make available as appropriate, traditional knowledge, including language, to ensure the longevity of their culture and heritage (KTLA 2014).



Karajarri traditional owners, Kurriji Pa Yajula Nature Reserve. Being on country is the best place for old people to pass on traditional knowledge to the younger generation.
Photo – Ilse Pickerd/Enviros Kimberley

Management of this value will focus on gaining a better understanding of traditional knowledge applicable to the planning area, and investigating opportunities for integration with contemporary conservation science and management. Previous collaborative research projects in the planning area have benefited both scientists and traditional owner groups (e.g. Yu 2000 and Semeniuk Research Group 2000). Successful integration requires an understanding and appreciation that traditional knowledge is part of a complementary worldview with its associated values, institutions and management systems.

3.3 Plants, animals and sites of significance



Nyangumarta elder with bush turkey. This is a culturally important species that may benefit from sustainable harvest strategies and targets.
Photo – Chris Nutt/DBCA

Plants and animals have sustained Aboriginal people living on country for many years, providing them with food, water and medicine. Elkin (1933) noted that many plants and animals are totems for the Karajarri people; special ceremonies are performed, “expressing desire for the spirits of totemic species to go forth and increase”. In addition, knowing when plants and animals are in season is an important part of maintaining good health and provides guidance for safe travel overland for long periods of time (KTLA 2014). Establishing sustainable harvest strategies for favoured animals, bush foods and medicines on country is necessary to ensure that these resources maintain a healthy condition and persist into the future in good numbers (KTLA 2014). Appropriate fire regimes (‘right-way fire’) are also a key factor in their successful conservation. The emu (*Dromaius novaehollandiae*) and the Australian bustard or bush turkey (*Ardeotis australis*) are two species that are culturally important to the area’s traditional owners but, based on anecdotal evidence, may be in decline locally.

The pathways of Ancestral Beings traverse the planning area and their tangible form is present in sacred sites. As outlined above, traditional owners are responsible for and obliged to protect, preserve and manage sites and objects of significance associated with their country. Seven Aboriginal sites within the planning area are recorded on the Department of Planning, Lands and Heritage’s Aboriginal Heritage Enquiry System, although this probably only represents a small proportion of the actual sites that occur there. These include water sources as well as ceremonial, mythological, and men’s and

women’s sites. Kurriji Pa Yajula was also noted by Yu (2000) as an important place for Karajarri people to exchange trading parcels and objects with the nearby Martu people and establish friendships and alliances, which sometimes led to marriages.

More generally, permanent and seasonal/temporary water sources, especially the wetlands of the planning area, hold great cultural and spiritual significance. Water plays a key role in cultural practices and stories, as well as being used by traditional owners for survival as they traversed country following the seasonal availability of resources and in modern times when just spending time on country (KTLA 2014; Yu 2000).

Many of these sites also have spiritual value, having been created and inhabited by *pulany*, snake beings or serpents with the powers to produce rain, regenerate or damage country and take people's lives (Yu 2000). Acknowledging and respecting the origin, type and hydrological integrity of these water sources ensures the health of the *ngurrara* (country) and all forms of life, as well as visitor safety, is maintained.

Box 1: *Pulany*

Both the Karajarri and Nyangumarta people regard *pulany* as powerful beings who are to be respected and approached in prescribed ways. They believe that *pulany* can exhibit human emotions, such as anger, which can be manifested as violent storms, with lightning and wild winds, and cyclones.

The presence of *pulany* at springs is often indicated by *panyjin* reeds, which grow in the springs and are said to be the whiskers of the *pulany*. It is considered dangerous, particularly for children, to swim near areas where the *panyjin* grow. Because of the unpredictability of the *pulany*, traditional owners never camp in the immediate vicinity of permanent water sources.

(Yu 2000; Nyangumarta People *pers. comm.* 2012)

There is a strong connection to the adjacent coastal pastoral stations, associated with long-term employment dating back to the 1920s, birth place, ceremonial areas and burial sites, the latter of which are highly vulnerable to disturbance (NWAC and YMAC 2015). Most burial sites are unfenced and traditional owners would like to fence them to stop damage by cattle (*Bos taurus*). A considerable proportion of the planning area was previously part of these pastoral leases and may contain some of these significant sites (e.g. burial sites located in coastal dunes).



Nyangumarta traditional owners, Walyarta Conservation Park. Photo – Matt Fossey/DBCA

All Aboriginal sites, registered or otherwise, are protected under the *Aboriginal Heritage Act 1972*. Depending on the cultural sensitivity, these sites can be vulnerable to a variety of management issues (e.g. weeds, introduced animals, inappropriate visitation and development) that are discussed in more detail in the relevant sections of this plan. In many cases, maintaining confidentiality and restricting access to people who have special cultural authority in culturally sensitive areas will be imperative to retaining site integrity. Provisions for special access restrictions have been incorporated into this plan accordingly.

3.4 Enjoyment of country and practices for customary purpose

Although the majority of the traditional owners of the planning area live in towns and communities such as Port Hedland, Broome and Bidyadanga, families and individuals retain close personal connections (social, spiritual and cultural) with their country. For example, a number of *yirrau* (anecdotal songs composed and sung for pleasure) illustrate the connection the Ngarla people have with their coastal territory (Brown and Geytenbeek 2003).

There is a strong desire to continue living on country from time to time, learning about and enjoying important places and utilising the resources of the land. Provisions of the CALM Act enable traditional owners to access the planning area for customary purposes, such as preparing and consuming food, preparing or using medicine, and engaging in artistic, ceremonial or other customary activities. This will assist traditional owners of the planning area to continue these traditions, transfer knowledge to younger generations and protect and conserve these values. Further information is available in Department of Parks and Wildlife (2015b and 2016).

As much of the planning area is difficult to access, providing an appropriate level of vehicle access to sites where traditional owners can continue to undertake cultural activities and responsibilities is the main requirement for the management of this value. In particular the Karajarri people have expressed the need for improved access to Kurriji Pa Yajula Nature Reserve, as it takes several days by vehicle to reach the reserve from the Great Northern Highway (Reynolds *et al.* 2015).



Karajarri and Nyangumarta traditional owners fishing at Salt Creek, Walyarta Conservation Park. *Photo – Matt Fossey/DBCA*

Summary of management directions for cultural heritage values

Key points and considerations	
<ul style="list-style-type: none"> • Under traditional law, traditional owners have a binding responsibility to care for country and keep their culture strong. • Being on country is the best place for traditional owners to engage with their culture and for elders to pass on knowledge of country to younger generations. • Establishing some sustainable harvest strategies will ensure that favoured food animals and bush foods are available in healthy numbers. • Water sources, especially the wetlands of the planning area, hold great cultural and spiritual significance to traditional owners. Many sites are believed to be created and inhabited by <i>pulany</i> and must be respected and approached in the right way. • Local pastoral stations feature strongly in the memories of many traditional owners and are an important part of their heritage and contemporary identity. • Access to certain culturally sensitive areas may be restricted to people who have special cultural authority. • Traditional owners can continue to enjoy and maintain their customary practices in the planning area. • Traditional owners are concerned about difficulties in accessing parts of the planning area and thus carrying out customary practices and passing on knowledge of country. 	
Management objectives	Strategies
1. Recognise, protect and conserve the planning area as being part of living cultural landscapes.	Implement strategies in this plan to maintain or improve the health of country.
	Develop a shared understanding and appreciation of the cultural significance of the planning area to traditional owner groups (e.g. through cultural heritage mapping on country or other means as appropriate).
2. Support retention of traditional knowledge and its integration into management operations, research projects and monitoring.	Support the collation and recording of traditional knowledge from senior traditional owners and other sources, and encourage its uptake for management of the planning area.
	Develop and observe JMB-approved processes and protocols for undertaking management activities and/or integrating traditional knowledge with contemporary science and management (e.g. 'right-way fire' to protect important sites and species and promote habitat diversity).
3. Support traditional owners to carry out their roles and responsibilities as protectors and managers of their country and culture.	Support on-country trips by younger and older generations of traditional owners to the planning area to maintain permanent water sources and keep <i>pulany</i> alive, ensure knowledge, stories and songs about country are passed on, and to undertake other customary practices.
	Liaise with traditional owners to determine which sites of high cultural sensitivity may require special access restrictions and implement as appropriate.
4. Recognise and support the rights of traditional owners to continue customary practices in the planning area.	Ensure cultural and heritage places are protected and maintained, in particular highly significant and sensitive sites at immediate risk (e.g. fencing of burial sites).
	In partnership with each traditional owner group, identify culturally important species (e.g. availability and abundance of bush medicines, fruits and favoured food animals) and develop and apply sustainable harvest strategies and management targets.
5. Monitor changes of the key cultural heritage values of the planning area, to provide a basis to assess, adapt and improve management.	Assess factors that may inhibit the rights of traditional owners to enjoy country and maintain their customary practices, and explore/implement management interventions to address issues as necessary.
	Ensure that traditional owners have a primary and active role in communication about their culture and heritage.
	Monitor the condition of culturally significant sites and species in the planning area to determine whether these are being adequately protected and maintained.

KEY PERFORMANCE INDICATORS (KPIs)

Performance measures	Targets	Reporting requirements
Use of Traditional knowledge in management practices.	Taking into consideration feedback from traditional owners, the JMBs are satisfied that traditional knowledge is being consulted and adopted as appropriate into management of the planning area.	Annually.
Condition of significant cultural and heritage places.	<ul style="list-style-type: none"> • All sites and areas with cultural and gender access restrictions are communicated and observed. • No new signs of physical disturbance to specified sites and areas within three years of the release of the plan. 	Annually.
Condition of culturally important species.	To be developed by/with each traditional owner group.	Annually.
Accessibility of the planning area to undertake customary practices.	Taking into consideration feedback from traditional owners, the JMBs are satisfied that the planning area is accessible by traditional owners for the purposes of carrying out customary practices, transferring knowledge to younger generations and enjoying country.	Annually.

4. Caring for country (natural values)

This section focuses on the management of conservation significant species and communities, however a more general description of the natural environment of the planning area has been included in **Appendix II**. In 2015, a biodiversity survey of Mandora Marsh was undertaken. The results were compared with records from a previous survey undertaken in 1999. Combined with other minor surveys, these findings form the baseline ecological data known from the site. Information is still limited for other parts of the planning area.

4.1 Wetlands of significance

The planning area contains wetland landscape features recognised nationally and internationally for their geomorphic and hydrological values. These in turn support unique plant and animal communities, and sustain a range of ecosystem services (Department of Environment, Water, Heritage and the Arts 2009).

The wetlands of the planning area are largely a result of geomorphology and hydrological interactions (for more information, refer to **Appendix II**). They occur within a large palaeodrainage system called the Mandora Palaeovalley which was interpreted by Beard (1973), and later verified by Honey (1982), to connect across the Great Sandy Desert in a westerly course from Sturt Creek to Mandora on the coast (Magee 2009).

Walyarta Conservation Park principally comprises the Mandora Marsh wetland complex, which includes a number of saline and freshwater wetland types, such as intermittent saline lakes and marshes (Lake Walyarta and East Lake), permanent saline streams (Salt Creek), freshwater springs and freshwater peatlands. It is unusual for saline and freshwater wetland types to occur in close proximity to one another. The two largest wetlands, Lake Walyarta and East Lake, are predominantly supported by surface run-off flow during periods of cyclonic activity, while many of the other wetlands in the reserve are sustained by groundwater. There are 17 occurrences of peat mound springs scattered across Walyarta Conservation Park. Eil Eil Spring is the most developed in the region, and is considered a unique geomorphic formation wetland ecosystem (Department of the Environment 2016). English *et al.* (2016) provides a recent assessment of the mound springs of Mandora Marsh.



Saunders Spring with central, raised mound of peat, Walyarta Conservation Park. *Photo – Jan van de Kam*

Kurriji Pa Yajula Nature Reserve comprises two permanent mound springs (Dragon Tree Soak and the smaller Elizabeth Soak). The soaks and peatlands are small in size but are regarded as oases within the Great Sandy Desert. Like the springs of Mandora Marsh, they are groundwater dependent.

In addition to being part of the internationally significant Eighty Mile Beach Ramsar site (see **Appendix I**), the Mandora Marsh complex is listed on the Directory of Important Wetlands in Australia as it is a good example of a wetland type occurring within a biogeographic region in Australia (criterion 1); is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions prevail (criterion 3) and is of outstanding historical or cultural significance (criterion 6) (Environment Australia 2001). Dragon Tree Soak is also recognised as being nationally important by meeting criteria 1 and 6 (Environment Australia 2001).

The wetlands of the planning area are important research sites, with the mound springs and grey mangrove (*Avicennia marina*) community of Salt Creek being of considerable scientific interest. An improved understanding of surface water and groundwater recharge and flows is essential to their conservation and management.

4.2 Flora, fauna and ecological communities

Priority² flora

Atriplex eremitis is a Priority 1 species that has been recorded in the planning area. It is a recently described saltbush species which occurs on tussock grassland (Cranfield 2008) and halophyte and samphire shrublands (*Tecticornia* spp., *Trianthema turgidifolium*) (A. Markey pers. comm. 2017).



Atriplex eremitis. Photo – Adrienne Markey/DBCA

² Definitions for priority species can be found at <https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation%20code%20definitions.pdf>.

Eleven Priority 3 species have also been recorded: *Acacia glaucocaesia*, *Fimbristylis sieberiana*, *Fuirena incrassata*, *Gymnanthera cunninghamii*, *Indigofera ammobia*, *Pterocaulon xenicum*, *Nicotiana heterantha*, *Solanum oligandrum*, *Terminalia kumpaja*, *Tribulopsis marliesiae* and *Lawrenzia* sp. Anna Plains (N.T. Burbidge 1433).

Markey (2017) identified three putative new taxa (*Euphorbia* aff. *hassallii*, *Abutilon* aff. *hannii* and *Tecticornia* sp. “tall robust”), which require further work to determine their taxonomic status. Salt water couch (*Paspalum vaginatum*) was recorded around the mound springs of Mandora Marsh and while this species has often been recorded as introduced in some parts of Australia, in the tropics it is considered to be native and a potentially rare species mostly restricted to Kimberley mound springs (Keighery 2016 and Markey 2017).



Tecticornia sp. ‘tall robust’ is a putative new species. Photo – Adrienne Markey/DBCA



Salt water couch (*Paspalum vaginatum*) is a potentially rare species mostly restricted to Kimberley mound springs. Photo – Adrienne Markey/DBCA

Threatened and other significant fauna

The Mandora Marsh wetland complex in Walyarta Conservation Park provides important habitat for waterbirds, particularly when inundated extensively. During large floods in 1999 and 2000, the site supported around 480,000 and 490,000 waterbirds respectively (Halse *et al.* 2005), although the area surveyed included land outside the boundaries of the reserve and the Ramsar site.



White-winged black terns (*Sterna leucoptera*), Walyarta Conservation Park. When flooded, the lakes of the reserve support huge numbers of waterbirds. Photo - Jan van de Kam

Such flood events are also significant in supporting waterbird breeding, with species utilising different habitats within the complex (Hale and Butcher 2009). Recently, over one thousand breeding gull-billed terns (*Sterna nilotica*), straw-necked ibis (*Threskiornis spinicollis*) and black swans (*Cygnus atratus*) were recorded at Walyarta Conservation Park, demonstrating the ongoing importance of the area in providing foraging and breeding habitat resources for waterbirds (Greatwich 2017). Mandora Marsh also provides an important refuge and source of drinking water for other terrestrial fauna and supports a relatively rich aquatic invertebrate fauna with some likely endemic species (Quinlan *et al.* 2016).



Communal breeding event, Walyarta Conservation Park. Photo – Bruce Greatwich/DBCA

A number of fauna species occurring, or possibly occurring, in the planning area are listed under the Biodiversity Conservation Act or under the EPBC Act (Table 3).

Table 3 Fauna of conservation significance in the planning area

Species	Biodiversity Conservation Act	EPBC Act	IUCN Red List
Flatback turtle (<i>Natator depressus</i>)	Vulnerable	Vulnerable, Marine, Migratory	Data deficient
Greater bilby (<i>Macrotis lagotis</i>)	Vulnerable	Vulnerable	Vulnerable
Australian painted snipe (<i>Rostratula australis</i>)	Endangered	Endangered, Marine	Endangered
Bar-tailed godwit (<i>Limosa lapponica</i> subsp. <i>menzbieri</i>)	Vulnerable, Migratory	Marine, Migratory	Least concern
Curlew sandpiper (<i>Calidris ferruginea</i>)	Vulnerable, Migratory	Critically Endangered, Marine, Migratory	Least concern
Greater sand plover (<i>Charadrius leschenaultii</i> subsp. <i>leschenaultii</i>)	Vulnerable, Migratory	Marine, Migratory	Least concern
Grey falcon (<i>Falco hypoleucos</i>)	Vulnerable	Not listed	Vulnerable

The Eighty Mile Beach coastal reserves provide some of these species with a significant buffer from external influences or disturbance and is a key reason for their reservation.



View of Kujungurru-Warrarn Nature Reserve looking south from Waru Creek. The Eighty Mile Beach coastal reserves buffer the values of the adjacent marine park. *Photo – DBCA*

Flatback turtles are endemic to northern Australia and nest in the Eighty Mile Beach coastal reserves, with peak nesting from November to December and peak hatching from January to March. Research indicates that the flatback population at Eighty Mile Beach may be different genetically to populations further west in the Pilbara and north along the Kimberley coast (Pittard 2010). Existing and potential management issues in the coastal reserves include habitat degradation, disturbance from human interaction and activities, and disturbance or predation by feral animals. Turtles are recognised as a key value of the adjacent marine park and their management and monitoring is dealt with in the marine park plan.

The greater bilby has been recorded in a number of locations across the planning area (individuals were recorded at the north end of Eighty Mile Beach in 2017 [Dziminski and Bettink 2017] and north of Mandora Marsh complex in 2015 [Bettink and Sonneman 2016], as well as evidence of occupancy along the route to Kurriji Pa Yajula Nature Reserve in 2014) and will be a focus for management and monitoring over the life of the plan.

Bilbies occur across several broad landscape types including laterite, silcrete or stony rises and uplands (residual landforms); drainage lines including upland creek systems, calcareous areas and broad palaeodrainage systems (fluvial landforms); and flat or gently undulating plains and dune fields (Cramer *et al.* 2016).

Dziminski and Bettink (2017) provides a description of the habitat where bilbies were recently identified in the La Grange survey area, including the north end of Eighty Mile Beach coastal reserves, which included coastal dune habitat. The species can be highly mobile and individuals can have large home ranges.

Predation, habitat degradation by introduced herbivores, and unsuitable fire regimes are considered to be the major threats to the species in the planning area. In recent years, multiple large-scale, hot fires, coupled with an increase in cat predation have likely led to the loss of a bilby population at Pardoo, in the south-west of the planning area (Dziminski and Carpenter 2017).

A [greater bilby interim conservation plan](#) (Bradley *et al.* 2015) was prepared in 2015 to form the basis for a review and revision of the existing *National recovery plan for the greater bilby* (Pavey 2006). The new recovery plan is anticipated to be published in 2019.



The greater bilby is a threatened species that occurs at a number of locations across the planning area. Management of introduced herbivores, feral cats and fire regimes will help its survival in the reserves.
Photo – Damian Kelly Photography

In addition to the migratory birds listed in Table 4, at least 15 other migratory bird species have been recorded at Mandora Marsh, all of which are listed under Part 2 of the Biodiversity Conservation Act and are the subject of international agreements. The presence of eight migratory species recorded in the 2015 survey demonstrates that the complex continues to provide important habitat for migratory birds even when not in flood (Jackett and Graff 2017). As a key staging area within the East–Asian Australasian Flyway, many more migratory bird species visit Eighty Mile Beach each year. The shorebirds that feed on the beach (and roost in the coastal reserves at high tide) are a key value of the marine park and their management is primarily dealt with in the marine park plan and other key documents such as the [Wildlife Conservation Plan for Migratory Shorebirds](#) (Commonwealth of Australia 2015). Intertidal habitat loss in the Yellow Sea threatens the long-term prospects of several migratory species (Piersma *et al.* 2016).

Other conservation significant species recorded from the planning area include:

- two Priority 4 species: the kakarratul or northern marsupial mole (*Notoryctes caurinus*) and princess parrot (*Polytelis alexandrae*)
- two locally endemic aquatic invertebrate species: (*Kimberleybathynella mandorana* and *Assimineia* sp. nov.)
- a new species of fish (*Acentrogobius* sp. nov.)
- nine species that are potentially new: (two *Gehyra* sp., *Mentia* sp., *Delma* sp., *urus* [*Micruracarus*] MAN1, cf. *Celsinotum* n.sp., *Schizopera* sp. B23, *Cyprididae* n.gen. n.sp., and *Heterocypris* sp. MAN1 [nr vatia])
- ten species close to, or at, their range extent: striated heron (*Butorides striatus*), red-winged parrot (*Aprosmictus erythropterus*), spiny-cheeked honeyeater (*Acanthagenys rufogularis*), restless (paperbark) flycatcher (*Myiagra inquieta nana*), spinifexbird (*Eremiornis carteri*), the common blue tongue (*Tiliqua scincoides*), a whip snake (*Demansia* sp.), the northern Pilbara tree dragon (*Diporiphora vescus*), the eastern striped skink (*Ctenotus robustus*) and an aquatic invertebrate (*Microvelia* [*Pacificoveliea*] *lilliput* [Veliidae]) and
- other species that are rarely collected within the state or Australia (Bettink and Sonneman 2016, Jackett and Graff 2017 and Quinlan *et al.* 2016).

Ecological communities

Much of the planning area is mapped as hummock (spinifex) grassland with habitats and species commonly associated with arid, desert landscapes (Beard *et al.* 2013). The water regime, however, is regarded as the single biggest determinant of the ecology of the reserves.

Permanent water sources have significant conservation value as refuges from the surrounding dry landscape and make an important contribution to the regional diversity of flora and fauna. The coexistence of saline and freshwater wetlands in Walyarta Conservation Park gives rise to unusual vegetation associations, with plants able to tolerate saline conditions growing in proximity to species reliant on fresh water.

The inland grey mangrove community of Salt Creek is unique and represents one of only two such communities in Australia. Located more than 50km from the coast, it has been suggested that this is a relict from a time when sea levels were higher and the site was part of an estuary (Willing and Handasyde 1999). The soaks of Kurriji Pa Yajula Nature Reserve also have relict populations of flora not found elsewhere in the Great Sandy Desert.



Inland mangroves of Salt Creek, Walyarta Conservation Park.
Photo – Matt Fossey/DBCA

The planning area contains the following threatened ecological communities (TECs) and priority ecological communities:

- *Assemblages of the organic springs and mound springs of the Mandora Marsh area* – state-listed TEC, classified as Endangered. The ecological community is only known from 17 occurrences, covering a total area of about 53ha.
- *Assemblages of Dragon Tree Soak organic mound spring* – state-listed TEC, classified as Endangered. The community is known from only one occurrence covering approximately 7,940ha.
- *Inland mangrove (A. marina) community of Salt Creek* – Priority 1 (poorly known) ecological community. Known from only one occurrence covering approximately 40.7ha.



Dragon trees (*Sesbania formosa*) over bulrush (*Typha domingensis*) at Dragon Tree Soak, Kurriji Pa Yajula Nature Reserve.
Photo – Stephen Reynolds/EnviroNS Kimberley

4.3 Management issues

Other than resource use (see **Using resources from country**), which is currently the most significant pressure on key values of the planning area, weeds, introduced animals and inappropriate fire regimes also have an impact. The fragmented nature of the planning area and surrounding land uses increase the vulnerability of the reserves to these management issues, as well as climate change. Relationships between these issues are extremely complex, making them difficult to address in isolation.

Weeds

Remoteness helps to protect the planning area from weed impacts to an extent, though they have still entered and spread via pedestrian and vehicle access, introduced herbivores and pastoralism, particularly within Eighty Mile Beach coastal reserves and Walyarta Conservation Park. Traditional water resources are also at risk from weeds drawing on the water source and restricting access for traditional owners (KTLA 2014).

Introduced perennial grasses such as buffel grass (*Cenchrus ciliaris*) and birdwood grass (*Cenchrus setiger*) have been actively spread in the past through pastoralism and replaced many of the native grass species of the coastal dunes and the wetlands of Walyarta Conservation Park (see **Using resources from country**). Few significant weeds were noted during the 2015 survey and were mainly located in the mound spring moats (English *et al.* 2016). There is potential for some of the major species present (buffel grass, couch grass [*Cynodon dactylon*], kapok bush [*Aerva javanica*] and apple of sodom [*Solanum linnaeanum*]) to spread and have increased impacts on the mound springs in the future and it is recommended that these be controlled as a matter of urgency (English *et al.* 2016). Other weed species recorded include speedy weed (*Flaveria trinervia*), Panama berry (*Muntingia calabura*), whorled pigeon grass (*Setaria verticillata*) and carpet weed (*Phyla nodiflora*) (Markey 2017). Potentially serious weeds that may occur in the planning area are indigo (*Indigofera oblongifolia*), parkinsonia (*Parkinsonia aculeata*), stinking passionflower (*Passiflora foetida*) and *Stylosanthes* species (especially *S. hamata*) (G. Keighery *pers. comm.* 2015).

For most weeds, control is expensive. Preventing their introduction and spread is a more cost-effective option. Where weed species are detected in the planning area, the control of small manageable outbreaks is a priority. Buffel grass appears to be well established across parts of the planning area and may be difficult to contain and eradicate. Creation of the reserves should limit stock movements, though it is not understood how the recovery potential of the landscape is affected by the density or duration of buffel colonisation. Post-fire weed control can be a significant issue and further information is required to understand weed invasiveness after fire.

It should be noted that weeds can be beneficial for dune stabilisation and reducing erosion in the absence of native vegetation. In such instances, weeds should only be removed as part of an integrated weed management program that includes restoration of the site with native species.

Introduced animals

Feral camels (*Camelus dromedarius*) and donkeys (*Equus asinus*) occur in the planning area, causing habitat degradation through trampling, grazing and rubbing of vegetation, compaction and erosion of soil, and sedimentation and eutrophication of water sources (Done 1999). Both species threaten biodiversity and cultural heritage values, though camels are regarded as a higher priority for management. In Walyarta Conservation Park, camels mainly occur around springs in the eastern part of the site, although the extent of damage caused by them has not been confirmed. Between 2009-13, a national feral camel management project was carried out, which focused on managing the impacts of camels on nominated environmental sites including Mandora Marsh (Ninti One Limited 2013). Camel damage to Dragon Tree Soak was reported from site visits during the 1990s and from a trip in 2014 (Spurr 1996; Reynolds *et al.* 2015). The impacts from camels and donkeys would vary from year to year, based on seasonal conditions (Ninti One Limited 2013).

Heavy-duty exclusion fencing has previously been suggested as a method for managing the impacts of camels and donkeys on selected water sources. Disadvantages include the cost and difficulty of transporting fencing materials, risk of damage to the fencing and ongoing maintenance needs. Aerial culling is regarded as a more appropriate means of control in the planning area, where camels are at the edge of their distribution in the northern Great Sandy Desert and densities are still relatively low.



A group of feral camels in Kurriji Pa Yajula Nature Reserve. Camels threaten the natural and cultural values of the planning area.
 Photo – Ilse Pickerd/Environs Kimberley

Research and previous control efforts suggest that using a Judas animal control technique (i.e. where selected females are fitted with radio collars) can be effective in enhancing helicopter shooting programs in desert country (e.g. Spencer *et al.* 2015).

Feral cats (*Felis catus*), foxes (*Vulpes vulpes*) and wild dogs (*Canis lupus familiaris*) have been observed throughout the planning area and the wider region. They prey on native fauna and disrupt waterbird breeding (Department of Environment and Conservation 2009). Predation by cats and foxes in particular, combined with changed fire regimes, has driven mammal declines and local extinctions in many parts of the country (Woinarski *et al.* 2015).

The department is preparing a scoping document for the effective control of cats and foxes at Eighty Mile Beach and Walyarta Conservation Park (T. Sonneman *pers. comm.* 2017). It discusses the level of threat (abundance and potential impact) of cats and foxes and provides advice to maintain sufficiently low levels of these predators through regular strategic baiting with 1080. Trapping and shooting may also be undertaken as a supplementary control method, where necessary. Neighbouring land managers have also contributed to the control of cats and foxes in the past and if a consistent and collaborative approach is applied across boundaries in the future, control of cats and foxes will be much more effective.



Feral cat captured on remote camera at an active bilby burrow. Walyarta Conservation Park. Photo – DBCA

Cane toads (*Rhinella marina*) have not yet reached the planning area, but it is likely that they could spread into freshwater systems of Walyarta Conservation Park. While they have the potential to reduce populations of a wide range of native species through poisoning, predation and competition, the long-term impacts of cane toads are poorly understood (e.g. Shine 2010). Management priorities for the planning area include preparing for the arrival of cane toads and minimising the chance of new cane toad populations establishing ahead of the frontline (Parks and Wildlife 2014b).

For management issues from domestic livestock, see the section **Using resources from country**.

Fire

Fire is an important natural component of ecosystem function and is one of a number of factors that influences biodiversity and ecosystem condition. Cultural burning is a sustainable means of looking after country and cultural heritage values, while carbon abatement and sequestration projects may present future economic opportunities for traditional owners.

Traditionally, Aboriginal people moved seasonally throughout the landscape and lit small, patchy fires for hunting, regenerating food and medicinal plants or ‘cleaning up country’. In recent decades, these fire patterns have been replaced by large, hot and uncontrolled bushfires (‘wrong-way fire’) occurring in the mid-late dry season. Within the Kimberley, the increased intensity and frequency of fires have led to changes in vegetation structure and composition, soil erosion and declines in fauna populations, particularly small fauna with limited home ranges (Carwardine *et al.* 2011; Government of Western Australia 2011).

Fire in the planning area and surrounding lands will typically spread over large areas of grassland, particularly after cyclonic rainfall events that stimulate the growth of spinifex and annual grasses (Department of Environment and Conservation 2008a). Ignition is usually caused by dry lightning storms. Little has been documented about the impacts of fire in the planning area, although it is likely that large, hot fires would adversely affect key vegetation communities and habitats, species diversity, traditional food resources and other cultural heritage (KTLA 2014).

Fire-sensitive species and ecosystems are most typically associated with the less flammable parts of the landscape that are not regularly exposed to fire, such as moister areas and those with discontinuous vegetation. Saunders Spring in Walyarta Conservation Park is a good example of this, where it has long been isolated from fire due to the non-flammable nature of the surrounding vegetation and the damp conditions that prevail (Department of Environment and Conservation 2009). In general, the mound spring communities give rise to particular fire management considerations as their peat-based systems can smoulder for months, totally destroying peat substrate that has accumulated over at least hundreds of years (English *et al.* 2016).



Karajarri ranger Braedon Taylor undertaking fuel reduction burning. Photo – Ewan Noakes

Adding fire to the landscape by prescribed burning decreases the extent and frequency of unmanaged bushfires and can create a mosaic of reduced fuel levels as well as areas of older vegetation. This mosaic pattern represents habitat diversity at a landscape scale, with patches of unburnt vegetation providing refuges for native fauna. A variety of post-fire recovery (seral) states play a role in biodiversity conservation in desert landscapes (Haydon *et al.* 2000), with species such as the greater bilby likely to benefit from improved habitat favourability. Given the large fuel loads and limited vehicle access, aerial burning may be an appropriate approach for conducting prescribed burns in parts of the planning area (e.g. Kurriji Pa Yajula Nature Reserve). Monitoring of post-fire survival and recruitment success is also necessary to determine if ecological communities are benefiting from prescribed burns.

In collaboration with the Nyangumarta traditional owners, researchers from La Trobe University are investigating prescribed burning options in the Nyangumarta Warrarn IPA that are conducive to maintaining their cultural beliefs and practices as well as ecological values. Leonard and Smith (2016) reported that protecting mound springs and soaks, as well as maintaining dense vegetation around significant cultural sites to discourage public access, were important considerations along with a planned fire management regime that aimed to reduce the spread of large

wildfires. A plan to guide fire management practices in the Nyangumarta Warrarn IPA is currently being prepared (S. Leonard *pers. comm.* 2017) and will have relevance to fire management planning for the reserves.

The interaction of fire with flammable weed species such as buffel grass remains a complicating factor for fire management in parts of the planning area. Fire may enhance weed invasion, which in turn can lead to more frequent or intense fires or suppress the regeneration of native species. Nonetheless, prescribed fire, when cool and patchy and applied to areas adjoining buffel infestations, may maintain native grass swards and provide some competition to limit the expansion of buffel grass (Department of Environment and Conservation 2008b). Where buffel grass is interspersed with native grasses, care should be taken with prescribed fire to minimise the potential for such fire events to facilitate the spread or intensification of buffel infestations. For large parts of the planning area dominated by spinifex, fire planning and management is also guided by 16 management principles based on existing knowledge of fire behaviour and effects (see **Appendix III**).

Climate change

Climate change adds an overarching pressure to the planning area and the broader region. It interacts with existing stressors, leading to complex and unpredictable outcomes (Steffen *et al.* 2009). In 2015, CSIRO released a set of climate change projections based on natural resource management boundaries of Australia. The projections indicated that the Monsoonal north-west region (the relevant climatic sub-cluster to the planning area) will increase in average temperatures across all seasons and while changes in rainfall are unclear, extreme rainfall events are projected to be more intense but with fewer occurrences of tropical cyclones (CSIRO 2015).

If rainfall decreases, prolonged drought will result in depletion of shallower aquifers, potentially impacting any freshwater mound springs in the planning area that are dependent on this groundwater source. Longer dry phases of the ephemeral wetlands of Walyarta Conservation Park could also place endemic spring biota at higher risk with little capacity to recolonise. These impacts may be offset by the increased intensity of extreme rainfall events.

Mound spring communities that primarily depend on deeper groundwater are less vulnerable to the direct impacts of climate change, as the aquifers are not sustained by local contemporary rainfall but they are thought to be more sensitive to increased water demand (Harrington and Harrington 2017), see **Using resources from country**. A rapid climate change vulnerability assessment for the mound springs of Mandora Marsh, based on the framework by Gitay *et al.* (2011), is provided in **Appendix IV**.

An increase in the intensity of cyclones will increase the vulnerability of the inland mangroves, melaleuca and dragon tree (*Sesbania formosa*) communities to wind damage, and may affect their ability to recover between disturbance events. The dunes of the Eighty Mile Beach coastal reserves are particularly vulnerable to erosion from severe weather if vegetation cover is reduced. For traditional owners, climate change may also affect seasonal patterns in resource availability, rendering some traditional knowledge inaccurate (KTLA 2014).

Management must aim to increase the resilience and resistance of species and ecosystems, and decrease their vulnerability to a changing climate. Uncertainty about appropriate responses to the effects of climate change means that protecting critical habitats in the planning area (e.g. wetlands) and managing other issues (e.g. weeds, introduced animals, fire and physical disturbance) are likely to be among the best options to conserve biodiversity in the immediate future. Such approaches are sometimes referred to as 'no-regret' or 'low-regret' strategies as they address short-term conservation challenges under current conditions, and provide large benefits under a range of future climate scenarios (Gross *et al.* 2016). Further research will be important in better understanding climate change impacts at a species and community level, and management should be adapted on the basis of these findings.



Departmental research scientists take a sediment core from a mound spring in Walyarta Conservation Park. Under a changing climate, the responses of different springs will vary, with those more reliant on shallow aquifer discharge likely to show more rapid changes. Photo – Val English/DBCA

Summary of management directions for natural values

Key points and considerations	
<ul style="list-style-type: none"> The planning area includes a number of internationally, nationally and regionally significant wetlands that support unusual and relict vegetation communities and have important refugia value. Many of these are groundwater dependent, though the hydrological regimes require further investigation. Several fauna species of conservation interest have been recorded in the planning area, including the greater bilby, flatback turtle and species that are migratory, priority-listed, endemic, potentially new or at, or near, their range extent. Records of large numbers of waterbirds are associated with flooding in Walyarta Conservation Park, though these events are infrequent. The planning area contains two TECs and a Priority 1 ecological community. The fragmented nature of the planning area and surrounding land uses increase the vulnerability of the reserves to weeds, introduced animals, 'wrong-way fire' and climate change. Management efforts must consider interactions between these issues, noting they may produce synergistic effects. A number of weed species occur in the Eighty Mile Beach coastal reserves and Walyarta Conservation Park and buffel grass is widespread in the coastal reserves. Weeds can stabilise dunes in the absence of native vegetation and should only be removed as part of an integrated weed management program that includes restoration with native species. Control of camels, donkeys, cats and foxes is needed across the planning area. Camels, in particular, threaten the integrity of freshwater springs and soaks. Cane toads may reach the reserves over the life of this plan. Fire management will require implementation of strategic burning and input of traditional knowledge. Mound spring communities, soaks, significant cultural heritage sites and buffel grass infestations have specific fire management considerations. Protecting climate refugia such as the mound springs and reducing the impact of existing stressors are important climate change adaptation approaches. Research should be a strong focus in the early years of implementation. For new additions to the planning area, collection of baseline data is needed to allow the condition of values to be monitored over and beyond the life of the plan. Additional, specific monitoring and reporting requirements apply to Mandora Marsh and the primary coastal dunes due to their designation as a Ramsar wetland (see Appendix I). 	
Management objectives	Strategies
<ol style="list-style-type: none"> Sustain the hydrological regimes of the planning area, with a particular focus on groundwater dependent communities and species. Conserve native flora, fauna and ecological communities of the planning area, with priority on the greater bilby and those associated with significant wetlands. Sustain or restore ecosystem processes and function in the planning area by addressing key management issues of introduced herbivores and 'wrong-way fire' and the impacts of resource use (also see Using resources from country). 	<p>Develop and implement a collaborative and cost-effective research and monitoring program that:</p> <ul style="list-style-type: none"> maps the location of all groundwater-dependent wetlands in Walyarta Conservation Park and considers concurrent cultural heritage mapping. improves understanding of the hydrological regimes and ecological water requirements, in particular, establishing baseline data and investigating the dependence of springs and lakes on episodic flooding and/or groundwater from different aquifers characterises the stygofauna of the planning area continues to build upon baseline data for key species and communities, including vegetation boundary and condition mapping addresses knowledge gaps for values and threats for which performance measures have been identified, including risks and vulnerabilities associated with climate change enables limits of acceptable change and operational limits to be set for critical components and processes of the Mandora Marsh portion of the Eighty Mile Beach Ramsar site establishes and maintains post-fire monitoring sites evaluates the conservation status of the inland mangrove community of Salt Creek

Management objectives	Strategies
<p>4. Maintain or improve the ecological character of the Eighty Mile Beach Ramsar site (including Mandora Marsh in Walyarta Conservation Park and the areas protected by the Eighty Mile Beach coastal reserves).</p> <p>5. Obtain an understanding of the key natural values of the planning area and the factors affecting those values through baseline research, mapping and addressing key knowledge gaps.</p> <p>6. Monitor changes in the key natural values of the planning area, including critical components and processes of the Eighty Mile Beach Ramsar site, to provide a basis to assess, adapt and improve management.</p>	<ul style="list-style-type: none"> examines the response of terrestrial vertebrate fauna to destocking in the Walyarta Conservation Park (see Using resources from country) utilises remote sensing technologies (e.g. for monitoring vegetation cover and extent of surface water) where feasible.
	<p>Ensure that weed and feral animal management for the planning area is considered and incorporated into a regional management program that:</p> <ul style="list-style-type: none"> assesses and prioritises threats presented by weeds and feral animals (i.e. new occurrences are likely to be a higher priority than those that are established) identifies key values (e.g. important springs, fauna nesting and roosting sites) that are most vulnerable to the impacts of weeds and feral animals and prioritises them for protection maintains dune vegetation cover in the Eighty Mile Beach coastal reserves and investigates opportunities to revegetate designated areas of weed cover with native species maintains or reduces the densities of feral herbivores (e.g. regular, late dry season aerial cull, with a focus on the freshwater springs where camels and donkeys congregate) outlines hygiene, quarantine and surveillance procedures (e.g. clean down of machinery, vehicles and equipment used in the reserves) to reduce introduction and spread of weeds and feral animals.
	<p>Plan and implement fire management for the planning area as part of a landscape-scale program that:</p> <ul style="list-style-type: none"> protects key values including fire sensitive ecosystems (e.g. the central peaty areas of mound spring communities) reduces the area burnt by late dry season fires creates a fine-scale patch mosaic of different seral stages (fuel ages) integrates fire management planning with efforts in adjacent IPAs.
	<p>Where feasible and assessed as manageable and suitable, establish and maintain a strategic system of protective fire breaks and access tracks for fire management, with a focus on areas of high conservation value, sites of cultural significance and other community assets (e.g. boundary fences and neighbouring properties).</p>
	<p>Identify and, where practicable, protect corridors, microhabitats and landform features suitable for species migration and refugia in response to extreme events and climate change.</p>
	<p>Develop recovery plans for threatened and priority communities in the planning area and implement recovery actions for listed species and communities (in accordance with approved recovery and conservation plans where they exist).</p>
	<p>Work with the appropriate bodies (e.g. Wetlands and Aquatic Ecosystems Sub-Committee) and technical experts (e.g. Australasian Wader Studies Group) to coordinate aerial and/or ground surveys of waterbirds in Walyarta Conservation Park during episodic flooding events.</p>

KEY PERFORMANCE INDICATORS (KPIs)

Performance measures	Targets	Reporting requirements
Water quality and quantity measures (e.g. nutrients, salinity, groundwater levels, flow rates, extent of surface water).	No significant change in water quality and quantity parameters (i.e. beyond natural seasonal or other cyclic variation) at selected high risk and/or high value sites.	Annually.
Level of understanding of the hydrological functioning of the springs and the ecological water requirements of groundwater dependent communities and species.	The hydrological functioning of the springs and the ecological water requirements of groundwater dependent communities and species in Walyarta Conservation Park and the Eighty Mile Beach coastal reserves are defined by 2022.	Every 2 years.
Areal extent, condition and number of occurrences of key vegetation assemblages (e.g. inland mangroves and melaleuca thickets in Walyarta Conservation Park, dragon trees in Kurriji Pa Yajula Nature Reserve).	<ul style="list-style-type: none"> • At least 90 per cent of the areal extent of key vegetation assemblages maintained at the same or improved condition (determined using Bush Forever condition scales) over the life of the plan. • No loss in the number of occurrences of key vegetation assemblages. 	Every 3 years.
Greater bilby presence and abundance.	<ul style="list-style-type: none"> • No decline in bilby occupancy rates and numbers from baseline levels over suitable habitat in the first three years of implementation. • An increase in bilby occupancy rates and numbers over suitable habitat over the next five years of implementation. 	Annually for the first 5 years, then reduced to every 2 years once a positive response is established.
Proportion of each reserve within the planning area burnt by late dry season fires.	No more than 20 per cent of each reserve within the planning area to be burnt per annum by late dry season fires.	Annually.
Extent (fire season, frequency and area) to which fire sensitive ecosystems are burnt.	Central peaty areas of mound spring communities remain unburnt (or fire intervals of > 20 years).	Every 3 years.
Diversity and distribution of seral stages.	A fine-scale mosaic (i.e. patches <6,000ha) of seral stages including recently burnt and long unburnt patches that provide suitable habitat diversity for bilbies and other fauna over the life of the plan.	Every 5 years.

5. People on country (recreation, tourism and community values)

The department and traditional owners support the concept of ‘healthy parks, healthy people’ and endeavour to safely facilitate people’s enjoyment and recreational use of the lands and waters that they manage while still looking after other values that occur there. Over the life of the plan, recreation and tourism activities will likely be focused on the adjoining Eighty Mile Beach Marine Park. Visitor opportunities, constraints and management in the planning area are discussed in more detail below.

5.1. Planning for visitor use

The planning area is in Tourism Western Australia’s ‘North West’ region. It is dissected by the Great Northern Highway, however visitation is limited due to the isolation of Kurriji Pa Yajula Nature Reserve, coupled with large parts of the planning area historically being pastoral land.

Eighty Mile Beach and Cape Keraudren Coastal Reserve are popular stopovers and holiday destinations for travellers between Broome and Port Hedland, providing some indication of visitor use in the vicinity. Most visitors arrive during the dry season (May to October) to enjoy the remote atmosphere and panoramic vistas, boating, recreational fishing, camping, four-wheel driving and wildlife viewing (Department of Parks and Wildlife 2014a). The recent establishment of the marine park is likely to attract more visitors and may create demand for visitor facilities and activities in the planning area.

The coast will be the focus for visitation (especially around existing nodes at Cape Keraudren and Eighty Mile Beach Caravan Park). These points provide access to the distinctive seascapes of the marine park, and offer the best opportunities for visitors to experience and enjoy the natural environment. Importantly, the existing nodes provide the safest options for visitors.

With its value predominantly nature-based, any recreation activities and/or facilities within the planning area should be:

- low impact and compatible with the area’s values
- appropriate to visitor demand
- consistent with [Corporate Policy Statement No. 18: Recreation, tourism, and visitor services](#) (Department of Parks and Wildlife 2017).

Access opportunities and constraints, funding and resource availability, and provision of visitor facilities/activities elsewhere in the surrounding area are other important factors in planning for visitor use.

Eighty Mile Beach Caravan Park, Cape Keraudren Coastal Reserve and Pardoo Station (located near the south-western extent of the marine park) comfortably accommodate all overnight stays. Camping requirements are not expected to exceed current provisions over the life of the plan. For safety reasons, visitation to Kurriji Pa Yajula Nature Reserve requires departmental approval to undertake remote camping. Day use facilities that may be suitable in the planning area include boardwalks, lookouts and bird hides.



Beach spinifex (*Spinifex longifolius*), Kujungurru-Warram Nature Reserve. Photo – Chris Nutt/DBCA

5.2. Access

The remote nature of the planning area, together with numerous unsealed tracks, many of which traverse private property, restrict access to the reserves.

In the southern half of the Eighty Mile Beach coastal reserves, there are only two major public roads (Cape Keraudren Road and Eighty Mile Beach Road) that lead from Great Northern Highway to the coast, allowing access to this part of the planning area. Four-wheel driving is permitted on Eighty Mile Beach, though generally limited to the area adjacent to Eighty Mile Beach Caravan Park (i.e. between about 6km south and 18km north of the beach access point). Some visitors drive along the beach and access the Eighty Mile Beach coastal reserves by traversing the coastal dunes, however, vehicles are not permitted in these reserves (see **Access management** below).

The western boundary of Walyarta Conservation Park is defined by the Great Northern Highway, the only major sealed road in the vicinity.

There is no other formal public access to the planning area and attempts to reach the reserves could be detrimental to visitor safety. Access to Kurriji Pa Yajula Nature Reserve, in particular, is extremely difficult and dangerous due to its remote location in the Great Sandy Desert.

Traditional owners have expressed concern about the difficulties in accessing the planning area to undertake customary practices (see the section **Connection to country**).

Visitation to Kurriji Pa Yajula Nature Reserve requires access across exclusive possession native title country and permission should be sought from the Karajarri traditional owners. They have also developed a permit system to manage visitor access to coastal recreation sites in the Karajarri IPA. These sites are located outside the planning area.



Karajarri cultural advisors Celia Bennett and Rene Hopiga.
Photo – Tom de Souza



Tyre tracks across a salt pan, Kurriji Pa Yajula Nature Reserve. It takes several days to reach the reserve from the Great Northern Highway.
Photo - Stephen Reynolds/Environs Kimberley

Access management

The limited access to Eighty Mile Beach has led to unauthorised off-road driving and camping in the Eighty Mile Beach coastal reserves to reach selected and isolated fishing spots or other smaller pastoral station tracks that are not open to the public. This has adverse impacts on important cultural heritage sites and practices, which are a key concern for the area's traditional owners. The practice can destroy fragile coastal vegetation, impact turtle nesting sites, disturb migratory shorebirds, and potentially introduce or spread exotic species. It can also disturb stock and disrupt pastoral operations on surrounding lands.

There are no 'permitted areas' for off-road vehicles under the *Control of Vehicles (Off-road Areas) Act 1978* in the Eighty Mile Beach coastal reserves. As such, the use of all vehicles (licensed and unlicensed), including motorbikes, quad bikes and dune buggies is not permitted in the reserves.

Other unauthorised activities that can cause disturbance and risk to key values and other visitors include campfires, littering, physical damage to cultural heritage sites and artefacts, and general inappropriate behaviour.

Legal access for departmental operations will be considered as required during the life of the plan and negotiated in consultation with pastoral lessees and traditional owners.

5.3. Safety

The planning area experiences extreme temperatures, tropical cyclones and flooding, and has remote and challenging terrain with limited communications and emergency assistance.

Visitor safety will be managed in accordance with [Corporate Policy Statement No. 53: Visitor risk management](#) (Parks and Wildlife 2015c) and will include dissemination of information to visitors about safety risks and personal preparedness. Through their laws and customs, traditional owners also have a responsibility to keep visitors safe on country.

5.4. Visitor information, education and interpretation

Visitor information, education and interpretation will raise awareness about the planning area, engender support for its management, and encourage community involvement and appropriate behaviour.

Visitor information, education and interpretation within, or in the vicinity of, the planning area may cover:

- cultural heritage (place names, stories and language) and natural (significant wetlands, flora and fauna, ecological communities and Ramsar) values
- management issues and management intent
- relevant cultural laws and protocols
- appropriate visitor use and visitor safety
- research and monitoring findings
- opportunities for community involvement.

Several communication and education messages could be given priority, including the:

- cultural significance of the planning area and the traditional owner associations with the area's wetlands
- importance of the coast for migratory birds and nesting turtles, the effects of disturbance, and steps the community can take to minimise disturbance to migratory birds and turtles
- need for a collaborative approach to address key issues such as introduced herbivores and inappropriate fire regimes
- need to accurately determine the hydrological regime of the mound springs and wetlands in the planning area to ensure resource use is ecologically sustainable.



Nyangumarta elder Margaret Rose with the green bird flower (*Crotalaria cunninghamii*), Walyarta Conservation Park. The cultural significance of the planning area is a key communication message. Photo – Matt Fossey/DBCA

In addition to signage, information bays, publications, the department's website and other electronic media, the department encourages its own staff, traditional owners, neighbouring land managers, commercial tour operators, conservation groups and the wider community to disseminate this information.

5.5. Commercial operations

Commercial concessions, such as licences and leases for commercial operations, provide opportunities for private businesses to offer tourism and recreation opportunities, facilities and services to the public. They can also provide benefits for reserve management by engendering visitor support and respect for key values and associated management regimes through education. Licences allow commercial operators to enter and use lands and waters managed under the CALM Act to conduct activities such as guided walks and tours. Leases can be granted for commercial services that occupy land, require exclusive rights of access and require substantial infrastructure.

Commercial concessions are granted in consultation with the Conservation and Parks Commission and traditional owners through the JMBs, and must be consistent with the purpose of the planning area, the protection of its values, the conditions of the department's [Commercial operator handbook](#) and the objectives of this plan. Most importantly, natural values must be maintained and cultural heritage protected and respected including associated site restrictions and protocols.

The department encourages traditional owners to develop commercial opportunities that celebrate Aboriginal culture on land that the CALM Act applies to. While there are no existing commercial concessions relevant to the planning area, the Nyangumarta people have expressed an interest in cultural ecotourism opportunities and a desire to develop an interpretive centre near Eighty Mile Beach Caravan Park (NWAC and YMAC 2015). Potential also exists for traditional owners to lead and operate dry season tours in Walyarta Conservation Park from Sandfire Roadhouse or Eighty Mile Beach Caravan Park to view the springs in the western part of the reserve and the inland mangroves of Salt Creek. However, the area's remote location, combined with the independent campers that it attracts, mean the ability to generate visitor interest will be challenging and must be well planned in consultation with key stakeholders from the tourism industry.



Nyangumarta elder Teddy Hunter at Salt Creek, Walyarta Conservation Park. The planning area may provide cultural ecotourism opportunities over the life of the plan. *Photo – DBCA*

5.6. Community involvement

In addition to joint managers, neighbouring land managers and relevant government agencies, involving the wider community is integral to the development and implementation of this plan. It increases the capacity to undertake works programs, research and monitoring, and fosters communication links, sense of place and understanding within the community.

Non-government organisations, research institutions, tour operators and volunteers are key groups within the community that contribute to management of the planning area through programs such as revegetation, weed control, flora and fauna surveys, interpretation and development of visitor facilities. Several of these groups have already provided input to the development of this plan.

Through other projects in the planning area, traditional owner groups have built productive working relationships with a range of organisations and institutions including Yamatji Marlpa Aboriginal Corporation, Kimberley Land Council, BHP Billiton, Greening Australia, Rangelands NRM and La Trobe University.

Summary of management directions for recreation, tourism and community values

Key points and considerations	
<ul style="list-style-type: none"> The creation of new reserves may result in increased interest in visiting the planning area. Visitation will be focused on the adjacent marine park and accessible locations along the coast. Public access to the planning area is limited. Most tracks are unsealed and traverse private property. Unauthorised vehicle access along the dune system is a management issue and damages coastal vegetation and landforms, and impacts fauna and cultural heritage sites. Vehicles (including motorbikes, quad bikes and dune buggies) are not permitted in the Eighty Mile Beach coastal reserves. The remote nature of the planning area, combined with the harsh terrain, high daytime temperatures and the occurrence of tropical cyclones, pose a risk to the safety of visitors. Appropriate education and interpretation will increase public awareness of the values of the planning area, and promote responsible behaviour. Where cultural information is available, visitors should have greater understanding of, and respect for, cultural values, laws and protocols. External organisations and community groups may be encouraged to undertake and support on-ground works, research and monitoring. 	
Management objectives	Strategies
<ol style="list-style-type: none"> Provide and promote appropriate access for cultural, recreation and management purposes without impacting on the values of the planning area. Minimise safety risks to visitors to the planning area. Enhance visitor enjoyment and appreciation of the values of the planning area and encourage behaviour that assists with management. Promote and facilitate community involvement in the management of the planning area. 	<p>Review access provisions to the public, traditional owners and for management purposes (liaising with relevant land managers if cross boundary management applies) to:</p> <ul style="list-style-type: none"> maintain or improve roads and tracks that are required close and re-route (and where feasible, rehabilitate) unnecessary or inappropriate access routes (i.e. tracks not needed for public access or management purposes or where unauthorised camping is apparent) or apply access restrictions to areas where key values are vulnerable to disturbance (e.g. threatened species and communities, sites of cultural significance and measures consistent with the marine park management plan). <p>Ensure that visitor risk management for the planning area is considered as part of a regional risk management program that includes:</p> <ul style="list-style-type: none"> measures to mitigate the main and most serious safety issues cultural laws and protocols regarding visitor risk and safety.

Management objectives	Strategies
	<p>Investigate the need for, and prepare and implement as appropriate, specific education and interpretation strategies that communicate:</p> <ul style="list-style-type: none"> • the importance of the values of the planning area • appropriate behaviour to reduce human impacts and ensure public safety • the purpose of access restrictions and other regulations • key research and monitoring findings where appropriate.
	<p>As visitor demand requires and as resources allow, investigate the feasibility of providing some basic visitor infrastructure (e.g. installation of shelter and interpretive facilities) to cater for activities such as cultural ecotourism and wildlife appreciation.</p>
	<p>Seek support from Eighty Mile Beach Caravan Park, other land managers accommodating visitors, and tour operators to disseminate information on key values of the planning area and to promote appropriate visitor behaviour.</p>
	<p>Develop specific licence conditions for commercial operators who operate in the planning area and access important cultural sites, to ensure visitation to these sites is undertaken in a culturally appropriate way.</p>
	<p>Investigate, and where possible support, cultural ecotourism opportunities in the planning area.</p>
	<p>Consider opportunities and provide support (i.e. advice, financial and/or logistical assistance) for community participation in management (including research and monitoring) of the planning area (e.g. universities, non-government organisations and community groups).</p>
	<p>Monitor vegetation cover in the Eighty Mile Beach coastal reserves to assess the nature and level of vehicle use and human impact on coastal communities, and take remedial action where needed.</p>

6. Using resources from the country (sustainable resource use)

The responsible and sustainable use of natural resources in, and adjacent to, the planning area is recognised for its contribution to long and short-term economic and social outcomes. The main existing and potential activities associated with the planning area are irrigated agriculture (pastoralism and horticulture) and resource exploration and development.

6.1 Pastoralism

Domestic livestock grazing (pastoralism) outside the planning area is an accepted economic activity that produces food and fibre for the community and generates export products. Prior to mid-2015, the Eighty Mile Beach coastal reserves and a significant portion of Walyarta Conservation Park were held under pastoral lease.

The presence of permanent water, dense vegetation and shade has made the mound spring communities of Mandora Marsh particularly attractive to cattle. At least seven of the mound springs assessed by the department in 2015 were noted as having been impacted by cattle, some of which have been completely degraded as a result (English *et al.* 2016). Impacts from cattle grazing and trampling are identified as the most significant ongoing threat to the integrity of these mound springs (English *et al.* 2016). The primary dunes along Eighty Mile Beach also had a long history of livestock grazing. These areas are still at risk from livestock grazing, particularly where adjoining boundaries remain unfenced. The presence of cattle along Salt Creek is also a concern due to the cultural significance of this area.

Grazing impacts include trampling vegetation, pugging and compacting of soil, introducing nutrients and exotic pasture grasses and other weeds and increasing vulnerability to erosion. It also alters:

- habitat structure, negatively affecting species that depend on understorey vegetation for foraging and nesting (Martin and Possingham 2005)
- species movement and behaviour
- fire, nutrient and surface water flow regimes.

Weeds and introduced animals are often favoured by ecological changes arising from grazing (e.g. nutrient availability) and the integrity of cultural heritage sites and values can often be diminished.

Research from sites with a history of pastoralism elsewhere suggests that ecological recovery can occur reasonably quickly following removal of livestock, however, the species most susceptible to pastoral impacts may have long disappeared from the landscape and may not return (Legge *et al.* 2011; Woinarski and Ash 2002). Landscape-scale experiments involving the removal of stock are being undertaken across northern Australia to explore interactions of fire pattern with grazing regimes. Results from a study site in the central Kimberley indicate that mammal recovery after stock removal was only pronounced when fires were simultaneously managed to be lower in frequency, size and intensity (Ziembicki *et al.* 2015).



Parts of the planning area have long been subject to the adverse effects of domestic stock. Destocking is a priority to allow these areas to recover.
Photo – Dave and Fiona Harvey/Naturalist Volunteers



Soil pugging by cattle at a spring, Walyarta Conservation Park.
Photo – Karen Bettink/DBCA

Pastoral operations will continue on surrounding land and therefore incursion of livestock is both an existing and potential management issue for the reserves. It is a priority for management that the cattle and associated infrastructure be removed from the planning area as soon as possible. The department will consider the construction or realignment of fences to contain the cattle as required and in consultation with pastoral lessees and traditional owners.

6.2 Water abstraction

Plans exist for future developments in the wider region, including diversification of current pastoral use that involve more water intensive practices and activities such as horticulture and aquaculture (Hale and Butcher 2009). Mining and petroleum activities require large amounts of groundwater abstraction and may be undertaken within the vicinity of the planning area. These activities for irrigated agriculture and other developments pose a significant potential threat to the hydrology and functioning of groundwater dependent wetlands and springs in the planning area (English *et al.* 2016), with those dependent on the deeper confined Wallal aquifer thought to be at highest risk (Harrington and Harrington 2017), if the critical groundwater supply to these areas is disrupted or depleted. Such changes in hydrological regimes could have adverse impacts upon associated ecological assemblages and stygofaunal communities, potentially leading to their loss or affecting the ecological character of the Ramsar site (see **Appendix I**). Irrigated agriculture may also facilitate the movement of weeds into the planning area and the southward movement of cane toads. Groundwater abstraction can also impact cultural heritage values. Parts of the planning area are also at risk of acid sulfate soils occurring near or beyond the natural soil surface and the effects of dewatering or disturbing them include contamination of groundwater and ecological damage to wetland ecosystems.

Groundwater use in the Eighty Mile Beach coastal reserves and Walyarta Conservation Park is managed by DWER in accordance with its [Pilbara Groundwater Allocation Plan](#) and [La Grange Groundwater Allocation Plan](#). Current abstraction is below the annual allocation limit, however an increase in population growth in Port Hedland, potential for mineral exploration and development and an increased interest in irrigated agriculture in the region is seeing an increase in applications for water allocations. Management triggers and specific local area management rules (e.g. bore restrictions within the Ramsar site boundary and the surrounding areas of the Mandora management zone and salinity monitoring requirements in the coastal management zone) assist with sustainable groundwater management and protection of key values in the planning area (Department of Water 2010). The DWER also commits to identifying the local investigations required to determine an ecological water requirement (Department of Water 2010). Increasing the level of understanding about the hydrology of these parts of the planning area is an important outcome for both groundwater allocation plans.

Impacts of groundwater abstraction require monitoring and management at the sites where groundwater resources are being developed in addition to having a robust conceptualization of the hydrological function of the springs and wetlands. The spatial distribution of abstraction and monitoring bores outside the Mandora management zone is an important consideration and should be designed using analytical and numerical models (J. Rutherford *pers. comm.* 2015).

6.3 Mineral and petroleum exploration and development

The region has identified (and prospective) mineral and petroleum resources that are important to the economy. There are three pending exploration tenements (Squadron Resources Pty Ltd – E 45/4941; E 45/4942 and E 45/4956) over a significant part of Walyarta Conservation Park and a Petroleum Special Prospecting Authority Application (STP-SPA-0040) over the southern portion of this reserve. A Western Australian Petroleum Release Area (L12-8) also occurs over some western parts of Walyarta Conservation Park as well as some of the Eighty Mile Beach coastal reserves.

Exploration and development proposals relevant to the *Mining Act 1978* and the *Petroleum and Geothermal Energy Resources Act 1967* must undergo the necessary environmental and heritage assessments. They may be specifically referred to DWER for environmental impact assessment, and approval under the EPBC Act may also be required where potential significant impacts on matters of national significance (e.g. Ramsar sites or listed species) are identified. Although it is unlikely that these activities would be permitted within environmentally sensitive parts of the planning area, approvals would include rehabilitation conditions which are set in accordance with the relevant regulations as well as standards and guidelines of the department and the Department of Mines, Industry Regulation and Safety. Mining and petroleum activities undertaken in the wider region, could also potentially impact on key values.

Local and state government agencies may require the extraction of basic raw materials (such as gravel, shale, clay, sand, limestone and rock) for use on roads, trails and foundations for infrastructure. Due to the area's landforms (wetlands and dunes vulnerable to erosion), conservation value and low demand for visitor facilities, basic raw material extraction is unlikely to be sourced from, or supported for, the reserves. Where basic raw materials are sourced from within the planning area, the materials should only be used to contribute to the protection or management of the reserves.

Summary of management directions for sustainable resource use

Key points and considerations	
<ul style="list-style-type: none"> The Eighty Mile Beach coastal reserves and a significant portion of Walyarta Conservation Park have long been subject to livestock grazing. The planning area will soon be destocked but grazing will continue on surrounding lands. Access by cattle has impacted the coastal dunes, inland mangroves and mound spring communities. Managed and unmanaged stock are the most significant threat to the condition of the mound springs at Mandora Marsh. Other resource use in the vicinity of the planning area include horticulture and mining and petroleum exploration. An increase in groundwater abstraction associated with these activities may disrupt or deplete groundwater contributions supporting sites of significance in the planning area (e.g. groundwater-dependent springs and wetlands). 	
Management objective	Strategies
1. Protect key values of the planning area from adverse impacts of resource use.	Facilitate the removal of livestock and associated infrastructure from former pastoral lease areas of the planning area.
	Investigate the need for, and feasibility of, installing and maintaining cattle-proof fencing to exclude livestock from sensitive sites and locations (e.g. mound springs of Walyarta Conservation Park).
	Undertake regular surveys of feral stock abundance and the integrity of fencing around sensitive sites where cattle still occur.
	Consider requirements and opportunities for active control of livestock (e.g. mustering off reserves and aerial culls) as part of a regional feral animal control program (also see Caring for country).
	Collaborate with DWER to define the ecological water requirements for significant groundwater-dependent wetlands of the Eighty Mile Beach coastal reserves and Walyarta Conservation Park (also see Caring for country).
	Consider the possibility of encountering acid sulfate soils and avoid disturbing, compacting, dewatering and displacing saturated soils at risk.
	Work with the relevant agencies to evaluate land use, exploration and development proposals that may impact on the key values of the planning area and seek to avoid or mitigate these impacts.
	Provide advice to ensure that any sites disturbed by resource exploration and development within the planning area are rehabilitated in accordance with the conditions of the mining or exploration tenure or approval documentation, as well as departmental rehabilitation standards and guidelines.

7. Performance assessment

Provisions for monitoring, evaluating and assessing the implementation of management plans are specified in section 19(g) of the CALM Act.

Progress towards achieving the objectives of the plan is demonstrated by regular monitoring, evaluation and reporting to investigate the effectiveness of management strategies and identify opportunities for improvement. These are key elements of an adaptive management framework, enabling strategies to be revised where needed. A set of KPIs will be used to assess the implementation and success of this plan.

The KPIs (comprising performance measures, management targets and reporting requirements³) have been identified for selected values and management issues and are presented in the relevant management tables throughout the plan. The KPIs are linked to objectives and strategies, and reflect the highest conservation and management priorities of the Conservation and Parks Commission, the department, joint management partners and the community. Any sustained change (e.g. a continuous decrease or increase) will trigger the need for further investigation to determine the cause of that change and therefore the requirement for, and type of, management intervention.

Providing accurate and relevant data and information as evidence of plan implementation is essential to ensure the assessment process is performed quickly and effectively. A portfolio will be maintained showing evidence of those areas where the plan is being successful and those where changes are needed. Some examples of evidence that may be used to assess implementation of this plan include:

- specific, quantitative monitoring of significant assets such as conservation significant flora and fauna and TECs
- series of photographs, mapping or other imagery that show whether spatial and temporal changes have occurred
- checklists
- surveys
- incident reports or records
- other written documents or correspondence.

Assessment should also be informed by monitoring and reporting under the Karajarri Healthy Country Plan and the Nyangumarta Warrarn IPA plan.



Kujungurru Warrarn Nature Reserve. Photo – Matt Fossey/DBCA

³ While reporting requirements may be annual (or other), determining reliable trends might not be possible for a number of years.

Acronyms and key terms

Acronyms	Definition
Biodiversity Conservation Act	<i>Biodiversity Conservation Act 2016</i>
CALM Act	<i>Conservation and Land Management Act 1984</i>
customary purpose (practices for)	Preparing or consuming food, preparing or using medicine or engaging in artistic, ceremonial or other cultural activities customarily undertaken by Aboriginal people.
DBCA	Department of Biodiversity, Conservation and Attractions
DFES	Department of Fire and Emergency Services
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
department (the)	Department of Biodiversity, Conservation and Attractions
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ILUA	Indigenous land use agreement
IPA	Indigenous protected area
JMA	joint management agreement
JMB	joint management body
joint management	Arrangements where the department jointly manages parts of the planning area with traditional owner groups where those parts are located within their respective native title determination areas. These arrangements are formalized through a joint management agreement (JMA) made under the CALM Act and signed by the relevant parties.
Karajarri	A traditional owner group with a determined area over part of the planning area (see Maps 1-4)
KPI	key performance indicator
KTLA	Karajarri Traditional Lands Association
Ngarla	A traditional owner group with a determined area over part of the planning area (see Maps 1-2)
NKAC	Nyangumarta-Karajarri Aboriginal Corporation
Nyangumarta	A traditional owner group with a determined area over part of the planning area (see Maps 1-3)
NWAC	Nyangumarta Warrarn Aboriginal Corporation
planning area	A collective term used in this plan that refers to Eighty Mile Beach coastal reserves (Jinmarnkur Conservation Park, Jinmarnkur Kulja Nature Reserve, an unnamed nature reserve, Kujungurru-Warrarn Nature Reserve, Kujungurru-Warrarn Conservation Park, unnamed 'Gap' nature reserve and Jarrkunpungu Nature Reserve), Walyarta Conservation Park and Kurriji Pa Yajula Nature Reserve.
Ramsar (wetlands)	Wetlands that are representative, rare or unique, or are important for conserving biological diversity and are included on the List of Wetlands of International Importance developed under the Ramsar Convention.
TEC	threatened ecological community
Traditional owner	A person of Aboriginal descent with traditional rights and interests in the planning area
WAC	Wanparta Aboriginal Corporation

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Appendices

Appendix I: Eighty Mile Beach Ramsar site

The Eighty Mile Beach Ramsar site was listed as a wetland of international importance under the Ramsar Convention on 7 June 1990. The site covers two separate and distinct areas, totalling 175,487ha: Eighty Mile Beach and associated intertidal flats and primary dunes (known as the beach section) and Mandora Marsh. The beach section is largely protected by the Eighty Mile Beach coastal reserves and the adjacent marine park and Walyarta Conservation Park covers the majority of Mandora Marsh. Small areas of the Ramsar site occur on pastoral lease outside the formal conservation reserve system.



The planning area formally protects a significant portion of the Eighty Mile Beach Ramsar site. *Photo – DBCA*

Ramsar listing criteria

To qualify for listing, a wetland must meet at least one of the nine Ramsar criteria. The Eighty Mile Beach Ramsar site currently meets criteria 1-6.

Table 4 Listing criteria met by portions of the Ramsar site in the planning area

Group A of the criteria: Sites containing representative, rare or unique wetland types	
	<p>Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.</p> <ul style="list-style-type: none"> Mandora Marsh, within the Great Sandy Desert bioregion, contains an important and rare group of wetlands, including periodically inundated lakes, a permanent hyper-saline creek, freshwater, tree-dominated wetlands, and freshwater and saline mound springs.
Group B of the criteria: Sites of international importance for conserving biodiversity	
Species and ecological communities	<p>Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.</p> <ul style="list-style-type: none"> The greater bilby, listed as Vulnerable under the Biodiversity Conservation Act and the EPBC Act, has been recorded at Mandora Marsh. The coastal dunes and inland wetlands support several threatened shorebird species including the Australian painted snipe, bar-tailed godwit, curlew sandpiper and greater sand plover. The dunes of Eighty Mile Beach provide nesting habitat for the flatback turtle, listed as Vulnerable under the Biodiversity Conservation Act and the EPBC Act. One threatened ecological community and one priority ecological community are located at Mandora Marsh.
	<p>Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.</p> <ul style="list-style-type: none"> Mandora Marsh contains temporary and permanent wetlands recognised as important refugia for biodiversity in a predominantly arid bioregion. In particular, the mound springs make a significant contribution to the regional diversity of flora and fauna.
	<p>Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.</p> <ul style="list-style-type: none"> When flooded, Mandora Marsh supports the critical life stage of breeding for at least 13 waterbird species, including large numbers of Australian pelicans (<i>Pelecanus conspicillatus</i>) and black swans. Eighty Mile Beach is one of the major stopover and non-breeding areas for migratory shorebirds visiting Australia. Many of these feed almost exclusively on the intertidal flats of the marine park, but use the coastal reserves for roosting at high tide. The coastal dunes also support flatback turtle nesting.
Waterbirds	<p>Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.</p> <ul style="list-style-type: none"> The beach section, including the coastal reserves, is considered to regularly support in excess of 500,000 birds. There are records of large numbers (i.e. > 20,000) of waterbirds associated with flooding at Mandora Marsh, though on an infrequent basis.
	<p>Criterion 6: A wetland should be considered internationally important if it regularly supports one per cent of the individuals in a population of one species or subspecies of waterbird.</p> <ul style="list-style-type: none"> Maximum counts for at least two resident waterbirds – the black-winged stilt (<i>Himantopus himantopus</i>) and Eastern great egret (<i>Ardea modesta</i>) – at Mandora Marsh exceed the one per cent population thresholds. Maximum counts in the beach section exceed one per cent of the flyway population (or one per cent of the Australian population for resident species) for 21 waterbird species.

Critical components and processes

Under the Convention, Contracting Parties commit to promoting the conservation of listed wetlands, with the aim of preventing changes to their ecological character. Ecological character is determined by key physical, chemical and biological components and processes. The critical components and processes for the Eighty Mile Beach Ramsar site, as identified by Hale and Butcher (2009), are listed below:

Beach section

Hydrology
Geomorphology
Primary production
Invertebrates
Fish
Waterbirds
Turtles

Mandora Marsh

Hydrology
Geomorphology
Water quality
Phytoplankton and primary production
Vegetation
Invertebrates
Waterbirds

While the components and processes of the beach section have relevance to the Eighty Mile Beach coastal reserves, their management and monitoring is generally dealt with by the marine park management plan.

Limits of acceptable change

The department is the lead agency for implementation of the Ramsar Convention in Western Australia and part of this responsibility involves reporting to the Australian Government if the ecological character of the Ramsar site has changed, is changing or is likely to change. To assist with this, limits of acceptable change and interim limits of acceptable change were set by Hale and Butcher (2009) but these will need to be reviewed as new information is gained from future monitoring. To ensure that limits of acceptable change are not exceeded, operational limits may need to be identified as early warning triggers. Where an operational limit is reached, management should intervene to determine whether the change is detrimental and, if required, prevent further deterioration.

Research and monitoring in Walyarta Conservation Park will enable limits of acceptable change and operational limits to be set and reviewed for the critical components and processes of Mandora Marsh. If it is not possible or practical to set limits for all components and processes, priority should be given to those which are the primary determinants of ecological character (e.g. hydrology) and those which can be managed and monitored (e.g. water quality and vegetation).

Reporting

The department is responsible for reporting on the condition and status of the ecological character of the Eighty Mile Beach Ramsar site every three years, as part of a rolling review. The department's Wetlands Section will coordinate the triennial review and reporting to the Australian Government.

Appendix II: Physical and biological environment

Climate

The climate of the planning area is semi-arid monsoonal with a prolonged dry season between April and November. Temperatures range from warm to hot year-round and, on average, evaporation greatly exceeds rainfall. The Eighty Mile Beach coastal reserves receive an average rainfall of 370mm decreasing further inland to 300mm at Walyarta Conservation Park and about 250-200mm at Kurriji Pa Yajula Nature Reserve. Much of the rain comes from thunderstorms and the proximity of cyclones (Willing 2014).

Tropical cyclones frequently impact the region, most commonly during the wet season (December to April), bringing extremely strong winds and torrential rainfall. This can have dramatic effects on the landforms and ecology of the planning area. Flooding is sometimes associated with these cyclonic events and is enhanced when multiple tropical lows occur within a few weeks of each other. As the cyclonic centres move across land, their strength diminishes and wind speeds abate.

Geomorphology and landforms

In geological terms, the planning area is situated in the southern part of the Canning Basin where a large palaeodrainage system called the Mandora Palaeovalley extends in a westerly direction from Sturt Creek across the inland reserves to Mandora on the coast (Magee 2009). The geomorphology or contemporary landscape is influenced by a combination of deep-seated geological structures and external fluvial and aeolian processes.

Fluctuations in mean sea level have also had a major impact on the local landscape, with the most recent occurring around 10,000 years ago when the wetlands of Walyarta Conservation Park and the coastal plains that back Eighty Mile Beach were thought to exist as a shallow marine system. This is reflected by the fine, carbonate-dominated lithology of the area (Semeniuk 2008). The retreat of the sea level and its recent relative stability enabled sand dunes to build up along the coastline. Carbon dating of the sediments of Eil Eil Spring in Walyarta Conservation Park and Dragon Tree Soak in Kurriji Pa Yajula Nature Reserve suggests that these landscape features formed about 7,000 years ago, and have been geographically isolated since (Wyrwoll *et al.* 1986).



Eil Eil Spring, Walyarta Conservation Park. *Photo – Jan van de Kam*

The dunes of the Eighty Mile Beach coastal reserves are comprised of coarse sand, dominated by calcareous sediments of marine shell origin (Pearson *et al.* 2005). The southern sections of the shoreline are characterised by calcarenite bluffs, 3-5m in height. There are also a small number of shallow tidal creeks that dissect the dunes in the south.

The wetlands of Walyarta Conservation Park are surrounded by linear dunes of red quartz sand. The floor of the two large, periodically inundated wetlands comprise sand, silt and clay of alluvial origin. To the south and north of these (but more extensive in the south) are areas of clay soil that retain surface water for longer than the surrounding landscape. There are also significant rocky exposures of calcrete. The mound springs contain peat soils, accumulated over thousands of years.

The dominant landforms of Kurriji Pa Yajula Nature Reserve are the sandplains and dunes, comprising longitudinal dunes of red quartz sand with a predominant east-west trend and the plains between them. The two mound springs, Dragon Tree Soak and the smaller Elizabeth Soak, contain black peaty mud and are situated in a series of claypans.

Hydrology

Walyarta Conservation Park principally comprises the Mandora Marsh wetland complex, which includes a number of wetland types. The predominant features are two large, periodically inundated wetlands, Lake Walyarta and East Lake. Salt Creek is a braided saline channel system between the two lakes that is predominantly groundwater fed, but after heavy rain carries surface water east to west into Lake Walyarta. At other times the creek exists as a series of isolated pools (Hale and Butcher 2009). The Mandora Marsh complex also contains 17 occurrences of mound springs that vary in size from less than 1 hectare to over 11 hectares, occupying a combined total area of approximately 53 hectares (English *et al.* 2016). These are characterised by a thick mound of saturated peat, topped by dense vegetation and surrounded by either an inundated moat or tail.

The diverse range of wetlands that occur in the reserve reflects the different water balance requirements that occur within the complex. The most important hydrological input for Lake Walyarta and East Lake is surface run-off flow during periods of cyclonic activity. Flooding events are significant in directly providing habitat for aquatic organisms and a breeding site for many waterbirds (Halse *et al.* 2005). However, most years the lakes are either dry or after partial inundation, they dry to form bare clay beds surrounded by saltmarsh. Importantly for the freshwater springs, flooding within the upgradient dunes and swale systems is also likely to be important in encouraging groundwater recharge within aquifers beneath the wetlands.

Groundwater is a significant component of the hydrology of Walyarta Conservation Park. Findings from a recent hydrochemistry investigation of peat mound springs within Mandora Marsh (Harrington and Harrington 2017) indicated that the Wallal aquifer was a significant groundwater source discharging into springs along geological faults. Groundwater contributions from the Broome Sandstone aquifer require further investigation to confirm its role in sustaining the freshwater mound springs of Mandora Marsh. A lesser contribution to the hydrology of the reserve is the input of discrete channelised flow from Salt Creek (Department of Environment and Conservation 2012). This waterway appears to be fed through a series of springs from a saline aquifer (Graham 1999). Salt Creek is an important wetland in its own right as it supports a unique mangrove community, which is thought to depend on springs in the area producing water of similar salinity to seawater (Willing 2014).

Kurriji Pa Yajula Nature Reserve contains two permanent mound springs, which lie about 2km apart. The soaks and fringing permanent swamps are small in size but are regarded as oases within the Great Sandy Desert. Due to their isolation within the surrounding landscape, it is likely that the mound springs are supported by a hydrological regime similar to those at Walyarta Conservation Park (J. Rutherford, pers comm. 2017).

Flora

Diverse vegetation associations occur within the planning area, reflecting its location in both the Dampierland and Great Sandy Desert bioregions, and the fact that it includes areas on the coast and hundreds of kilometres inland. At a very broad scale, much of the vegetation of the planning area is mapped as hummock grassland (Beard *et al.* 2013). Seven different vegetation communities for the Mandora Marsh/Walyarta area have been identified, including one which was further separated into two sub-units. The vegetation types include *Triodia* hummock grasslands, *Melaleuca* shrublands, samphires and mound spring woodlands. Further detail on these can be found in Markey (2017).

The primary dunes of the Eighty Mile Beach coastal reserves are generally sparsely vegetated with beach spinifex (*Spinifex longifolius*) and grey soft spinifex (*Triodia epactia*). Creepers, shrubs and low herbs occur on the secondary dune ridges and swales, including thickets of dune wattle (*Acacia bivenosa*). Some small tidal creeks near Mandora Station support two minor mangrove stands. Samphire communities are known to occur in the vicinity (Johnstone 1990).

The coexistence of saline and freshwater wetlands in Walyarta Conservation Park gives rise to unique and unusual vegetation associations, with plants that are able to tolerate saline conditions occurring in close proximity to species reliant on fresh water. In some areas for example, grey mangroves have a close association with freshwater species such as dragon trees and bulrush (*Typha domingensis*).

The grey mangrove community of Salt Creek is more than 50km from the coast and represents one of only two such communities in Australia, the other being at Lake Macleod. It has been suggested that this is a relict stand from a time when sea levels were higher. A few mangroves also occur on the more brackish springs (e.g. Fern Spring).

The freshwater mound springs contain a complex mosaic of vegetation associations (e.g. Department of Environment and Conservation 2009) and provide a sharp contrast to the surrounding shrub steppe. Tall stands of paperbark (*Melaleuca leucadendra* and *M. alsophila*) and dragon trees grow on the peat mounds and make the springs stand out on the landscape. *Acacia ampliceps* is present as a tall shrub layer here and a dense ground cover of the mangrove fern (*Acrostichum speciosum*) also occurs. Stands of bulrush, sedgelands dominated by *Schoenoplectus* species, rusty sedge (*Fimbristylis ferruginea*), and patches of salt water couch have also been recorded (Markey 2017, English 2016). Not only is the dominant vegetation of the springs variable between occurrences, it is variable over time as the area is frequently subject to cyclonic impacts.



Tall stands of paperbark are associated with many of the freshwater mound springs of Walyarta Conservation Park.
Photo – Jan van de Kam

Lake Walyarta and East Lake are generally bare of vegetation, or support low open shrublands of samphires dominated by *Tecticornia* spp. (Markey 2017). When flooded, they contain a mix of submerged aquatic species including ribbon weed (*Vallisneria spiralis*) and freshwater macroalgae (Graham 1999). The extensive alluvial plains to the north and south of these wetlands support low woodlands or shrub thickets of saltwater paperbark (*M. alsophila*) and *A. ampliceps*, also over low samphire shrublands largely comprising *Tecticornia* spp. (Markey 2017). The surrounding red sand dunes and sandplains support a selection of pindan and desert plant species.

Kurriji Pa Yajula Nature Reserve has relict populations of flora not found elsewhere in the region. The centre of Dragon Tree Soak is dominated by *T. domingensis* and a small patch of jointed rush (*Baumea articulata*), which is at the edge of its extent. Two main clusters of dragon trees grow as a low forest at the northern and southern ends and scattered specimens also occur in the *B. articulata*. A dense band of salt water couch exists around the soak in damp mud and a more extensive ring of *S. virginicus* surrounds this on higher, drier ground.

The nearby smaller Elizabeth Soak has similar vegetation communities. Beyond the soaks, the vegetation quickly assumes that of the desert landscape, dominated by spinifex grasses, acacia and melaleuca thickets, and desert walnut (*Owenia reticulata*).



Scattered grove of desert walnut, Kurriji Pa Yajula Nature Reserve. When roasted, the nuts are a popular food for traditional owners.
Photo – Stephen Reynolds/Environs Kimberley

Fauna

The diverse aquatic habitat of the planning area suggests that the reserves are significant for a range of fauna species and populations. In particular, the permanent wetlands provide habitat and a source of drinking water for a variety of terrestrial animals as well as supporting aquatic invertebrate fauna year-round.

The Eighty Mile Beach coastal reserves border the entire length of the beach and provide habitat value for the nesting flatback turtle and many migratory shorebirds. The greater bilby was recently recorded at the northern end of Eighty Mile Beach in 2017 (Dziminski and Bettink 2017). Acacia and melaleuca thickets support high densities of red kangaroo (*Macropus rufus*), euro (*Macropus robustus*) and agile wallaby (*Macropus agilis*). The reserves and adjacent coastal plains are regarded as a stronghold for the Australian bustard, though anecdotal evidence suggests the species may be in decline locally.

Terrestrial vertebrate surveys of Mandora Marsh were conducted in 1999 and 2015 (Graham 1999; Jackett and Graff 2017; Bettink and Sonneman 2016). Several major differences were found between species recorded, abundances and distribution, highlighting the need for further research and monitoring.

Of particular significance is the presence of the threatened greater bilby (recorded near Salt Creek in 2015), species that are migratory, priority-listed, potentially new and at, or near, their range extent (Bettink and Sonneman 2016 and Jackett and Graff 2017).

At least 135 birds have been recorded from Walyarta Conservation Park (Jackett and Graff 2017), though the number of species present across the broader planning area is unclear. Lake Walyarta and East Lake in Walyarta Conservation Park are important for waterbirds, including migratory species, when inundated extensively. When Lake Walyarta flooded in 1999 and 2000, it was found to be supporting around 480,000 and 490,000 waterbirds respectively (Halse *et al.* 2005), although the area surveyed included inundated land outside the boundaries of the reserve and the Ramsar site.

The site is also significant for the role it plays in supporting individual waterbird species, with maximum counts exceeding the one per cent population thresholds for several species (Hale and Butcher 2009). Three waterbird species, with a combined total of 1,150 individuals, were recorded breeding at Walyarta Conservation Park in 2017 (Greatwicz 2017).

Aquatic invertebrate surveys of Mandora Marsh conducted in 1999 and 2015 (Storey *et al.* 2011; Quinlan *et al.* 2016), have documented a combined total of 216 species to date. Storey *et al.* (2011) attributes the relatively rich aquatic invertebrate fauna to the different types of wetlands within the one location. For example, the Salt Creek sites in the 2015 survey supported a very different fauna composition to that of all other sites surveyed at the time (Quinlan *et al.* 2016). Furthermore, the species composition that was recorded in 1999 was quite different to that recorded in 2015 and Quinlan *et al.* (2016) discusses this in

relation to the dynamic nature of these wetlands and springs and the full invertebrate diversity that they support over a range of climatic and hydrological conditions. Across the two surveys, a number of species were identified as being locally endemic, potentially new or collected at the extent of their range (see **Caring for country**). The springs are regionally important for maintaining virtually all aquatic invertebrates and are believed to provide a source of invertebrates to colonise the main lake bodies when in flood (A. Pinder *pers. comm.* 2016).

Fauna surveys in Kurriji Pa Yajula Nature Reserve have mainly focused on Dragon Tree Soak itself. Bamford and Davies (1996) noted that the site had high avian species richness for an arid area. Waterbird species not recorded elsewhere in the region but present in the dense vegetation of the central sedgeland include the Australian crake (*Porzana fluminea*), clamorous reed-warbler (*Acrocephalus stentoreus*) and little grassbird (*Megalurus gramineus*) (Australian Nature Conservation Agency 1996; Charles 2004). The giant frog (*Cyclorana australis*) and at least three bat species have been recorded at the soak, along with signs of bilby activity (Burbidge *et al.* 1991; Handley 1996).



Breeding colony of pelicans, black swans and straw-necked ibises in 2004, Walyarta Conservation Park. Photo – Jan van de Kam



The little grassbird is rare in the Great Sandy Desert but inhabits the thick reed beds of Dragon Tree Soak. Photo – CSIRO

Appendix III: Guiding principles for fire management in landscapes dominated by spinifex grasslands

1. Climate and vegetation make landscapes dominated by spinifex grasslands highly prone to fire. For thousands of years, lightning and human ignitions have ensured that fire is an environmental factor that has influenced the structure, function and biodiversity of spinifex grasslands.
2. Species and communities vary in their adaptations to, and reliance on fire. Knowledge of the ways in which species and communities respond to fire, and of the temporal and spatial scales of fires in relation to life histories of organisms or communities, underpins the use of fire.
3. Rainfall is a primary driver of the rate of fuel accumulation and subsequent flammability of spinifex grasslands, and large, extensive bushfires are usually preceded by several seasons of above average rainfall.
4. The response of species and communities to fire will be influenced by subsequent rainfall and the fire's scale and patchiness, which can drive systems towards a new transient state with respect to species composition and structure.
5. Fire management is required primarily to conserve biodiversity. In some circumstances, it may be necessary to manage fire to protect property, infrastructure and cultural values.
6. Fire management should be both precautionary and adaptive, considering the requirements of both fire sensitive (habitat specific) and fire maintained communities and species in order to optimize biodiversity conservation outcomes.
7. Landscapes dominated by spinifex grasslands are vast, remote and difficult to access. Fire management resources are scarce, so active fire management including fire suppression and prescribed burning, should focus on areas of high conservation value and on high value built and cultural assets. On much of the spinifex grasslands, passive management, including allowing unplanned fires to burn, is a realistic and acceptable management option.
8. Fire diversity can support biodiversity both at landscape and local scales. At the landscape scale, a fine grain mosaic of patches of vegetation representing a range of interlocking seral (post-fire) stages will provide diversity of habitats for organisms that are mobile and can move through the landscape. At the local scale, appropriate intervals between fire, based on vital attributes of key species, are necessary to ensure the persistence of sessile or less mobile organisms.
9. Avoid applying the same fire regime (frequency, interval, season and scale) over large areas for long periods and avoid seral and structural homogenization by not treating large areas with extreme regimes such as sustained frequent burning or infrequent burning.
10. The scale or grain size of the mosaic should a) enable natal dispersal, b) optimize boundary habitat (boundary between two or more seral stages), and c) optimise connectivity (ability of key species to migrate between seral stages).
11. Two to three years or more of above average rainfall will result in rapid growth of spinifex and flammable soft grasses, predisposing landscapes to large bushfires capable of burning through fire mosaics. While such events are infrequent, strategically located low fuel buffers 500-1,000m wide may be required to contain bushfires under these conditions.
12. All available knowledge including scientific, local and indigenous knowledge should be utilized to develop ecologically appropriate fire management.
13. Consultation and partnerships with neighbours, including traditional custodians, is an effective way of managing fire for mutual benefit.
14. Fire management should be planned and implemented in an adaptive management framework. Use of tools including remote sensing and aircraft, will be essential for planning and implementing fire use and for mapping and monitoring fire mosaics and fire history.
15. As part of an adaptive management framework, biodiversity monitoring should focus on; 1) threatened species and communities, 2) fire sensitive species and communities and 3) the remaining biota. Threats such as introduced plants and animals, and abiotic processes including weather (rainfall) and fire history, must be monitored/recorded to help interpret changes in biodiversity.

16. Where spinifex grasslands have been invaded by flammable weed species such as buffel grass, which is capable of adversely altering the frequency and intensity of fire, prescribed fire should be used conservatively and strategically to break up the run of major bushfires.

Appendix IV: Climate change vulnerability assessment of mound spring communities, Walyarta Conservation Park

Description: Suite of approximately 15 mound springs in the Mandora Marsh wetland complex.

Risk assessment

Present status = Good

Springs are classified as evolutionary refugia because they are likely to support short-range endemic species. Biodiversity conservation value is high. Springs are protected within a Ramsar site and conservation estate.

The most significant drivers of change are livestock grazing and feral herbivores (camels). Recent surveys indicate that springs across the site have been adversely impacted by cattle. The site will soon be destocked; the threat of feral animals remains.

Risk perception

Sensitivity

Low to direct climate impacts because springs are groundwater-fed. **Very high** to indirect climate impacts (groundwater abstraction) and other stressors (e.g. degradation of habitat and water quality due to impacts of livestock and feral herbivores).

Adaptive capacity

High for habitat, **low** for endemic biota because although some springs may be more resilient to direct climate impacts due to being sustained by deeper groundwater, endemic spring biota have little capacity to recolonise if springs run dry.

Note the responses of different springs will vary (e.g. those with a higher reliance on shallow aquifer discharge are likely to show more rapid changes). The open water areas of the springs also dry out regularly and altered climatic conditions may change the periodicity of this drying.

Risk minimisation/management

Vulnerability = Moderate

Low vulnerability to direct climate impacts. **High** vulnerability to indirect climate impacts and other stressors.

Risk minimisation and adaptation strategies

Protect aquifers and monitor water levels in selected springs. Fence sections of the reserve adjacent to pastoral operations and undertake culling of camels and donkeys to maintain low density populations of feral herbivores. Assess degraded habitats and restore if needed. Assess new developments for potential impacts on springs and the aquifers supporting them.

Appendix V: Section 56A joint management agreements

This page has been left blank intentionally and will be replaced with the relevant section 56A joint management agreements as they become available.

